



BEST PRACTICES for your house

The power of solar technologies –
how to use solar power at home
Investment in Marek's house

Under the technical supervision of Prof. Andrzej Szlęk, Ph.D. (Eng)

#SilesiaBlueSkyRestored



TABLE OF CONTENTS

1. About the “Silesia. Blue Sky Restored” project.	2
2. Environmental consultants in the Silesian Voivodeship	2
3. Investment in Marek’s house	3
4. Applied solutions	5
5. Expert’s view: on green home technologies	15
6. The pros and cons of the investment	18
7. Steps required to complete a similar investment	20

ABOUT THE “SILESIA. BLUE SKY RESTORED” PROJECT

Starting from January 1st, 2022, the Silesian Voivodeship has been implementing a LIFE integrated project called “Silesia. Blue Sky Restored” whose main goal is smooth and effective implementation of the air protection programme for the Silesian Voivodeship and the anti-smog act.

The scope of the project covers the whole Silesian Voivodeship and all residents, engages 84 partners, including as many as 74 Silesian municipalities and cities. The total value of the project is € 16 515 020. The activities related to the project have already been recognised twice – the Silesian Voivodeship was awarded the title of the Energy Transformation Leader and won the 2022 WPROST Innovator Award.

The project includes both soft activities and investments, including the ones aimed at improving the energy efficiency of public buildings or increasing green areas by developing post-industrial areas.

ENVIRONMENTAL CONSULTANTS IN THE SILESIA VOIVODESHIP

As part of the project, a group of 74 representatives of municipalities was created, the so-called environmental consultants, who work locally within a municipality. In the municipalities that do not have their own environmental consultant, residents are supervised by sub-regional environmental consultants. Their role is to provide consultancy services for residents and initiate and coordinate local activities aimed at improving air quality.

The scope of the environmental consultants’ activities is broad and includes:

- assistance in obtaining funding – they help residents receive funding for replacing the heating source and improving the energy efficiency of buildings,
- technical consultancy – they provide professional advice on the replacement of the heating source improvement of energy efficiency,
- education in society – they educate residents on the improvement of air quality,
- initiating eco-friendly activities - they initiate and coordinate local activities and investments aimed at improving air quality and reduction of greenhouse gas emissions,
- inspections and compliance with regulations – they actively participate in the inspections of furnaces for compliance with the anti-smog resolution and the prohibition of waste disposal by burning,
- supporting local administration – they assist in obtaining external financial support for municipalities within the scope of environmental activities.

The full list of environmental consultants can be found at:
przywracamylekit.slaskie.pl/ekodoradcy

INVESTMENT IN MAREK'S HOUSE

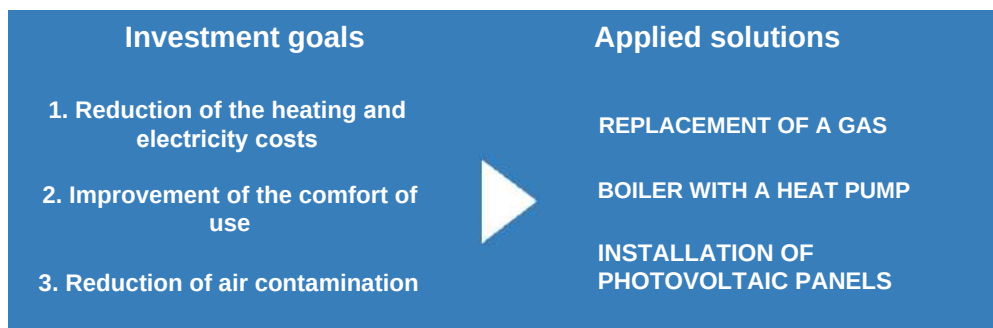
Marek, a resident of Kamieńskie Młyny, a village in the Lubliniec county, in the municipality of Woźniki, had the opportunity to learn more about the benefits of solar power a few years earlier, when he decided to install solar collectors. Thanks to that totally sustainable solution he was able to produce the heat for utility water. When new funding programs for investments in renewable energy sources became available, he decided to improve the comfort of living in his house, become independent from the rising prices of fossil fuels and contribute to the efforts to make the air cleaner. From 2021 to 2022 he was completing an investment for which he received funding.



Technical conditions before the investment

Building type	single-family detached house
Year built	1978
Usable floor area	220 m ²
Estimated annual building heating needs	± 26 400 kWh (120 kWh/m ² x 220 m ²)
Number of floors	3 (including the basement)
Basement	full, unheated basement
Exterior walls construction technology	masonry block walls, insulated
Roof construction	flat roof
Roofing material	tar paper
Roof insulation material	polyurethane foam
Window technology	PVC double-chamber
Heating source prior to the investment	classless coal-fired boiler
Room heating type	mixed: underfloor heating and radiators
Water heating method prior to the investment	classless coal-fired boiler, vacuum solar collectors
Number of residents	3
Average annual hot utility water consumption	40 m ³
Average air temperature in the building during winter	23 C

The heating needs are one of the key factors affecting the building heating costs. It specifies the amount of heat required to maintain proper temperature in the building. This need includes many variables, such as: building volume to be heated, thermal insulation (exterior walls and roof construction technology, including the type and thickness of the insulation material used), window and door area and their technology, condition of the heating equipment, air temperature, building ventilation type. In the case of older, insulated buildings, such as Marek's house, building's heating needs are estimated at around 120 kWh/m².



The selection of the applied technological solutions was preceded with the assessment of own financial resources and the possibility of achieving the investment goals. Eventually, Marek chose a heat pump and photovoltaic panels.

Each technology selected by Marek has a particular intended use. A heat pump is a heating device supplying heat partially absorbed from outside, usually from the air or ground, to the central heating and hot utility water system. It is distinguished by its high comfort of use and eco-friendliness. It must be powered with electricity. In the case of the system functioning in Mark's house, the photovoltaic panels that convert solar energy to electricity are the perfect addition to the heat pump. On sunny days they generate electricity which is used to power electrical devices, including the heat pump. The previously installed solar collectors, used to heat the utility water, are the perfect addition to the house's heating system.

Learn more about the benefits of using this type of solution in your house.

