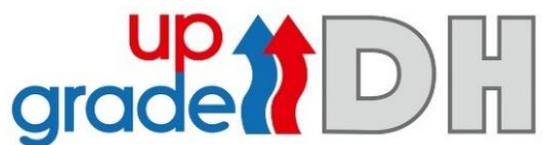




National action plan for retrofitting DH networks in Poland



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Abbreviations

DH	District Heating
EU	European Union
RES	Renewable Energy Sources
ETS	Emission Trading System

1. Introduction

The overall objective of the Upgrade DH project is to improve the performance of district heating (DH) networks in Europe by supporting selected demonstration cases for upgrading, which can be replicated in Europe.

The Upgrade DH project supports the upgrading and retrofitting of DH systems in different climate regions of Europe, covering various countries: Bosnia-Herzegovina, Denmark, Croatia, Germany, Italy, Lithuania, Poland, and The Netherlands. In each of the target countries, the upgrading process was initiated at concrete DH systems of the so-called Upgrade DH demonstration cases (demo cases). The gained knowledge and experiences is further replicated to other European countries and DH systems (replication cases) in order to leverage the impact.

Core activities of the Upgrade DH project include the collection of the best upgrading measures and tools, the support of the upgrading process for selected district heating networks, the organisation of capacity building measures about DH upgrading, financing and business models, as well as the development of national and regional action plans.

This document specifically focuses on the **development of a national action plan** for the retrofitting of inefficient district heating networks **in Poland** and includes the results of the retrofitting approaches (see also the *District Heating Handbook* developed within the project [1]).

As a background information, Poland (together with Germany) remains the biggest market for District Heating and Cooling in the EU in terms of absolute figures with the total installed district heating capacity of 54,912 MWth and 16,500.000 citizens served by district heating in 2017. The dominant fuel is hard coal and coal products.[2]

The analysis showed that there are several laws, acts and thermo-modernisation programmes relevant for the DHC sector (Chapter 2). On the planning side political directions are given for big grid extensions, while upgrading and extension of smaller areas depends solely on economics for the utilities with the possible plausible degree of connection of consumers that can be stipulated. An integrated strategy for retrofitting of DHC on the national level is still missing. Therefore, a **list of solutions / actions / activities** that could support the development or retrofitting of DH networks was elaborated and can serve for inspiration to other countries with a similar DH market situation and legislative framework.

More specifically, in Poland, DH is already considered as solution by the Polish Government for the green transition process. The Chapter 3 “Proposed action plan” provides recommendations, which can be considered in the transition process. The solutions can be divided in three main areas, where the district heating is acting: production, distribution and end-use. Furthermore, a fourth area regarding policy and regulation can be considered, which does not directly act on the district heating network but can incentivise its development.

2. Current policy framework

2.1 Fuel use for district heating over the last 10 years

Hard coal is still the fuel that is used the most in Poland, even though its share in the production of heat has fallen by 5% over the past ten years. Reduced heating oil consumption has been noted as well, which is linked to its high price compared with other fuels. In fact, within the ten-year period, there has been a significant increase in natural gas consumption, which is expected to increase further, due to the increase in the number of co-generation systems powered by this fuel. The share of renewable fuels, especially biomass, in heat production increased to 6.3% and its share is growing steadily. It has increased by 2.5 times over a ten-year period. A further increase in the use of renewable fuels is expected due to the construction of new installations in District Heating and CHP plants, which will run 100% on biomass and will replace the coal and biomass (co-firing) mixture, that was normal practice in the last years.

Currently, one of the main problems in the heating systems is a continuous reduction in heat demand by end users. This is due to increased heat efficiency. Heat production in heat sources connected to District Heating in 2006 amounted to 421.1 PJ and decreased to the level of 392 PJ in 2011. At the same time the amount of heat supplied to customers connected to the District Heating network fell from 284.6 PJ to 240.4 PJ. Heat demand forecasts assume that an increase in the demand for heat is unlikely and that it will be a success for heating companies if they maintain current sales levels. During this period, the size of heating networks increased by about 5.7%. The increase in the size of heating networks and the decline in heat sales led to an increase in heat losses (the ratio of lost heat to the amount of heat delivered to the network) from 11.4% in 2006 to 12.4% in 2011 despite the fact that, in the last five years, many of the old parts of heating networks have been replaced with new ones, which are made using pre-insulated technology. One of the goals for heating companies is to optimise the operation of the network through proper hydraulic control of the system and by reducing heat losses. The next task, which has been carried out consistently over the years, is the modernisation of heat sources to increase the efficiency of production and the construction of new production installations based primarily on co-generation using gaseous fuels (natural gas) and renewable fuels (biomass).

