



BEST PRACTICES for your house

Green electricity and heat for your house –
a photovoltaic installation integrated with a heat pump

Investment in Artur's house

Under the technical supervision of Prof. Jacek Smółka, Ph.D (Eng)

#SilesiaBlueSkyRestored



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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 resolution.

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. BLUE SKY RESTORED PROJECT

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:
przywracamyblekit.slaskie.pl/ekodoradcy

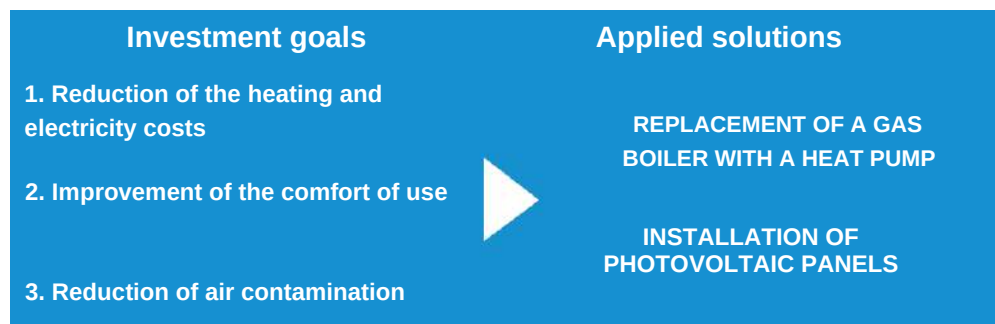
INVESTMENT IN ARTUR'S HOUSE

Artur, a resident of a small town called Brynek – a village located in the Tarnowskie Góry County, in Tworóg municipality – decided to invest in renewable energy sources because of the possibility of obtaining high funding (85%) under a EU project supporting such investments and environmental issues. The vision of reducing electricity and heating bills and the comfort of use of the heat pump was equally important. Artur received funding for the investment in 2022.



Technical conditions before the investment	
Building type	single-family detached house
Year built	2019
Usable floor area	200 m²
Estimated annual building heating needs	8500 kWh
Number of floors	2
Basement	No
Exterior walls construction technology	masonry brick walls, plastered
Roof construction	pitched roof
Roofing material	metal shingles
Roof insulation material	mineral wool, 30 cm thick
Heating source prior to the investment	a gas boiler of 12 kW
Room heating type	underfloor heating
Water heating method prior to the investment	a gas boiler of 12 kW
Number of residents	4
Average annual hot utility water consumption	96 m³
Average air temperature in the building during winter	21° 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 newer, insulated buildings, such as Artur's house, building's heating needs are estimated at 40-45 kWh/m².



The EU program thanks to which Artur received funding for the investment offered support for photovoltaic installations, solar collectors and heat pumps. 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, Artur chose a heat pump and photovoltaic panels.

Each technology selected by Artur 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 Artur'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.

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 Artur 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!

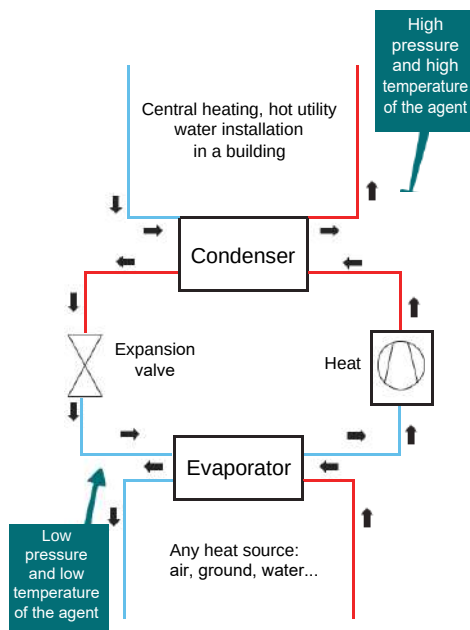


By choosing to install a heat pump and photovoltaic panels Artur and his family joined other people who restore blue sky in the Silesian Voivodeship.