Are you considering a similar investment in your house? Would you like to enjoy affordable and eco-friendly heat and electricity? Learn more about how Marek dealt with heat pump and photovoltaic installation. After reading our publication you will know how to prepare for installation of modern technologies using renewable energy sources!

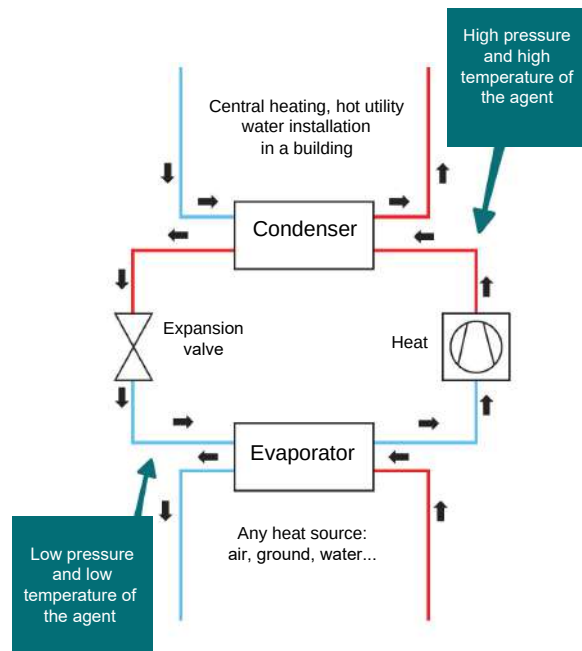


By choosing to install a heat pump and photovoltaic panels, and earlier the solar collectors, Marek and his family joined other people who restore blue sky in the Silesian Voivodeship.

APPLIED SOLUTIONS

Heat pumps

A heat pump is a device which produces heat for a central heating system and/or hot utility water installation while using the heat obtained from the environment (air, ground or water) and electricity used to power a compressor.



Heat pumps used in houses, even though there are several types, have four basic elements:

- Evaporator (heat exchanger) is a component in which the heat from outside is collected to a working agent (a special fluid) flowing inside the pump system compressor. The heat supplied the working agent fluid evaporates and flows into the compressor in the form of gas.
- The compressor is an element in which the working agent in the form of gas is compressed, which raises its pressure and temperature.
- Condenser (heat exchanger) is

a component in which the working agent transfers the heat to the heat agent – water. As a result of the heat transferred, the working agent condensates and flows to the expansion valve in liquid form.

- The expansion valve is an element that reduces the pressure and temperature of the working agent which flows into the evaporator in liquid form.

Usually, a heat pump is comprised of the so-called indoor and outdoor unit. The outdoor unit collects the heat from the outside to the working agent with lower temperature, and transfers the heat in the indoor unit to the working agent with higher temperature to the heating agent in the house installation. There are heat pumps in which these elements are placed in one external casing.

How does a heat pump work?

The construction and operation of a heat pump is similar to a refrigerator, where we transfer the heat from the inside of the fridge compartment outside to the kitchen space, thanks to a compressor. Depending on the type of the heat pump, heat is collected from the air, ground or water and transferred to the heating system, also thanks to a compressor, powered with an engine, which is powered with electricity.

At the first stage, inside the heat pump, the working agent absorbs the heat from the outside (air, ground, water) and changes to gas in the device's evaporator. At the second stage, the working agent in gas form inside the compressor raises its pressure and temperature. At the third stage, the working agent in gas form with high pressure and temperature transfers the heat to cooler water in the heating system and changes to liquid in the heat pump's condenser. At the last, fourth, stage, the working agent in liquid form in the expansion valve lowers its pressure and temperature. In this way the thermodynamic cycle ends and the first stage of the heat pump operation starts.

➤ A heat pump in a standard building of 100 square metres requires about 3,000-4,000 kWh per year, out of which about 2,000-3,000 kWh is the need for heat for central heating, while about 1,000 kWh is the need for heat for hot utility water circulation. These are estimated values which differ, depending on several factors, such as the building's heating needs, which depend mainly on the building's energy standard, energy tariff, number of residents, their lifestyle, etc.

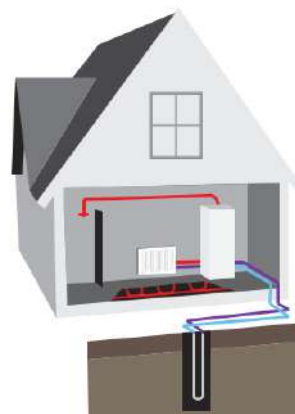
➤ A heat pump has a long life expectancy because it usually lasts for around 20-25 years. Similarly to other heating devices, its high performance requires regular (usually annual) maintenance inspections.

➤ A heat pump is more effective when used with low-temperature heating, e.g. underfloor heating.

➤A heat pump ensures proper thermal comfort in a building, also at lower outside temperatures. It is equipped with an electric system supporting its operation which turns on when the outside temperature is below the optimum temperature for the evaporator to work. In such a situation, the costs of its operation are slightly higher.

Types of heat pumps

Types of heat pumps differ, depending on their energy source. Usually, heat pumps absorb energy from: the air, ground, surface or ground water.



Ground source heat pump

in which the heat for the evaporator is absorbed from the ground
vertical collector system



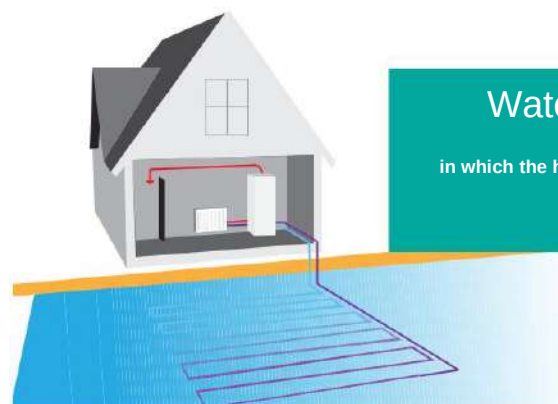
Air source heat pump

in which the heat for the evaporator is absorbed from
air outside



Ground source heat pump

in which the heat for the evaporator is absorbed from
the ground horizontal collector system



