ENERGY EFFICIENCY IN POLAND
2015 REVIEW

SINGLE-FAMILY HOUSES
MECHANISM TO SUPPORT MODERNISATION

WHAT SHOULD THE MECHANISM SUPPORTING MODERNISATION OF SINGLE-FAMILY HOUSES INVOLVE?

WHAT KIND OF HOUSES ARE HEATED WITH COAL?

HOW IS THERMAL MODERNISATION HANDLED IN OTHER COUNTRIES?

WHAT IS THE ENERGY PERFORMANCE OF NEW SINGLE-FAMILY HOUSES?

CAN BANKS BECOME INVOLVED IN SUPPORTING MODERNISATION?

Institute of Environmental Economics

Efficient Poland

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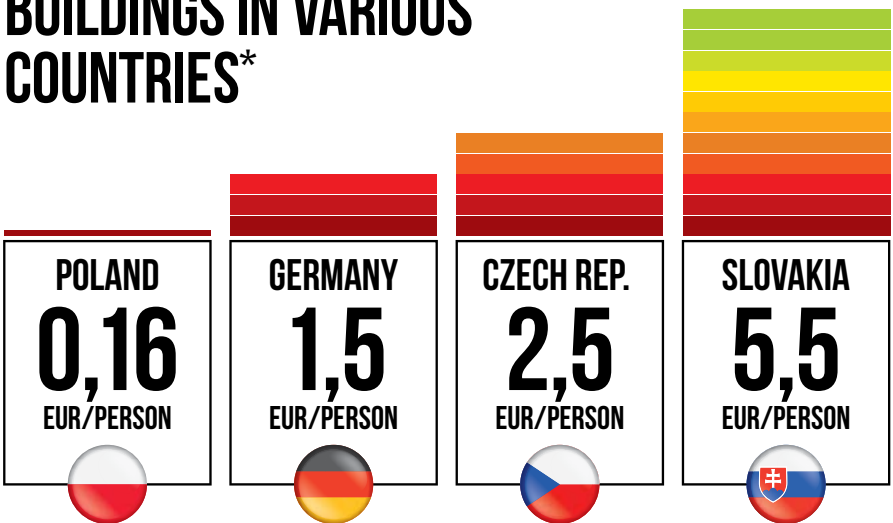
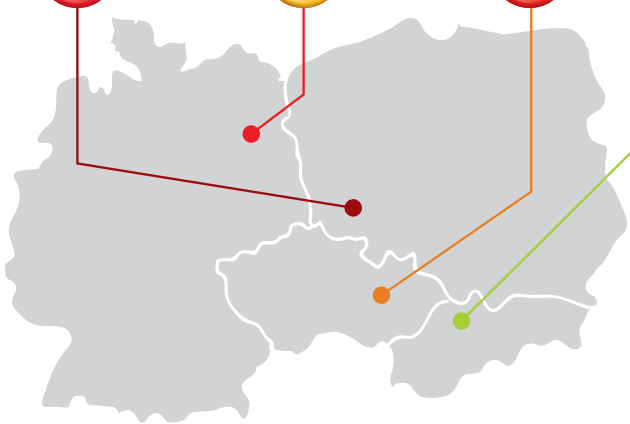
FUNDS SPENT ON IMPROVING ENERGY EFFICIENCY OF SINGLE-FAMILY BUILDINGS IN VARIOUS COUNTRIES*





SUPPORT PROGRAMMES AVAILABLE

GERMANY
KFW ENERGY EFFICIENCY PROGRAMME SINCE 1996

CZECH REPUBLIC
NOVA ZELENA USPORAM SINCE 2009 (EARLIER KNOWN AS ZELENA USPORAM)

SLOVAKIA
PROGRAMME STARTING IN 2016

POLAND
PROGRAMME STARTING IN 2016

* the infographic presents the amount of subsidies aimed at improving energy efficiency of single-family buildings calculated on a per capita basis. Czech Republic (2014) Nova Zelena Usporam, Slovakia (2016), Poland (2016)**, Germany (2013) KfW Energy Efficiency Programme.

** RYŚ, the subsidy programme to be run by the National Fund for Environmental Protection and Water Management, planned budget of EUR 30 million for a period of 5 years.

Source:
- h.p://www.mindop.sk/index/index.php?ids=36301&prm2=180176&sword=&date[od]=1&date[om]=1&date[or]=2005&date[dd]=09&date[dm]=10&date[dr]=2015
- h.p://ec.europa.eu/eurostat/sta©s©cs-explained/index.php/File:Demographic_balance,_2014_(thousand)_YB15_II.png
- h.p://www.nfosigw.gov.pl/o-nfosigw/aktualnosci/art,733,program-termomodernizacji-polskich-domow.html

INTRODUCTION

MAREK **ZABOROWSKI**
INSTITUTE OF ENVIRONMENTAL ECONOMICS

In this year's edition of the Review we present a series of analyses relating to single-family buildings. A key lesson stemming from these analyses is **the necessity to develop an effective strategy for modernising single-family buildings**, and to make it an integral part of the National Action Plan for Energy Efficiency and the Strategy for the Modernisation of Buildings, which has to be developed by the Polish Government every three years (the 2015 strategy did not provide for any actions addressing single-family buildings)*.

We focus on this sector of buildings for a number of important reasons.

* http://www.cire.pl/item,95820,1-,0,0,0,0,0,organizacje-branzowekrytykuja-rzad-za-krajowastrategie- wspierania-remontow-imodernizacji-budynkow.html

10 REASONS TO DEAL WITH SINGLE-FAMILY BUILDINGS

1. 50% of Poles live in single-family buildings. This type of dwelling is more common among people from villages and small towns, with lower income and in the less affluent regions of the country.
2. Owners of single-family buildings have not received any support from the state so far. This results, among other things, from the erroneous conviction that these people are well-off, as well as from the difficulties in developing and implementing support schemes for the highly dispersed group of beneficiaries with relatively low financial needs.

3. Single-family buildings, especially those erected in the 1960s, possess significant potential to reduce energy consumption. At the same time, however, they need refurbishment (due to decapitalisation).
4. Owners of single-family buildings (especially the poorest ones) need the state's support just like owners of flats in housing cooperatives or in blocks of flats built of large pre-fabricated concrete panels needed it in the past. State support has for many years been provided only to residents of multi-family buildings, who are usually richer and live in cities. This approach is clearly erroneous and unfair.
5. Winter smog in Poland is mainly caused by the burning of solid fuels in primitive and inefficient household heating appliances, most of which are installed in single-family buildings. Improving thermal insulation of buildings and replacing heat sources with more air-friendly ones will significantly contribute to improving the quality of air in Poland.
6. The single-family housing sector has the greatest potential for innovation in the field of heating based on modern combustion of high quality solid fuels.
7. Investments into single-family housing contribute to the development of small business (refurbishments in this sector are usually carried out by small companies).
8. The state's involvement in the refurbishment of single-family buildings may help reduce the shadow economy (support from the state can only be provided to registered and taxed investments).
9. Owners of single-family buildings are often creditworthy enough to take a loan that would allow them to carry out an extensive refurbishment. It is necessary to encourage them to take socially optimal decisions (and to support economically sound actions to reduce energy consumption).

10. Refurbishing single-family buildings is one of the cheapest ways of reducing greenhouse gas emissions. Moreover, it is in no way socially controversial.

The assessment of the condition of single-family buildings presented in this year's report clearly shows that modernisation of single-family houses should become a political, economic, social and environmental priority in Poland.

POLITICAL PRIORITY

The problem of single-family building modernisation affects the poorer half of the population. Ignoring this fact means a deliberate disregard for the interests of 50% of the Polish population.

ECONOMIC PRIORITY

Support schemes for promoting the modernisation of single-family buildings contribute to the development of small business and, even more importantly, in the areas where such development is needed most. They also result in increased state budget revenues from taxes. The experience of the neighbouring countries, such as Germany or Czech Republic, show that each euro invested in the modernisation of single-family buildings "returns" to the budget at least doubled.

SOCIAL PRIORITY

Statistically speaking, residents of single-family houses are usually less well-off, live in rural areas and have more children than the remaining part of the population. By reducing energy consumption which, in consequence, helps reduce energy bills, it is possible to improve the living conditions of the poorer citizens who will then be able to spend more money on other things and cease ineffective burning of waste and low quality coal.

ENVIRONMENTAL PRIORITY

Modernisation of single-family buildings may lead to the complete elimination of winter smog from Polish cities, towns and villages. This refers to very high concentrations of particulate matter, including fine particles that penetrate into the lung alveoli and blood, as well as of the mutagenic and carcinogenic benzo[a]pyrene, whose concentrations in Poland are several times above the permissible levels. It is worth stressing that the problem of smog does not only affect large cities such as Kraków, Warszawa, Wrocław or the urban area of Katowice, but also small towns and villages, including health and holiday resorts such as Zakopane.

Another important argument in favour of modernisation of single-family buildings is the fact that it is a simple, effective and socially accepted way of combating climate change by reducing the consumption of thermal energy, which will lead directly to a reduction in CO_2 emissions.

The National Action Plan for Energy Efficiency along with the Strategy for the Modernisation of Buildings (constituting Annex 4 to the Plan) contain a description of actions taken by various government departments and state institutions. Unfortunately, as regards energy efficiency of the existing building stock, no common strategy that would prioritise objectives for the next few years has been developed. **From the social and environmental point of view (the latter referring to air quality and climate protection, as well as the use of renewable energy sources), the top priority is to set up a sound national programme for the single-family building sector.** As far as cities and urban areas are concerned, there should be a particular focus on the air pollution problem, whereas in rural areas additional attention should be paid to the local use of renewable energy sources. In order for such a programme to be put in place, active participation on the part of all ministries and harmonisation of their actions are a must – for example, harmonisation of actions relating to the funding from a number of available sources managed by various ministries.

THIS YEAR'S REVIEW

At the beginning of this year's review we present the assessment of the energy performance of the existing coal-heated single-family houses. We have decided to analyse this type of buildings more closely as they constitute the vast majority of the single-family building stock and the main source of particulate matter and polycyclic aromatic hydrocarbon emissions in Poland. The results of the assessment show that a comprehensive instrument must be implemented urgently to help house owners have their heat sources replaced and energy efficiency of the buildings in which they live improved.

Apart from the analysis relating to the existing buildings, we also present a report prepared in cooperation with BuildDesk on newly constructed single-family buildings. According to the report, investors are more and more willing to use non-standard technologies to increase energy efficiency of buildings, whereas constructors and architects are learning how to design such buildings. Unfortunately, the pretence of using biomass for heating purposes is still maintained, which allows investors to indicate the desired primary energy value in the required documentation only, but does not contribute to any real improvement in terms of reducing its consumption.

We have also analysed the barriers to effective modernisation of single-family buildings and the features that the support scheme for the single-family building sector should possess as well as the functions it should perform. Our analysis shows that such an instrument should provide access to both subsidies and loans. It should, therefore, take on the nature of a hybrid instrument. The instrument should be characterised by simple subsidy and loan procedures. Both the instrument itself and attitude change must be promoted. It is essential that heat source replacement is taken into account when planning modernisation (this refers to households using old and inefficient solid fuel boilers, stoves and furnaces).

This year's review also presents the opinions of bank representatives on what features should characterise the instrument to improve the energy efficiency of single-family houses so that banks are willing to take part in its implementation as well. Such a solution is successfully used in Germany where the support is provided through the network of KfW bank branches.

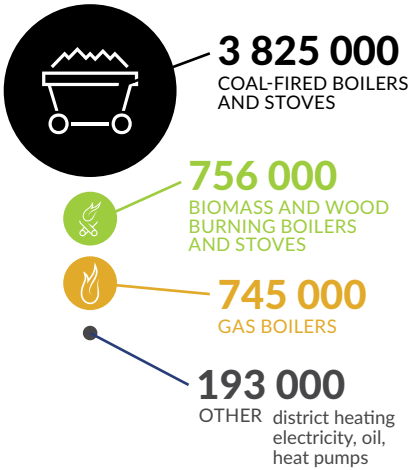
ENERGY PERFORMANCE OF SINGLE-FAMILY BUILDINGS HEATED WITH COAL
SUMMARY AND COMMENTS ON THE RESEARCH

ANNA **DWORAKOWSKA**
INSTITUTE OF ENVIRONMENTAL ECONOMICS

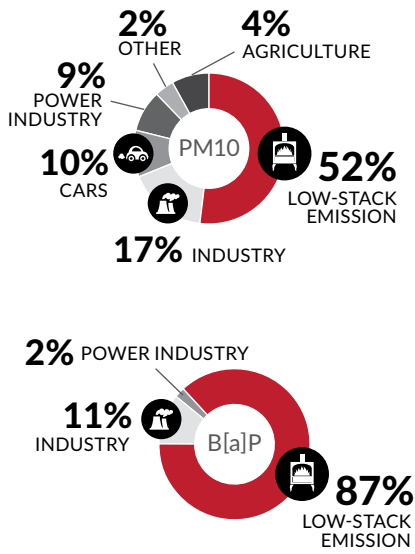
The latest edition of our quantitative research focuses on single-family houses heated with coal boilers and stoves. We decided to examine this particular group of buildings more closely as it constitutes a dominant segment among single-family houses – as many as 70% of single-family buildings, i.e. 3.8 million houses, are heated with coal-fired boilers or stoves. In this respect, Poland is totally unlike any other country in Europe. Unfortunately, this situation has a highly negative impact on the quality of Polish air. Poland has the most polluted air in the whole European Union – the main problem we are facing concerns too high concentrations of particulate matter and benzo[a]pyrene, which is known to be highly carcinogenic. We have been violating air quality standards for particulate matter, set by the national and EU legislation, for 10 years. The limits for annual benzo[a]pyrene concentrations are exceeded by up to 1000%. Low-stack emission, i.e. emission from household heating appliances (mainly coal-fired stoves and boilers), is the main source of particulate matter and benzo[a]pyrene emissions.

Low-stack emission: the main source of air pollution in Poland

Heating appliances used in Poland:



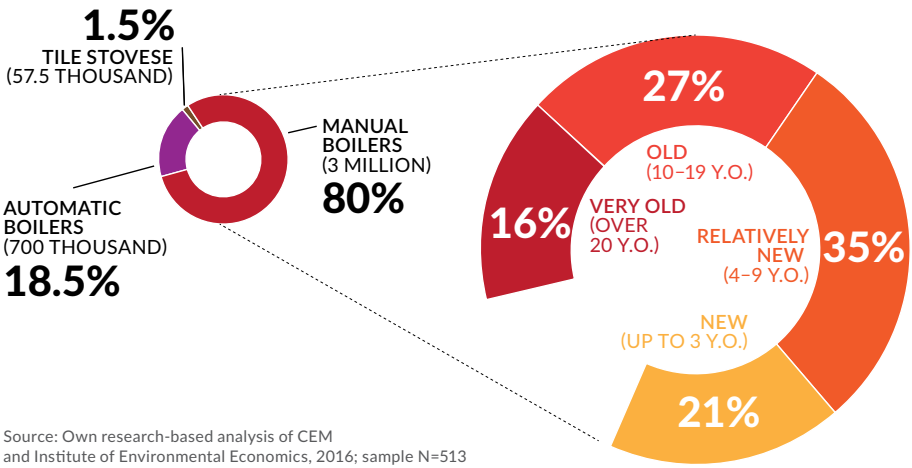
Main sources of particulate matter and benzo[a]pyrene emissions:



Source: Own research-based quantitative analysis (sample N=500 single-family houses); Energy Efficiency in Poland – 2013 Review, Institute of Environmental Economics, Kraków 2014 and data provided by the National Centre for Emissions Balancing and Management

The problem lies not only in the widespread use of coal-fired stoves and boilers, but most of all in their quality. The results of the analysis show that Poles mainly use manually-fed boilers (nearly 80% of all boilers) and almost half of these devices are over 10 years old. This means they are worn out and inefficient, i.e. they use more coal than modern boilers to generate the same amount of heat. Secondly, they are responsible for high emissions of air pollutants. Manually-fed boilers, not without reason nicknamed “smokers”, emit significant amounts of particulate matter and benzo[a]pyrene.

Coal-fired boilers used in Polish homes



Source: Own research-based analysis of CEM and Institute of Environmental Economics, 2016; sample N=513

Nearly 1.5 million boilers used by owners of single-family houses are old manually-fed devices. The fact that so many single-family houses are heated with inefficient, technologically outdated and emission-intensive devices must be regarded as a serious development gap and, on the other hand, a huge modernisation challenge.

The construction of a boiler has an impact on its efficiency and emission intensity – automatic devices are generally more efficient and they emit much lower amounts of such air pollutants as particular matter or benzo[a]pyrene. These parameters are also affected by the age of the device – the older the boiler, the more pollutants it emits and the less efficient it becomes. A similar correlation can also be seen when analysing the quality of fuel – the higher the quality, the better the efficiency and lower emission intensity. The table below shows the efficiency, PM and benzo[a] pyrene emission values for manual and automatic boilers, as well as for boilers meeting the requirements of the Commission Regulation on ecodesign*. PM and benzo[a]pyrene emission values for manual boilers are much higher than for automatic ones. This in particular refers to older devices.