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 inside 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.

Inside a heat pump, at the first stage, the working agent in liquid form with low pressure and low temperature collects heat from outside, where it is warmer (air, ground, water), and changes to gas in the heat pump'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 m² requires about 3,000-4,000 kWh per year, to meet all heating needs, 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.

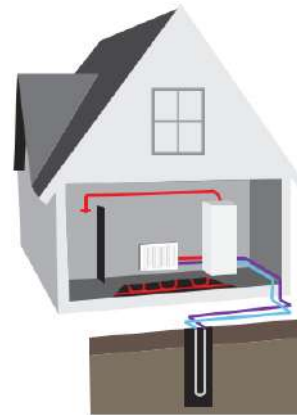
➤ A heat pump has a long life expectancy because it usually lasts for around 20-25 years. Similarly to other heating devices, its high performance requires regular (usually annual) maintenance inspections.

➤ 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

Heat pump types differ, depending on the lower heat source. Usually, heat pumps, as the lower heat source, use: air, ground, surface water, groundwater.



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



Water source heat pump

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



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
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

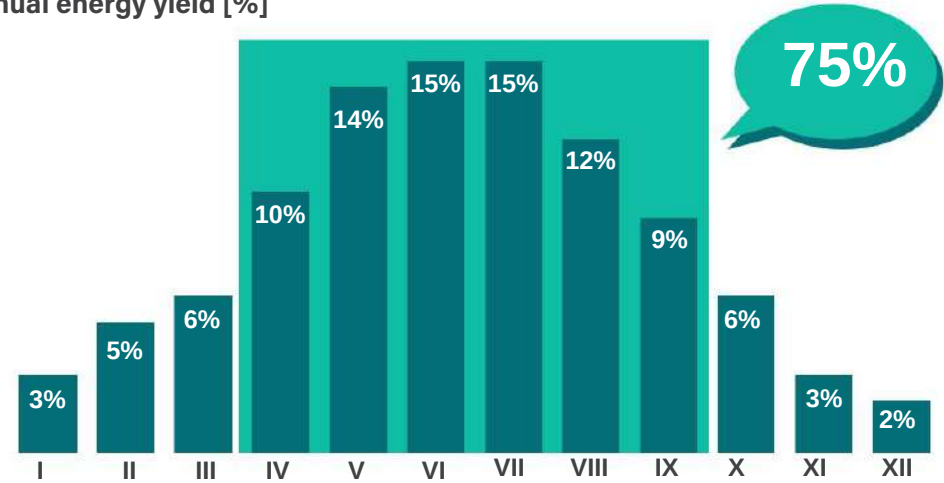


Photovoltaic panels

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.

Most energy 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 [%]