Water source heat pump

in which the heat for the evaporator is absorbed from
surface water



Water source heat pump

in which the heat for the evaporator is absorbed from
ground water

Heat pump type	How it works	Characteristics compared to other types of heat pumps
Air-air	They absorb the heat from air outside and transfer the heat at higher temperature directly to the inside of the building using ventilators placed in outdoor units.	+ integrated heating, ventilation and cooling systems (free air conditioning in rooms in summer when powered by a photovoltaic installation with appropriate power) + no medium (e.g. water) which reduces heat loss + lower costs + it does not require central heating installation, so it is perfect for buildings where its installation is impossible or cost-ineffective (e.g. summer cabins) - less efficient at lower temperatures - cannot produce hot utility water (an additional unit must be purchased) - relatively loud - lower comfort of use compared to water installations (e.g. underfloor heating)
Air-water	They absorb the heat from air outside and transfer the heat at higher temperatures to water-based systems, e.g. radiators or underfloor heating. Can be used to heat hot utility water.	+ relatively easy installation + multifunctionality (house, utility water heating, air conditioning) - less efficient at lower temperatures - relatively low cost - requires more space for installation



Heat pump type	How it works	Characteristics compared to other types of heat pumps
Ground-air	They absorb the heat from the ground and transfer the heat at higher temperature directly to the inside of the building using ventilators placed in outdoor units.	+ high efficiency + stable, regardless of the outside temperature + quiet and maintenance-free + ability to cool the building on hot days - high initial investment costs - requires expensive boreholes (for vertical collectors) or excavation (for horizontal collectors)
Ground-water	They absorb the heat from the ground and transfer the heat at higher temperature to water-based systems, e.g. radiators or underfloor heating. Can be used to heat hot utility water.	+ high efficiency + stable, regardless of the outside temperature + quiet and maintenance-free + multifunctionality (house, utility water heating, air conditioning) - high initial investment costs - requires expensive boreholes (for vertical collectors) or excavation (for horizontal collectors)
Water-water	They absorb the heat from underground or surface water and transfer the heat at higher temperature to water-based systems, e.g. radiators or underfloor heating. Can be used to heat hot utility water.	+ high efficiency + stability depends on the temperature and the stream of underground or surface water + quiet and maintenance-free + ability to cool the building on hot days - high initial investment costs - requires clean ground water

Benefits of installing a heat pump – summary

Characteristics	Benefits
Do not emit harmful exhaust gas	Eco-friendly
Cheaper to maintain than traditional heating systems	Energy saving
Require minimum maintenance and repairs	Comfort
Eliminate the risk of fire, explosion or carbon monoxide poisoning	Safety
Can heat rooms and utility water and cool rooms	Multifunctionality
Easy to install, long lifespan	Easy installation, long lifespan

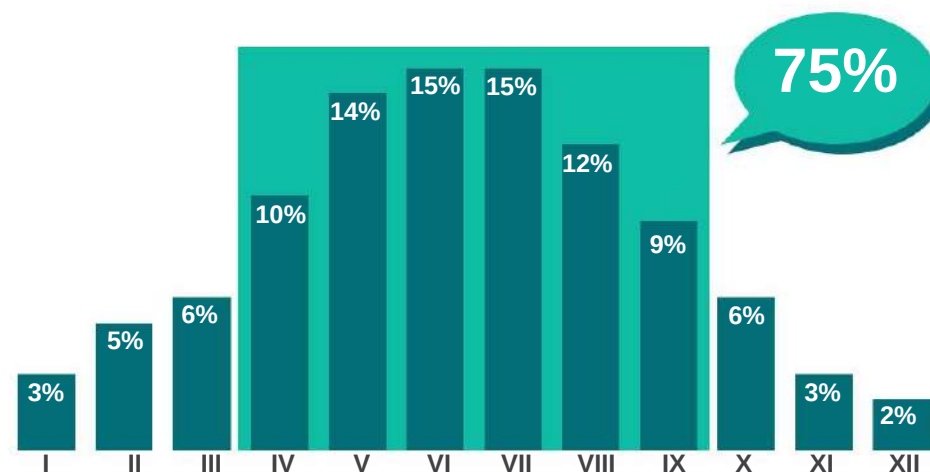


Photovoltaic panels

To minimise the costs of heating, preparing hot utility water and building cooling on hot days, it is worth considering an installation integrating a heat pump and a photovoltaic installation. This solution allows for the use of the energy from solar radiation to directly power a heat pump with free electricity. This solution is 100% green. Any possible energy surplus produced by the photovoltaic installation on sunny days can be stored in the form of heat in the utility water reservoir or sold to the power grid.

The amount of electricity produced by the photovoltaic installation is dependent on the proper direction of photovoltaic panels in relation to sunrays and their inclination angle. In countries located north of the equator, including Poland, the biggest yield of the energy produced by photovoltaic panels is obtained when they are directed to the south. The optimal inclination angle of photovoltaic panels in our latitude is 30-40°. At https://re.jrc.ec.europa.eu/pvg_tools/en/ production of energy in actual photovoltaic installations with different power ranges located in many cities in Poland and other countries is monitored and archived, while the estimated distribution of energy production in photovoltaic installation in individual months is shown in the chart below:

Annual energy yield
[%]



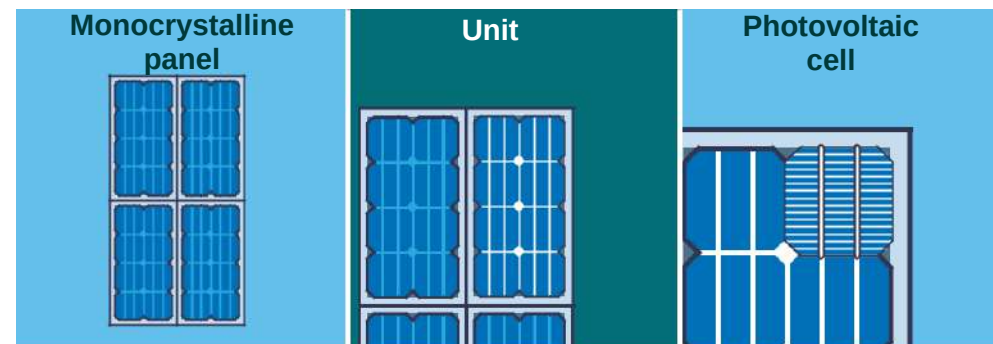
Photovoltaic panels are usually installed on the roofs of buildings. If the roof construction makes it impossible to install the solar panels, due to insufficient area, small load-bearing capacity or inadequate roof position in relation to the cardinal points, the photovoltaic system is placed on the ground using special constructions. Such installations are least frequent on the walls of buildings.