The main potential of cogeneration lies in medium and small heating systems, in which only heat is currently produced. Opportunities and challenges for the heating sector are as follows:

- Change in production systems - the change from urban heating plants to CHP plants.
- Expanding activities: cooling, constructing local heat sources and «receiving installations' management services».
- Coverage of new buildings with system heat and the elimination of low emission devices (in areas with high levels of urbanisation), as well as the installation of hot water systems where they have not yet been present.
- A widespread use of waste as fuel.
- The construction of modern treatment systems (desulphurisation, denitrification, and undusting) to fulfil the standards of the IED Directive (Directive on industrial emissions 2010/75/EU).

2.2 National legislative framework having an impact on district heating

The most important legislation [5] on which Polish District Heating is based includes:

- Energy Law - the Act of 10 April 1997 together with a number of renewals, with the last one made in September 2011. This Act is the most important piece of legislation defining the relationship between the producer, the distributor and the customer of all utilities, including heat distributed through District Heating systems, including obliging municipalities to have plans for heat, electricity and gas supply.
- Energy policy until 2030 is a notice of the Minister of the Economy of 21 December 2009 on energy policy until 2030, laying down the priorities for the development of the energy sector, including the development of heating systems, as part of supporting the development of high-efficiency cogeneration.
- Energy Efficiency Act of 15 April 2011, which aims to improve energy efficiency and the promotion of innovative technologies that reduce the harmful effects of the energy sector on the environment. It sets out rules for the creation of energy efficiency audits. Projects that lead to reduced energy consumption can obtain white certificates, like the existing green certificates for renewable energy and the red certificates for the production of energy in co-generation, i.e. the generation of heat and electricity in the most efficient manner.
- Act on the management of emissions of greenhouse gases and other substances of 17 July 2009, which regulates the emissions rights market and together with • Act on the Trading Scheme for greenhouse gas emissions of 28 April 2011 and
- Law on accounting and budgeting system emissions of sulphur dioxide (SO₂) and nitrogen oxide (NO_x) emissions from large combustion plants (draft) provide a package of three regulations aimed at reducing the environmental impact. Their implementation will have a significant impact on the price of District Heat, and thus the development or lack of development of District Heating systems.

2.3 Existing driving forces and/or opportunities that favour an expansion of district heating

Thermo-modernisation programmes are implemented for residential, commercial and industrial premises and are at the same time connected to District Heating networks. For many years, work has been underway to eliminate the so-called low-emissions, i.e. replacing traditional furnaces used for heating houses (especially old residences) and small, inefficient coal-fired boilers.

The heat from these sources is replaced by network heat. For owners of premises, where heating is being changed in this way, special loans have been introduced, which can be repaid almost totally based on the savings that are generated. Another direction to promote system heat is the establishment of hot water installations where water is heated by a District Heating network and which in effect eliminates gas furnaces, which pose a potential threat of carbon monoxide poisoning.

Better use of heat by customers reduces the need for this energy carrier. Companies are therefore looking for new solutions. In addition to acquiring new customers, work is underway to optimise the operation of heating systems, which are designed to reduce heat losses and to improve the safety and comfort of supplying consumers. Upgrades of heating networks include the replacement of channel pipelines (heating pipelines installed in concrete casings) with pre-insulated ones, reducing unnecessary pipe diameters and the introduction of intelligent network management. Heat source upgrades include the construction of cogeneration units, coal-fuelled heating plants are modernised in the direction of biomass co-firing or are converted to peak heating plants with a working time of no more than 1,500 hours per year. In the future, during summer periods, in addition to the preparation of central hot water production, heating companies will be interested in fuelling central generators of chilled water like absorption chillers or building local central cooling networks. At present, for technical and economic reasons, the use of heating plants in cooling production in Poland is a marginal phenomenon.