* Commission Regulation (EU) 2015/1189 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel boilers

Efficiency and emission levels of coal-fired boilers with a nominal heat output <20 kW

Type of boiler	Efficiency [%]	Total particulate matter [mg/m^3]	Benzo[a]pyrene [µg/m^3]
Manual – old model	60–45*	420–1120*	430–630*
Manual – new model	78–65*	240–420*	270–490*
Automatic	85–78*	100–130*	100–140*
Manual - Ecodesign	75	60	80
Automatic - Ecodesign	75	40	20

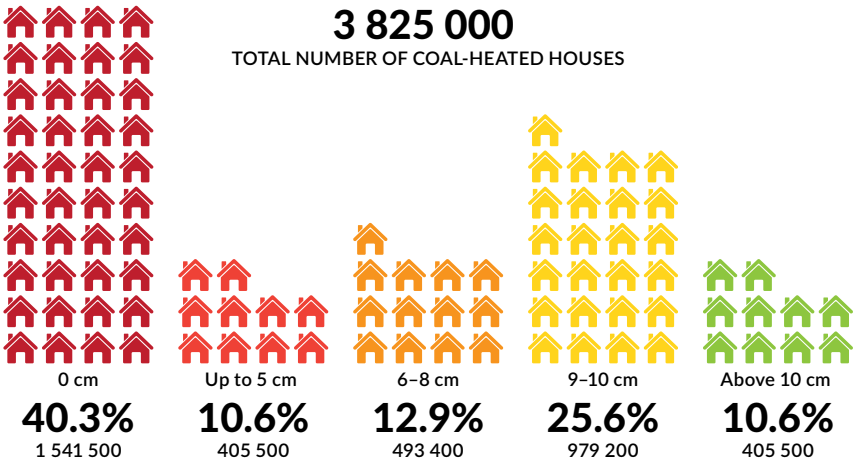
* Depending on the quality of coal – lower value for nut coal (calorific value 24 MJ/kg, moisture content <15%), higher value for poor quality coal (calorific value 21 MJ/kg, moisture content >15%)

Source: Guidelines and database of indicators for calculating the level of emissions from low-power solid fuel boilers, Krystyna Kubica, Robert Kubica, Institute of Environmental Economics, Kraków 2015

The situation is no better when it comes to the heating systems – in nearly 50% of coal-heated houses the radiators are not fitted with thermostatic valves. With an outdated heating system it is practically impossible to adjust the temperature and to save heat. Thermal insulation of single-family buildings heated with coal is also unsatisfactory. In as many as 40% of those buildings (over 1.5 million) the walls are not insulated at all and in 10% of them the thinnest possible insulation layer was used (up to 5 cm). Thicker insulation (more than 10 cm) was used only in 10% of the buildings – most of which include newer houses erected after the year 2000. There is also a strong correlation between the household income and the energy performance of buildings – the lower the income, the poorer the thermal insulation.

The analysis of the above data clearly shows that energy performance of coal-heated houses is highly unsatisfactory. Most of these houses are poorly insulated against heat loss or not insulated at all, in many cases no thermostatic valves are fitted to the radiators. Heating such buildings requires large amounts of thermal energy. Therefore, it is not surprising that people living in them choose the cheapest source of heat – coal. The problem is aggravated by the fact that coal is burnt in inefficient manual boilers, which leads to even greater coal consumption.

Thermal insulation thickness in coal-heated houses



Source: Own research-based analysis of CEM and Institute of Environmental Economics, 2016; sample N=513

As many as 3 million single-family houses in Poland are heated with manually-fed boilers in which all kinds of fuels are burnt, including waste and poor quality coal. This causes serious problems with air quality in our country. **Without a truly comprehensive modernisation of heat sources, the quality of air in Poland will not improve. Heat source replacement should be accompanied by the implementation of instruments supporting thermal modernisation of houses in order to reduce the demand for thermal energy.**

The results of our analysis show that owners of single-family houses are rather reluctant to take thermal modernisation loans. This provides an important indication as to the future of such programmes as KAWKA or RYŚ*. Although currently (at the beginning of 2016) they are based on a system of state subsidies, the possibility of transforming these programmes into credit instruments (loans with low interest rates) is now being considered. If such transformation took place, practically no support would be provided by the state for the replacement of heat sources and thermal modernisation of houses because loans, even those with low interest rates, are much less popular than subsidies. As shown by the results of our latest survey, 71% of

* "KAWKA" is a subsidy programme for coal stove replacement run by National Fund for Environmental Protection and Water Management in Poland. RYŚ is a planned mix instrument for supporting thermal modernisation of single-family houses, based on preferential loans and subsidies

respondents prefer to finance thermal modernisation works with cash and only 20% of them consider taking a loan. Without a comprehensive state subsidy system designed to encourage the replacement of old boilers and thermal modernisation of single-family houses, their owners will not take any action in this regard. This applies particularly to poorer people who will simply lack sufficient creditworthiness to be granted a loan.

It is also worth stressing that as many as 76% owners of coal-fired boilers are not planning to have these devices replaced in the next two years. **Changing the form of support from subsidies to loans or completely removing such support would lead to an increase in the number of people who continue using old coal-fired boilers.** This little interest in boiler replacement despite the availability of subsidies clearly calls for the need to establish emission standards for low-power boilers used in a given area. Resolutions

establishing such standards can be passed by regional councils on the basis of the amended Environmental Protection Act (Article 96, commonly referred to as the "anti-smog amendment"). If the standards were established, people wishing to continue heating their houses with solid fuels would be obliged to have their old boilers replaced with new ones meeting the tighter emission specifications. **The above data clearly suggest that subsidies, and much less loans, are not enough to encourage people to replace "smokers" with modern and more air-friendly heat sources. In order to alter the current state of affairs and remove old, inefficient and emission-intensive solid fuel boilers relevant regulations in this area must be introduced.**

The improvement of air quality in Poland will require an extensive modernisation in the sector of single-family houses focused on heat sources, heating systems and building envelope insulation. **Given the number of houses that should be covered by these measures, it is the largest modernisation challenge for the years to come.** Is it possible at all? Is the state able to support such an extensive modernisation scheme? We could put this question another way though. Can Poland afford to do nothing about air quality given the fact that around 45 000 people in our country die prematurely every year as a result of air pollution?* Can we continue to ignore the problem facing at the same time the risk of paying huge financial penalties that may be imposed on us by the European Court of Justice for violating air quality standards? Should we turn a blind eye to the fact that the vast majority of single-family houses in Poland waste energy and are heated with inefficient air polluting devices, which must be considered a significant development gap? Although the elimination of low-stack emission is a serious challenge, Poland cannot ignore this problem anymore.

* Cost Benefit Analysis of Final Policy Scenario for the EU Clean Air Package, European Commission 2013

ENERGY PERFORMANCE OF SINGLE-FAMILY BUILDINGS HEATED WITH SOLID FUEL BOILERS

REPORT FROM RESEARCH
ŁUKASZ **PYTLIŃSKI**
CEM MARKET AND PUBLIC OPINION RESEARCH INSTITUTE

INFORMATION ABOUT THE RESEARCH

Research date

The research was conducted by the CEM Market and Public Opinion Research Institute and the Institute of Environmental Economics on 2-25 February 2016.

Research methodology

The research was conducted by means of the CATI telephone interview technique. The interviews were carried out by trained interviewers from the CATI centre located in CEM's premises in Kraków.

Sample group

513 adult Poles, owners of single-family houses heated with coal-fired boilers, were interviewed. The sample group consisted of the people responsible for making technical decisions in their households (due to the specific character of the research, most of the respondents were male).

The respondents were randomly selected from databases with fixed line and mobile telephone numbers. The structure of the sample was controlled according to building location (urban/rural areas) and building age.

Research tools

The research was based on a standardised interview questionnaire, composed mainly of closed questions.

INTRODUCTION

Single-family buildings heated with coal-fired stoves and boilers constitute the largest segment of the housing sector in Poland. The number of such houses in our country runs into around 3.5 million, which accounts for nearly 70% of the total housing stock. Almost **one in three Poles** lives in a building of this type. Such a high share of houses heated with local coal-fired sources has a significant impact on the quality of air in Poland.

As shown by the results of our research, **large-scale modernisation investment is necessary** in this segment, which refers both to heat source modernisation and retrofitting of buildings, and especially to works that fulfil the thermal modernisation objectives. The data indicate that old and inefficient manually-fed coal-fired boilers are used by one in three single-family houses in the analysed group. It can be estimated that **in order to achieve a significant improvement in air quality, even several million old and technologically outdated coal-fired boilers will have to be replaced in the nearest future with devices meeting the modern emission standards**. It must be stressed at the same time that without a strong intervention by the state, providing for comprehensive legislative, economic and social measures, it will not be possible to carry out such large-scale modernisation. Relying only on bottom-up renovation processes carried out by single-family house owners at the

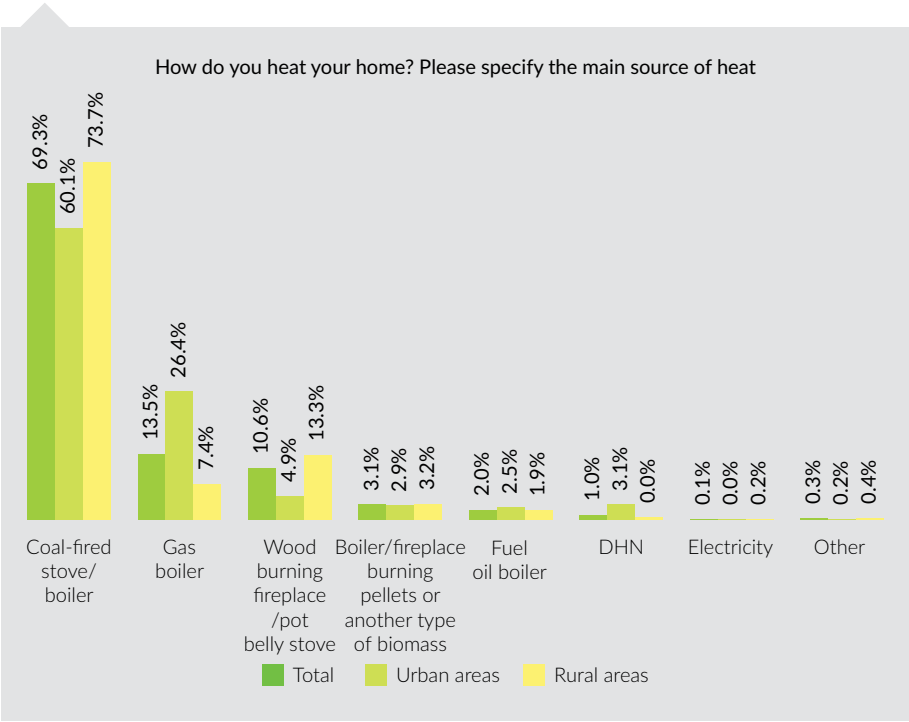
current pace would delay the achievement of the objective pursued for an unspecified period of time.

Encouragingly, according to the results of our research, the number of coal-fired boiler users who become aware of the fact that this source of heating has a significant adverse impact on the quality of air in their area is increasing.

THE STRUCTURE OF HEATING SOURCES

The research conducted in 2014 on a randomly selected group of single-family house owners shows that solid fuel boilers and stoves hold the lion's share of the structure of heating sources in Polish single-family houses. **Coal-fired boilers and stoves are the main source of heating in nearly 70% of houses. 11% of them use fireplaces, cast iron pot belly stoves or wood burning boilers**. 3% of respondents claim that they use boilers or fireplaces burning pellets or another type of biomass. It must be pointed out, however, that biomass and wood are often used also by respondents who heat their houses with coal-fired boilers, hence the biomass-related percentage mentioned above is in fact underestimated. 13.5% of single-family houses are heated by gas boilers. A small share of buildings use oil-fired boilers, electric heating, district heating network (DHN) and renewable sources (e.g. heat pumps).

The percentage of coal heated buildings in cities is slightly lower than in the total sample and reaches 60%. There are also fewer houses which mainly rely on wood burning installations. Gas boilers are used in quite a lot of buildings (26%). The number of houses connected to the district heating network is also relatively higher (3%).



Source: CATI 2014; sample N=500; own analysis

In rural areas over 90% of houses are heated with solid fuels. Other buildings are mainly heated with gas boilers, but oil boilers and, occasionally, electric heating or renewable heat sources are used in some rural houses as well. As regards the category of "other" heating sources, green solutions, such as heat pumps, are mentioned most frequently. Their share in the whole structure of heating sources used in rural areas is marginal though.

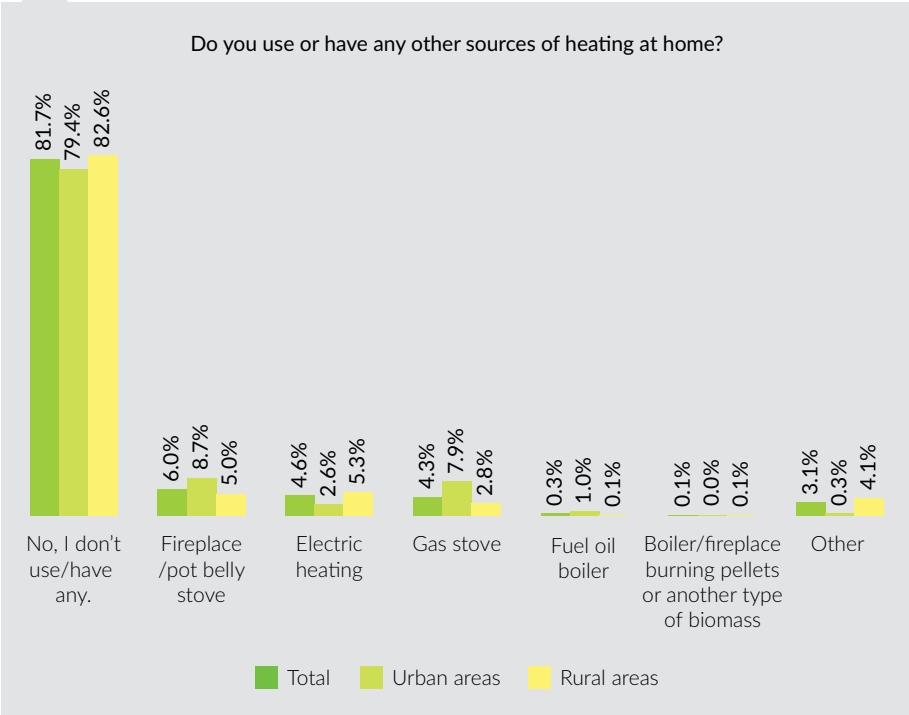
The share of coal heating is significantly lower in houses built after the year 2000. At the same time, the number of fireplaces and pot belly stoves has notably increased. **The structure of heating sources directly depends on the income level.** Solid fuels are used more commonly by less well-off respondents than by the wealthier ones.

How do you heat your home? Please specify the main source of heat	Total	Age of the building				Household net income	
		Erected before WWII	Erected between 1945-1988	Erected between 1989-2000	Erected in 2001 or later	Above PLN 3.5 thousand	Below PLN 3.5 thousand
Coal-fired stove/ boiler	69.3%	68.4%	76.3%	67.0%	37.1%	66.4%	74.9%
Gas boiler	13.5%	11.6%	10.4%	18.8%	27.8%	18.5%	7.8%
Wood burning fireplace/pot belly stove	10.6%	15.7%	6.7%	7.0%	23.8%	8.4%	13.8%
Boiler/fireplace burning pellets or another type of biomass	3.1%	0.7%	3.4%	4.9%	4.8%	1.9%	3.1%
Fuel oil boiler	2.0%	3.6%	1.6%	1.4%	1.7%	2.4%	0.2%
DHN	1.0%	0.0%	1.6%	0.4%	0.9%	1.9%	0.2%
Electricity	0.1%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%
Other	0.3%	0.0%	0.0%	0.5%	2.7%	0.7%	0.0%
Sample (N)	**500**	**121**	**267**	**63**	**50**	**245**	**227**

Source: CATI 2014; sample N=500; own analysis

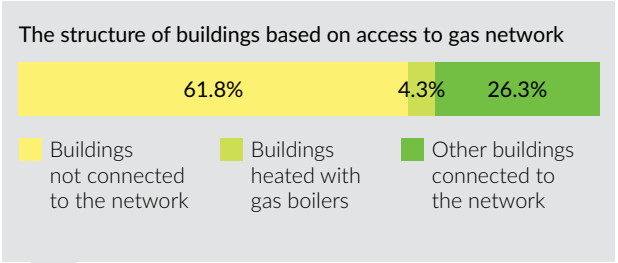
The research conducted this year focused on owners of single-family houses heated with coal-fired boilers or stoves. **Almost 80% of respondents claim that a coal-fired boiler or stove is the only source of heating in the building.** Other alternative or supplementary sources are used in one out of five houses. These are mainly fireplaces, cast iron pot belly stoves and gas boilers. Electric heaters are slightly less common. The differences between urban and rural areas are not too big. Gas boilers are, however, slightly more popular in urban areas, whereas electric heaters are used more frequently in rural areas. Only 18% of respondents who have got alternative or supplementary heating sources claim that they use them as frequently as the coal-fired boiler or stove. The others admit that they use these

alternative or supplementary sources much less frequently (in most cases, only sporadically).



Source: CATI 2016; sample N=513; own analysis

Gas boilers are used in 4% of houses as an alternative or supplementary source of heating. 26% of buildings where coal-fired boilers or stoves are the main source of heating are connected to a gas network, which means they could potentially be heated with gas boilers.



Source: CATI 2016; sample N=513; own analysis

Unsurprisingly, more buildings are not connected to the gas network in rural areas – 72% of the analysed buildings in rural areas have no access to the gas network. The corresponding share for urban areas is 62%. The largest proportion of buildings which are not connected to the gas network can also be observed among the oldest (built before the Second World War) and the newest houses (built after the year 2000).