How does a photovoltaic installation work?

- Sunrays falling on the semiconductor panel in the photovoltaic cells, force the electrons out of their orbits in atoms, stimulating their movement which generates electric current.
- As a result, the so-called direct current is produced which cannot be used to power other devices in a house.
- Using wires, direct current is transported to the inverter, where the energy produced is transformed into alternating current.
- After the electricity is transformed, it is sent to the electrical installation in a house to power devices. Electricity surplus reaches the external power grid, moving through the bidirectional power meter.

A photovoltaic installation is comprised of photovoltaic panels (also called PV panels), an inverter, a bidirectional meter, wiring, as well as assembly and safety elements.

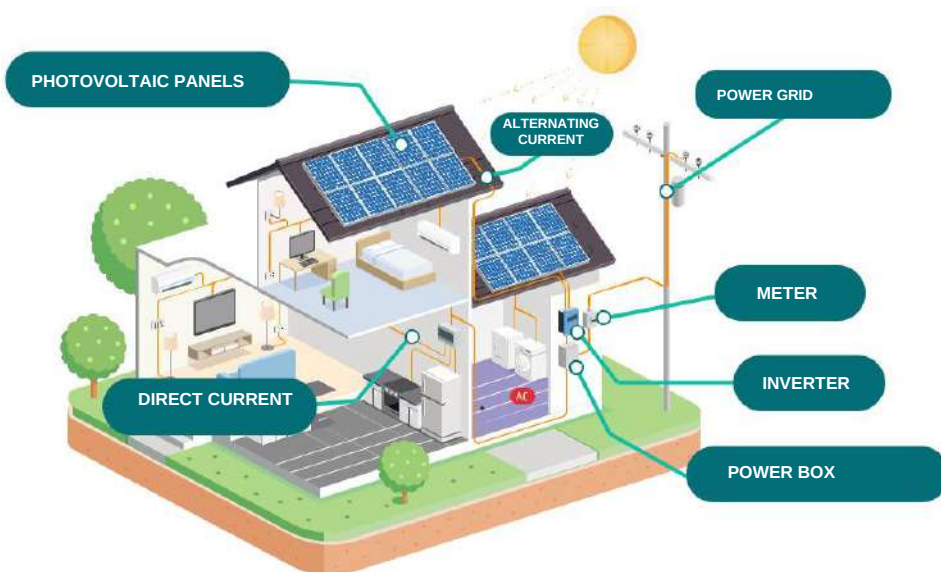
The most important elements of a photovoltaic installation are PV panels. They are made of photovoltaic cells, i.e. small semi-conductive elements, in which light-activated photovoltaic phenomenon occurs. The cells are connected in parallel in sets, called units, which, when placed in one casing, create photovoltaic panels.



The inverter is the heart of the photovoltaic installation. It transforms direct current produced by photovoltaic panels to alternating current. It also controls the whole installation to optimise energy production.

It particularly reduces voltage in situations when it is too high and turns on power supply if a failure is detected.

The bidirectional power meter measures electricity produced by the installation and then transferred to the power grid (in the so-called on-grid systems if it is connected to the external power grid). Moreover, the meter measures the electricity drawn from the power grid when the current needs of a household are higher than the electricity produced by the photovoltaic installation.



➤Positioning of the photovoltaic panels in the east-west direction increases the energy yield by approx. 10-15%, however, it also allows for an increased electricity self-consumption (using it in the household instead of releasing it to the power grid) using the hourly billing system.

➤It is assumed that the minimum inclination of photovoltaic panes in Poland is 10°, so the panels can self-clean (e.g. when it rains).

➤When planning a PV installation you should remember that the units and their construction add weight to a roof which must be handled by the roof truss. A single photovoltaic installation unit weights about. 16-20 kg. An installation with the power of 5 kWp can weigh up to 400 kg.

➤A photovoltaic installation can be also combined with the so-called energy storage or batteries which allow for gathering energy surplus and then using it when the amount of energy produced is insufficient. These types of systems require installation of hybrid inverters, more expensive than the ones in on-grid installation.

➤The whole photovoltaic installation operation is safe for the environment. It is all because of the fact that electricity production using a photovoltaic installation does not emit harmful chemical compounds. As a result, by using this solution, we contribute to the improvement of air quality in the region.

➤Most elements of a photovoltaic installation are recyclable, so up to 90% of materials can be recycled. In addition, the components are easy to maintain and repair, they last for up to 30 years.

How to specify the required power of photovoltaic panels

One of the most important issues to consider is determination of the household's needs in terms of the amount of electricity that the photovoltaic panels should produce. A well-designed photovoltaic installation should produce approximately the amount of electricity that we use annually. It is simple when we have been living in the house for a few years because we can specify energy consumption precisely. It is more difficult when we are moving to a new house. In this case, we need to calculate the estimated annual energy consumption. It depends on several factors.

The most important ones are: the number of residents, whether they work from home or not, the scope of use of the installed electrical devices. Moreover, we need to consider the following issues: heating method (e.g. are we going to use a heat pump?), air conditioning (e.g. are we going to cool the house on hot days?), house ventilation (e.g. are we going to use heat recovery ventilation?) and electric vehicle charging (e.g. are we going to charge an electric vehicle, bicycle or scooter using our own electrical installation?).