A big boost for the development of District Heating based on cogeneration sources is being given by the change in the Construction Law of 7 July 1994 (Article 33 paragraph 2 item 6) introduced by the Law on Energy Efficiency of 15 May 2011. It includes, among other things, a provision imposing an obligation to connect buildings for which the expected peak thermal power of installation and equipment for the heating of these buildings is not less than 50 kW to the District Heating network. This obligation is valid when the object is located in an area where there are technical conditions for the supply of heat from the network as well as:

- in the source powering the heating network, no less than 75% of the heat throughout the calendar year is generated from renewable energy sources or the heat is cogeneration- or waste heat from industrial plants.
- Providing heat to the building from a heating network ensures higher energy efficiency than that of any other individual heat source which can be used to supply heat to this object.

2.4 Existing barriers to the expansion of district heating

The basic problem standing in the way of the development and modernisation of systems is a lack of financial resources. Heating, as a result of a long-term regulatory policy, has become unprofitable. In the years 2007 to 2011, the profitability of the industry was as follows: 2007: +2.26% 2008: -1.12%, 2009: -2.19%, 2010: -0.35%, 2011: -1.56%.

Positive changes in this area are possible provided market pricing methods are introduced and the current policy of rigid connection between current heat prices and so-called reasonable costs is abandoned.

Another important problem for the development of systems are the outstanding legal issues concerning the foundation of linear infrastructure on land belonging to a third party, which lead to a range of problems during the operation, modernisation and expansion of the network. Since a short time ago, it has been possible to build heating networks on premises belonging to third parties. Unfortunately, the law of transmission corridors, which should solve this problem, is still at the drafting stage. The Act envisages a comprehensive regulation for linear investments for the transmission of electricity, gas, liquid, vapour and information, clarifying the legal status in this field, simplifying procedures and regulating historical issues.

It is estimated that the length of the network in Poland demanding a legal status arrangement amounts to around 15,900 km whereas the cost of this reorganisation amounts to 6.5 billion PLN (approx. 1.45 billion €). Other difficulties in the development of heating systems are formal and legal barriers piling up in front of District Heating companies in the investment process (apart from the lack of ownership relations):

- The length of time needed for the localisation procedure,
- The length of time needed for the appeal procedure,
- A frequent lack of properties' land registries,
- Problems in determining the actual real estate possessors,
- A lack of actual maps, which makes it necessary for them to be prepared by the investor.

However, now, the main problem is the possibility of consistent appeals against published decisions, which prevents the completion of work.

A significant increase in the price of heat due to the need for the modernisation of dedusting systems and the construction of new installations for flue gas desulphurisation and denitrification, which will have to be created to meet the requirements of the European Directive on new standards of emissions from industrial sources, can be another barrier in the development of heating systems. An increase in heat prices will also result from the need to purchase CO₂ emission limits for district heat producers in sources of installed capacity exceeding 20 MW. This situation may result in the construction of small, individual sources of

heat (not covered by the ETS) and the resignation from the heat supply network of existing customers.

2.5 Green transition, green programmes, and green projects in Poland – by Poland’s National Fund for Environmental Protection and Water Management [6],[7],[8].

The National Fund for Environmental Protection and Water Management (NFEP&WM) which was established in 1989 as a result of the regime transformation in Poland, in cooperation with voivodeship funds for environmental protection and water management is the pillar of the Polish system of financing environmental protection. The basis of the National Fund’s operation as a State legal person is the Act on Environmental Protection Law.

In the last years, the green transition program defined by the EU is setting new requirements for Poland. Following the European directives, the government defined the targets of CO₂ emission reduction and conversion to RES as shown in Figure 1.

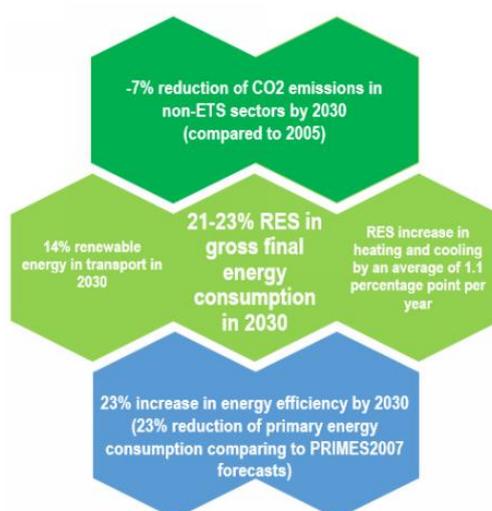


Figure 1. CO₂ emission reduction and RES introduction targets in Poland [3]

The CO₂ emission reduction was set to 7% for non-ETS sectors by 2030 (compared to 2005) with a total reduction of CO₂ emission by 30% by 2030 (compared to 1990) [4]. Furthermore, there will be a plan of increasing the RES share up to 21-23% of the gross final energy consumption by 2030, and focusing to the heating and cooling market, it is expected an average yearly increase of RES of 1.1%. These solutions will be followed by an increase in energy efficiency of 23% by 2030.