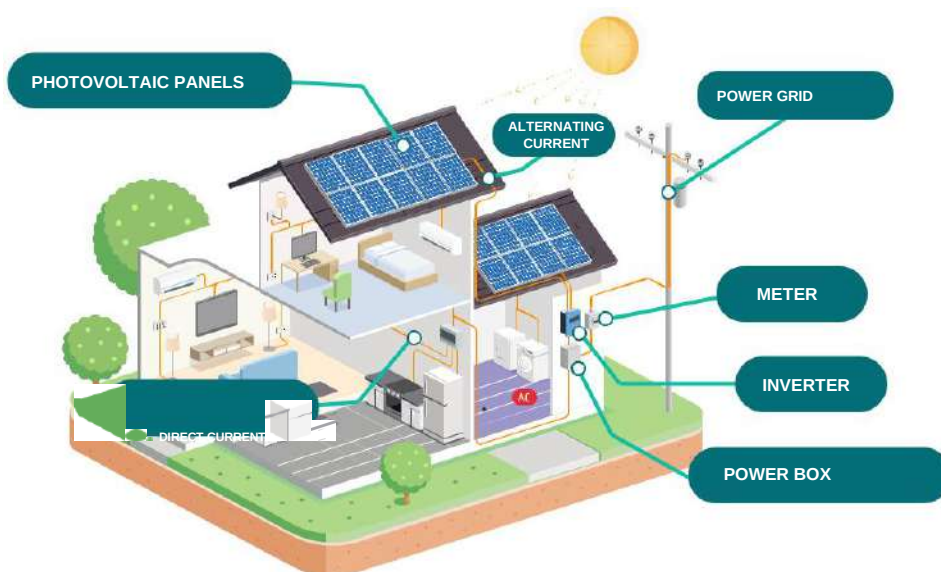
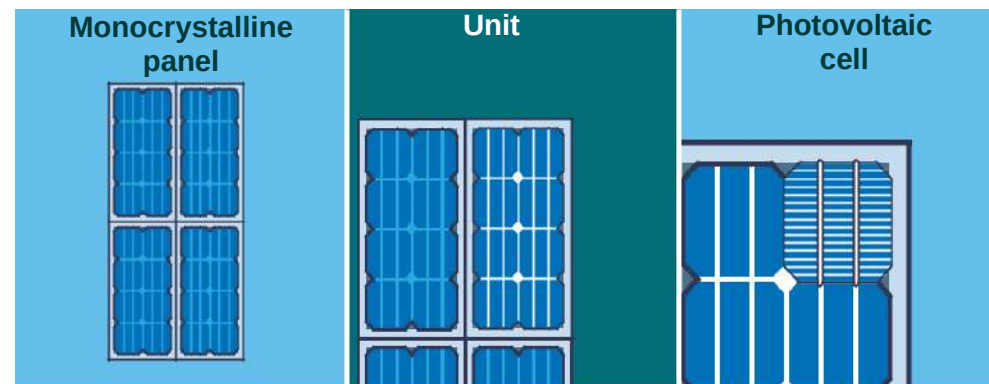
Photovoltaic panels are usually installed on the roofs of buildings. If the roof construction makes it impossible to install the panels, due to insufficient load-bearing capacity or inadequate roof position in relation to the cardinal points, the photovoltaic installation is placed on the ground using 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 flow.
- 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 energy 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 photovoltaic panels. They are made of photovoltaic cells, i.e. small semi-conductive elements where 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 collected 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