		Age of the building				Household net income	
The structure of buildings based on access to gas network	Total	Erected before WWII	Erected between 1945-1988	Erected between 1989-2000	Erected in 2001 or later	Above PLN 3.5 thousand	Below PLN 3.5 thousand
Buildings heated with gas boilers	4.3%	1.2%	5.0%	5.9%	5.5%	6.6%	2.3%
Other buildings connected to the network	26.3%	16.9%	32.5%	21.3%	11.4%	28.1%	25.2%
Buildings not connected to the network	69.4%	81.8%	62.5%	72.8%	83.2%	65.2%	72.5%
Sample (N)	**513**	**123**	**302**	**62**	**27**	**162**	**267**

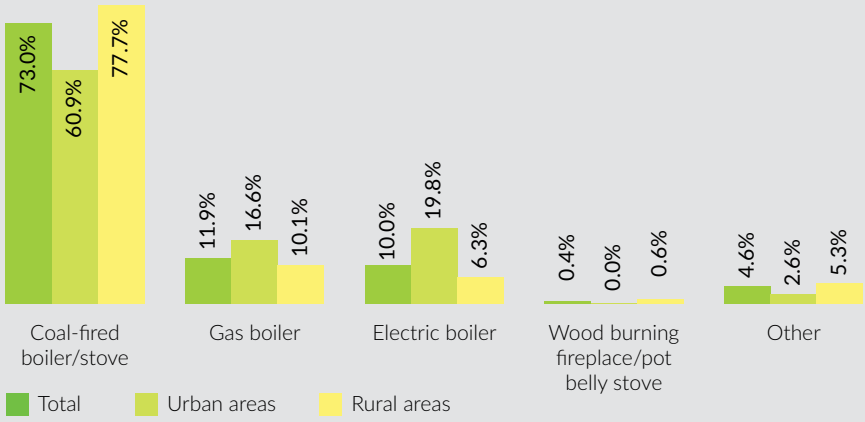
Source: CATI 2016; sample N=513; own analysis

THE STRUCTURE OF DOMESTIC HOT WATER SOURCES

In single-family buildings where coal-fired boilers and stoves are the main source of heating, the same installations are usually used for heating water. **Over 70% of house owners indicated coal-fired boilers and stoves as the main source of domestic hot water.** It must be pointed out that solid fuel sources are used for water heating purposes a little more frequently in rural areas than in cities. Gas boilers are used by 12% of the respondents. Electric boilers and heaters are used in about one out of ten buildings. The latter source is much more popular in cities. Wood and biomass boilers are mentioned only sporadically. Among other sources, the most frequently mentioned ones include solar collector systems, which are a little more popular in rural areas.

Some owners of single-family houses claim that the way in which they prepare domestic hot water depends on the season. During the heating season they rely on solid fuel boilers, whereas during the warmer months they use other sources.

Which source of hot water do you use? Please specify the main source



Source: CATI 2016; sample N=513; own analysis

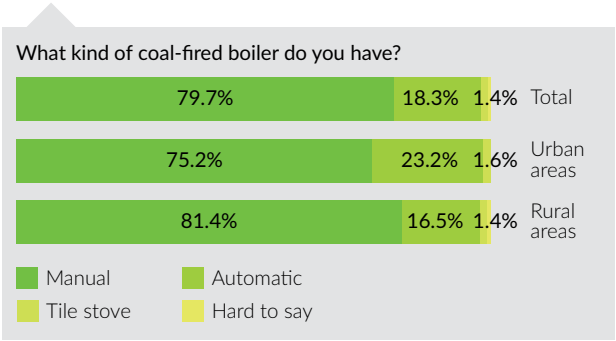
Neither the age of the building nor the level of wealth of its owners have a significant impact on how domestic hot water sources are chosen. What can be noted, however, is that coal-fired boilers and stoves are most frequently used for water heating purposes in pre-war buildings.

		Age of the building				Household net income	
Which source of hot water do you use? Please specify the main source	Total	Erected before WWII	Erected between 1945-1988	Erected between 1989-2000	Erected in 2001 or later	Above PLN 3.5 thousand	Below PLN 3.5 thousand
Coal-fired boiler/stove	73.0%	84.2%	67.0%	78.4%	76.0%	75.2%	71.9%
Gas boiler	11.9%	5.0%	14.9%	12.7%	9.2%	12.8%	10.8%
Electric boiler	10.0%	10.4%	11.1%	4.3%	10.1%	9.6%	12.1%
Wood burning fireplace/pot belly stove	0.4%	0.0%	0.7%	0.0%	0.0%	0.0%	0.8%
Other	4.6%	0.5%	6.3%	4.6%	4.7%	2.3%	4.4%
Sample (N)	**513**	**123**	**302**	**62**	**27**	**162**	**267**

Source: CATI 2016; sample N=513; own analysis

CHARACTERISTICS OF COAL-FIRED BOILERS AND HEATING SYSTEMS USED IN POLAND

Most of the coal-fired boilers installed in single-family houses are manually-fed. They are used by 80% of respondents. In towns and cities this percentage is slightly lower than in the total sample and the share of automatic boilers is 23%. In rural areas, only 17% of coal-heated buildings are equipped with automatic boilers. Tile stoves are used only sporadically. They can be found in a small percentage of pre-war and early post-war houses.



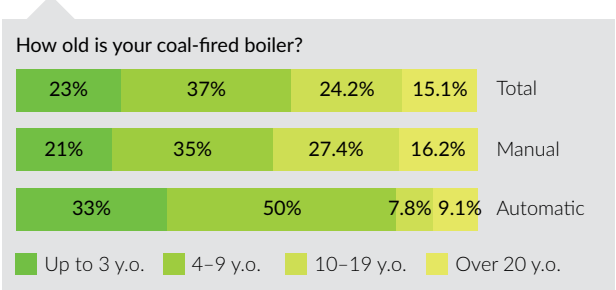
Source: CATI 2016; sample N=513; own analysis

Automatic boilers are much more common in buildings erected after the year 2000. **Manual boilers are still used, however, in over 60% of houses built in this century, which makes their share considerable**. Automatic boilers are used a little more frequently by wealthier house owners.

What kind of coal-fired boiler do you have?	Total	Age of the building				Household net income	
		Erected before WWII	Erected between 1945-1988	Erected between 1989-2000	Erected in 2001 or later	Above PLN 3.5 thousand	Below PLN 3.5 thousand
Manual	79.7%	82.5%	80.0%	80.3%	62.2%	72.4%	84.0%
Automatic	18.3%	14.0%	18.1%	19.7%	37.8%	27.6%	12.4%
Tile stove	1.4%	1.2%	1.9%	0.0%	0.0%	0.0%	2.6%
Hard to say	0.5%	2.2%	0.0%	0.0%	0.0%	0.0%	1.0%
Sample (N)	**513**	**123**	**302**	**62**	**27**	**162**	**267**

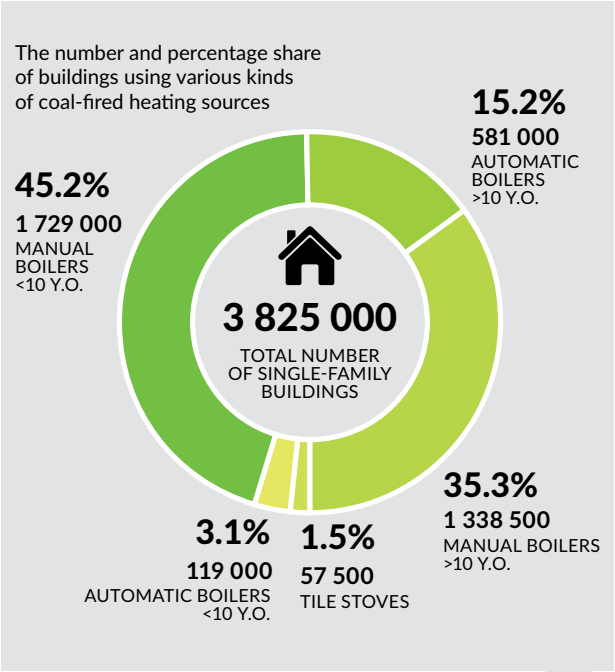
Source: CATI 2016; sample N = 513; own analysis

Most coal-fired boilers are rather outdated. Relatively new boilers, up to 3 years old, constitute only 23%. A further 37% of the devices are between 4 and 10 years old. The remaining 40% of boilers are 10 years old or older. The average age of automatic boilers (7.5 years) is much lower than the age of manually-fed boilers (10.5 years).



Source: CATI 2016; sample N=513; own analysis

The analysis of the structure of heating sources leaves no room for doubt – **the average quality of coal-fired sources used in single-family buildings is poor or even very poor**. As many as 35% of buildings in this segment are heated with 10-year-old or older manually-fed boilers. When expressed in absolute figures, it turns out that nearly 1.5 million of worn



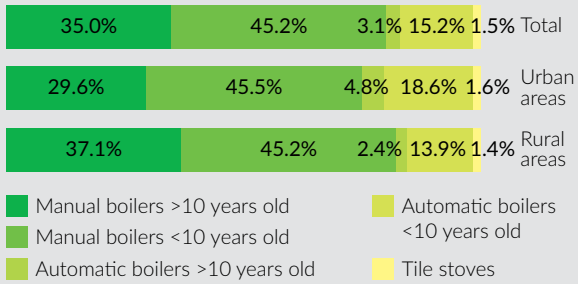
Source: CATI 2016; sample N=513; own analysis

out and outdated boilers are installed in Polish single-family buildings. A further 1.7 million buildings are heated with manually-fed boilers up to 10 years old. **Relatively new automatic boilers are used only in 15% of single-family houses**.

The comparison of the structure of heating sources in urban and rural areas shows that in cities the share of manual boilers older than 10 years is slightly smaller than in villages. At the same time, the percentage of automatic boilers is much higher than the corresponding figure for rural areas. The largest proportion of relatively new automatic boilers is used in buildings erected after 2000. It must be noted, however, that also in this segment over ten-year-old coal-fired boilers can be found in 25% of these houses. **The structure of heating sources also depends on the level of income in a given household. The share of older manual boilers in less well-off households exceeds 40%**, whereas newer automatic boilers (less than 10 year old) are installed

in only every tenth building (in the group of wealthier respondents the corresponding figure stands at 25%).

The percentage share of buildings using various kinds of coal-fired heating sources

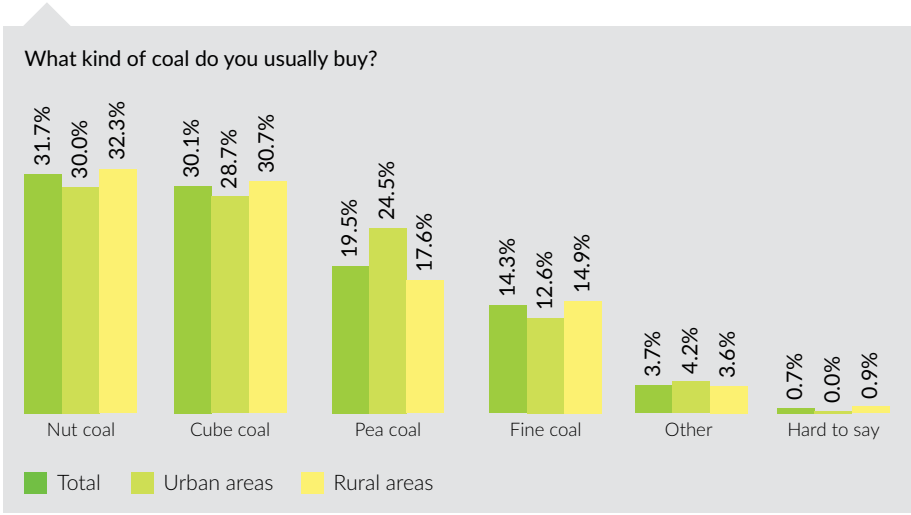


Source: CATI 2016; sample N=513; own analysis

The percentage share of buildings using various kinds of coal-fired heating sources	Total	Age of the building				Household net income	
		Erected before WWII	Erected between 1945-1988	Erected between 1989-2000	Erected in 2001 or later	Above PLN 3.5 thousand	Below PLN 3.5 thousand
Manual boilers >10 years old	35.0%	32.6%	35.5%	40.5%	26.9%	25.0%	40.7%
Manual boilers <10 years old	45.2%	51.7%	44.6%	39.7%	35.3%	47.0%	44.7%
Automatic boilers >10 years old	3.1%	1.3%	4.2%	2.7%	0.4%	3.1%	2.1%
Automatic boilers <10 years old	15.2%	13.1%	13.7%	17.1%	37.4%	24.8%	9.8%
Tile stoves	1.5%	1.3%	2.0%	0.0%	0.0%	0.0%	2.7%
Sample (N)	**513**	**123**	**302**	**62**	**27**	**162**	**267**

Source: CATI 2016; sample N=513; own analysis

Nut and cube coal are the most common type of fuel used in coal-fired boilers. These types of coal are used by one third of the respondents each. **A further 19% of the respondents use pea coal and 14% of them use fine coal**. As for the type of coal used, there are no significant differences between urban and rural areas. Pea coal, however, seems to be used slightly more often in cities. **Wood is another type of fuel commonly used in coal-fired boilers and stoves.** Over 80% of owners of single-family houses equipped with coal-fired sources use wood as an additional type of fuel. This is a little more common in rural areas where wood is used in nearly 90% of households.

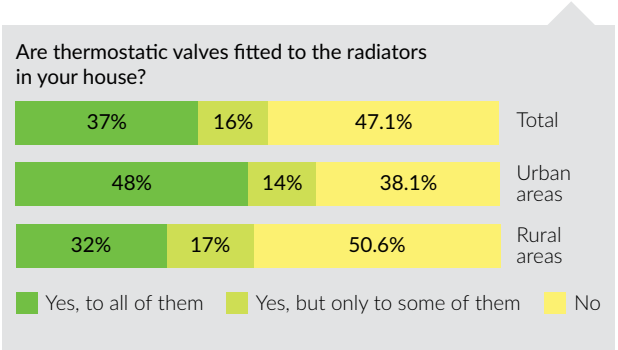


Source: CATI 2016; sample N=513; own analysis

What kind of coal do you usually buy?	Total	Age of the building				Household net income	
		Erected before WWII	Erected between 1945-1988	Erected between 1989-2000	Erected in 2001 or later	Above PLN 3.5 thousand	Below PLN 3.5 thousand
Cube coal	33.3%	32.2%	33.7%	31.4%	34.6%	37.2%	19.0%
Nut coal	31.4%	29.7%	32.1%	33.9%	31.7%	29.5%	21.1%
Pea coal	19.3%	22.8%	18.0%	17.3%	18.8%	16.8%	40.6%
Fine coal	12.0%	11.7%	12.1%	12.0%	11.7%	11.2%	17.4%
Coal sludge	0.1%	0.0%	0.2%	0.0%	0.0%	1.1%	0.0%
Other	3.3%	3.5%	3.2%	5.5%	2.8%	2.0%	1.8%
I don't know	0.5%	0.0%	0.7%	0.0%	0.4%	2.2%	0.0%
Sample (N)	**513**	**123**	**302**	**62**	**27**	**162**	**267**

Source: CATI 2016; sample N=513; own analysis

Less than half of the respondents have thermostatic valves fitted to all the radiators and as many as 37% do not have such valves fitted at all. Thermostatic valves are used more commonly in urban areas where they are fitted to all radiators in 48% of the analysed buildings. The corresponding percentage in rural areas is only 32%.



Source: CATI 2016; sample N=513; own analysis

Despite the fact that thermostatic valves are most commonly used in the newest buildings, it must be noted that in a lot of them (including those erected after the year 2000) this important part of the heating system is missing.

		Age of the building				Household net income	
Are thermostatic valves fitted to the radiators in your house?	Total	Erected before WWII	Erected between 1945-1988	Erected between 1989-2000	Erected in 2001 or later	Above PLN 3.5 thousand	Below PLN 3.5 thousand
Yes, to all of them	36.7%	37.0%	33.9%	38.2%	64.0%	43.3%	30.8%
Yes, but only to some of them	16.2%	16.8%	16.9%	14.6%	8.0%	23.1%	11.5%
No	47.1%	46.1%	49.2%	47.2%	28.0%	33.6%	57.6%
Sample (N)	**513**	**123**	**302**	**62**	**27**	**162**	**267**

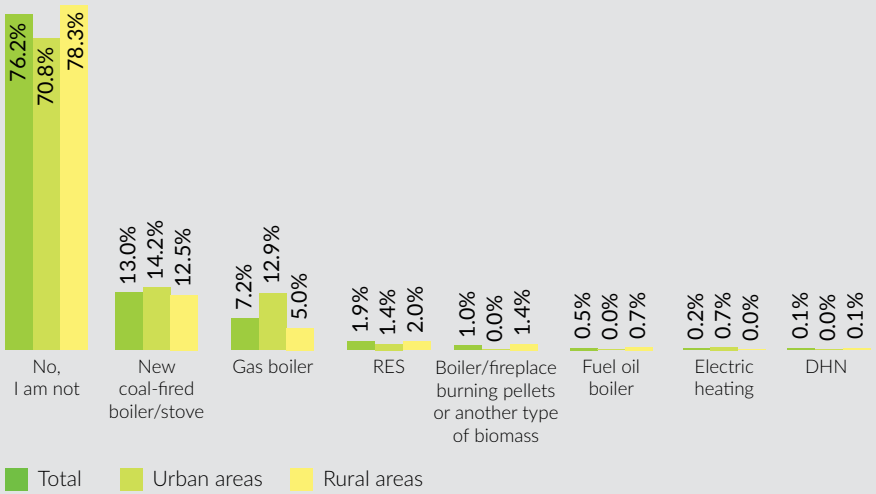
Source: CATI 2016; sample N=513; own analysis

Heating systems have not been modernised since the building was put into use in one fourth of the total number of single-family houses built before 2000 and in one fifth of those built before 1989.

