



# THERMOS

## **Baseline Replication Assessment Report – Pilot Cities**

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# 1 Introduction

The Baseline Replication Assessment Report aims to map-out and assess the national and local framework conditions for a successful adoption of the THERMOS model.

This document constitutes the final issue of the Baseline Replication Assessment Report and focuses on the four Pilot Cities of the THERMOS project: Granollers, Islington, Jelgava and Warsaw, and the 4 Replication Cities: Alba Iulia, Berlin, Cascais and the Greater London Authority.

Throughout this document the most relevant characteristics and features that should be considered for the adoption of the THERMOS tool are analysed. The analysis covers the following elements in each of the four Pilot Cities studied:

- **Heating and Cooling in the local context:** this section contains an analysis of the local energy system (energy mix, key performance indicators on power and thermal supply and demand), the key energy policy and legislation, the adoption of Renewable Energy Sources (RES) in the city and the existing energy objectives and plans, among others;
- **Stakeholder Identification and Engagement:** the main local and national stakeholders that should be engaged for a successful adoption of the tools developed throughout THERMOS are listed in this section, together with the roles that they can hold towards the THERMOS model replication and the strategies to be followed for their engagement;
- **Towards THERMOS Uptake:** in this section the principal barriers that could prevent the adoption of the THERMOS tool and the solutions to overcome them are examined;
- **THERMOS Case Study:** finally, the document focuses the analysis on a single opportunity in a city district or quarter where the THERMOS tool will initially be applied.

This report is therefore meant to establish a baseline and serve both as a guide and a set of practical examples on the information that should be gathered and the stakeholders that should be engaged for a successful replication and adoption of the THERMOS tool.

## 2 Warsaw

### 2.1 Introduction

Warsaw is the capital and largest city of Poland. The city has a population of 1.7 million inhabitants within city boundaries. Warsaw is located in the central-eastern part of Europe, in the Mazovian Lowland. Warsaw's climate is humid continental with cold, snowy and cloudy winters and warm, sunny and stormy summers. Average temperatures range between  $-1.8\text{ }^{\circ}\text{C}$  in January and  $19.2\text{ }^{\circ}\text{C}$  in July. The average annual temperature is  $8.5\text{ }^{\circ}\text{C}$ .

The City of Warsaw provides public services for Warsaw's citizens, including housing, waste collection and management, tax collection, education, libraries, social services, transport, planning, licensing, cemeteries etc.



Warsaw's mixture of architectural styles reflects the turbulent history of the city and the country. During the Second World War, Warsaw was razed to the ground by bombing raids and planned destruction. After liberation, many of the historical buildings were thoroughly reconstructed, but also Soc-realist architecture was introduced in the City. The examples of post-war architecture include the Palace of Culture and Science, a Soc-realist skyscraper located in the city centre, and the monumental Constitution Square. Prefabricated concrete buildings with basic designs, typical of Eastern bloc countries, were erected to rebuild residential buildings.

In recent years, public spaces have attracted significant investment, and thus the city has gained entire new squares, parks and monuments. Warsaw's current urban landscape is one of modern and contemporary architecture.

Lately Warsaw has undergone tremendous changes and development. Every year there are almost 20 thousand flats built. The biggest ecological investment in Europe – ‘Czajka’ Wastewater Treatment Plant – was completed and a big programme of revitalisation of the Praga district – located on the right bank of the *Vistula* River – was launched. Apart from these infrastructural changes, a great effort to raise awareness of Varsovians on climate change and to promote ecological behaviour and a conscious approach to ecology has been made. This is extremely important because Warsaw is a unique capital in terms of nature. It borders with one of the largest national parks and a huge half-wild river, the *Vistula*, is flowing through the centre of the city. The right bank of the *Vistula*, in the area of the reserve, has no regulated structure over a distance of almost 4 km, which is quite unusual for a city so large.

## 2.2 Heating and Cooling in the Local Context

### 2.2.1 Local energy system

#### 2.2.1.1 Introduction

The energy sector in Warsaw consists of three main subsectors: electricity, heat and gas.

Electricity in Warsaw is supplied from the National Power System, produced in large power plants that are powered with coal and inside the city in combined heat and power plants. In winter, more than 50% of the electricity comes from Warsaw’s CHPs, thanks to the large production of heat in this time of the year. In summer about 90% of the electricity is imported from the National Power System.

Gas – used for cooking and in some parts of the city for heating – is 100% delivered from outside of the city.