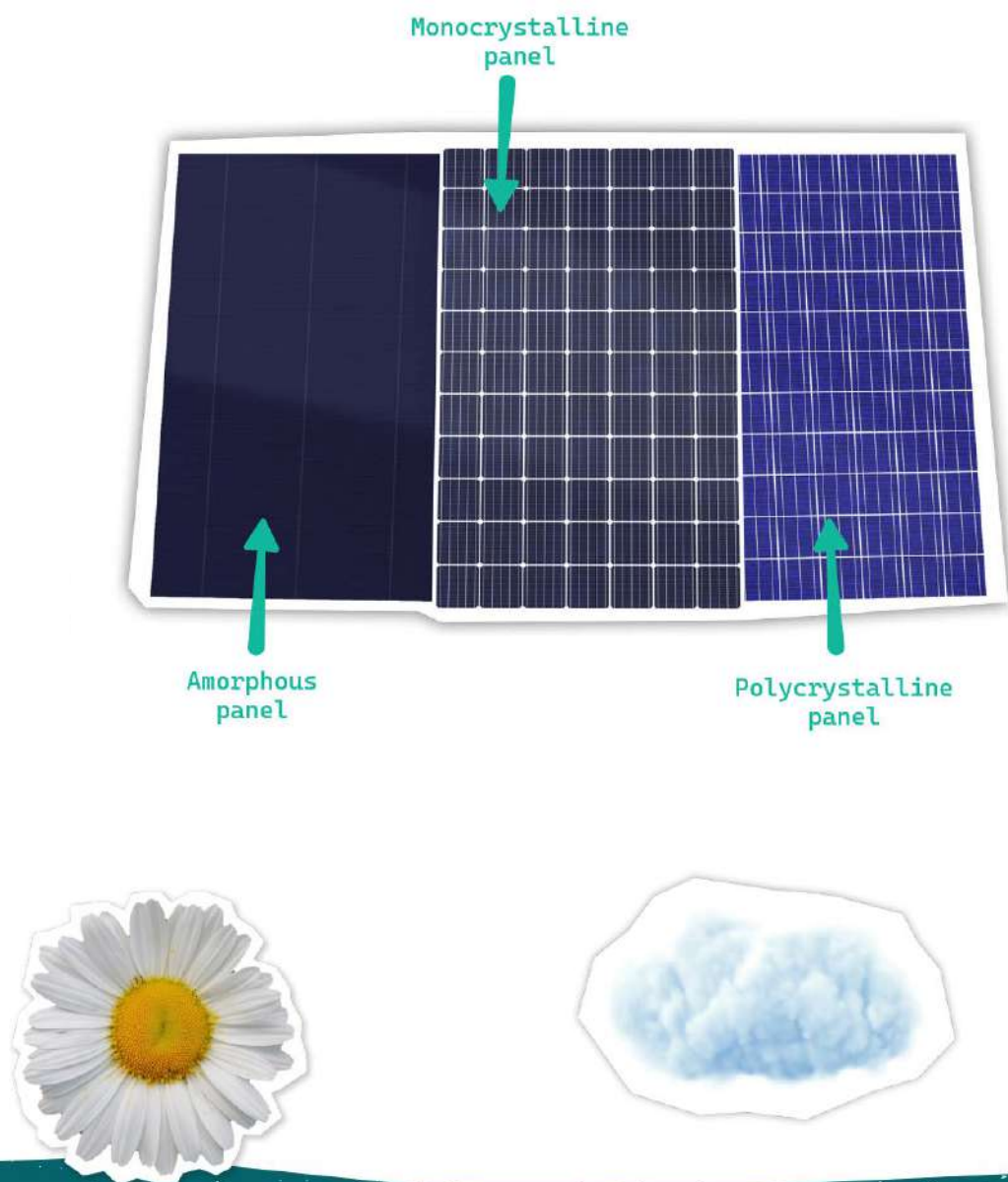
It is assumed that for every 1000 kWh we need about 1.25 kWp of the photovoltaic installation power.

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 benefits 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 Monocrystalline panel	• the cells are made of many small silicon crystals • the cells are black • high performance • more expensive compared to polycrystalline panel • smaller installation area with a specific power compared to an installation made of polycrystalline panels • long lifespans
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

Benefits of installing photovoltaic panels – summary

Characteristics	Description	Benefits
They produce electricity that can be used in a household, and the surplus can be sold.	A photovoltaic installation allows for lower electricity bills by up to 70%, although usually the value is much lower.	Lower bills for electricity
They use an unlimited solar energy source	A photovoltaic installation allows for partial independence from external factors affecting the electricity prices. Moreover, the feeling of energy safety can increase the purchase of an 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 United States showed that a photovoltaic installation increases the value of a property 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 Artur's house

Air-water heat pump

Let's take a closer look at Artur'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 Artur's heat pump:

Heat power	11 kW
Coefficient of performance (COP) of the heat pump*	4.72
Dimensions (width/height/depth)	130.5 X 129.5 x 52 cm
Weight:	115 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.