It is estimated that energy consumption in a typical household is:

- 2,800 kWh/year, for 2 adults and 1 child
- 4,200 kWh/year, for 2 adults and 2 children
- 5,600 kWh/year, for 2 adults and 3 children

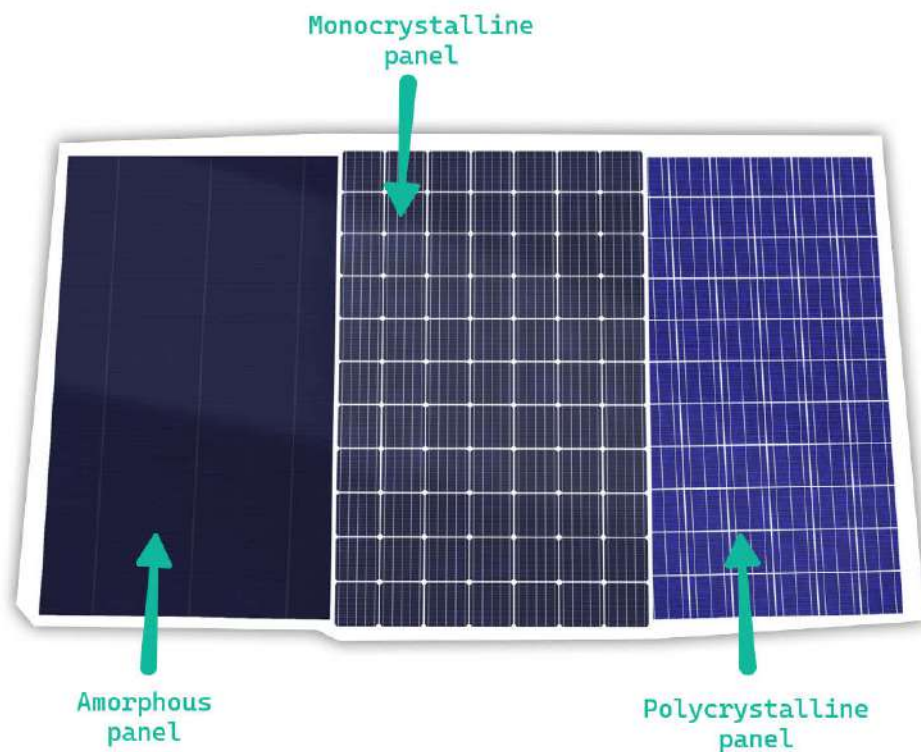
It is assumed that for every 1000 kWh we need about 1.25 kWp of the photovoltaic installation power.

And what area on the roof or a special construction do we need? The area required for a photovoltaic installation with the power of 1 kWp is around 5.5-6 m², which means that a PV installation with the maximum power of 4 kWp requires around 22-24 m², while a PV installation with the maximum power of 8 kWp covers around 44-48 m². Additionally, we must take into consideration the fact that the distance between the units and the roof edges cannot be less than approx. 0.5-1.0 m, and 0.4-1.0 m from the lightning protection installation.



Types of photovoltaic panels

Currently, we can choose between three main types of photovoltaic panels:



The table below presents the characteristics of specific types of photovoltaic panels.

Type of photovoltaic panels	Characteristics
Amorphous panel	- unlike mono- and polycrystalline panels, which are comprised of a set of connected cells, the whole amorphous unit is a single photovoltaic cell - the cells are thin and elastic, so they can be installed on surfaces with a specific curvature - relatively cheap due to a relatively small amount of silicon used - low performance
Monocrystalline panel	- the cells are made of many small silicon crystals - the cells are black - high performance - more expensive compared to polycrystalline panels - smaller installation area with a specific power compared to an installation made of polycrystalline panels - long lifespan
Polycrystalline panel	- the cells are made of homogeneous silicon crystal with an ordered structure - the cells are blue - average performance - less expensive compared to monocrystalline panels

Characteristics	Description	Benefits
They produce electricity that can be used in a household and the surplus can be sold.	A photovoltaic installation reduces electricity bills by up to 70%, although it is usually much lower.	Lower bills for electricity
They use an unlimited solar energy sources	A photovoltaic installation allows for partial independence from the external factors affecting electricity prices. Moreover, the feeling of electricity safety can increase the purchase of energy storage.	Energy independence
They contribute to reduction of greenhouse gas emissions	Electricity production of solar radiation increases the share of clean energy in a household	Positive effects on the environment
They have a positive effect on the house's image	A photovoltaic installation makes a building more attractive for potential buyers. A study carried out in the U.S. shows that a photovoltaic installation increases property value by approx. 4-5%.	Increases property value
They are not harmful to the environment	A photovoltaic installation is not loud and does not have a negative impact on the health and well-being of humans or animals.	Comfort of use

Technical solutions used in Marek's house

Air-water heat pump

Let's take a closer look at Marek's air-water heat pump. It is installed outside the building. Thanks to that it absorbs the heat from the outside and transfer heat at higher temperature to the water flowing through the pipe system in the building in the central heating and hot water systems.

Technical specification of Marek's heat pump:

Heat power	12 kW
Coefficient of performance (COP) of the heat pump*	4.74
Dimensions	180 X 59.8 x 71.7 cm
Weight:	124 kg
Energy efficiency class	A+++

* result for intake air temperature 7° C and water temperature upon release from the heat pump at 35°C, according to the EN 14511 standard.