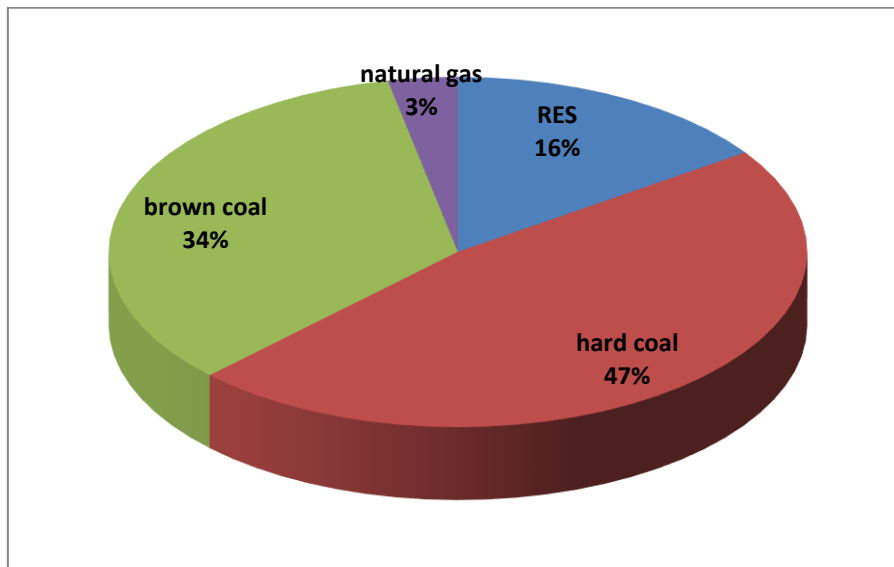
As for the heat system, almost 80% of Warsaw inhabitants uses heat from the district heating network, that is mostly powered by CHPs. The households that are not connected to the district heating network use heat from gas (from the network or individual boilers), heating oil or coal. These are mostly inhabitants of individual houses.

The energy consumption in Warsaw in 2015 was the following:

- District heating: 7,917 GWh
- Gas: 5,195 GWh
- Electricity: 7,447 GWh

The production of electricity and heat is based on coal. The energy mix for electricity used in Warsaw is as follows:

Figure 1: Electricity mix in Warsaw (2015)



In terms of heat production, the basis of the energy system in Warsaw are two large combined heat and power plants (CHP *Siekierki* and CHP *Żerań*), two large heating plants (*Kawęczyn* and *Wola*) and several smaller sources. 89% of the heat in Warsaw is produced through cogeneration. The two main CHPs operate in cogeneration mode, i.e. they produce electricity and heat simultaneously. In contrast to the typical power plant, the waste heat is not squandered into the air or the river water but used for heating buildings and producing domestic hot water.

As a rule, the volume of electricity production depends on how much of the waste heat can be picked up by the district heating system. Therefore, the electricity that can be produced increases with the number of buildings heated by CHPs. This also results in an improved energy security, because Warsaw is not self-sufficient in energy terms and, as mentioned before, the missing part of the electricity demand is taken from the National Power System.

Power sources in Warsaw	Electric and heat power	
CHP <i>Siekierki</i>	[622 MWe]	[1,966 MWt]
CHP <i>Żerań</i>	[334 MWe]	[1,435 MWt]
CHP <i>Ursus</i>	[6 MWe]	[143 MWt]
CHP <i>MPO</i>	[2.2 MWe]	[9 MWt]
CHP <i>Czajka</i>	[7.2 MWe]	[6.8 MWt]
HP <i>Kawęczyn</i>		[465 MWt]
HP <i>Wola</i>		[465 MWt]
HP <i>Międzylesie</i>		[70 MWt]
HP <i>Rembertów</i>		[29 MWt]

The fuel used in the two largest CHPs is mainly coal (96%), but in *Siekierki* CHP there is a biomass boiler that produces approx. 50 GWh of heat, giving an additional 3.5 % of biomass to heat mix in Warsaw.

District heating

Warsaw has the largest district heating system in the European Union and the third largest in the world, after Saint Petersburg and Kiev. The total length of the double heating pipes is 1,763 km, including 647 km (45%) in pre-insulated technology. District heating supplies 18,600 buildings with 15,000 substations. This represents 78% of the heat demand of the city. Warsaw’s district heating (DH) network covers 56% of the city’s urban area. The largest diameter heating pipes is 1,200 mm.