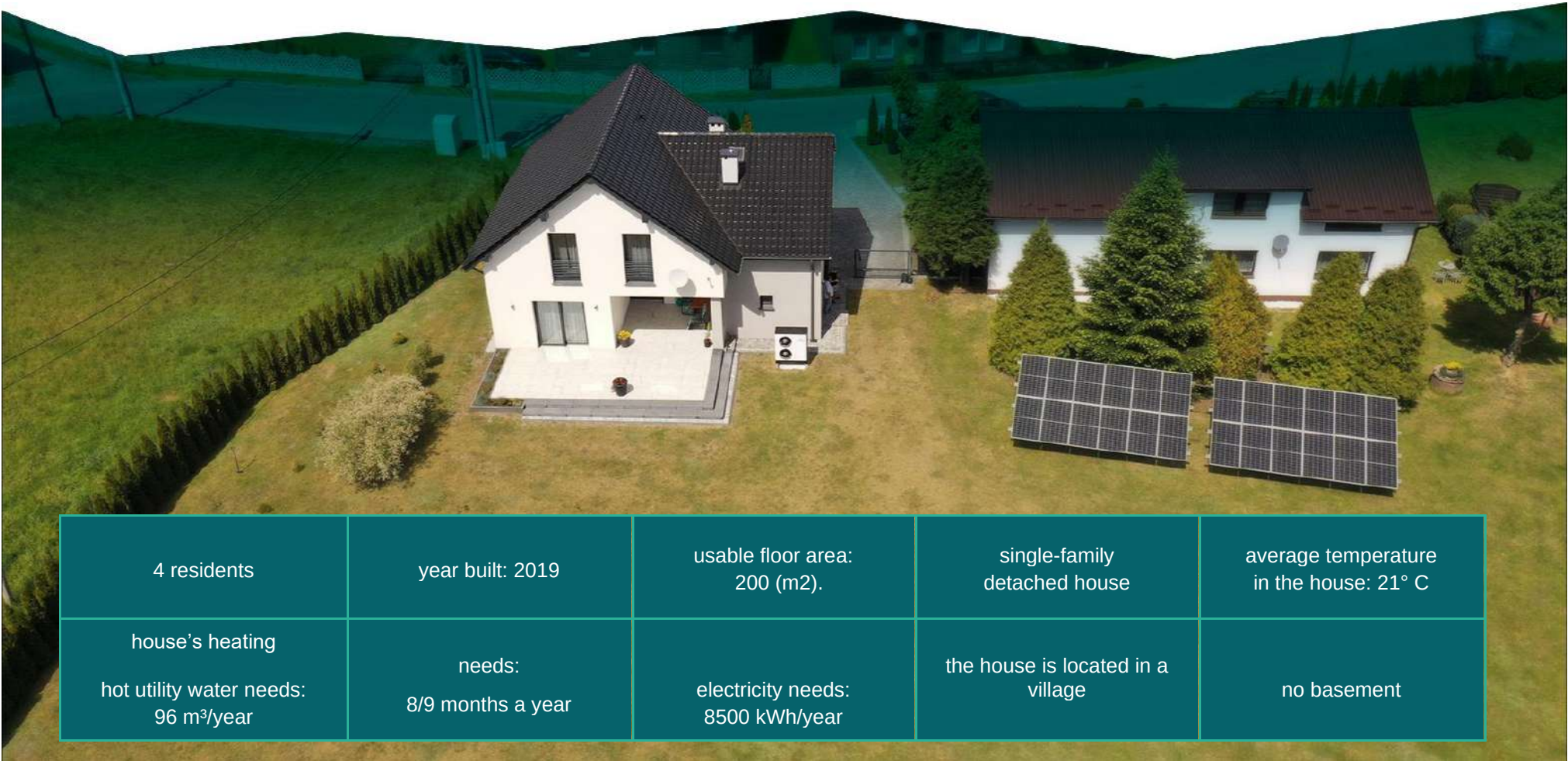
The value of COP at the level of 4.72 means that for every electricity unit used the heat pump produces 4.72 heat units. In the heating season COP for heat pumps usually varies between 2 and 7. It is worth mentioning that the higher the value, the less electricity the pump needs to produce heat

Usually, air-water heat pumps require space, both outside and inside. The device outside 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. However, Artur chose a heat pump that does not take too much space. The outdoor unit is integrated with the elements that are typically placed in the indoor unit.

To sum up, there are different solutions available in the market which supply heat to a house and some of them do not take a lot of space.