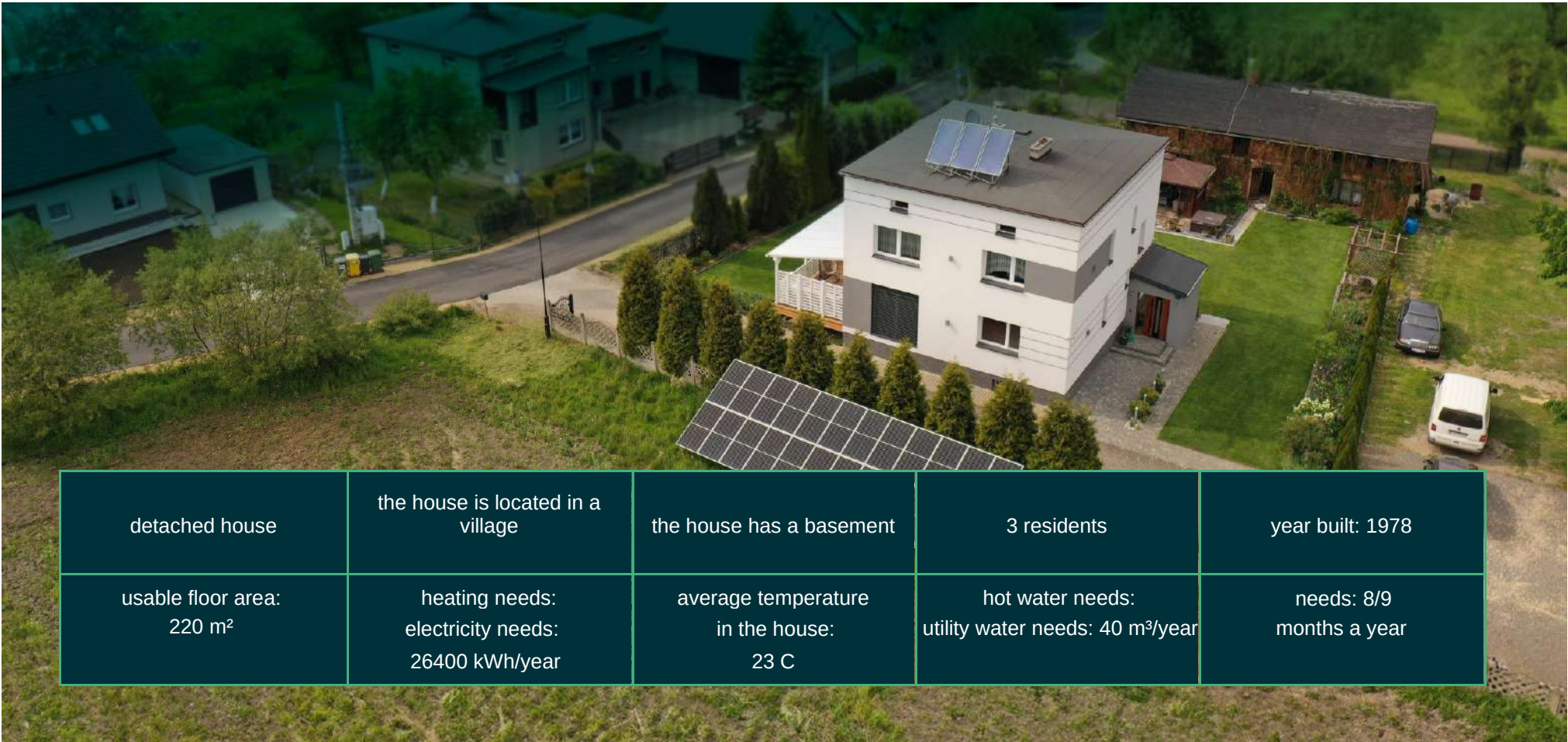
The value of COP at the level of 4.74 means that for every electricity unit used the heat pump produces 4.74 heat units. In the heating season COP for heat pumps usually varies between 2 and 7. It is worth mentioning that the higher the value, the less electricity the pump needs to produce heat.

Usually, air-water heat pumps require space, both outside and inside. The outdoor device is a generator which absorbs the heat from the air, while in the indoor unit the heat is transferred to the water reservoir and the water is moved to the building's outdoor installation.

In Marek's central heating system a buffer tank was connected to the heat pump, for the purposes of storing hot water which powers heating in the house. The buffer tank ensures the heat pump works properly.

Photovoltaic installation

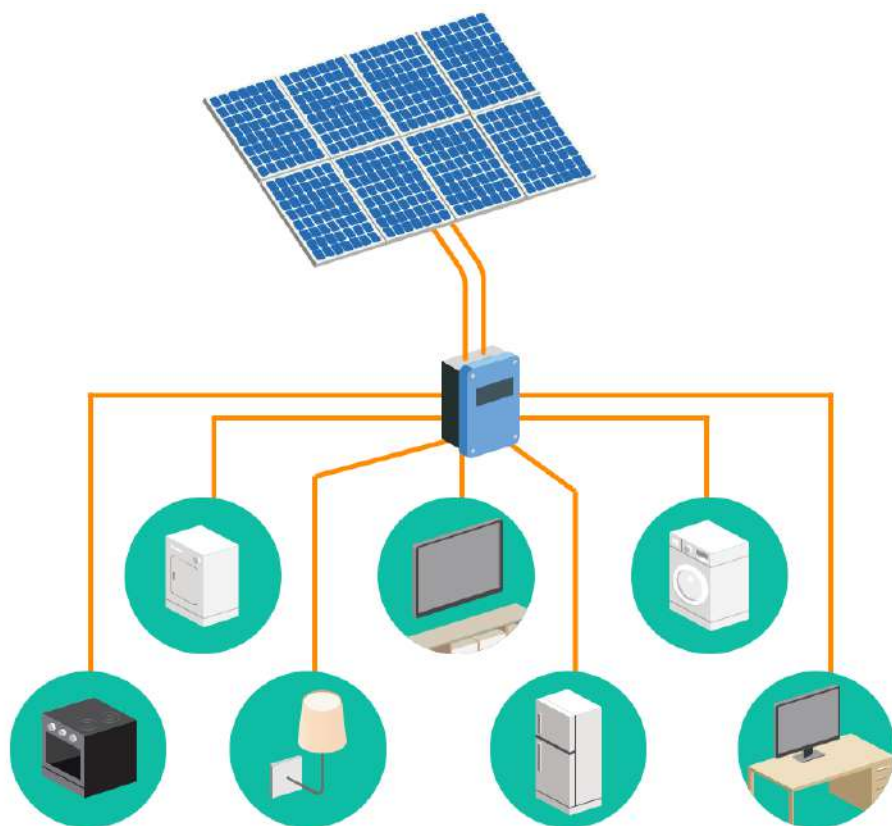
Marek decided to install monocrystalline photovoltaic panes with the total power of 9.9 kWp on the ground near his house. The area where the panels are installed is 55 m². The size and location of the land made such a solution possible. In order to optimise the production of energy in photovoltaic panels it is necessary to use a proper construction setting the panels at the right angle, even if they are installed on a flat roof.



detached house	the house is located in a village	the house has a basement	3 residents	year built: 1978
usable floor area: 220 m²	heating needs: electricity needs: 26400 kWh/year	average temperature in the house: 23 C	hot water needs: utility water needs: 40 m³/year	needs: 8/9 months a year

Integration of a heat pump with a photovoltaic installation

Different technologies using renewable energy sources can complement each other. For example, a photovoltaic installation works perfectly with a heat pump. In Marek's case the heat pump first takes the electricity produced by the PV installation. If the installation produces less electricity than the heat pump needs, the remaining electricity is drawn from the power grid. Even if the photovoltaic installation does not fulfil 100% of the house's needs for electricity, as in the case of Marek's house, then such solutions still reduce both electricity and heating bills. The solar collectors installed in 2017 bring extra savings to Marek, as they heat hot utility water all year round.