The district heating network was owned by the City until 2011, but was then sold to the private company 'Veolia Energia Warszawa'. This means that the City of Warsaw has no direct influence on the directions of development and modernization of the district heating network. It doesn't mean, however, that Veolia has no obligation in this area. According to investor's contractual obligations it is Veolia's obligation to invest EUR 250 million in 7 years from 2011 – 80% of this amount is meant to be invested in the district heating network, according to the list of guaranteed investments. Another positive side of the privatization and the selling of shares to a company of global range is the possibility to use their experience and introduce new technologies in the City that allow the district heating network to be more efficient, modern and eco-friendly.

The plans for the development of the DH network in the following years will be focused on connecting social buildings in the Prague District (more in 2.2.3.1) to the network, on expanding the network in the areas of City development and on modernizing the existing network.

**2.2.1.2 Thermal energy supply and demand**

Key performance indicator	
Number and type of energy generation units	See section 2.2.1.1



Solar thermal energy generation (MWh/ year)	157,998
Heat pump energy generation (MWh/ year)	2,143
Biomass energy generation (MWh/ year)	No data
Waste heat potential (MWh/ year)	No data
Buildings' energy consumption in the residential sector (MWh/ year)	12,548,616
Buildings' energy consumption in the commercial sector (MWh/ year)	3,876,568
Buildings' energy consumption in the industrial sector (MWh/ year)	2,778,039

### 2.2.2 Key Heating and Cooling policy and legislation

According to the Local self-government Act, Warsaw, as the municipality, is responsible for the supply of electricity, heat and gas. Article 18 of the Energy Law states that the commune's own tasks include planning and organizing the supply of heat, electricity and gas fuels within the municipality.

The energy planning at local level is two-step and two-pronged. The Mayor of Warsaw, as an executive body, is obliged to prepare a document named "Assumptions for the plan of supply with heat, electricity and gas fuels for the City of Warsaw", which is an inventory of all energy systems and forecasted energy demand. On the other hand, energy companies prepare their own development plans. If the assumptions are not consistent with the development plans of enterprises, the Mayor of Warsaw prepares plans for the supply of heat, electricity and gas for the individual areas for which energy companies do not provide the supply.

These assumptions constitute a legal tool for shaping the energy economy and energy planning in the city. The assumptions are the numerical description of the functioning of the energy system. The core principles are the values of the current and projected demand for heat, electricity and gas fuels in the city and the assessment of its fulfilment.

The assumptions are prepared for the area of the municipality for at least the following 15 years and updated at least once every three years.

Other City documents that shape energy planning in Warsaw are:

- Energy Policy of The City of Warsaw until 2020 adopted by the City Council in 2006. In terms of the heat subsector this policy assumes:

- Providing safe conditions of heat supply
- Motivating large heat recipients and system operators to energy saving
- Stimulating development and modernization of district heating networks
- Supporting thermal retrofitting of building and promoting use of RES for heating

- Sustainable Energy Action Plan (SEAP) for The City of Warsaw in the perspective of 2020 adopted by the City Council in 2011.

The main goals of SEAP are:

- 20% reduction of CO<sub>2</sub> emissions in 2020 compared to 2007
- 20% reduction of energy consumption in 2020 compared to 2007
- Introduction of RES in energy mix in Warsaw

Activities planned for implementation to ensure the fulfillment of these goals are:

- Thermal retrofitting of public, private and residential buildings
- Modernization of heat sources and distribution networks
- Reduction in electricity and heat consumption due to, among others, utilization of new technologies
- Use of RES for generation of electricity and heat

- Low-carbon Economy Action Plan adopted by the City Council in 2015

It acquires SEAP targets in terms of CO<sub>2</sub> reduction and reduction of energy consumption and adds the goal of improvement of air quality in the City.

The Low-carbon Economy Action Plan has a list of investments to be implemented by the City of Warsaw and other stakeholders of the city, like 'Veolia Energia Warszawa' – operator of Warsaw district heating network.

Examples of these investments in terms of district heating network are:

- Connection of social buildings to the district heating network in the framework of the Revitalization Programme
- Modernization and development of Warsaw's district heating network
- Replacement of group, exchanger-based heating substations with individual heating substations and modernization of heat distribution network

## **2.2.3 Heating and Cooling within urban development and renovation programmes**

### **2.2.3.1 Heating and Cooling Objectives**

Most of the heat needs of Warsaw's inhabitants are covered by the district heating network. However, there are some parts of the City where the DH network is not developed, especially in areas with individual residential houses and on the right bank of *Vistula* river, in the Prague district, where there is a significant amount of social buildings. These areas are often heated by individual sources using coal or even illegal wastes for heating, which leads to a deterioration of the air quality.