PLANS CONCERNING THERMAL MODERNISATION

Most of the interviewed owners of coal-fired boilers and stoves are not planning to have their devices replaced over the next two years. Quite a large group of respondents, one in four owners of a single-family house heated with coal, claim that they are thinking, however, of making such an investment in the near future. This trend is more common in cities – nearly one third of the respondents living in urban areas would like to have their heat source replaced in the next few years.

Are you planning to have your coal-fired boiler replaced with a new model or with a different source of heat?



Source: CATI 2016; sample N=513; own analysis

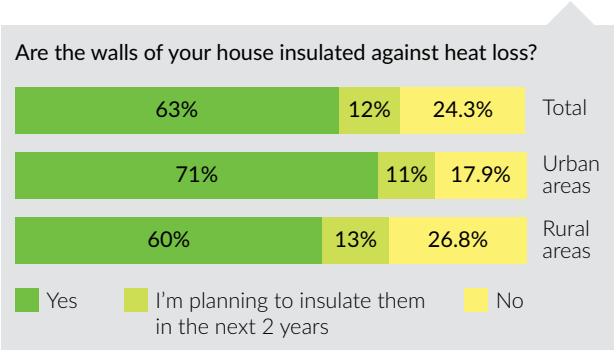
Among those planning to modernise their heat source, 50% of house owners are interested in replacing their coal-fired boilers or stoves with more modern models. The reason most frequently given for this decision is that the devices they currently use are old, worn out and inefficient. Some respondents have also mentioned the issue of safety of using old coal-fired boilers. 7% of single-family house owners are planning to have their coal-fired heating sources replaced with gas boilers. This trend is much more common in cites. Respondents from this group are interested in gas boilers because in their opinion these devices are more convenient and easier to use. The need to protect air quality is also mentioned quite frequently. On the basis of opinions spontaneously expressed by the respondents we can conclude that environmental considerations are taken into account more and more frequently and the **awareness of the adverse impact of old coal-fired heat sources on local air quality problems is growing noticeably, especially in urban areas**. A small number of respondents are also encouraged to make thermal modernisation investments which they have been postponing

so far because of the availability of programmes aiming to eliminate low-stack emission sources.

BUILDING ENVELOPE

Although 64% of the respondents claim that the external walls of their houses are insulated against heat loss, a more in-depth analysis shows that in most cases the insulation layer (usually polystyrene foam) is very thin.

12% of the respondents are planning to have their houses insulated in the next two years. One fourth of the buildings in the analysed segment are not and will not be, according to their owners, insulated in the near future.



Source: CATI 2016; sample N=513; own analysis

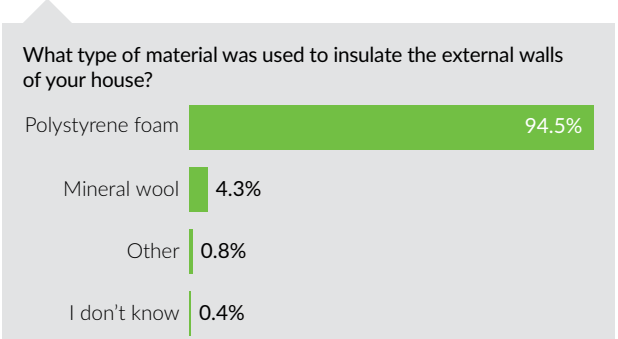
The existence of wall insulation, even the thinnest one, is closely associated with the age of the building. Among owners of coal-heated houses built before the Second World War, 60% declare that the walls are insulated. The percentage is slightly higher for houses built between 1945-1989 and 1989-2000, and much higher for those erected after the year 2000 (83%). **The existence of wall insulation seems to be linked with income levels too** – the percentage of thermally insulated houses is slightly higher among the wealthier respondents.

Are the walls of your house insulated against heat loss?	Total	Age of the building				Household net income	
		Erected before WWII	Erected between 1945-1988	Erected between 1989-2000	Erected in 2001 or later	Above PLN 3500	Below PLN 3500
Yes	63.4%	60.0%	62.6%	65.4%	83.0%	72.4%	58.7%
I'm planning to insulate them in the next 2 years	12.4%	7.2%	16.2%	7.1%	4.7%	11.2%	12.0%
No	24.3%	32.9%	21.2%	27.5%	12.3%	16.4%	29.3%
Sample (N)	**513**	**123**	**302**	**62**	**27**	**162**	**267**

Source: CATI 2016; sample N=513; own analysis

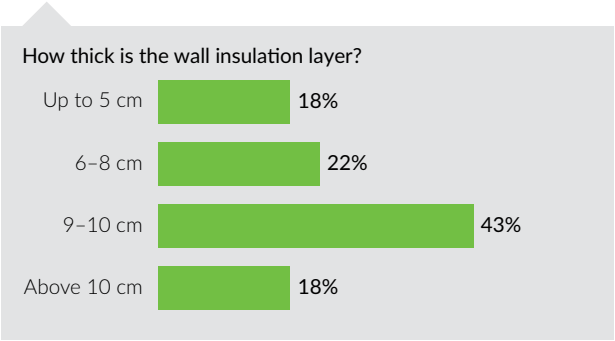
Polystyrene foam is the most common material used for wall insulation. Over 90% of respondents say that polystyrene foam is used for insulation of external walls of their houses.

Quite a lot of **house owners carry out insulation works themselves**. As many as 44% of respondents whose houses are insulated say they carried out the works themselves. Unsurprisingly, this method of laying wall insulation is more popular among the less well-off owners of single-family houses. The method is becoming less popular though – among those planning to insulate their buildings in the next two years only one quarter of respondents are going to do it themselves.



Source: CATI 2016; sample N=327 (100%: respondents who claim to have had their walls insulated); own analysis

Wall insulation layers are usually thin. Thicker layers (more than 10 cm) have only been used in 18% of insulated buildings. The insulation layer does not exceed 5 cm in the same percentage of buildings. Even in the newest houses, erected after the year 2000, the average thickness of wall insulation layers only slightly exceeds 10 cm. Similar thickness (10 cm on average) is mentioned by house owners planning to invest in thermal modernisation in the next 2 years. Thinner insulation layers are also used in lower-income households.

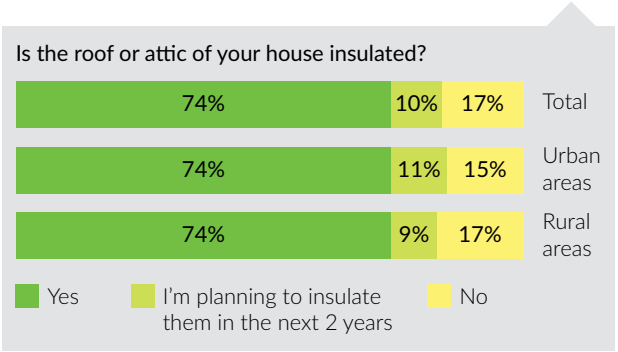


Source: CATI 2016; sample N=327 (100%: respondents who claim to have had their walls insulated); own analysis

Average thickness of the wall insulation layer		
Total		9.3 cm
Location of the building	Urban areas	9.7 cm
	Rural areas	9.2 cm
Age of the building	Erected before WWII	9.3 cm
	Erected between 1945–1988	9.2 cm
	Erected between 1989–2000	9.1 cm
	Erected in 2001 or later	10.8 cm
Household net income	Above PLN 3.5 thousand	9.7 cm
	Below PLN 3.5 thousand	9.0 cm

Source: CATI 2016; sample N=327 (100%: respondents who claim to have had their walls insulated); own analysis

74% of the respondents claim that the roof or attic of their house is insulated and a further 10% are planning to make such an investment in the next two years. Analysis of results relating to buildings located in urban and rural areas does not reveal any differences.



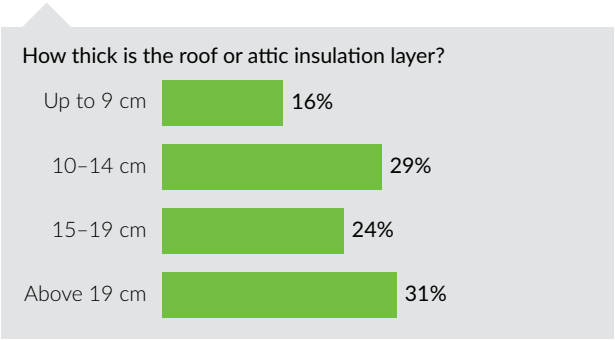
Source: CATI 2016; sample N=513; own analysis

The existence of roof insulation also depends on the age of the building. As far as houses built before the Second World War are concerned, 68% of respondents claim to have insulated roofs. The percentage is higher for houses built between 1989 and 2000 (90%) and among the newest buildings it almost reaches 100%.

		Age of the building				Household net income	
Is the roof or attic of your house insulated?	Total	Erected before WWII	Erected between 1945-1988	Erected between 1989-2000	Erected in 2001 or later	Above PLN 3.5 thousand	Below PLN 3.5 thousand
Yes	73.7%	69.2%	70.4%	89.5%	95.3%	83.2%	68.8%
I'm planning to nsulate them in the next 2 years	9.6%	8.2%	12.4%	1.8%	2.5%	10.1%	9.7%
No	16.7%	22.6%	17.3%	8.7%	2.1%	6.7%	21.5%
Sample (N)	**513**	**123**	**302**	**62**	**27**	**162**	**267**

Source: CATI 2016; sample N=513; own analysis

Roof or attic insulation is usually much thicker than wall insulation. Every third respondent claims that roof insulation layer in their house is at least 20 cm thick or thicker. At the same time, the insulation layer in 16% of the buildings does not exceed 9 cm. The average thickness of roof insulation is 15 cm and in the newest houses it is about 20 cm.



Source: CATI 2016; sample N=314 (100%: respondents who claim to have had their roof or attic insulated); own analysis

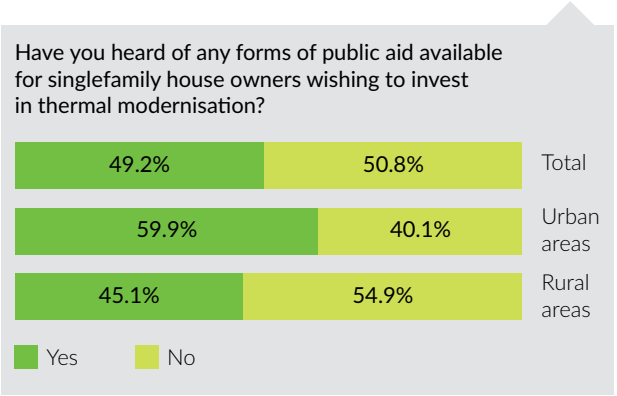
Average thickness of roof or attic insulation layer		
Total		15.2 cm
Location of the building	Urban areas	15.6 cm
	Rural areas	15.0 cm
Age of the building	Erected before WWII	15.2 cm
	Erected between 1945–1988	15.0 cm
	Erected between 1989–2000	13.8 cm
	Erected in 2001 or later	19.3 cm
Household net income	Above PLN 3.5 thousand	15.6 cm
	Below PLN 3.5 thousand	14.3 cm

Source: CATI 2016; sample N=314 (100%: respondents who claim to have had their roof or attic insulated); own analysis

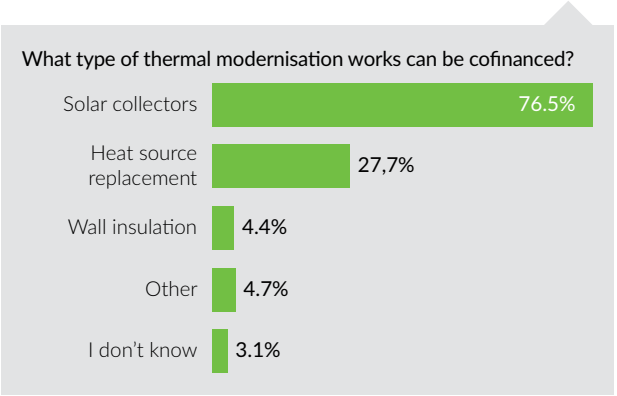
The results of the research show that **double glazed windows have already become a standard solution,** also in coal heated buildings. 90% of the respondents claim to have had such windows fitted.

FINANCING
THERMAL MODERNISATION PROJECTS

50% of the respondents claim to have heard about the availability of subsidies for reducing the consumption of heat in singlefamily buildings. The level of awareness is higher among urban populations. Subsidies to solar collectors are mentioned by the vast majority of respondents. One in four interviewees mention cofinancing for heat source replacement.



Source: CATI 2016; sample N=513; own analysis

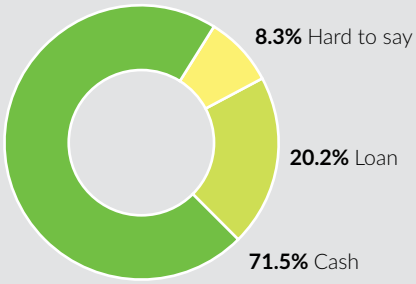


Source: CATI 2016; sample N=253 (100%: respondents who claim to have heard about some forms of public aid); own analysis

Photo by Stowarzyszenie EPS

As for the preferred form of cofinancing for thermal modernisation projects, the vast majority of respondents mention cash rather than loans. Given these two options, only one out of five people would choose a loan.

Which form of public aid would you choose to finance thermal renovation works (such as wall or roof insulation, window replacement, etc.) aimed at reducing heat loss in your home?

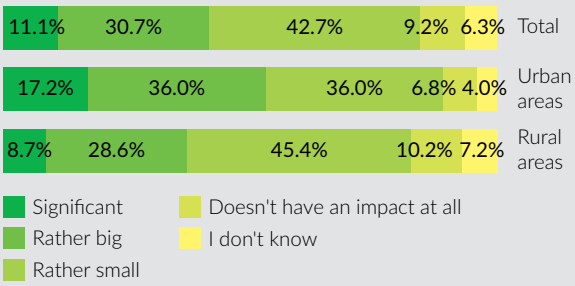


Source: CATI 2016; sample N=513; own analysis

THE ASSESSMENT OF COAL COMBUSTION IMPACT ON AIR POLLUTION

As shown by the results of our research, the **awareness of the adverse impact of solid fuel combustion on local air quality problems is slowly growing**. Over 40% of the respondents who use coal-fired boilers and stoves acknowledge the fact that burning coal in domestic heating appliances contributes to air pollution in their city, town or village. One tenth of them think that this impact is significant. Interestingly, **the awareness of how coal combustion relates to air quality is higher in urban populations**. Over 50% of the respondents in this group say they are aware of that relationship, whereas the corresponding percentage in rural areas is slightly less than 40%.

How big is the impact of burning coal in domestic heating appliances on the air pollution in your town?



Source: CATI 2016; sample N=513; own analysis

"RYŚ" (LYNX) – PILOT PROGRAMME MANAGED BY THE NATIONAL FUND WHO IS IT ADDRESSED TO? (INITIAL ASSESSMENT)

EDYTA **WALCZAK**
INSTITUTE OF ENVIRONMENTAL ECONOMICS

Single-family houses, inhabited by 19.5 million people, constitute the most numerous group in the sector of residential buildings in Poland. **As many as 90% of the rural population live in single-family houses** and over 50% of large families live in rural areas. Apart from the voivodship of Mazowieckie, the largest numbers of single-family houses are found in south-eastern Poland: the voivodships of Małopolskie, Lubelskie and Podkarpackie. Most of these houses were built between 1945 and 1988, which means their technical condition is rather poor and they need to be modernised. Nearly 90% of rural single-family houses are owned by people whose income level is lower than the income level of people living in cities, while inhabitants of the eastern regions of the country are the least well-off.

Our analysis shows that the **less well-off residents of rural areas of south-eastern Poland are those that would benefit most from the financing schemes to support thermal modernisation of single-family houses such as, for instance, "Ryś"**. Therefore, the pilot programme should continue to be implemented and modified so that it becomes more attractive for the stakeholders (banks and regional branches of the National Fund for Environmental

Protection). It should also be made more easily accessible and advantageous for the beneficiaries – the less-well off owners of single-family houses. For this to happen, the programme should cover both loan and subsidy measures.

ABOUT "RYŚ"

"Ryś – thermal modernisation of single-family residential buildings"* is intended as one of the priority programmes run by the National Fund for Environmental Protection and Water Management (NFEP)**. It aims to reduce CO_2 and PM emission levels by improving the energy efficiency of the existing single-family housing stock. **"Ryś" is the only Polish programme supporting thermal modernisation dedicated exclusively to single-family houses*****.

It is scheduled for implementation between 2015 and 2023. The proposed budget for the pilot phase (2015-2020) is PLN 400 million (including 120 million for subsidies) providing for the possibility to conclude subsidised loan agreements until 2017. Beneficiaries of the programme include natural persons, local government units and non-governmental organisations (such as foundations, associations, churches, religious groups) having the ownership of single-family residential buildings. Subsidies are to be granted for carrying out thermal insulation improvements, modernisation of internal systems and replacement of heating sources. Subsidised loans granted on preferential terms will cover up to 100% of the total eligible costs of a project, where subsidies for refurbishment works are to cover 20% or 40% of the eligible costs (for RES – 15% after 2016). The financial support is to be provided through banks and regional branches of NFEP, which were supposed to submit their applications to participate in the programme by 29 February 2016. Until that date, however, no applications had been submitted by banks and only 10 regional branches of NFEP expressed their wish to cooperate. Due to the recent changes in the management of NFEP, it is not known when the call for applications for beneficiaries will be published.

* http://nfosigw.gov.pl/oferta---finansowania/srodki-krajowe/programy-priorytetowe/rys---termomodernizacja- budynko-jednorodzinnych/

** At the time of finalising this report (May 2016) the future and the form of the "Ryś" programme were uncertain as its objectives had been submitted for analysis to the new management of the NFEP.