Focusing to the heating market, the Energy Policy of Poland until 2040 [4] assess that it is important to ensure energy planning at the level the municipalities and regions, since the heat demands takes place at local level. It is therefore fundamental to create a detailed heating map, which would facilitate planning and investments.

Customers should prioritize DH as heat supply source in areas where this is possible and efficient, while alternative solutions can be considered only if they are “greener” than the DH connection. The use of DH heating will be incentivized by extending the actual connection obligation to all buildings, where the network is available. Furthermore, a new market model will be developed, so that heat prices will be acceptable to customers [4].

The technical development of district heating will be related to the development of co-generation by converting the power plants also to heat plants. In this process, a larger share of RES will be considered, such as biomass or the use of waste. Lastly, a modernization and expansion of the existing networks is required, with the integration of heat storage and smart city solutions, so that a larger number of customers can be connected [4]. The introduction of

RES in the electricity production system will also give the possibility to phase out old coal boiler by replacing them with heat pumps.

As mentioned, part of the green transition strategy is the energy efficiency improvement to reach lower energy costs. Poland has the target of 23% energy savings within 2030 (compared to 2005). The potential of implementing energy savings solutions involve many sides of the economy. For the district heating sector, it is not only important to upgrade the old production system, replacing coal boiler, but it will be necessary to improve the distribution network to reduce heat losses as well as consider a renovation plan of the existing building stock, which can help the optimization of the DH systems.

Poland absolutely needs green investments as they are going to help drive the economy, create new jobs and strengthen the competitive advantage of our domestic businesses on the international markets.

Following that path will give us a chance to develop and is going to bring us specific economic benefits. That is why in this year alone, the Ministry of Climate will utilise, for instance, the EU, Norway and national funds, and put PLN 7.8 billion (approximately €2 billion) towards facilitating green investments.

The funds will be used to implement projects related to energy transformation, improving air quality, thermal upgrading of buildings, development of electromobility, investments in RES micro-installations or solutions related to mitigating the effects of drought.

The concept of “Just Transition” – ensuring environmental protection without slowing down the economy and with due respect to jobs – was introduced by Poland.

the Recovery Fund proposed by the European Commission of an estimated total value of €750 billion which aims, among others, to facilitate economic growth based on green investments.

From the perspective of the transformation of the energy sector, the key role will be played by the increase of the Just Transition Fund from €7.5 to 40 billion, as Poland will become one of its key beneficiaries.

The Polish Green Investment Scheme (GIS) guarantees the "greening" of financial resources generated from the sale of AAUs, creating an institutional structure to ensure the effective management of the scheme and that funds are used for purposes directly or indirectly related to climate protection

The National Fund for Environmental Protection and Water Management (National Fund) acts as the Operating Entity for the GIS. Within the National Fund, a special Climate Account is created for resources stemming from AAU sales transactions.

Following founding opportunities, among many others emerging, will play a key role in Poland's green transition:

- **The Fund for Refurbishment and Repair of the housing stock.** Poland has an effective measure promoting energy efficiency in buildings called the Fund for Refurbishment and Repair. It is financial support in the form of cheap loans with a so-called refurbishment surplus, that is a repayment of the interest rates that can be used to a certain percentage of the investment value. The surplus can be as high as 21%, when refurbishment and investment in RES take place simultaneously, or it can rise to 50% when a block of flats is refurbished. The measure applies to all types of housing stock: single, multifamily and communal housing. To access a loan, housing must carry out an energy audit and renovation must lead to at least 25% in energy savings. The scheme is managed by a BGK–Bank Gospodarstwa Krajowego – and is funded by the state.
- **The Clean Air (Czyste Powietrze) renovations scheme.** Clean Air is a nation-wide public grant scheme to support building renovations, replacements for

polluting heat sources and small-scale PV. It aims to address the air pollution problem by funding the replacement of polluting coal boilers in more than 3 million single-family homes in Poland over ten years.