One of the main priorities for the City of Warsaw is counteracting the formation of air pollution. This implies a strong commitment to ensure the development of the district heating network and the connection of new buildings to it.

A programme named 'District heating for social buildings' has been launched in recent years. The programme is connected to the already mentioned Revitalization Programme and is focused on 3 districts: Prague-North, Prague-South and *Targówek*. From 2010 to 2016 there were 131 buildings connected to the district heating network and the plans for next years (2017-2020) expect 229 social buildings to be connected to the network.

In addition, to encourage citizens to replace their inefficient and air polluting heat sources by the connection to the district heating network or to a gas source, the City of Warsaw is offering subsidies from the beginning of 2017. In terms of DHN, the subsidies amount to 2,500 Euros for natural persons and 5,000 Euros for housing associations, legal persons or entrepreneurs.

The development of the district heating network is, as mentioned before, dependent on the company running it.

Finally, Warsaw introduced a significant project in the period 2012-2017 named "Replacement of group, exchanger-based heating substations with individual heating substations and modernization of heat distribution network in Warsaw Capital City's high-density multi-family housing areas where permissible air pollution levels are exceeded" - marketing synonym - "Individual substations for Warsaw". The main objective of this project is to increase energy efficiency and reduce emissions and air pollution in Warsaw. A heating substation is a device or plant used for changing the type or parameters of a heating medium delivered from a connection point, and for controlling the quantity of heat delivered to end-user lines. Initially, this project involved the replacement of 100 group substations with 765 individual substations. In 2015 it has been expanded, resulting in 111 group substations liquidated and 810 individual substations built.

The outcomes of the project will be:

- reduction of CO<sub>2</sub> emissions, by 20,305 Mg/year
- reduction of emissions of particulate matter PM10 by 2,613 kg/year, SO<sub>2</sub> by 76,193 kg/year, NO<sub>x</sub> by 38,197 kg/year, which corresponds to the overall reduction of heat consumption and losses at 201,038 GJ annually

### **2.2.3.2 Energy Efficiency Opportunities**

The improvement of energy efficiency is one of the main goals of the City. Activities to achieve this goal may be undertaken in many sectors of the city operation. One of the most important sectors in terms of the possibilities for energy efficiency improvement are buildings. This sector is crucial because the provisions of the Directive on energy performance of buildings states that after 31 December 2018, new buildings occupied and owned by public authorities shall be nearly zero-energy buildings and points to the leading role of the public sector in

implementing policies and actions that stimulate the transformation of buildings to the level of nearly zero-energy.

Because of that, the improvement of energy efficiency in buildings will be one of the most important goals of the currently emerging 'Warsaw Housing Standard', which will be a set of guidelines for constructing new buildings or estates and modernizing the existing ones. This standard will be applied to the buildings built and owned by the City, mostly social, but can also be used by property developers.

In terms of energy efficiency of the district heating network, the main opportunity in recent years was the privatization of the district heating company. As already mentioned, the current owner of the DHN is an international company with many years of experience. That leads to the possibility to utilize the knowledge, best practices, experiences and ideas of the projects implemented by this company in other countries.

One of the projects that will have a positive impact on the energy efficiency of Warsaw's district heating network is 'Intelligent heating network' (IHN). The main goal of IHN is to support all processes related to the efficient operation of the network. The existing district heating network will be equipped with measuring equipment, means of data transmission and decision support applications for optimizing the control of the network operation under both normal and emergency operating conditions. The predicted benefits of the project are:

- 123 TJ/year - Savings in transmission heat losses
- Greater heat supply security, faster fault detection
- Avoidance of CO<sub>2</sub> emissions by 14,500 tones/year

### **2.2.3.3 Renewable Energy Adoption and Potential**

Renewables are a valuable energy source in the city. One of the main goals of Warsaw is to increase the share of RES in the energy mix. In terms of RES used for heat production, it is important for Warsaw to promote this kind of energy source in the areas where the development of the district heating network is subject to technical difficulties or economically unjustified. To encourage Warsaw inhabitants to invest in RES, subsidies for RES introduction are operating in the city from 2012. Between 2012 and 2016 almost 1 million Euro was conceded as a subsidy for more than 300 projects (PV, solar panels, heat pumps). In the first quarter of 2017, 110 proposals for solar panels and heat pumps have been registered:

Type of installation	2014		2015		2016	
	Number of installations	Grants awarded [EUR]	Number of installations	Grants awarded [EUR]	Number of installations	Grants awarded [EUR]
Solar panels	45	83 528	37	60 640	32	48 781
PV	1	724	43	118 895	89	247 298
Heat pumps	9	48 855	29	129 460	18	79 948

Summary	55	133 107	109	308 995	139	376 027
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As mentioned before, the majority of the heat produced in the CHPs plants is produced from coal, but in the *Siekierki* CHP plant there is a biomass boiler operating which produced 50 GWh of energy in 2015.