EXPERT'S VIEW: ON GREEN HOME TECHNOLOGIES

"Heat pumps are a heating technology that is becoming more and more popular in residential buildings. The pumps are powered by electricity, therefore their maintenance does not emit any harmful substances in the vicinity of the heated building which significantly improves air purity. From the point of view of global climate changes the effect of heat pumps depends on how the electricity used as power is produced. Considering the growing share of renewable energy sources in Poland's energy system and the planned construction of power plants, greenhouse gas emissions related to electricity production are decreasing. Because of this the impact of heat pumps on climate has weakened and will continue to do so. Probably, in 20-30 years heat pumps will be the basic heating technology used in single-family houses."

The barrier that prevents a bigger expansion of heat pumps in the Polish market is the high investment cost and the high, and also variable, electricity cost. Reduction of the investment costs is possible thanks to funding programs that help co-finance the investments. Electricity costs can be decreased if an independent source of electricity, in the form of photovoltaic panels, is installed. A comprehensive investment involving installation of photovoltaic panels and a heat pump in a building, supported by funding programs, is definitely worth considering. It helps build a heating system which does not emit harmful substances in the vicinity of the heated building and is compliant with the European Union long-term strategy.

However, we need to remember that electricity is produced by photovoltaic panels only during the day and mainly in summer. A system comprised of photovoltaic panels and a heat pump has energy surplus in summer and deficit in winter. Therefore its user has to sell electricity surplus in summer and buy electricity in winter. Currently, it is not technically possible to store electricity in a single-family house in amounts that would allow for storage of the summer surplus and its use in winter. In order for the investment to be cost-effective, the key factor is an agreement made with an electricity supplier

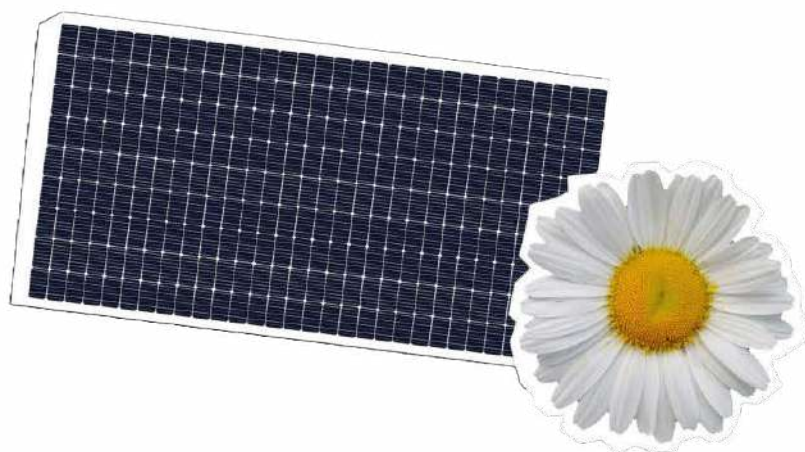
specifying the price at which electricity surplus is sold and the price electricity is purchased in the periods it is in deficit. However, within 24 hours it is possible to store the surplus of electricity produced during the day and use it at night. It is also possible to store the heat produced by a heat pump during the day and use it at night for heating.

The above description shows that an investment involving a system comprised of photovoltaic panels and a heat pump and, optionally, an energy storage is quite complex and dependent on many factors. Considering the above, it is worth consulting environmental consultants who, as employees of a municipal office, not the manufacturer of a specific solution, can help select the optimal heating system.

Moreover, air conditioning in houses is growing in popularity. In the case of air conditioning, there is full compliance of the AC cooling needs with the period of increased electricity production in the panels. Therefore air conditioners can be powered with the electricity produced by the panels without the need to transfer that electricity to the external power grid or its storage.”

Prof. Andrzej Szlęk, Ph.D. (Eng)

Silesian University of Technology
Faculty of Energy and Environmental Engineering
Department of Thermal Technology



THE COST OF THE INVESTMENT, SAVINGS AND FUNDING

How much money did Marek spend to complete his investment in 2021-2022?

Technology	Cost	Funding amount the funding	Cost less
Purchase and installation of the photovoltaic panels	PLN 40,000	PLN 5,000	PLN 35,000
Purchase and installation of the heat pump and buffer tank	PLN 40,000	PLN 18,000	PLN 22,000
TOTAL	PLN 80,000	PLN 23,000	PLN 57,000

In relation to the investment Marek incurred the total cost of PLN 80,000, out of which the purchase and installation of the photovoltaic panels was PLN 40,000, the purchase and installation of the heat pump was another PLN 40,000 (including materials) and the buffer tank. After completing the investment and submitting appropriate documents and with the assistance of an environmental consultant on the “Silesia. Blue Sky Restored” project, Marek received a partial refund of the costs in the form of funding under the My Electricity program amounting to PLN 5,000 (the photovoltaic panels) and the Clean Air program amounting to PLN 18,000 (the heat pump and the buffer tank). Therefore the actual cost of the investment in renewable energy sources in his case was reduced by PLN 23,000.

To sum up, the final cost of the investment related to the purchase and installation of the photovoltaic panels, the heat pump and the buffer tank, after receiving partial refund of the costs in the form funding, was PLN 57,000.

Funding options are popular, so we recommend contacting an environmental consultant appointed for a given municipality. An environmental consultant will inform you about the current and future funding opportunities for the purposes related to thermal modernisation.

Photovoltaic panels and heat pump – more money saved in the home budget

How have the costs related to heating, preparation of hot utility water and energy consumption changed?

2023 was the first full year the new installation was used. The savings are shown in the comparison of the costs that would be generated if the coal boiler was still in use and the actual costs incurred while using the modernised heating system and electricity production using the photovoltaic installation.