- **Co-financing Programme for Photovoltaic Micro Installations "My Electricity" (Mój prąd).** On 30 August 2019, the National Fund for Environmental Protection and Water Management started the "My Electricity" priority programme. This is a grant scheme to support the development of renewable energy, specifically prosumer photovoltaic (PV) rooftop arrays.
- **Fund for Low-emission Transport.** In 2018, Poland established a new fund for the development of infrastructure and vehicles powered by alternative fuels. The Fund has an internal source of financing from excise taxes, energy fees and from emissions fees imposed on fuel producers. The fund is managed by the National Fund for Environmental Protection and Water Management. In June 2020, a few supporting schemes for the purchase of private electric cars, light commercial vans and taxis were issued under the fund.

Polish Energy Policy 2040



Figure 2 Polish Energy Policy 2040 with three main pillars.

Poland's emissions levels vs GDP

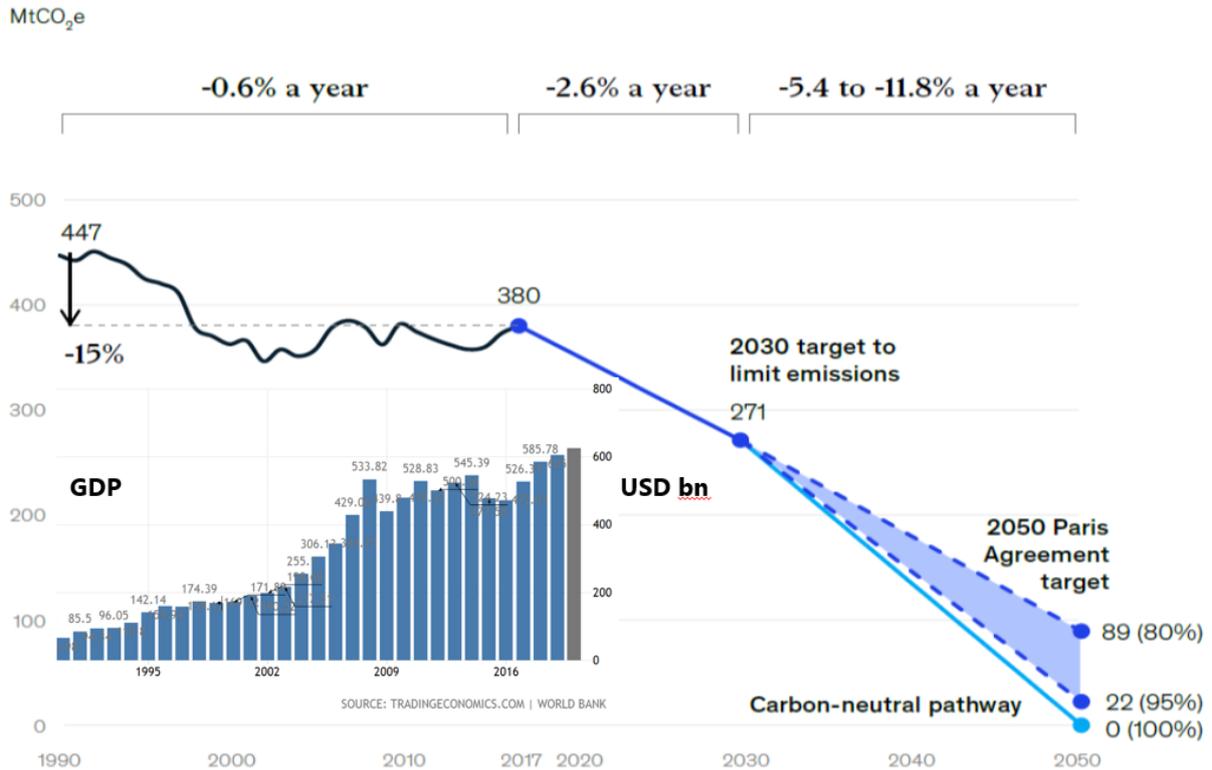


Figure 3 Poland's emissions levels vs GDP.