#### **2.2.3.4 Transport and infrastructure**

Public transport plays a key role in global mobility system of Warsaw. Public transport consists of buses, trams, two metro lines and the Urban Rapid Rail. The biggest share in the use of public transport system is for buses – 573 million passengers in 2015, trams – 272 million passengers in 2015 and metro – 224 million passengers in 2015.

Several activities have been undertaken for improving energy efficiency in the transport sector. All the new trams that are bought by the City of Warsaw have braking energy recovery systems. As for buses, Warsaw is in the process of purchasing a bus fleet that will reduce emissions of pollutants and will utilize modern technologies. Now in Warsaw there are 4 hybrid 18-metre Solaris buses in operation since 2011, 35 gas buses that joined the Warsaw fleet in 2015 and 10 e-buses purchased in 2014. 10 additional e-buses will be available in Warsaw in the following months. The operation of electric buses brings significant savings in operating costs, besides environmental benefits.

For that reason, Warsaw is planning a big project on electric buses. It will be a major step forward towards the transformation of Warsaw's urban transportation, lessening its dependency on fossil fuels. The project aims to set 130 buses (1/10 of vehicle stock of Warsaw MZA municipal bus operator) in operation, together with modern associated infrastructure, including the construction of aerial chargers at the end of selected bus lines and the adaptation of bus depots. In the long run, the project shall assist the Poland-wide trend towards electric mobility, limiting risks related to CO<sub>2</sub> emissions generated by fossil fuels consumed in the transportation sector worldwide. The project will also massively reduce the amount of pollutants such as NO<sub>x</sub> and SO<sub>2</sub>, which are generated by Diesel buses, apart from the reduction of noise produced by standard vehicles.

#### **2.2.4 Financing Opportunities and Instruments**

In general, it is possible to obtain funding for heating and cooling development investments and investments in heat savings in buildings through thermal retrofitting. The main institution offering subsidies is the National Fund for Environmental Protection and Water Management. Currently in the Infrastructure and environment Programme there are the following possibilities for funding:

- **Supporting energy efficiency in buildings (private and public)** – investments in deep thermal retrofitting of buildings
- **Effective distribution of heat and cooling** - reconstruction of existing district heating and cooling networks to reduce transmission and distribution losses;

construction of connections to existing buildings and installation of individual nodes resulting in the liquidation of group nodes; construction of new sections of the heating network together with connections and heating nodes, in order to eliminate existing local sources of heat, fired with solid fuel and connection of buildings to the district heating network aimed at the liquidation of individual and collective low emission sources

The white certificate scheme is another significant instrument for funding infrastructure projects. In the context of district heating and cooling systems, it should be recalled the Announcement of the Ministry of Energy, dated 12 December 2016, that included a detailed registry of ventures that help increase energy efficiency and a list of activities to increase energy efficiency related with district heating, such as:

- replacement or modernisation of individual and group district heat substations with higher energy efficiency equipment and technology (e.g. insulation, drives, armature, exchangers),
- modernisation of system supplied by group heat substations by converting those systems into individual systems,
- installation or modernisation automation systems and monitoring of the performance of the work of heat substations and heating networks,
- replacement or modernisation of local cooling and air condition systems,
- use of cogeneration systems in local heat sources,
- modernisation of local heat sources (boiler plants, neighbourhood heat plants),
- modernisation of drainage for steam-based installations

There is also the possibility of subsidizing the connection to district heating network from the budget of the City of Warsaw. Details of these subsidies can be found in section 2.2.3.1.

## **2.3 Stakeholder Identification and Engagement**

### **2.3.1 Local stakeholders**

#### **2.3.1.1 Veolia Energia Warszawa**

'Veolia Energia Warszawa S. A.', a part of the Veolia Group, is a private company that owns the district heating network in Warsaw. Veolia manages the network and delivers heat to 18,000 buildings. It operates in Warsaw since 2012 (between 2012 and 2014 as *Dalkia Warszawa*), when the privatization of the SPEC company was performed. Now Veolia holds 85% of the shares with the remaining 15% belonging to company employees.