Cost type	Hypothetical costs that would be incurred in 2023 if the old installation was still in use	Actual costs incurred in 2023 while using the new installation
Coal cost (6 tonnes x PLN 2,137/tonne – averaged price for 2023)	around PLN 12,800	-
Electricity production costs	PLN 3,000	PLN 2,900 (including the heat pump operation)
Cost of heating utility water	- (included in the coal cost)	- (included in the costs of electricity used by the heat pump and solar collectors)
Coal boiler maintenance cost	PLN 300.00	-
Heat pump inspection cost	-	PLN 350.00
TOTAL	PLN 16,100	PLN 3,250



By investing in the photovoltaic panels and the heat pump Marek saved PLN 12,850 in 2023 on the costs related to heating the house, preparing hot utility water and energy consumption. In this case the combination of a heat pump heating the house and utility water and the photovoltaic installation generating electricity works perfectly. Additionally, savings are possible thanks to the use of the solar collectors previously installed by Marek which heat utility water.

All this means that the costs incurred in relation to the investment can pay off after about 5 years, Not to mention the comfort of use, reduction of the risk of lack of availability and fossil fuel price fluctuations, as well as environmental protection.



Marek’s savings
PLN 12,850 saved in 2023 on the costs related to heating the house, preparing hot utility water and energy consumption.

THE PROS AND CONS OF THE INVESTMENT

Financial aspect

Pros	Cons
• Use of free solar energy, resulting in lower bills for electricity, heating the house and utility water (in the case of photovoltaic installation and a heat pump). • Possibility of partial independence from external electricity providers (in the case of photovoltaic installation). • Heating optimisation thanks to a high level of automation (in the case of a heat pump) • Higher value of the building related to the use of modern technological solutions (in the case of a heat pump and photovoltaic installation). • Long lifespan with proper maintenance and repairs (in the case of a heat pump and photovoltaic installation). • Possibility to obtain funding for the investment (in the case of a heat pump and photovoltaic installation). • Higher rating of the tourist attractiveness of a given location which may contribute to the municipality’s higher revenue from tourism (in the case of the heat pump and photovoltaic installation)	• High initial cost of the investment (in the case of a heat pump and photovoltaic installation). • High dependency of electricity production on weather conditions (in the case of photovoltaic installation) • Lower performance of an air source heat pump at very low temperatures outside the building (in the case of a heat pump).

Environmental aspect

Pros	Cons
• Possibility to obtain electric without polluting the environment (in the case of photovoltaic installation). • Possibility to heat the house without significantly polluting the environment (in the case of a heat pump).	• Affects the environment, in the case of water source heat pumps or heat pumps using groundwater (in the case of a heat pump).

Health aspect

Pros	Cons
• Contributing to reduction of the level of pollution in the environment, which will result in lower incidence rate for conditions caused by air pollution (in the case of a heat pump and photovoltaic installation). • Protection against the risk of carbon monoxide emission and explosion while using boilers powered with fossil fuels (in the case of a heat pump).	• Noise generated by an air source heat pump (in the case of a heat pump).

Use aspect

Pros	Cons
• Cleanliness in the building resulting from the use of a clean heat source (in the case of a heat pump). • Great comfort of use related to the high level of automation and no need to perform physical maintenance of the device (in the case of a heat pump). • Possibility to use it to cool the building on hot days (in the case of a heat pump).	• When installed on the roof, with low level of roof load capacity, it may be necessary to strengthen the construction of the roof (in the case of photovoltaic installation). • Some people claim that it disrupts building's aesthetics (in the case of the photovoltaic installation).



STEPS REQUIRED TO COMPLETE A SIMILAR INVESTMENT

Step	Description	
1	First contact with an environmental consultant on the "Silesia. Blue Sky Restored" project who: -assess the building's needs for heat energy, presents possible technological solutions including the investment goals, -specifies estimated costs related to the investment while using different technological solutions, - specifies available funding resources.	☐
2	Independent review of the advantages and disadvantages of individual technological solutions in relation to the cost of the investment and selection of the technological solution.	☐
3	Second contact with the environmental consultant who adjusts the parameters of use of the selected technological solution to the needs of the household.	☐
4	Market research on the companies offering the selected technological solutions, including initial verification (among family members, friends, etc.) and their reliability.	☐
5	Collecting quotations from the companies for installation, an analysis of the agreement and warranty terms and conditions.	☐
6	Selection of the best proposal.	☐

Step	Description	
7	Contacting the company that presented the best proposal and informing it about the decision.	☐
8	Following positive results of the verification of the reliability of the selected company, signing an agreement with the company on completion of the investment.	☐
9	Third contact with the environmental consultant who helps prepare proper documents that must be submitted to the entity providing funding (before the investment is completed, during or after its completion).	☐
10	After the investment is completed, thorough review of the conditions of use and maintenance of the installation, explanation of possible doubts in this matter.	☐
11	Submission of documents enabling funding for the completed investment to the entity providing the funding.	☐
12	Within 14 days of launching the installation, application submitted to the Central Emission Register of Buildings (https://ceeb.gov.pl/).	☐
13	If the costs related to the thermal modernisation were not funded from a different source, deduction from personal income tax (PIT), in the calendar year following completion of the investment, of the costs incurred in relation to the investment as part of the tax relief for thermal modernisation.	☐



Follow us on social media

 [slaskie.przywracamy.blekit](https://www.facebook.com/slaskie.przywracamy.blekit)

 [slaskie.przywracamy.blekit](https://www.instagram.com/slaskie.przywracamy.blekit)

 Ślaskie. Przywracamy błękit

 [@slaskie.przywracamyblekit](https://www.youtube.com/@slaskie.przywracamyblekit)



przywracamyblekit.slaskie.pl



Województwo
Śląskie

LIFE20 IPE/PL/000007 - LIFE-IP AQP-SILESIA-SKY



#SilesiaBlueSkyRestored

Office of the Marshall of Silesia Department
of Regional Projects Regional Centre for
Environmental Information

main office address: ul. Dąbrowskiego 23, 40-037 Katowice
mailing address: ul. Ligonja 46, 40-037 Katowice
phone: +48 (32) 77 40 554 | e-mail: przywracamyblekit@slaskie.pl
przywracamyblekit.slaskie.pl



Województwo
Śląskie

LIFE integrated project "Silesia. Blue Sky. Restored". Comprehensive implementation of the Air Protection Program for the Silesian Voivodeship funded by the EU's LIFE programme and the National Fund for Environmental Protection and Water Management.
LIFE20 IPE/PL/000007 - LIFE-IP AQP-SILESIA-SKY