The National Fund in numbers



30 years of experience in financing environmental & energy projects

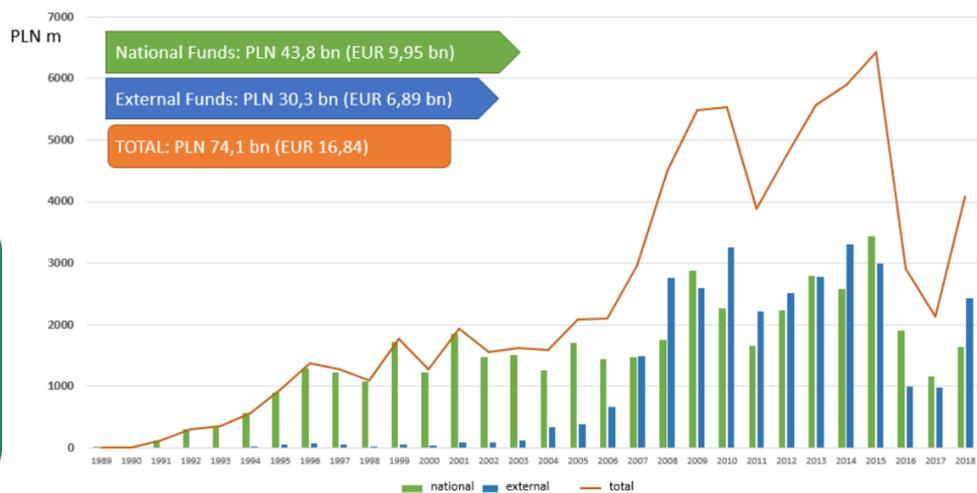


Figure 4 Historical and future break down of numbers of National Fund in Poland.

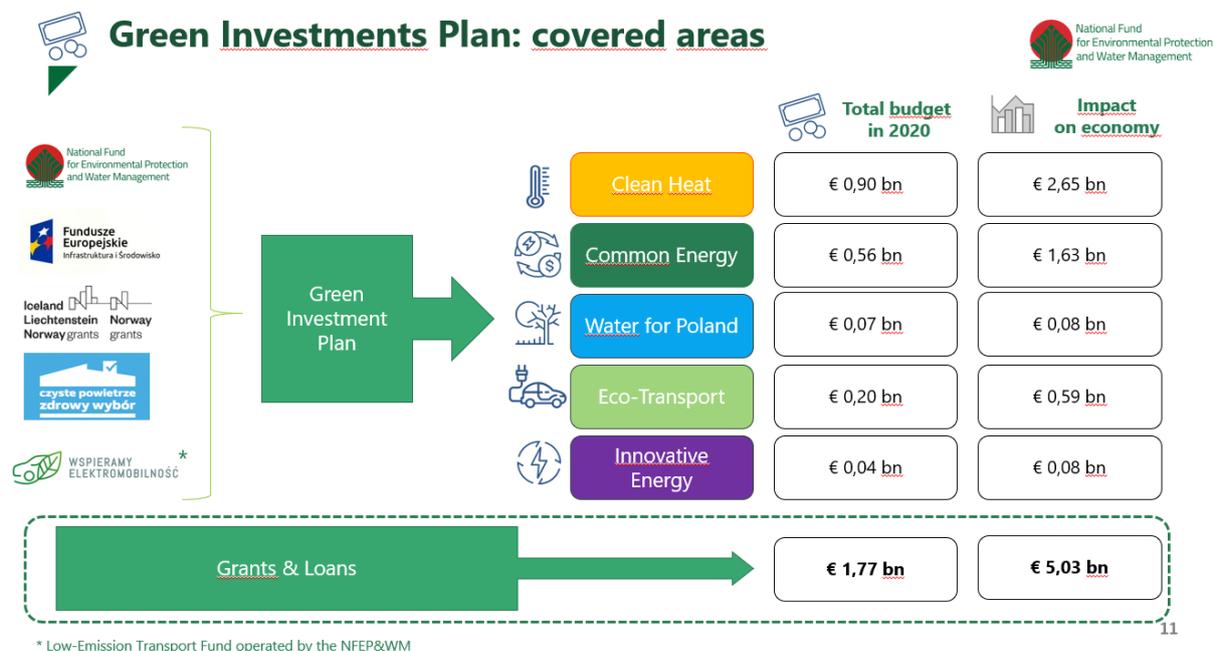


Figure 5 Polish green investment plans broken down by main areas.