Veolia is bound with the City with contractual obligations of:

- Investing EUR 250 m in the next 7 years following the privatization of the network – 80% of this amount invested in district heating network, according to the list of guaranteed investments
- not selling shares in at least 10 years
- assuring that the company offices will stay in Warsaw, which means that tax will be paid in the city
- following the rules of cooperation in terms of energy safety policy and Energy Law

Veolia creates and implements energy efficient solutions in Warsaw, in line with Veolia's sustainable development policy. It is actively involved in the life of the city, working for the protection of the environment by implementing a number of pro-ecological investments and cooperating in the education of children and youth.

### **2.3.1.2 PGNiG TERMIKA**

*PGNiG Termika*, a state-owned company, is the biggest producer of electricity and heat through cogeneration in Poland. The production of electricity and heat within the City borders is undertaken in two CHPs – *Siekierki* and *Żerań* and HPs *Kawęczyn* and *Wola*.

The main goal of *PGNiG Termika* is ensuring the security of heat and electricity supplies in the City and its respect for the environment. This is visible in the continuous development of installations that ensure less air pollution and an improved energy efficiency.

### **2.3.1.3 City of Warsaw Departments**

Warsaw City Hall consists of 37 departments, of which some should be THERMOS stakeholders. Some examples would be the Architecture and Spatial Planning Department, responsible for the creation of spatial planning policy for the city, the Mobility Policy Department, responsible for the coordination of the activities in the scope of functioning of public transport in Warsaw and the Centre for Public Communication, responsible for society participation and dialogue.

### **2.3.1.4 Warsaw University of Technology**

The Warsaw University of Technology is one of the leading institutes of technology in Poland and one of the largest in Central Europe. It employs 2,453 teaching faculty, with 357 professors (including 145 titular professors). The number of students as of 2011 amounted to 36,156, mostly full-time. There are 19 faculties (divisions) covering almost all fields of science and technology, from which some could be THERMOS stakeholders: Faculty of Geodesy and Cartography, Division of Power Engineering, Division of Thermodynamics or Division of Rational Use of Energy.

### **2.3.1.5 The Association of Municipalities Polish Network 'Energie Cités'**

The Association of Municipalities Polish Network '*Energie Cités*' (PNEC) is a non-governmental organization which supports sustainable energy planning and implementation on the local level. Since 1994 PNEC promotes energy efficiency and the use of renewable energy sources, implements projects supporting the sustainable energy development of Polish municipalities

and organizes conferences, seminars, workshops and study tours devoted to energy-related issues.

#### **2.3.1.6 Polish District Heating Chamber of Commerce (IGCP)**

The organization gathers companies whose business activities are related with district heating, mainly owners and managers of municipal assets used for generation, processing, storage, transmission of heat and trade heat. The primary objective of the chamber is the initiation and collaboration in upgrades and the complex development of heating in accordance with changing needs.

#### **2.3.1.7 Municipal Waste Company (The Urban Solid Waste Treatment Station)**

The Municipal Waste Company is a public company with an integrated waste management system that owns the first incinerator in Poland.

#### **2.3.1.8 Municipal Road Authority**

The Municipal Road Authority is a budget entity with the main focus of maintaining the existing status of the district, state and Voivodship roads, with expiation highways and express dual carriageways. Within the sphere of competence of the Municipal Road Authority is 800 km or roads, sidewalks and bike paths, 108 thousand luminaires, 487 bridge gullies or the Road Traffic Management System.

#### **2.3.1.9 Municipal Bus Operator (MZA)**

The purpose of the company's operation is to provide bus public transport within the capital city of Warsaw. MZA operates more than 1300 buses. It is 74% of Warsaw bus fleet. Remaining 26% belongs to private bus companies.

### **2.3.2 National stakeholders**

The main stakeholders for the replication of the THERMOS application could be other cities in Poland that have a district heating network. It could be especially interesting for the cities that have their own municipal district heating network operator to assess the possibility of expanding the network and the benefits or challenges related to it.

### **2.3.3 Existing stakeholder participation processes**

The City of Warsaw is focused on ecological education of the citizens. Because of that, many events are organized to raise awareness on ecology, climate, energy efficiency. Two of the main events where THERMOS could be exploited are:

- Warsaw Energy Day – organized every year within the European Energy Week. It is an event where new solutions regarding energy efficiency, RES, e-mobility are presented.
- Picnic with Climate - organized every year within the platform "Partnership for Climate", whose members are embassies, companies and NGO's that are committed to act against climate change.