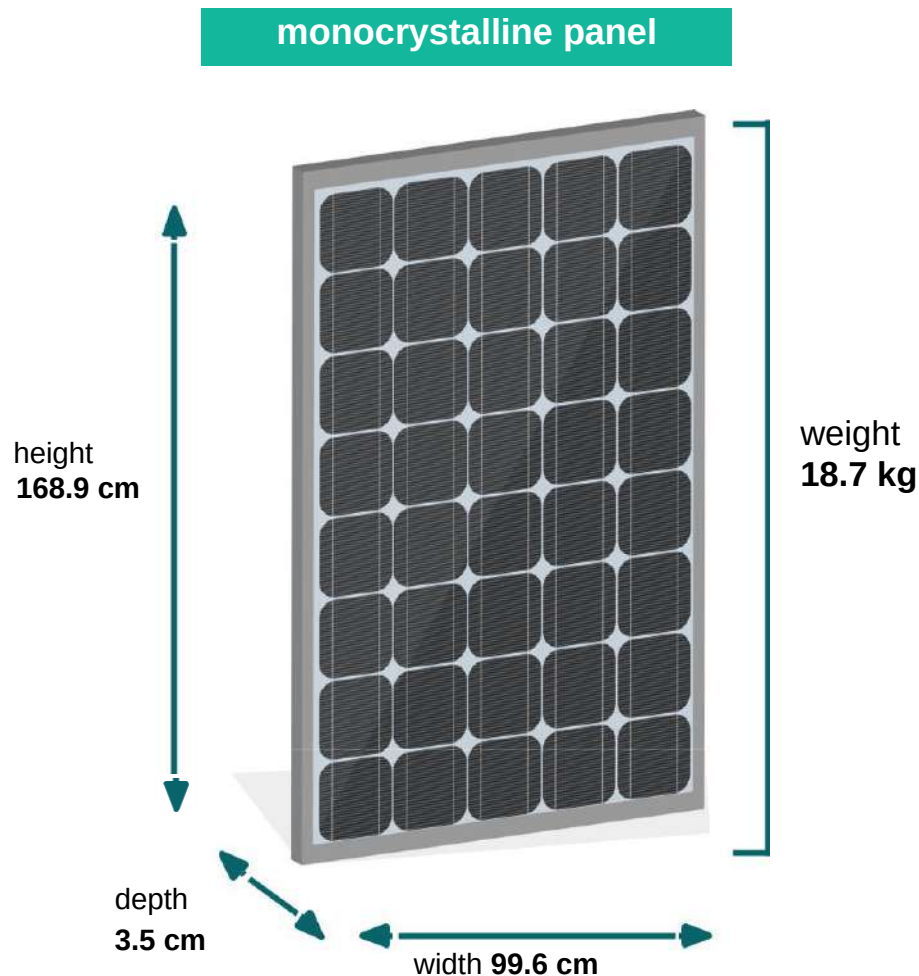
Photovoltaic installation

Artur decided to install photovoltaic panels on the ground near his house. The analysis of the amount of electricity produced by the photovoltaic installation and the total energy consumption (including the heat pump) shows that the installation selected by him fulfils almost all of the the household's needs for electricity.