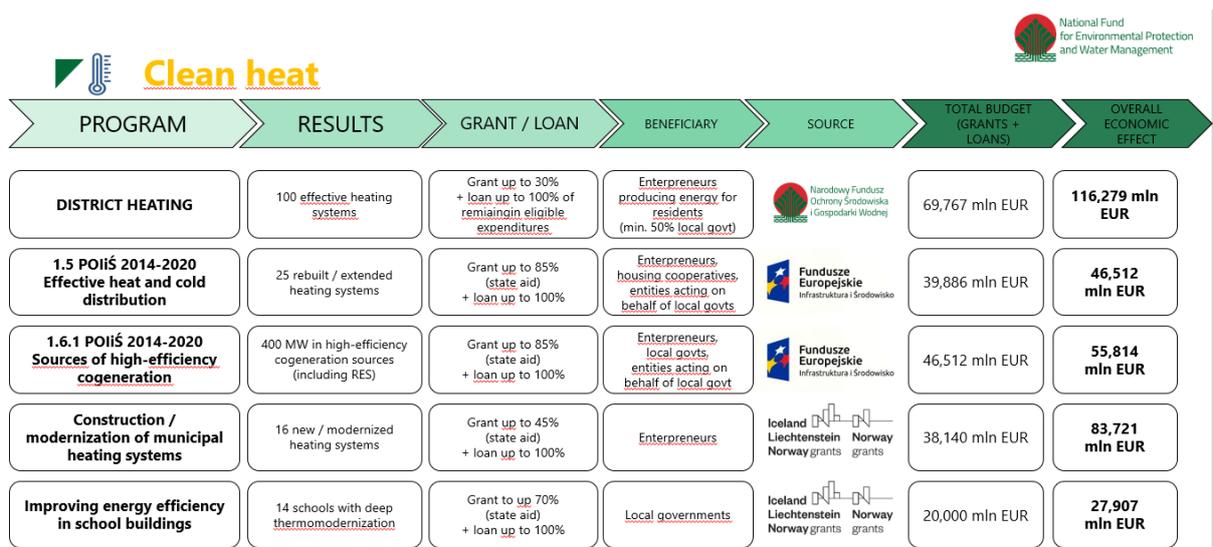


Figure 6 Clean heat programme break down, including financing sources.

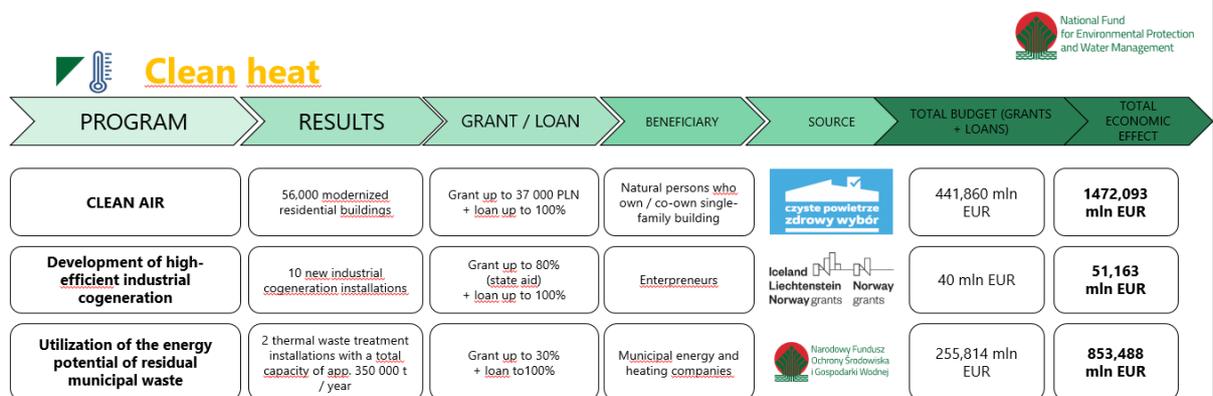


Figure 7 Clean heat programme break down, including financing sources.

3. Proposed action plan

The goals defined by the Polish Government to implement the green transition require actions in many different sectors of the entire economy. Energy production, distribution and final use of both electricity and heat will play an important part in this transition. District heating is known as an efficient way to cover the heat demand and as it is planned by the Polish Government, where possible, DH must be considered as primary heat source. What is important in Poland, is that the old and obsolete DH systems already available in Poland will be gradually renovated and expanded to boost the green transition and help the process of phasing out old and inefficient coal heaters.

As it was mentioned, DH is already considered as solution by the Polish Government for the green transition process. The following paragraphs provide recommendations, which can be considered in the transition process. The solutions can be divided in three main areas, where the district heating is acting: production, distribution and end-use. Furthermore, a fourth area regarding policy and regulation can be considered, which does not directly act on the district heating network but can incentivise its development.

The proposed action plan can be considered by different actors that are involved or related to the heating sector, such as private or public companies and organizations, municipalities, and government.