*** *Strategy for the modernisation of buildings: 2050 Roadmap*, p. 73–76 http://efektywnapolska.pl/wp-content/uploads/2015/03/ Strategia_modernizacja_budynkow_mapa_drogowa_2050.pdf

WHO LIVES IN
SINGLE-FAMILY BUILDINGS

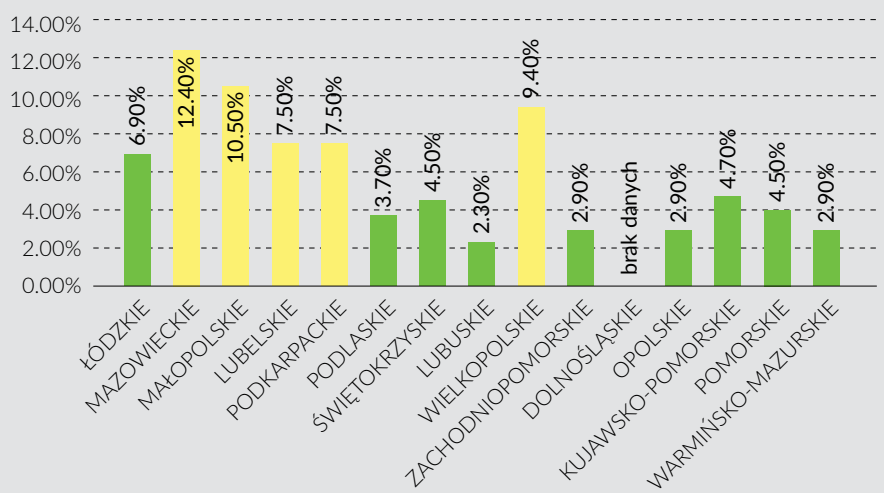
Poland has a population of 38 million and **over 50% of Poles (around 19.5 million people) live in single-family houses**. In urban areas, almost 6.5 million people (nearly 30%) live in such buildings and the corresponding number in rural areas is 13 million (nearly 90%).

Number of people in inhabited buildings per type of building in 2011

	Number of people in inhabited buildings	Including:		
		residential buildings	Including:	
			single-family	multi-family
Total	38 121.4	38 005.7	19 474.7	18 531.0
Urban areas	23 184.7	23 123.0	6 352.3	16 770.7
Rural areas	14 936.6	14 882.6	13 122.4	1 760.3

Source: Inhabited buildings. National Population and Housing Census 2011, Central Statistical Office of Poland 2013

Distribution of single-family buildings per voivodship



Source: Central Statistical Office of Poland 2013

ACCORDING TO THE NATIONAL POPULATION AND HOUSING CENSUS CARRIED OUT IN 2011 IN POLAND THERE ARE OVER

6 MILLION BUILDINGS

OUT OF WHICH:

1.7 MILLION
IN URBAN AREAS

OVER
5 MILLION
SINGLE-FAMILY HOUSES

3.3 MILLION
IN RURAL AREAS

MORE THAN 50% OF POLES

19.5 MILLION

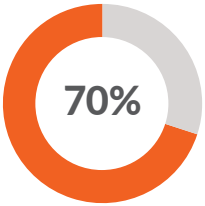
LIVE IN SINGLE-FAMILY HOUSES

13 MILLION
IN RURAL AREAS

6.5 MILLION
IN URBAN AREAS

OF
RURAL
POPULATION LIVE IN SINGLE-FAMILY HOUSES

OF
URBAN
POPULATION LIVE IN SINGLE-FAMILY HOUSES



OF SINGLE-FAMILY HOUSES ARE POORLY INSULATED OR NOT INSULATED AT ALL

The graph above illustrates the percentage distribution of single-family buildings per voivodship in relation to the total number of such buildings in Poland. Single-family houses are the most numerous in Mazowieckie – 12.4% of the total number in Poland, Małopolskie (10.5%), Wielkopolskie (9.4%), Lubelskie (7.5%) and Podkarpackie (7.5%). According to 2013 reports on inhabited buildings compiled by Regional Statistical Offices, three of the above mentioned voivodships (Małopolskie, Lubelskie and Podkarpackie), situated in the south-east of Poland, have the highest share of rural single-family houses.

Large families

Families with children (in thousands)	Total	Urban areas	Rural areas
Total	8 130.9	4 892.3	3 238.7
Including:			
With 3 children	735.2	324.9	410.3
With 4 or more childreni	273.3	88.6	184.7

Source: Households and families. National Population and Housing Census 2011, Central Statistical Office of Poland 2013

The analysis of the above demographic data shows that the percentage share of single-family houses in inhabited buildings is higher in the less well-off voivodships situated in the eastern part of the country. It must also be stressed that a significant share of large families lives in single-family houses. As many as 59% of families with three or more children live in rural areas. Given the fact that as many as 90% of the rural population live in single-family houses, it can be concluded that nearly all these families also live in single-family houses.

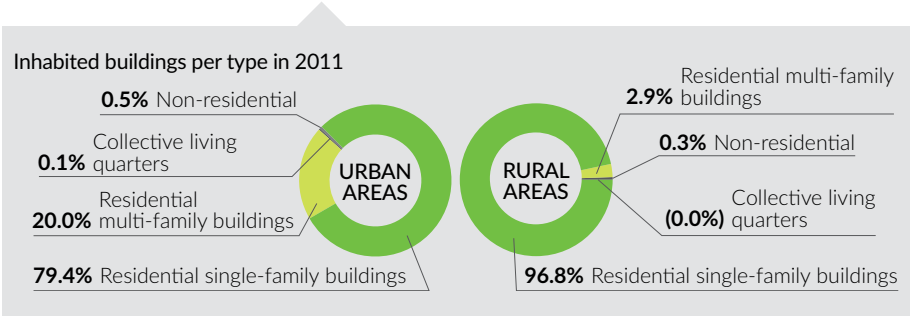
SINGLE-FAMILY BUILDING SECTOR

Single-family houses represent an important part of the housing sector in Poland. Statistical data on this segment of buildings are scarce. According to the National Population and Housing Census carried out in 2011, there are over 6 million buildings in Poland and over 5.5 million of them include residential buildings. In the latter group, there are over 5 million single-family buildings and around 535 thousand multi-family ones. Single-family houses are not only predominant in rural areas, where they constitute 97% of all inhabited residential buildings, but also in towns and cities where their share equals 80%. The vast majority of single-family buildings are situated in rural areas – nearly 3.3 million, whereas in urban areas there are over 1.7 million of them.

Buildings per type in 2011

	Total (in thousands)	Including: Inhabited buildings	Including: Residential buildings	Including: Single-family buildings	Multi-family buildings
Total	6 047.1	5 567.6	5 542.6	5 007.5	535.1
Urban areas	2 285.6	2 189.2	2 176.4	1 738.2	438.2
Rural areas	3 761.5	3 378.4	3 366.2	3 269.3	96.9

Source: Inhabited buildings. National Population and Housing Census 2011, Central Statistical Office of Poland 2013



Source: Inhabited buildings. National Population and Housing Census 2011, Central Statistical Office of Poland 2013

AGE OF BUILDINGS
IN RURAL AREAS

65% of single-family buildings are found in rural areas and most of them are old, 21% erected before 1945 and 27% between 1945 and 1970. The largest number of rural pre-war houses can be found in western Poland (the voivodeships of Zachodniopomorskie, Lubuskie and Dolnośląskie), whereas buildings erected between 1945 and 1988 are predominant in the south and east of the country (Podlaskie, Mazowieckie, Łódzkie, Świętokrzyskie, Podkarpackie, Małopolskie and Lubelskie).

Age of buildings in urban and rural areas

	Total (in thousands)	Erected:							
		Before 1918	1918–1944	1945–1970	1971–1978	1979–1988	1989–2002	2003–2007	2008–2011
		% share of all inhabited residential buildings							
Total	5 542,6	7.3	14.6	24.6	11.8	13.6	12.1	5.8	3.7
Urban areas	2 176,4	8.0	15.1	20.5	11.3	14.5	14.1	6.7	3.7
Rural areas	3 366,2	6.9	14.3	27.2	12.2	13.1	10.8	5.2	3.6

Source: Inhabited buildings. National Population and Housing Census 2011, Central Statistical Office of Poland 2013

Age of buildings in rural areas per voivodship

Voivodship	Erected: before 1944	1945–1988	1989–2002	2003–2011 and under construction
Dolnośląskie	60.6%	14.2%	6.3%	12.2%
Kujawsko-pomorskie	22.5%	51.9%	8.9%	10.5%
Lubelskie	10.1%	67.9%	11.5%	6.0%
Lubuskie	64.0%	15.3%	5.5%	9.8%
Łódzkie	11.1%	64.7%	10.6%	8.1%
Małopolskie	12.5%	57.6%	14.0%	9.6%
Mazowieckie	7.9%	60.7%	13.4%	10.7%
Opolskie	52.3%	33.9%	4.7%	4.8%
Podkarpackie	11.8%	63.3%	12.4%	8.1%

Voivodship	Erected: before 1944	1945–1988	1989–2002	2003–2011 and under construction
Podlaskie	13.1%	67.7%	9.5%	6.0%
Pomorskie	27.2%	34.0%	11.3%	15.0%
Śląskie	16.2%	57.5%	10.3%	10.1%
Świętokrzyskie	8.2%	67.5%	11.7%	5.8%
Warmińsko-mazurskie	53.0%	27.4%	6.2%	8.8%
Wielkopolskie	24.4%	46.2%	11.0%	11.9%
Zachodniopomorskie	55.0%	21.4%	6%	10.4%

Source: Inhabited buildings. National Population and Housing Census 2011, Central Statistical Office of Poland 2013

TECHNICAL CONDITION OF BUILDINGS

22% of residential buildings in Poland were erected before the Second World War, whereas 50% of them between 1945 and 1988. Energy consumption in the pre-war buildings is almost three times as high and in the 1945-1988 ones over twice as high as in the buildings erected in 2007. Research conducted by the CEM Market and Public Opinion Research Institute in 2014 also shows that coal-fired boilers are the most common source of heating in pre-war single-family houses in Poland (used in 68% of the buildings*). Moreover, 49% of the buildings are very poorly and 32% of them poorly insulated against heat loss. Nearly half of the buildings do not have external wall insulation, roof is not insulated in 45% of them and in those which are insulated, the thinnest possible layers of insulation material are used (7.9 cm for walls and 13.9 cm for roofs on average).

As for buildings erected between 1945 and 1988, coal-fired boilers are the most common source of heating as well (used in 76% of them). Moreover, 43% of the buildings are very poorly and 36% of them poorly insulated against heat loss. 43% do not have external wall insulation, roof is not

* *Energy Efficiency in Poland* – 2013 Review, Institute of Environmental Economics, Kraków 2014

insulated in 21% of them and in those which are insulated, rather thin layers of insulation material are used (8.6 cm for walls and 13.8 for roofs on average; in line with the modern standards it should be around 15-20 cm for walls and 25-30 for roofs).

Costs of heating depending on the age of building

Erected	E_A [kWh/ (m^2 • year)]	Cost per unit of heat generated by a gas boiler [PLN/kWh]	Building floor area [m^2]	Monthly costs of heating [PLN/m^2]	Annual costs of heating [PLN]
Before 1966	350	0.16	47	4.7	2 632
1967-1985	260	0.16	47	3.5	1 955.2
1986-1992	200	0.16	47	2.7	1 504
1993-1997	160	0.16	47	2.1	1 203.2
1998-2007	120	0.16	47	1.6	902.4
Energy efficient	80	0.16	47	1.1	601.6
Low-energy	45	0.16	47	0.6	338.4
Passive	15	0.16	47	0.2	112.8

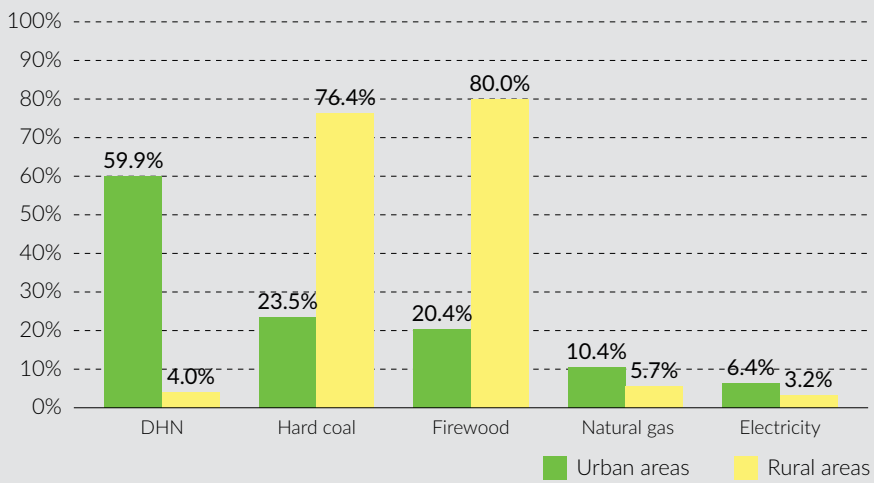
Source: http://www.przegladbudowlany.pl/2010/11/2010-11-PB-39_Alsabry.pdf

The results of CEM research also show that buildings found in urban areas are usually better insulated than those in rural areas. The average thickness of wall insulation in urban areas is 9.3 cm, whereas in rural areas it is 8.8 cm. As for roof insulation, the average thickness is 15 cm and 14.6 cm for urban and rural areas respectively. The older the building, the lower the quality of its insulation. Around 40% of single-family buildings erected before 1988 are poorly or very poorly insulated. 42% of houses built between 1989 and 2000 have poor insulation and in 31% of them its quality is medium. As for houses built from 2001 onwards, 29% have medium or good insulation and in 10% its quality is very good. Moreover, 46% of houses built before 1988 do not have their walls insulated externally and 33% of them lack roof insulation; the average thickness of insulation used in the buildings that are insulated is 8.25 cm for walls and 13.9 cm for roofs. The percentage of insulated houses

is higher in the group of buildings erected between 1989 and 2000, their wall and roof insulation is usually thicker as well. 90% of houses built from 2001 onwards have their walls insulated externally and 96% of them have roof insulation. The average thickness of insulation layers is 11.1 cm for walls and 20 cm for roofs.

Another conclusion to be drawn is that the older the building, the worse sources of heating it uses. 68% of pre-war single-family houses are heated with coal-fired boilers (29% of which are 10 years old or older), 12% with gas boilers, 16% with boilers/fireplaces burning wood or biomass, and 3.6% are connected to district heating networks, use electric heating or other sources. In subsequent years, the use of coal-fired boilers as a heating source in newly erected buildings was gradually becoming less popular and other options (gas boilers, boilers/fireplaces burning wood or biomass, DHN, electricity, other) were more frequently chosen. In houses built after 2001 onwards the percentage share of coal-fired boilers is 37%, gas boilers – 28%, boilers/fireplaces burning wood or biomass – 29%, DHN, electricity and other sources – 7%.

The structure of heating sources in Polish households



Source: Energy consumption in Polish households in 2012, Central Statistical Office of Poland 2014

According to data provided by the Central Statistical Office of Poland, a significant share of urban households is connected to district heating networks (nearly 60%), whereas the corresponding percentage in rural areas is only 4%. Rural households use mainly hard coal (76%) and firewood (80%). What is more, an urban household consumes on average 66 GJ of energy per year (which equals PLN 3 653), whereas in rural households, the average annual consumption is higher, i.e. 125 GJ (PLN 4 766).

OWNERSHIP
OF SINGLE-FAMILY BUILDINGS

There are no exact data on the ownership of single-family houses in Poland. It is known, however, that the vast majority of houses in rural areas belong to natural persons who own 3 out of 3.4 million buildings, i.e. 88% of the whole stock.

Ownership of residential buildings

	Total (in thousands)	including those owned by:						
		Natural persons	Housing associations	Municipalities	The state	Companies	Social housing associations	Other entities
Total	5 542.6	4 616.1	20.4	56.8	19.6	28.3	3.1	12.0
Urban areas	2 176.4	1 598.4	18.7	39.5	5.8	11.1	3.0	5.0
Rural areas	3 366.2	3 017.7	1.7	17.4	13.8	17.2	0.1	7.0

Source: Inhabited buildings. National Population and Housing Census 2011, Central Statistical Office of Poland 2013

FINANCIAL SITUATION OF SINGLE-FAMILY HOUSE OWNERS

No data are available on the income earned by owners of single-family houses. In rural areas, however, the average disposable income per household is almost PLN 500 lower than in urban areas and nearly PLN 1 000 lower than the income of people living in the largest cities. Lowest income levels are achieved in eastern Poland, in the voivodships of Lubelskie, Świętokrzyskie and Podkarpackie. In all voivodships (except Mazowieckie) where single-family houses constitute the largest group in the segment of residential buildings, i.e. Małopolskie, Lubelskie, Podkarpackie and Wielkopolskie, the average income is PLN 200 lower than the average income in Poland.