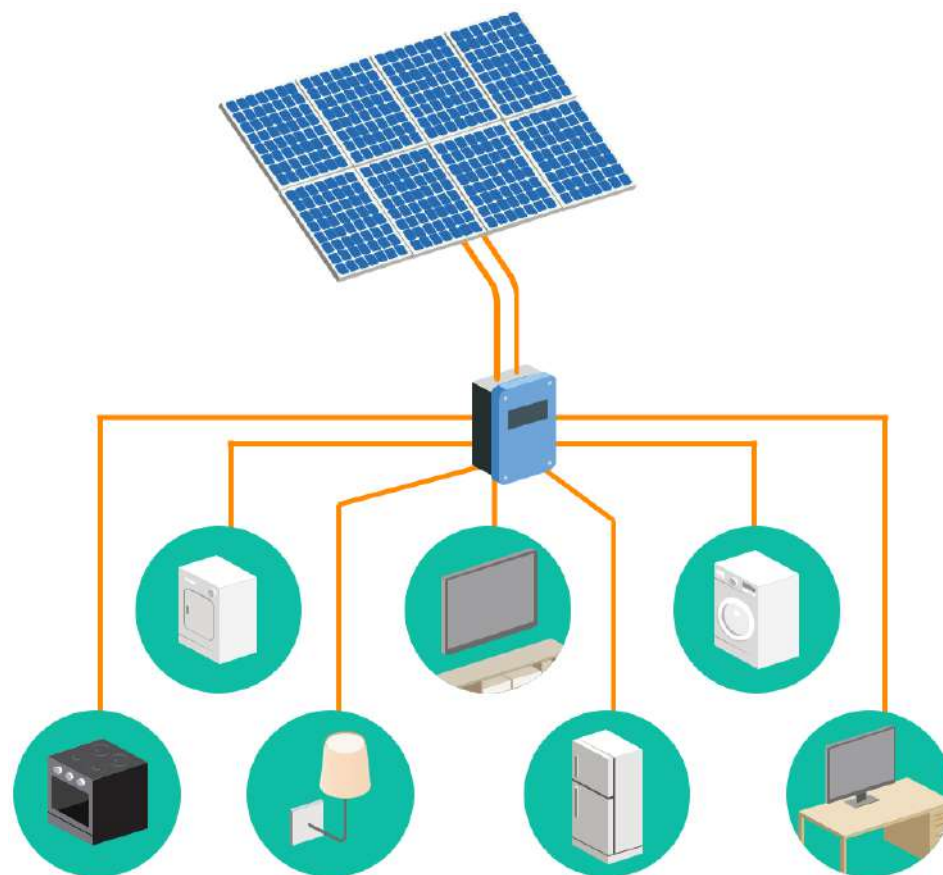
4 residents	year built: 2019	usable floor area: 200 (m2).	single-family detached house	average temperature in the house: 21° C
house's heating hot utility water needs: 96 m³/year	needs: 8/9 months a year	electricity needs: 8500 kWh/year	the house is located in a village	no basement

Artur invested in an installation with the power of 8.28 kWp with 24 panels with the maximum power of 345 W. In his case, the PV panels are installed on the ground, not on the roof. The reason for this is their optimum position in relation to the cardinal directions and sufficient land area. Thanks to that they can work at full power, as long as possible during the day. The figure below shows the dimensions and weight of Artur's panels.



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 Artur'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, then such solutions still reduce electricity and also heating bills.



EXPERT'S VIEW: ON GREEN HOME TECHNOLOGIES

"The consumption of energy needed to heat a building depends on its condition and heating and ventilation systems used. However, regardless of whether a building is new or have been used for some time, the most important thing is proper insulation of walls, roof, windows and floors, as well as reduction of loss related to room ventilation. Once the heat loss is reduced following thermal modernisation, one can focus on the selection of the proper type and power of the heat source and installation of central heating which ensures a convenient and financially viable indoor temperature of 20-21°C in the heating season. The whole process should be managed by a person who is trained in this field, e.g. an environmental consultant, due to the high investment costs and the complexity of technical issues.

The materials available for wall insulation ensure a significant reduction of the heat loss because their conductivity indexes are slightly different. Therefore the selection of a given material, with properly selected thickness of the insulation layer, may depend on the technical parameters, such as the acoustic insulation, vapour permeability and the total cost of thermal modernisation using a given insulation material.

A heat pump is a device which is a very efficient heat source, provided that it operates at a small temperature differences between the building's interior and exterior. Taking into consideration the conditions in Poland, a ground-water heat pump is a good choice because the ground temperature at appropriate depth is above zero and almost fixed during the heating season, but due to the financial reasons the most popular choice is an air-water heat pump. In both cases a heat pump is the most efficient when combined with low-temperature underfloor heating. If traditional radiators are used, we should remember about appropriate heating surface, to ensure the desired room temperature.