However, considering that many systems in Poland are old and outdated, the implementation process must be organised gradually with a long-term perspective.

3.1 Production

- Increase efficiency of the production side, by introducing modern CHP plants and large-scale heat pumps that exploit renewable heat sources.
- Introduction, development, and expansion of renewable sources such as biomass, solar thermal energy, geothermal energy, and biogas. Photovoltaic systems and wind energy will also play an important role for increasing the penetration of renewable energy sources in the heating sectors, due to the larger use of electricity on the production side thanks to the use of heat pumps.
- Enhance energy flexibility on the production side by integrating the electricity grid in the heat production and introducing a larger share of thermal storage in the network.
- Implement use of waste heat from industrial processes (waste-to-heat potential).

3.2 Distribution

- Reduction of losses in the distribution network by introducing a range of solutions to control and optimise the heat delivery. New digital tools can help the DH companies in lowering the temperatures in the network and achieving lower heat losses. Additionally, old networks should be refurbished in case the insulation properties are deteriorated. Lastly, new and optimized substations can be considered to improve the networks.
- The previous solutions can lead to a reduction of distribution temperatures.
- Optimisation and expansion of the network must be considered to ensure the heat supply of the larger number of customers that will be connected and avoid bottlenecks in the network.

3.3 End-use

- The building renovation will have an important role on the introduction of renewables in the DH network as well as on the optimization of the DH network. Refurbished buildings will require lower energy and at the same time allow to reduce the supply temperature delivered by the DH network.
- Through digitalisation and consumer empowerment, the final users are made aware of the energy use at their building, which can lead to a reduction of heat demand.

3.4 Regulatory framework, taxation and legislation

- Reduction of heat consumption can be achieved by introducing new regulations that set a guide for building renovation which includes new solutions for the digitalization of the built environment, through smart metering and the use of apps.
- Increasing the awareness and acceptance of end-user can be achieved through campaigns on national, regional, or local level. Increasing awareness of professionals, e.g. installers and real estate developers can be done through education.
- Taxation can be considered for the technologies that should be phased-out. In that case, the users are incentivised to implement new solutions that are economically convenient.
- On the other hand, funding and support can be given to those technologies that need to be expanded.
- Heat planning/zoning should be considered on national, regional, and local level to define a better action for the transition towards a more sustainable heating sector. Furthermore, the heat mapping will also help in the decision-making process, so that it is possible to highlight the areas where it is more convenient to expand or introduce DH solutions.

4. Promotion of the action plan and recommendations

The document was shared with representatives of Veolia Energia Polska, who provided their comments and confirmed that the recommendations rightly point out the main and general direction to DH transformation in Poland.

UpgradeDH action plan was compared with the Strategy for district heating – Clean heat 2030 prepared by Forum Energii (the Polish think tank). Most of the main recommendations appear to be in line with the UpgradeDH action plan.

From the document, following recommendations were identified based on an assumption that an Effectivity Scenario would be implemented.

Effectivity scenario assumes 32% use of RES as well as 30% CO₂ emissions reduction by year 2030 and minimum of 60% use of RES and 80% CO₂ emissions reduction by year 2050.

In order to achieve the latter following is recommended:

1. 80% reduction of usage of non-RES sources in buildings by 2050 – actions would be derivatives of thermo modernization of dwellings as well as increased use of RES in main energy distribution channels.
2. 32% of RES by year 2030 – in order to achieve that goal, continuation of already started decarbonization actions of both heating and cooling sectors should bring minimum of 80% reduction in CO₂ emissions in 2050 compared to levels from 2016.
3. Until 2030 all dwellings with low emission sources shall be sourced by district heating, gas or biomass – and in longer perspective with more RES sources as well as ongoing “electrification” of district heating networks.

4. Modernization of District Heating systems – intelligent energy management and maximization of use of diversified primary energy sources in sync with closed loop market strategy.
5. Implementation of effective financing mechanisms, both EU and domestic, in order to have energy transformation on track.
6. Development of action plans for energy consumers, which sole goal is to improve their energy usage effectiveness.
7. Implementation of aid programs aimed to most poor society levels.
8. Implementation of educational programs which shall build and strengthen ecological awareness as well as how to use the energy in a best effective manner.

For more information in Polish language, please consult the report “Strategia dla ciepłownictwa_Czyste ciepło 2030” [9].

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- [9] Forum Energii “Strategia dla ciepłownictwa_Czyste ciepło 2030” (2019).