Household budgets in urban and rural areas (per capita)

	Total (PLN)	Urban areas						Rural areas
		Total	Number of inhabitants (in thousands)					
			Below 20	20–99	100–199	200–499	500 and more	
Net income	1 726.05	1 914.38	1 579.67	1 701.33	1 822.48	2 000.54	2 623.36	1 433.21
Including disposable income	1 340.44	1 516.05	1 233.21	1 379.83	1 444.05	1 583.08	2 046.04	1 067.38

Source: Household budgets in 2014, Central Statistical Office of Poland 2015

Household budgets per region

	Total (PLN)	Regions of Poland					
		Central	Southern	Eastern	North-Western	South-Western	Northern
Net income	1 726.05	2 140.94	1 625.43	1 536.64	1 592.15	1 680.62	1 671.73
Including disposable income	1 340.44	1 574.44	1 329.80	1 166.54	1 296.49	1 334.60	1 277.62

Source: Household budgets in 2014, Central Statistical Office of Poland 2015

Household budgets per region

Voivodship	Net income	Including disposable income
Dolnośląskie	1 667.99	1 366.33
Kujawsko-pomorskie	1 535.78	1 201.54
Lubelskie	1 600.29	1 208.35
Lubuskie	1 595.46	1 285.37
Łódzkie	1 718.65	1 293.36
Małopolskie	1 559.84	1 260.58
Mazowieckie	2 335.01	1 703.62
Opolskie	1 716.42	1 244.69
Podkarpackie	1 407.24	1 053.02
Podlaskie	1 628.27	1 258.62
Pomorskie	1 866.11	1 376.34
Śląskie	1 674.61	1 381.68
Świętokrzyskie	1 559.77	1 199.74
Warmińsko-mazurskie	1 555.69	1 229.74
Wielkopolskie	1 576.19	1 268.78
Zachodniopomorskie	1 625.59	1 365.40
Total	1 726.05	1 340.44

Source: Household budgets in 2014, Central Statistical Office of Poland 2015

SUMMARY

Single-family houses constitute 90% of all residential buildings in Poland. The vast majority of these houses are found in rural areas – nearly 3.3 million, and there are 1.7 million of them in cities and towns. The largest numbers of single-family houses can be found in the voivodships of Mazowieckie, Małopolskie, Lubelskie, Podkarpackie and Wielkopolskie. Three of these voivodships (Małopolskie, Lubelskie and Podkarpackie), situated in south-eastern Poland, have the highest share of rural single-family buildings. Most of the residential buildings in these three voivodships were erected between 1945 and 1988, they are poorly insulated, energy inefficient and heated mainly with coal-fired boilers. Therefore, they are in need of renovation and modernisation that could be co-financed from the "Ryś" budget.

Generally speaking, in rural areas (where single-family housing is the most common) houses usually have worse insulation than in cities and towns. The average thickness of insulation in urban areas is 9.3 cm for walls and 15 cm for roofs, whereas in villages the corresponding values are 8.8 cm and 14.6 cm respectively. Houses in rural areas consume on average 125 GJ of energy per year, i.e. almost twice as much as those in urban areas (66 GJ), and they are usually heated with hard coal (76%) and firewood (80%) – the two main sources of air pollution in Poland.

Single-family houses are inhabited by 19.5 million Poles, i.e. over 50% of the entire population. Expressed in percentage terms, nearly 90% of rural population and nearly 30% of urban population live in single-family houses. It is also worth pointing out that 59% of large families inhabit rural areas, which means that most of them live in single-family houses. 88% of single-family houses in rural areas are owned by natural persons for whom the "Ryś" programme is intended. Average disposable income per household is almost PLN 500 lower in rural areas than in urban areas and nearly PLN 1 000 lower than the income of people living in the largest cities. In the voivodships of eastern Poland where rural single-family houses constitute the largest

group in the segment of residential buildings, the average income is PLN 400 lower than the average income of city dwellers. It can thus be concluded that residents of single-family houses are often people with relatively low income levels who can hardly afford to invest in renovation and cover the costs of heating.

To sum up, our analysis shows that the **less well-off residents of rural areas of south-eastern Poland are those that would benefit most from the financing schemes to support thermal modernisation of single-family houses such as, for instance, "Ryś"**. Therefore, the pilot programme should continue to be implemented and modified so that it becomes more attractive for the stakeholders. It should also be made more easily accessible and advantageous for the beneficiaries.

ENERGY CONSUMPTION IN NEW BUILDINGS IN POLAND

PIOTR **PAWLAK**
BUILDDESK POLAND, ROCKWOOOL POLAND

MAREK **ZABOROWSKI**
INSTITUTE OF ENVIRONMENTAL ECONOMICS

This report on energy performance of new buildings and sources of heat used in them was prepared by the Institute of Environmental Economics and BuildDesk.

The analysis is based on a database of technical information on certified buildings collected by means of the BuildDesk system. The information relates mainly to the structure, elements and systems used in the buildings. As a result, the statistical analyses are based on actual numerical data which refer to the technical characteristics of the buildings. The system has been collecting the information since 2009, which allows us to carry out an initial analysis of trends in the Polish construction sector.

The data collected in the BuildDesk system come from around 75 000 buildings constructed in Poland (new, rendered for use, sold, modernised, etc.). Due to the extensive data volume it was possible to obtain objective, statistically verified information. The buildings which are analysed here were certified between 1 January 2009 and 31 December 2014.

As a system of obligatory certification has not been effectively implemented on the resale market, the data refer mainly to new buildings (existing buildings that are sold,

rented or extended account for only 20% of certified buildings). Given that the Directive on the Energy Performance of Buildings clearly defines an obligation to certify buildings on the primary as well as the resale market, this lack of certification for the resale market should be seen as a failure in implementing the Directive in Poland. The lack of reliable information about buildings at the resale market impedes effective state policy in this area.

It must be stressed that the analysis refers to the information contained in the documents from the database, but it cannot constitute the basis for determining the actual condition of a described building.

MAIN CONCLUSIONS

1. **The insulation of buildings is systematically improving**, thereby reducing their energy intensity – as compared to the 2009 figures, there has been a 16% drop in the consumption of usable and final energy and a 19% drop in the consumption of primary energy.

2. **A trend still exists for substituting gas heating with coal and biomass heating in single-family buildings**. More than 50% of newly installed sources of heat are now powered with biomass or coal, which means that although they are new, they constitute **a growing source of air pollution** (the share of these sources increased from 50% in 2009 to 60% in 2014). This is highly detrimental, not only due to increased greenhouse gas (GHG) emissions but also due to the negative impact of coal combustion on air quality in urbanised areas. The replacement of comfortable gas heating with much less convenient coal heating proves that coal is extremely competitively priced. As far as CO_2 emissions are concerned, coal heating reduces the positive effect obtained from better insulation of the building fabric.

3. The high declared use of biomass for heating most probably results from the fact that **energy certifiers just want to achieve the best Ep parameter (primary energy)** instead of really increasing the share of energy from renewable sources. It does not contribute to any real improvement in energy parameters for newly erected buildings.

4. **Designers and architects are becoming more aware** of how to prepare energy performance certificates and deal with energy efficiency of buildings. Consequently, the indicated energy parameters are still improving.

5. If we assume that energy performance certificates reflect the actual state of affairs, **the number of buildings with above-standard, increased thermal insulation is systematically growing**, which may suggest that not only designers and architects, but also investors are becoming more aware and willing to implement the necessary changes.

RECOMMENDATIONS

Based on this analysis we propose the following recommendations.

1. Amendment of the construction law facilitating the introduction of **limits on the use of coal and wood in newly erected buildings** situated in areas affected by air pollution. This could involve, for example, establishing obligatory emission standards for solid fuel boilers installed in newly erected buildings in a given area.
2. **Promotion of energy-efficient technologies** – the reduction of energy demand provides an effective solution for decreasing emissions (of carbon dioxide, particulate matter, benzo[a]pyrene and other air pollutants) regardless of the fuel. Media activities must **focus on all technologies** – not only on thermal insulation which is already relatively popular.

3. **An explanation of the growth in the popularity of biomass** – the Polish government should immediately introduce remedial measures aimed at a real increase in RES use for heating. This practice is simply aimed at circumventing the regulations in order to achieve the best Ep parameter instead of actually improving insulation of buildings.

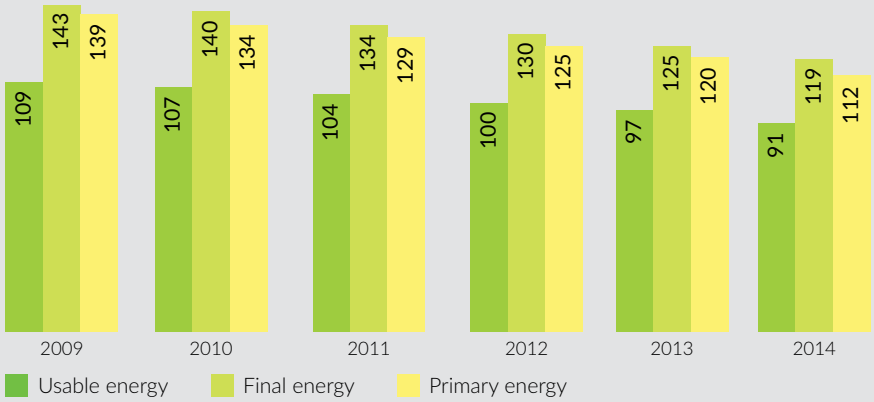
4. **Random checks carried out to verify the correctness of the certificates issued** (who should carry out these checks remains an open issue).

5. Controlled purchasing and obligation to maintain records of invoices for people declaring the use of biomass.

DATA ANALYSIS

In 2014, the Ep standard of single-family buildings in Poland reached 112 kWh/(m^2*K). **The energy efficiency of newly constructed single-family buildings has increased by nearly 20% over the last six years, which must be considered a great success.** The positive impact of improved insulation on air quality is limited, however, due to the growing share of solid fuels used for heating homes.

Changes in energy intensity (final, usable and primary energy) of single-family buildings in 2009-2014 [kWh/(m²*K)]



Source: BuildDesk database

Changes in energy intensity (final, usable and primary energy) of single-family buildings in 2009-2014 [kWh/(m²*K)]	2009	2010	2011	2012	2013	2014
Usable energy – Eu	109	107	104	100	97	91
Final energy – Ef	143	140	134	130	125	119
Primary energy – Ep	139	134	129	125	120	112
Sample (N)	16 575	13 381	12 603	11 822	9832	8473

Source: BuildDesk database

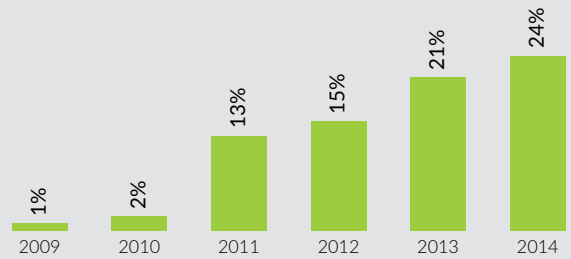
Newly constructed buildings are more energy efficient mainly due to the fact that their insulation is systematically improving. More frequent use of above-standard insulation proves that architects and construction designers are really gaining more knowledge and skills.

The need to use of above-standard insulation seems obvious – adding an extra centimetre of insulation during the construction phase does not cost much and the effect remains there for years. In other words, a small investment delivers relatively large benefits for decades. **Investors are becoming more and more interested in using above-standard technical solutions**. In 2014, the number of homes with

above-standard insulation increased by further 3 percentage points to 24%.

Why then did so few investors decide to use an additional insulation layer in 2009? It is probably a result of the outdated ideas represented by the "old school of construction", which focused on strict adherence to standards at the lowest possible cost. According to a new approach, buildings should be designed as well as possible – therefore, construction designers try to optimise both investment and maintenance costs. A significant improvement can be observed in this area.

The share of new single-family houses with above-standard thermal insulation

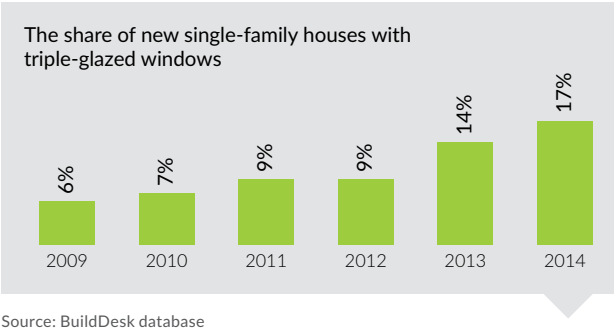


Source: BuildDesk database

The number of new single-family houses with above-standard thermal insulation	2009	2010	2011	2012	2013	2014
The number of houses with good insulation	186	320	1 696	2 111	2 064	2 054
The number of analysed houses	16 041	13 698	13 116	13 628	9 832	8 473
Share	1%	2%	13%	15%	21%	24%

Source: BuildDesk database

A similar trend can be observed on the triple glazed window market. Their share has also been systematically growing over the years. In 2014, it grew by further 3 percentage points to 17%.

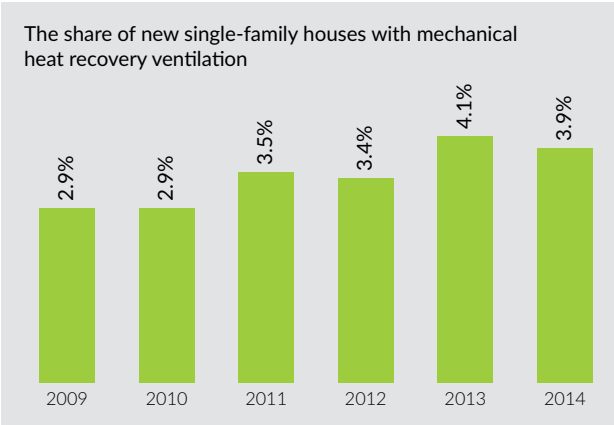


Source: BuildDesk database

The number of new single-family houses with triple-glazed windows	2009	2010	2011	2012	2013	2014
The number of houses with triple-glazed windows	955	962	1 219	1 285	1 376	1 418
The number of analysed houses	16 041	13 698	13 116	13 628	9 832	8 473
Share	**6%**	**7%**	**9%**	**9%**	**14%**	**17%**

Source: BuildDesk database

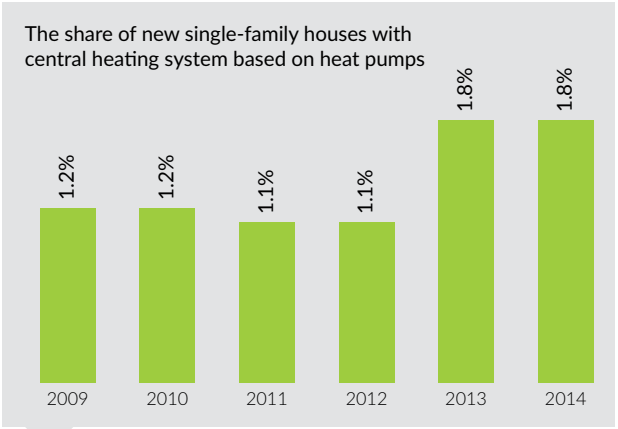
During the analysed period, heat recovery ventilation, heat pumps and solar energy were used in 4%, 2% and 3.5% of homes respectively.



Source: BuildDesk database

The number of new single-family houses with mechanical heat recovery ventilation	2009	2010	2011	2012	2013	2014
The number of houses with mechanical ventilation	462	402	458	464	405	333
The number of analysed houses	16 041	13 698	13 116	13 628	9 832	8 473
Share	**2.9%**	**2.9%**	**3.5%**	**3.4%**	**4.1%**	**3.9%**

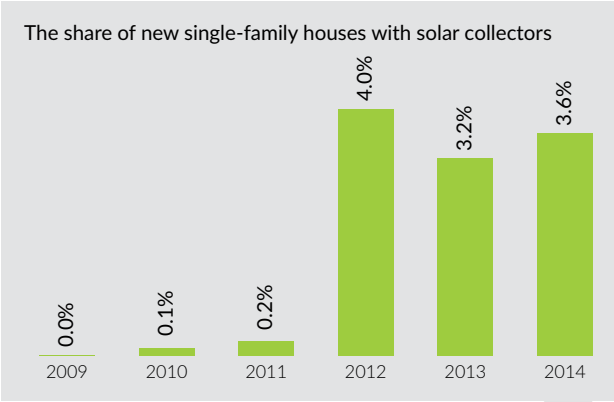
Source: BuildDesk database



Source: BuildDesk database

The number of new single-family houses with central heating system based on heat pumps	2009	2010	2011	2012	2013	2014
The number of houses with heat pumps	185	167	147	148	175	152
The number of analysed houses	16 041	13 698	13 116	13 628	9 832	8 473
Share	**1.2%**	**1.2%**	**1.1%**	**1.1%**	**1.8%**	**1.8%**

Source: BuildDesk database



Source: BuildDesk database

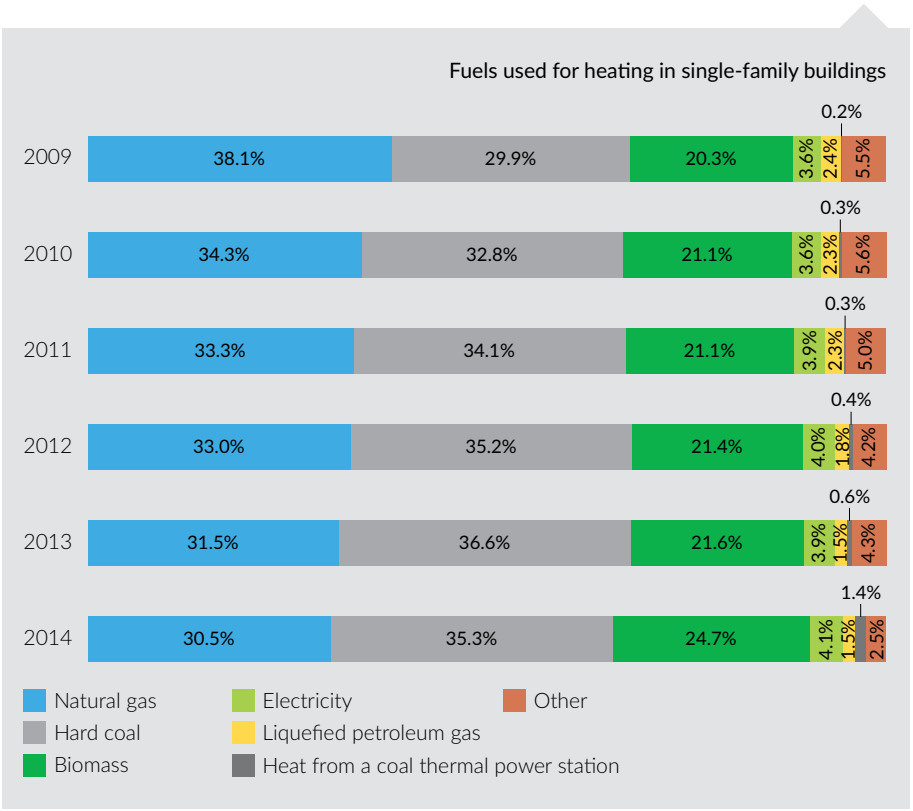
The number of new single-family houses with solar collectors	2009	2010	2011	2012	2013	2014
The number of houses with solar collectors	0	8	24	551	317	308
The number of analysed houses	16 041	13 698	13 116	13 628	9 832	8 473
Share	**0.0%**	**0.1%**	**0.2%**	**4.0%**	**3.2%**	3.6%

Source: BuildDesk database

Unfortunately, the total share of solid fuels in the structure of energy consumption of single-family buildings continues to grow. Increased reliance on solid fuels has a significant impact on the quality of air in Poland. Using these fuels, especially in urban areas with high density of development, results in air quality standards being significantly exceeded. Over the period 2009-2014, the share of coal-heated houses increased from 30% to 35.5% whereas the share of natural gas fell by over 7 percentage points. In 2014, solid fuels (coal and wood) were used to heat as many as 60% of newly erected single-family houses, which translates into a rise by 10 percentage points compared to five years earlier.