### **2.3.4 THERMOS Local Liaison Group**



1. Veolia Poland  
<http://www.veolia.pl/>
2. PGNiG Termika  
<http://www.termika.pgnig.pl/>
3. Warsaw University of Technology
  - <http://www.gik.pw.edu.pl/> - Faculty of Geodesy and Cartography
  - <http://www.itc.pw.edu.pl/> - Division of Thermodynamics, Division of Rational Use of Energy
4. The Institute of Heat Engineering - Division of Power Engineering,  
<http://www.itc.pw.edu.pl/>
5. Public Transport Authority  
<https://zdm.waw.pl/>
6. The Association of Municipalities Polish Network 'Energie Cités'  
<http://www.pnec.org.pl/pl/>
7. The Institute of Heat Engineering - Division of Thermodynamics  
<http://www.itc.pw.edu.pl/>
8. The Institute of Heat Engineering - Division of Rational Use of Energy  
<http://www.itc.pw.edu.pl/>
9. Municipal Waste Company (The Urban Solid Waste Treatment Station)  
<http://www.mpo.com.pl/>
10. Polish –District Heating Chamber-of Commerce (IGCP)  
<http://www.igcp.org.pl/igcp>
11. Municipal Road Authority (ZDM)  
<https://zdm.waw.pl/>
12. Municipal Bus Operator (MZA)  
<http://mza.waw.pl>

#### **2.3.4.1 Stakeholder roles towards THERMOS model replication**

##### **2.3.4.1.1 Veolia Energia Warszawa**

Heat supplier in the City of Warsaw – cooperation with the City in terms of development of the district heating network

##### **2.3.4.1.2 PGNiG TERMIKA**

Electricity and heat producer – cooperation in terms of the development of district heating network – providing sufficient amount of heat for the City.

#### **2.3.4.1.3 Warsaw University of Technology**

Support in testing Thermos tool, access to methodology of gathering energy and special data, assessing the quality and reliability of results.

#### **2.3.4.1.4 The Association of Municipalities Polish Network 'Energie Cités'**

Support in promoting tool, sharing experience and knowledge about specific needs.

#### **2.3.4.1.5 Polish District Heating Chamber of Commerce (IGCP)**

Support in promoting tool, sharing experience and knowledge about specific needs.

#### **2.3.4.1.6 Municipal Waste Company (The Urban Solid Waste Treatment Station)**

Potential prospective heat supplier.

#### **2.3.4.1.7 Municipal Road Authority**

Sharing experience and knowledge about activity of institution regarding the development of the district heating system.

#### **2.3.4.1.8 Municipal Bus Operator**

Introduction of e-buses in the city.

### **2.3.5 Stakeholder Engagement Strategies**

The assessment of possibilities for engagement is difficult. The possibility to engage the Polish District Heating Chamber of Commerce is high due to the strong relation of the institution with the subject of project. The engagement of other stakeholders depends on the level of relation with the subject and the potential benefits of involvement and is therefore difficult to foresee.

## **2.4 Towards THERMOS Uptake**

### **2.4.1 Barriers**

In general, district heating is quite popular in Polish cities. It was developed in the communist era but in many cases there is a need of modernizing and developing the network identified. The main barriers for it are:

- Costs of district heating network modernization and development
- Connection of individual houses or new estates build in the suburbs of cities not being cost effective
- Lack of subsidies for the development of larger installations using RES

### **2.4.2 Proposed solutions**

The economic and environmental outcomes of the THERMOS tool will allow to focus the development of the district heating network on the most favourable areas, not only in economic terms but also taking into account indicators on air quality and GHG emissions reduction.