A photovoltaic installation produces electricity on sunny days, which during this period translates into significantly lower electricity bills. During the winter season, this type of installation can only partially power a heat pump, and in turn reduce the costs of heating using this type of heat source."

Prof. Jacek Smółka, 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 Artur spend to complete his investment?

Practical scope	Total cost	Funding amount	Cost less the funding
Purchase and installation of photovoltaic panels	PLN 26,600	PLN 22,100	PLN 4,500
Purchase and installation of the heat pump	PLN 50,500	PLN 43,000	PLN 7,500
TOTAL	PLN 77,100	PLN 65,100	PLN 12,000

Artur is a beneficiary of one of the EU funding programs for the Silesian Voivodeship, launched by the municipality of Tworóg. As part of this program, beneficiaries could receive up to 85% of funding for green technologies related to renewable energy sources in their single-family houses. The entity granting the funding in this case was the Municipal Office.

The total cost of Artur's photovoltaic installation was PLN 26,000. However, he received funding of PLN 22,100. Therefore, the actual cost of the photovoltaic installation that he installed was reduced to PLN 4,500.

Artur also decided to buy a heat pump which cost PLN 50,000. In this case Artur also received EU funding of PLN 43,000. As a result, with the funding for purchase and installation of the heat pump he paid only PLN 7,500.

To sum up, the total cost of purchase and installation of the discussed technologies was PLN 77,100, but with the funding of PLN 66,100 in total Artur really paid only PLN 12,000.



As shown above, Artur covered most of his purchases using external funding.

It is worth adding that not every municipality implements such EU-funded projects. Generous funding is popular, so we recommend reaching out to an environmental consultant on the “Silesia. Blue Sky Restored” project, appointed by 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

Thanks to the photovoltaic installation Artur saved as much as PLN 4,000 per year on electricity bills.

But there is more. By replacing the gas boiler with the heat pump, partially supported with electricity powered by the photovoltaic installation Artur saved up to PLN 12,000 per year on heating (including hot utility water). Those savings were possible thanks to the milder winter compared to the previous one (prior to the investment) and can be lower in the coming years, however, their scale is significant.

Artur's total savings are around 16,000 per year. It is a significant amount that can be used to introduce other improvements in the house – to improve comfort or install other renewable energy technologies.

About funding for green technologies in Poland

Apart from the EU funds, public entities can receive funding from other sources. Available national and local programs include Clean Air, My Heat or My Electricity. Moreover, the funding and its amount depends on many factors, e.g. your income. If you are wondering if are eligible for such funding or looking for a most cost-efficient program funding renewable energy sources, reach out to one of the environmental consultants assigned to your place of residence. They are specialists who can help you, not only to select the best solutions for your house, but also the most beneficial funding programs.



PLN 4 000 + PLN 12 000 = PLN 16 000

savings on bills
electricity

savings on heating
(including hot
utility water)

annual savings on

THE PROS AND CONS OF THE INVESTMENT

Financial aspect

Pros	Cons
• Use of free solar energy,- translates to lower bills for electricity, home heating, and hot water (in the case of a photovoltaic system 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 a 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).)

Financial aspect

Pros	Cons
• Possibility to obtain electricity without polluting the environment (in the case of photovoltaic installation). • Possibility to heat the house without 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).

Pros

- 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).

Cons

- 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).



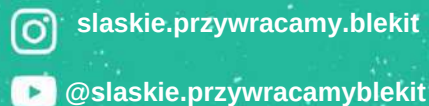
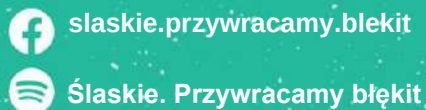
STEPS REQUIRED TO COMPLETE A SIMILAR INVESTMENT

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.	☐



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#SilesiaBlueSkyRestored

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