Interestingly, the declared use of biomass is still increasing. It may be largely linked with the need to meet the requirements concerning the consumption of primary energy (Ep). The easiest way to achieve the required Ep parameter

is to buy a coal-fired boiler and declare that 50% of energy will be derived from biomass. Later on, a lot of investors making such declarations, heat their buildings with coal only and in many cases its quality is rather poor. The actual quantity of coal used to heat newly erected single-family buildings may be much larger then.



Source: BuildDesk database

INSTRUMENT FOR FINANCING THERMAL MODERNISATION IN SINGLE-FAMILY HOUSING SECTOR – EXPERT OPINIONS

REPORT ON SURVEY AMONG ENERGY AUDITORS, REPRESENTATIVES OF THE SCIENTIFIC COMMUNITY AND LOCAL AUTHORITIES

ŁUKASZ **PYTLIŃSKI**
CEM MARKET AND PUBLIC OPINION RESEARCH INSTITUTE

ENERGY PERFORMANCE OF SINGLE-FAMILY HOUSING IN POLAND

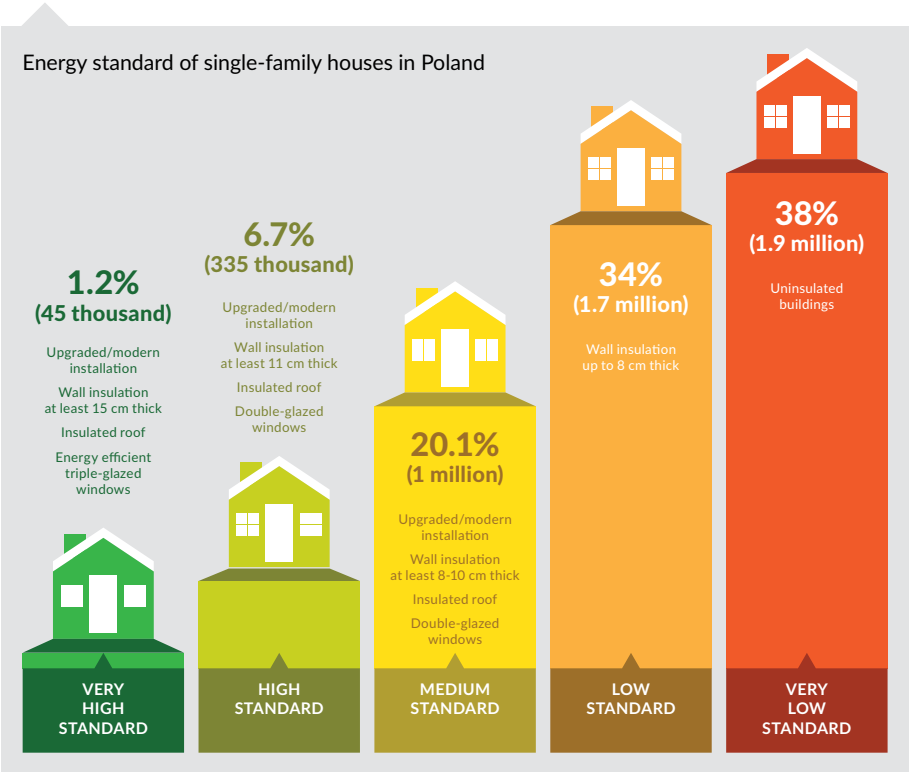
In the first half of 2015, in-depth quantitative research was conducted by the Institute of Environmental Economics in cooperation with CEM Market and Public Opinion Research Institute in order to evaluate the thermal modernisation progress made to date and analyse the desired measures for supporting this kind of activities in the sector of existing single-family buildings. The methods employed included in-depth interviews with experts in the fields relating to energy saving in buildings including energy auditors, representatives of the scientific community and local authorities (22 persons in total). **The main objective of the research was to identify barriers hindering the development of investment in improving the energy efficiency of existing buildings and to propose solutions that will effectively**

contribute to encouraging individual investors to take more decisive action in this area. This article presents the key findings of the research.

According to the data provided by the Central Statistical Office, there are more than 5.5 million single-family buildings in Poland. This sector has seen very dynamic development – over the last decade, 60-100 thousand new buildings were put into operation every year. Despite the fact that almost half of the population live in single-family buildings, successive governments have shown no interest in saving energy in this sector of housing. Multi-family sector has for years benefitted from numerous state-sponsored programmes supporting thermal modernisation. **As far as single-family housing sector is concerned, however, the scale and quality of the actions taken by public bodies to reduce energy consumption remain far from satisfactory and for the owners of single-family buildings the results of these actions are hardly noticeable**. Following years of underinvestment and neglect, the condition of single-family buildings in Poland, especially those erected before the year 2000, is very poor, especially when we look at the parameters concerning thermal insulation of their external envelope. According to the results of the research carried out by the IEE in cooperation with the CEM Institute in 2014, in over 60% of single-family buildings heat insulation is poor or very poor and around 30% of them do not have their external walls insulated against heat loss*.

All experts unanimously agree that the current pace of thermal modernisation in single-family housing sector is very slow, much slower than is the case of the multi-family housing sector. What is not very encouraging either is the fact that experts also agree that a considerable share of single-family building stock which, due to various factors, was likely to be covered by thermal modernisation measures initiated by investors, has already been covered by such measures, and the market has been saturated in this area. **Therefore, without a clear incentive from the state or a leap in fuel prices, actual stimulation of the market will be rather unlikely**.

* *Coal, old stoves and poor insulation. Heating systems and thermal insulation in single-family houses in Poland. Report from research* [in:] *Energy Efficiency in Poland. 2013 Review*, Institute of Environmental Economics, Kraków 2014.



Source: CATI 2014; sample N=500; Energy Efficiency Review 2013, Institute of Environmental Economics

„We can't really expect a lot of them [single-family houses] to be modernised in the nearest future. Those of them that were to be modernised, have already been. The modernisation works consisted mainly in replacing the windows; so, it wasn't a truly comprehensive modernisation."

It should also be noted that the quality of thermal modernisation works carried out so far in the single-family building stock leaves much to be desired. The majority of buildings that have already been modernised need further investment due to low standards adopted by the investors. The results of the above mentioned research show that the **average thickness of wall insulation in buildings erected before the year 2000 does not exceed 8 cm, which means it is far too inadequate from the point of view of modern standards of thermal modernisation**. Using thinner insulation layers in existing buildings is often based on a widespread misconception that

costs of thermal modernisation can be reduced this way and that thicker insulation has many disadvantages (buildings are like a "Thermos flask", less natural light in the rooms, walls don't "breathe"). In doing so, investors fail to see the advantages of following the modern recommendations relating to thermal insulation of the building envelope that aim at ensuring maximum energy savings over a long period of time.

BARRIERS HINDERING THERMAL MODERNISATION OF SINGLE-FAMILY BUILDINGS

The slow pace of thermal modernisation in the sector of single-family buildings is directly linked with the barriers resulting from the passive policy of the state in this area and the barriers resulting from the specific social context of our country. The first group includes, above all, the lack of effective financial instruments supporting thermal modernisation in the single-family housing sector. The only national aid scheme supporting thermal modernisation investments in multi-family, public and single-family sector, i.e. the Thermal Modernisation Fund, is not very popular with the latter ones.

This state of affairs mainly results from:

- significant additional costs for investors generated by a number of formal requirements, as a result of which this method of financing thermal modernisation investments may be seen as economically not viable;
- complicated system of providing the support, the principles of which are not intuitively understood by the vast majority of potential investors;
- the need to take out bank loans – given the fact that a large group of potential investors lack sufficient creditworthiness to be granted a loan, they cannot actually benefit from this instrument;
- the need to carry out comprehensive modernisation generating high costs, which in turn increases the costs of the loan;

MAIN BARRIERS HINDERING LARGE-SCALE THERMAL MODERNISATION OF SINGLE-FAMILY BUILDINGS IN POLAND:

- passive policy of the state: a lack of effective financial instruments supporting thermal modernisation in the single-family housing sector;
- low prices of solid fuels;
- lack of quality standards for solid fuels and emission standards for solid fuel boilers – very cheap and ineffective devices in which cheap and low quality fuels (including waste) are burnt are still commercially sold;
- lack of effective information campaigns;
- lack of attractive financial incentive.

- the financial incentive perceived by potential investors as economically not viable (a lot of investors, especially in rural areas, prefer to carry out the works by themselves or in cooperation with a local company offering construction and renovation services as they see this option as more attractive financially than using the support instrument).

„Investors think it's just not attractive enough. Even if they've received PLN 8 000, after deducting all indirect costs and bank commissions it suddenly turns out that there's only 5 000 left. And we have to bear in mind that all subsidies are also taxed."

Secondly, it should be noted that investors show little interest in carrying out thermal modernisation works also because the prices of solid fuels are so low. Houses heated with coal-fired boilers, especially with devices adapted to various types of solid fuels, are the most problematic ones. Nearly 70% of all single-family buildings are heated with solid fuels and the vast majority of them are equipped with very old

boilers which do not meet any emission standards*. Annual costs of heating with coal of the lowest quality groups are so low that rational arguments in favour of thermal modernisation, based on economic factors, are hard to justify.

* *Coal, old stoves and poor insulation. Heating systems and thermal insulation in single-family houses in Poland. Report from research* [in:] *Energy Efficiency in Poland. 2013 Review*, Institute of Environmental Economics, Kraków 2014.

„If, for example, somebody's home is heated with an oil boiler, the costs of insulating the building will be paid off within 7-8 years. But if someone uses fine coal, a tonne of which costs PLN 200, it may turn out that not much is actually saved. If, as a result of thermal modernisation, we manage to save 5 tonnes of coal dust and reduce the bill by PLN 1 000 or 800, then spending PLN 80 or 100 thousand on such modernisation means that it will take 100 years before the investment pays off."

Equally important is the above mentioned social context. In order to shape social attitudes, it is necessary to use well-targeted incentives that provide convincing arguments to potential investors. Experts agree that the currently conducted information campaigns do not present properly targeted arguments highlighting the benefits of long-term thinking. Vague information campaigns to promote energy saving do not motivate Poles anymore, they only contribute to raising environmental awareness, which does not translate, however, into undertaking any projects requiring substantial investment – and thermal modernisation definitely falls within this category. It has also been stressed that in order to stimulate large-scale action in our country, a very well-targeted incentive (in this case a financial one) must be used. Only tangible financial support, like the subsidies for the installation of solar collectors, can help remove the barriers and initiate a comprehensive process involving numerous investors who will be willing to follow each other's example, but only when the offer is generally considered attractive.

INSTRUMENT FOR FINANCING THERMAL MODERNISATION IN SINGLE-FAMILY HOUSING SECTOR – DESIRED FEATURES

Most experts agree that, due to the nature of the existing barriers, a new instrument for financing thermal modernisation dedicated exclusively to single-family housing sector must be created. This tool could contribute to a significant reduction in the amount of energy consumed by single-family buildings, but it would also stimulate the market for construction and renovation services, thereby influencing positively a number of other sectors of economy in Poland.

Creating an effective instrument is undoubtedly a huge challenge and its final form should be supported by numerous analyses and demand surveys, the results of which should facilitate identification of features that would make the instrument attractive for as many beneficiaries as possible. However, already at the design phase experts have pointed out a number of general requirements that such an instrument should meet if it is not to become another useless tool not addressing market expectations.

Experts are also convinced that the new financing instrument should be of a hybrid nature, providing access to both subsidies and loans. The subsidy should serve as an incentive for potential investors and the loan must be linked with financial savings resulting from the implementation of investment projects. Having analysed a number of proposed solutions experts suggest that the most optimal one would be to offer **a subsidy covering 30% of the eligible costs along with a commercial loan for the implementation of the remaining part of the investment**. It does obviously not solve the problem of investors lacking creditworthiness who will benefit only from subsidies only.

BASIC FEATURES OF AN EFFECTIVE INSTRUMENT SUPPORTING THERMAL MODERNISATION IN SINGLE-FAMILY HOUSING SECTOR:

- access to both subsidies and loans-hybrid instrument;
- simple procedures for granting subsidies and loans;
- adequate promotion of the instrument;
- linked with heat source replacement (for persons using old and inefficient solid fuel boilers).

„First of all, the financial instrument must be simple, it can't be associated with parameters which people don't understand (e.g. with thermal transmittance values). Requirements to be met in order to receive financing must be easy to remember."

The analysis of expert opinions also leads to the following conclusions concerning the form of the new financing instrument:

- one of the main shortcomings of the existing forms of support was the excessive number of complex procedures to be followed in order to obtain financing. Therefore, it seems quite clear that **the new instrument should first of all be characterised by simplicity**. Mechanisms governing the functioning of the instrument should be clearly described so that all potential beneficiaries know what steps to follow without the need to consult any specialists;
- the new instrument will only produce the desired results if it is accompanied by **a comprehensive information and promotional campaign**. A short catchy slogan should be used to summarise briefly how the instrument works and it should be accompanied by convincing, rational arguments;

- as far as loans are concerned, they will have to be granted through banks. The **procedures associated with granting a loan will, however, have to be limited to the minimum** (the problem of recognising the financial aid as additional income will also have to be solved, which necessitates changes in the legislation);
- it is obvious that those wishing to benefit from the new instrument would have to arrange for an energy assessment of their home to be conducted. Energy audits that have been conducted so far are, according to the auditors themselves, not adapted to the specifics of the single-family housing sector, outdated, too complicated, time consuming and costly. There is therefore **a strong need to develop a new tool for assessing the energy efficiency of single-family buildings**. According to experts, the tool should meet the following criteria:
    - the possibility of being used on a large scale;
    - low cost per unit;
    - full or partial financing by a financial institution;
    - the possibility of being used to assess both the initial condition of the building and the effects of thermal modernisation;
    - conducting the assessment does not require highly specialised knowledge.

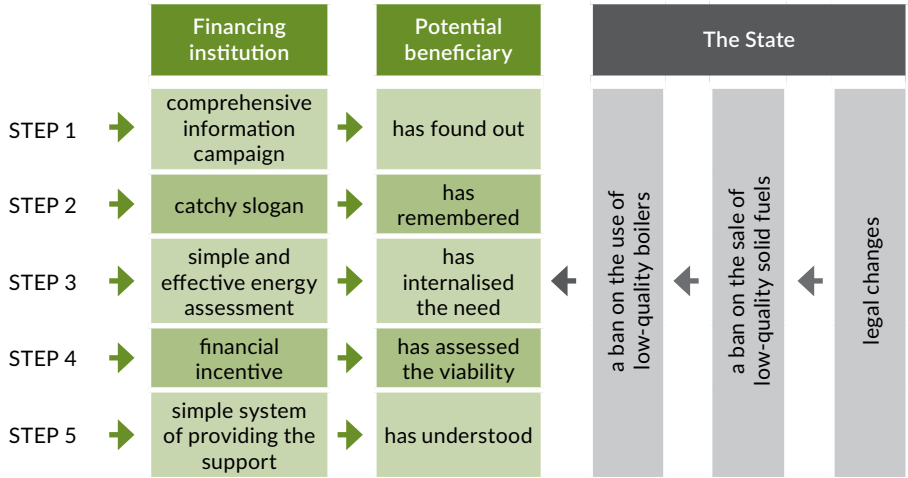
It is commonly agreed that the new financial instrument should be addressed to all owners of single-family houses. What is worth pointing out, however, is the fact that the attractiveness of the instrument will be assessed differently by different segments of potential investors, especially those identified according to the type of heat source used. **The most problematic group, which is at the same time the largest and undoubtedly the most troublesome one from an environmental point of view, comprises owners of houses heated with the most emission-intensive coal-fired appliances. Their needs should therefore be taken into account in the first place when deciding on the final form of the financial instrument – it should be adapted to the needs of those investors whose expectations will be the most difficult to meet**.