### 2.4.3 THERMOS exploitation opportunities

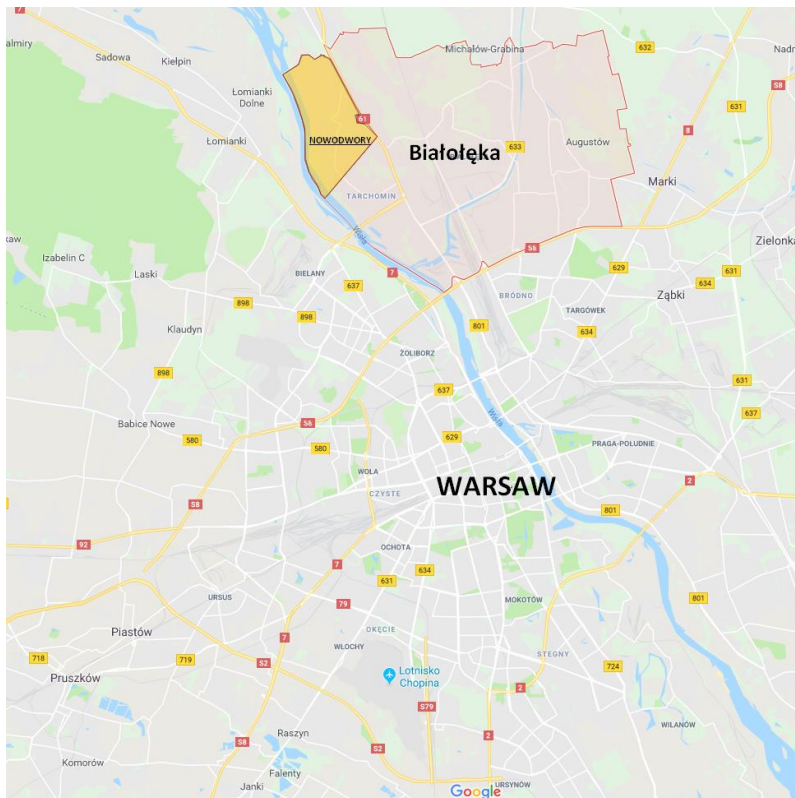
Taking into account that the district heating network in Warsaw is owned by a private company, the THERMOS tool could serve as an auxiliary tool for authorities for setting priorities for desirable directions of DHN development. In cities where the owners of the DHN are the City Administration, the THERMOS tool could be helpful in the decision-making process.

## 2.5 THERMOS Case Study

### 2.5.1 Objectives

*Białoleka Nowodwory* - Part of *Białoleka* District.

The *Białoleka* district is located in the northern part of the City of Warsaw. It is one of the districts with the highest number of new-built residential buildings and highest potential for development.



It is also the second district in terms of the number of buildings not connected to the district heating network and gas network, with almost 3,000 buildings, including single-family and multi-family residential buildings, office and public buildings. Because of that, the district can play a key role in improving air quality through the reduction of low-stack emissions by connecting buildings to the district heating and the gas networks.

In the north-western part of *Białoleka – Nowodwory* with area around *Czajka Wastewater Treatment Plant* is a residential area with significant anticipated growth in the next years due to its proximity to downtown Warsaw and its good transport infrastructure. This is an area where no district heating infrastructure exists at the moment. Currently heat for household sector is provided by gas boilers. Main objective is to analyse the usage of local heat sources

such as gas boilers and waste heat from sewage treatment plant as reserve heat suppliers for local users.

### 2.5.2 Key stakeholders

- Veolia Energia Warszawa – district heating network operator
- *PGNiG Termika* – producer of heat used in district heating network
- Warsaw City Hall - Architecture and Spatial Planning Department, responsible for creation of spatial policy in the City and Infrastructure Department, responsible for energy policy in the City

### 2.5.3 KPI indicators table

Key performance indicator	
Number and type of energy generation units	Please see section 2.2.1.1
Solar thermal energy generation (MWh/ year)	550
Heat pump energy generation (MWh/ year)	
Biomass energy generation (MWh/ year)	No data available
Waste heat potential (MWh/ year)	No data available
Buildings' energy consumption in the residential sector (MWh/ year)	213 224 (187 255*)
Buildings' energy consumption in the commercial sector (MWh/ year)	11 177 (6140*)
Buildings' energy consumption in the industrial sector (MWh/ year)	2 067 (526*)

\*heat consumption

### 2.5.4 Financing status/ opportunities

The financing of the development of the district heating network rests on the operator – Veolia Energia Warszawa. In general, new networks and connections to the buildings are implemented where it is economically justified. It is also possible to utilize EU or national funds designed for the development of district heating networks and improvement of air quality.

For inhabitants of single-family houses or housing communities in multi-family building it is possible to obtain subsidies from Warsaw City Hall for the connection to the district heating

network. These subsidies do not include the building of the district heating network, so it is just possible to use them in the cases where the network already exists.

## **2.5.5 Exploitation of the opportunity**

### **2.5.5.1 Barriers**

As mentioned before, the main barrier for the connection of the buildings to the district to the network is the mismatch between heat supplier's development plans and Warsaw's energy strategy. The heat supplier, as a commercial entity, would invest in areas that guarantee a high internal rate of return, with social interest occupying a second place. In addition, it is difficult to identify and engage stakeholders.

### **2.5.5.2 Proposed solutions**

Reliable information on economic circumstances from the THERMOS tool could constitute a strong support in the negotiation with suppliers on the direction of development of the district heating system.