In this context experts agree that thermal modernisation works must include both heat source replacement and building envelope renovations. The incentive to replace the sources which use the cheapest fuels must be significant. At the same time, if individual stages of investment projects (heat sources and building envelope) were financed partly from local programmes focusing on heat source replacement (as is the case, for example, in Kraków) and partly from the new national programme providing funds for building envelope renovations, **the amount of financial support should depend on whether the heat source in a given building has already been replaced or the owner of this building has made a binding commitment to have it replaced**.

„It would be good if those who have coal-fired boilers were offered a subsidy for the replacement of these appliances and if they they could at the same time benefit from a financial instrument linked with the subsidies or from an instrument functioning partly as a loan and partly as a subsidy for thermal modernisation. The latter one would be a nationwide instrument."

It should also be noted that the environmental objective of a maximum reduction of emissions from the single-family housing sector will not be achieved without decisive action taken by public bodies to introduce the necessary legislative

An outline of the actions with regard to the development of a new financial instrument



changes. The situation we are aiming for is one where the worst types of coal are no longer used in Polish households, a ban on low-quality solid fuels is introduced and, consequently, stricter emission standards are established for solid fuel boilers, as a result of which the most air polluting appliances can be eliminated. **There are still justified concerns that if public bodies do not send a clear signal that sooner or later each owner of a single-family building will have to comply with stricter emission standards for heating appliances, even a perfect instrument intended for the financing of thermal modernisation in single-family housing sector will lag behind the market reality.**

HOW AN INSTRUMENT SUPPORTING THERMAL RETROFITS OF HOUSES SHOULD LOOK LIKE

BANKS' PERSPECTIVE

AUTHORS OF THE FULL REPORT "BANK PRODUCTS SUPPORTING THERMAL RETROFITS OF HOUSES – CONTEXT, STATUS QUO, OPINIONS AND RECOMMENDATIONS": ANDRZEJ KOMAŃSKI AND RYSZARD SIKORSKI

AUTHOR OF THE SUMMARY:
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Under the project implemented by the Energy Efficiency Financial Institution Group, the Kraków's Institute of Environmental Economics has prepared a report summarising opinions of Polish banks regarding their involvement in the financing of thermal modernisation projects. The full report is available in Polish at the IEE's website: **www.iee.org.pl.**

Based on interviews with representatives of the banking sector, the report summarises the positions and recommendations voiced by all the most significant financial institutions in Poland. The authors of the report have defined barriers linked to financing of thermal retrofits of houses and presented recommendations that can translate into dynamic growth of this segment of financial products.

The authors of this report are aware that without widespread access to easily available loans for thermal retrofits, reduction of heat consumption in Polish households will be extremely problematic.

SUMMARY AND RECOMMENDATIONS

- The banking sector recognizes the large potential that lies in development and operation of financial products that address thermal retrofits of buildings. However, this will not be an easy task and will require reconciliation between two seemingly contradictory interests. **On the one hand, the loan scheme has to secure financial profits for banks and on the other it has to be easily available for potential clients, taking into account financing itself as well as procedures**.
- Loans for thermal retrofits should be available for as wide as possible group of buildings owners. This means, however, that **procedures for granting these loans should be as simple as possible.** This refers to both, documents and energy audits.
- It is also important that accessing the loan is relatively inexpensive for end users. This can be achieved by **low borrower's contribution, subsidies to loans or partial payment of loans from public funds**. Securing such support is particularly important in case of less affluent clients. This group of house owners requires special support in conducting thermal retrofits.
- The loan scheme for thermal retrofitting of houses has to secure financial institutions with stable and satisfactory income. At the same time, the financial risk should be low. Therefore, it would be helpful to introduce a system of guarantees for borrowers. In financial instruments supporting thermal modernisation the loan cost for the client and the actual commercial price obtained by the bank offering the loan should be separated.
- Development of central-level system solutions and support from public funds as well as under the fiscal policy are indispensable. Single family house owners should have access to tax exemptions in order to deduct costs of thermal retrofitting.

THE NEED OF THERMAL MODERNISATION OF SINGLE FAMILY HOUSES IN POLAND

According to the 2011 National Census, there are over 6 million buildings in Poland, out of which 5 million are single family houses (3.3 million in rural areas and 1.7 million in urban areas). As much as 90% of them are detached houses. Over half of Poles (19.5 million) live in single family houses – nearly 6.5 million in urban areas and over 13 million in rural areas. Nearly 90% of people inhabiting rural areas and nearly 30% of people living in urban areas reside in single family houses.

In last decades a growing number of Poles have moved to their own single family houses. The percentage of Poles inhabiting single family houses grew from 49.5% in 2005 to 53.7% in 2013. The research conducted in 2014 by the Institute of Environmental Economics and the CEM Market and Public Opinion Research Institute shows that around 70% of single family houses are of low or very low energy standard, while over 30% has no thermal insulation of the building envelope whatsoever.

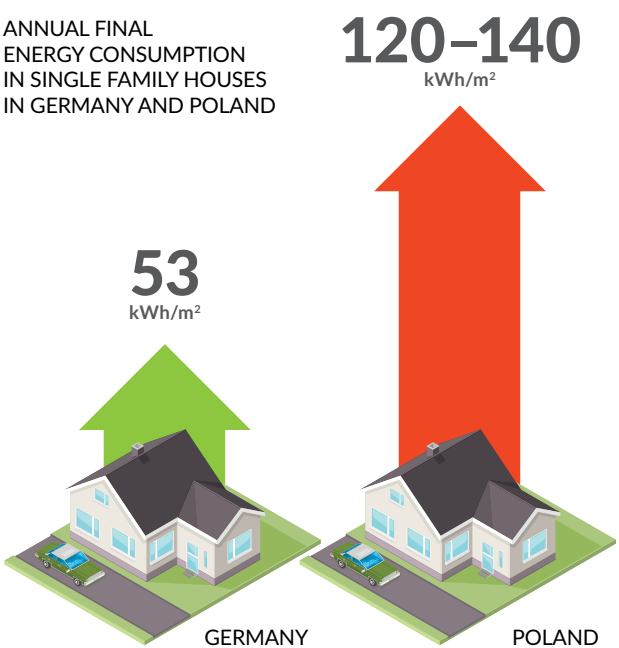
Energy efficiency issues are regulated in the Directive on energy efficiency (2012/27/EU). Article 4 of the Directive, entitled "Building renovation" is of key significance in the context of this report. **The Directive obliges the Member States to develop a long term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private.** The strategy has to encompass among other things: identification of cost-effective approaches to building renovations, policies and measures to stimulate cost-effective renovations of buildings as well as a forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions.

In the EU Member States, residential buildings consume more energy than industry (27% compared with 25%) and nearly as much as transport (32%). According to the Eurostat data for 2013, **the share of Polish households in final**

energy consumption is the highest from all EU Member States and exceeds 32%.

These data show that thermal modernisation possesses significant potential in lowering energy consumption and greenhouse gas emissions. Residential buildings in Poland have one of the worst energy consumption and CO_2 emission ratios. The EU average CO_2 emission is 54 kilo of CO_2 per m^2. In Poland it is over twice as high and reaches 110 kg CO_2/m^2. Last but not least, thermal retrofitting of single family houses will have a significant positive impact on air quality improvement in Poland.

Annual final energy consumption in the sector of single family houses in Germany has decreased from 246 kWh/m^2 in 1957 to only 53 kWh/m^2 in 2010. **In Poland single family houses consume 120-140 kWh/m^2, which can be compared with German houses in early 1970s.** Despite the fact that both countries lie in the same climate zone, an average Polish house consumes nearly three times more energy than an average German house. This means that **Poland has vast untapped possibilities for reducing energy consumption and increasing the country's energy independence.**



SUPPORT FOR THERMAL MODERNISATION OF SINGLE FAMILY HOUSES SO FAR

Past governments have been uniform in ignoring the need for energy efficiency improvement of single family houses in Poland. **Despite the fact that over half of the country's population live in single family houses, an attractive loan scheme for thermal retrofits in this building sector has not been developed.**

Most of single family houses in Poland are old, which means that they are characterised by high energy intensity. Renovation of these buildings is not comprehensive, on the contrary, it is incidental and lacks sufficient financial support.

The Institute of Environmental Economics estimates that **the value of the loan market addressing thermal retrofits of houses reaches PLN 70 billion!** Assuming that 70% of the existing stock of single family houses, i.e. houses without or with poor thermal insulation, is renovated and 3 million of old solid fuel boilers are replaced, **thermal retrofits of single family houses can create an important flywheel effect for a modern and innovative economy.**

Unfortunately the already exiting public and private financial instruments do not allow for effective financing of renovation and thermal retrofitting of single family houses. This can be illustrated by the case of the **Thermal Renovation Fund**, launched when the Act on support for thermal modernisation came into force. **During 16 years of its operation, only 750 thermal renovation bonuses were granted for single family buildings, which is less than 1% of all bonuses awarded by the Fund!** The reasons of this low uptake include: complicated procedures, lack of connection with bank offers, restricted availability of loans, high transaction costs and low awareness that such a financial instrument exists. Due to administrative and loan-related barriers, owners of single family houses do not apply for bonuses from the Thermal Renovation Fund. The authors of this report are convinced that this potential should be exploited.

RESEARCH METHODOLOGY AND PROCEDURES

The research was conducted in October and November 2015 and was based on a previously prepared questionnaire. Representatives of all significant financial institutions operating in Poland were invited:

- Bank PeKaO S.A.;
- PKO Bank Polski S.A.;
- Alior Bank S.A.;
- Bank Gospodarstwa Krajowego;
- Bank Zachodni WBK S.A.;
- BGŻ BNP Paribas S.A.;
- mBank S.A.;
- Bank Ochrony Środowiska S.A.;
- FM Bank Polski Bank Przedsiębiorczości S.A.;
- Bank Pocztowy S.A.;
- Raiffeisen Polbank S.A.;
- Bank BPH S.A.;
- SGB Bank S.A.;
- Bank Polskiej Spółdzielczości S.A.;
- Krakowski Bank Spółdzielczy.

These institutions were represented by high level staff, such as members of boards, directors of bank head offices, as well as experts working for banks' boards. Therefore, interviewees created a representative group. Their opinions can be regarded as opinions of the managerial staff of the most important institutions in the Polish banking sector. These institutions will have a significant impact on development of financial instruments aimed at providing loans for thermal renovation of single family houses and condominiums.

BANK OFFERS
FOR INDIVIDUAL CLIENTS

Analysis of interviews reveals that nearly all financial institutions offer loans that can be used for financing thermal renovation. However, these are commercial products, which means that they are to generate the highest possible income for the bank at limited risk. In such products interest rates are high, therefore, it would be wrong to expect that such instruments will translate into wide scale thermal renovation measures.

Some commercial banks that operate outside Poland possess experiences from other countries in financing of projects aimed at improving energy efficiency of single family or multifamily houses. These projects were often implemented with the use of public programmes and funds. These experiences constitute a valuable resource of lessons learnt.

Bank representatives stressed the difference between individual clients with an employment contract and freelancers. When developing financial instruments to provide loans for thermal renovation of houses, different methods for assessing creditworthiness applied in these groups.

In the respondents' opinion, the programmes aimed at financing of thermal renovation implemented in 2000-2014 and supported from public funds or external financing proved ineffective. Their main drawbacks, both for end clients and banks, are: complicated procedures, excessive documentation for obtaining financing and a high level of transaction costs.

Bank representatives have also stressed that low interest in loans for thermal retrofits results to a large extent from the fact that around **50-60% of buildings that should undergo thermal renovation is owned by people with low creditworthiness and low stable income**.

ASSESSMENT OF ATTRACTIVENESS OF PUBLIC PROGRAMMES SUPPORTING RENOVATION AND THERMAL MODERNISATION AND BANKS' WILLINGNESS TO PARTICIPATE IN DEVELOPMENT OF NEW MECHANISMS

According to banks' representatives **none of public programmes supporting bank financing of thermal renovation was attractive enough to have a visible impact on individual clients interest in loans for thermal retrofits**.

The programme implemented by Bank Gospodarstwa Krajowego under the Thermal Renovation Fund was assessed relatively positively, as an attractive programme for housing associations, condominiums and local government. However, the respondents voiced negative opinions about the large number of necessary documents and complex procedures, which inflate transaction costs covered by end clients. Communication with the managing institution and settlement procedures are also too complicated. The high transaction costs are the main reason behind the low interest in this mechanism among owners of single family houses.

The banks are planning to continue providing loans for residential buildings. Therefore, extending the loan scheme so that it covers loans for thermal renovation, especially with involvement of public funds, is well received. Unfortunately, **effectiveness of public programmes supporting thermal retrofits that have been implemented so far was low due to complicated procedures and high prices.**

Profitability of thermal renovation loans is of key importance for banks. The respondents stressed that their institutions are not able to provide access to the commercial offer for owners of single family houses who due to socio-economic reasons are not able to obtain a loan. Using real estate assets as a guarantee for the thermal renovation loan was considered as a good solution.

Banks prefer to provide thermal renovation loans from their own resources rather than public funds. Some institutions were considering cooperation with Bank Gospodarstwa Krajowego and the National Fund for Environmental Protection and Water Management for providing individual loans, but due to complex control and reporting procedures and related costs it was impossible.

Loan products offered for banks by funds are not attractive to banks as well as end clients. Bank margins are too low to cover the effort connected with documentation. The requirement to provide loans for 30 years also constitutes a barrier as banks prefer 20-year-long loan periods.

The need of an energy audit for thermal modernisation loans unnecessarily extends project duration and increases the costs covered by clients. The requirement to present invoices for renovation works is also an obstacle, as it makes the loan less attractive for people that perform renovation works themselves.

Bank representatives propose that procedures for thermal modernisation loans for individual clients are modified. The most important recommendations include:

- maximum simplification of procedures;
- shortening of the investment process by introduction of standardised requirements depending on the building's volume and defining a set of necessary works and materials;
- reimbursement of the costs connected with energy audit by the managing subject or the public institution.

POSSIBILITIES FOR COOPERATION IN DEVELOPMENT OF INSTRUMENTS FOR FINANCING OF THERMAL RETROFITS OF BUILDINGS WITH THE USE OF PUBLIC FUNDS

Providing loans for modernisation of single family houses can be attractive for a majority of banks, however, current interest stays with housing associations and condominiums. Banks are willing to cooperate with public institutions that are responsible for development of financial instruments within which loans will be provided for thermal retrofits of single family houses. The respondents are convinced that it is worthwhile to jointly develop a concept of a financial instrument that will allow for launching a commercial product for individual clients.

According to bank representatives, there are several obstacles hindering participation in public programmes supporting thermal retrofits. One of them is a lack of direct support mechanisms for banks to make them more active in financing this market segment, i.e. mechanisms that would lower the cost of capital. Another problematic area are high transaction costs for thermal modernisation loans subsidised from public funds.

All parties would be willing to participate in development of thermal modernisation long as long as such loans are supported from public funds (subsidies, partial or total repayment of interest, documentation cost reimbursement) and at the same time banks are guaranteed that these programmes are profitable for them. Otherwise financial institutions will not be interested in allocating their resources in development of the products, its management and marketing.

BANK'S EXPECTATIONS ON SUPPORT INSTRUMENTS FOR WIDE SCALE PROGRAMMES FOR FINANCING THERMAL RETROFITS OF BUILDINGS

- development of an effective and wide scale loan product for financing of retrofits and thermal modernisation requires that a system of incentives, tax reliefs and subsidies for end clients is developed. A modernisation loan has to be competitive and attractive for clients;
- the key point of interest for banks is the product's profitability. It covers the following factors: price parameters, financial support concept, risk optimisation cost and marginal efficiency of allocated capital;
- banks will not be willing to cover the costs of disseminating information about new loan possibilities if obtaining expected efficiency and the effect of scale is not highly probable;
- addressing the problem of loans for people with low creditworthiness is an essential point, as the needs for retrofits and thermal modernisation are the highest in this segment of clients;
- development of an independent guarantee fund would allow for opening loans for clients without financial security;
- available public funds will be crucial for developing an effective support system and making the loan scheme open to a wide group of clients. They should be used for lowering transaction costs and improving access to financing for people with lower income;
- providing subsidies to loans on the level of mechanisms that lower the principal part of the loan (pre-financed, reversed own contribution);
- resigning from the requirement of own contribution in case of individual clients;

- significant simplification of the system and application procedures, standardisation of requirements and procedures for loan documentation;
- guaranteeing proper loan parameters (interest rate, provision, guarantees, loan period);
- elimination of entry costs covered by clients and minimisation of transaction costs.

RECOMMENDATIONS FOR A BANK PRODUCT AIMED AT FINANCING OF RETROFITS AND THERMAL MODERNISATION OF SINGLE FAMILY BUILDINGS

Attributes of a commercial product

Bank representatives underline that modernisation and energy efficiency of buildings possess a large product and market potential, provided that the following criteria are fulfilled:

- uncomplicated and cost-free procedures;
- public support for investment costs and interest rates;
- low own contribution on the part of clients;
- stable and expected profits for bank with a relatively low credit risk and no operational risk;
- mortgage guarantee as the main solution, for transaction below a certain threshold – bill of exchange with a possibility of credit payment insurance.

Mechanism for limiting credit risk

A mechanism limiting credit risk for a product dedicated to financing of retrofits and thermal modernisation of single family houses should contain the following elements:

- assessment of creditworthiness according to bank's own procedures;

- possibility of lowering the loan when certain conditions are met (from public subsidies), e.g. repayment of a part of the loan from public funds;
- independent assessment of real estate in terms of energy consumption and real estate value estimation covered from assistance funds after positive formal and legal verification of the client by the bank;
- guarantee fund.

Public support according to priorities

Forms of public support ranked according to declared priorities include:

- guarantee fund;
- subsidies to a part of investment costs, e.g. to own contribution;
- covering costs of documentation from public funds;
- subsidies to interest rates.