



## **Extraordinary house for ordinary people**

Case story – Brzezie, Poland

HEAT PUMPS

This home is a tribute to nature. It is hidden below earth and amalgamated into the surrounding forest. It is located on a beautiful lot, near the pond where a garden will be set up. Its construction is similar to the dwellings of J.R. Tolkien's fictional race of Hobbits who lived in the Shire and in Bree in the north west of Middle-earth. The concept of this unusual house was originally developed by Zdzisław Bolanowski - an interior designer, painter and sculptor who graduated from the Academy of Fine Arts in Łódź.

### My dreams

*"I think that this project is based on two ideas and two dreams or, in fact, two contradictory human needs: the first one is to escape to nature and to live a life of primitive people who inhabited mountain caves and, the second one, is to live in a comfortable environment with all the amenities our civilization can offer. Of course, such a cave should be equipped with modern devices such as air conditioning, a convenient heating system and other contemporary technologies including heat pumps and wind turbines for generation of electric power. However, I quickly gave up the idea of using "windmills" for generation of electricity because of their intrusive character and unfriendliness for birds. I have always dreamed of my house being a self-sufficient unit with solar panels, independent energy sources and a geothermal heating system. Additionally, my new house should be constructed in a beautiful location, near a small pond or a natural water source"* - said Mr Bolanowski, the owner of this extraordinary house.

Mr Bolanowski started to search a building lot suitable for construction of the house. One of the initial requirements imposed by land prices was the location: approximately 35 kilometres or more from a large town. The first potential site near Łódź was rejected because it lacked an appropriate slope to accommodate the front wall of underground structure. Finally, the investor decided that the house would be built in Brzezine village where a building lot was found that met all the

requirements for construction of an underground structure with south facing front wall (a southward facing slope was necessary). The lot with sandy soil with good mechanical properties consisted of a 5 meter hill and a small depression with remnants of an old pond, which could easily be enlarged to create an impression of additional space. Because of local conditions the main entrance to the building had to be located on the right side of the structure. *"The present professionally designed version of the house is a compromise between my personal dreams and architectural, constructional and other requirements imposed by the availability and prices of technical equipment"* - said Mr Bolanowski

### Construction process - easy said than done

The construction of this unusual house was a real challenge for contractors who had no experience with underground structures. The first attempt to create a "green" roof was unsuccessful. It soon became evident that additional reinforcements and non-standard water proofing solutions were necessary. Fortunately, all these obstacles did not discourage the investors who continued the construction process.

*"Most of the passers-by who saw the building site were convinced that a bizarre hotel is being built. When they were told that a dwelling house is being constructed they said it was simply unbelievable."* - said Leszek Miecz, one of the construction workers. Adam Wolinowicz - the building site manager - emphasizes that constructing of this underground house is very difficult and stressful for his team.



Photo 1 "My house will be built here" says Mr Bolanowski



Photo 2 Krystyna and Zdzisław Bolanowski visit the construction site

*“The roof has to be made of reinforced concrete and effectively water-proofed. The load caused by earth and negative influences of moisture must not be ignored.” - said Wolinowicz.*

### **Modern energy saving technologies**

Because of its underground location, the house will utilize thermal energy accumulated in the surrounding earth. Additionally, the southern location of the building will further reduce the energy consumption, and the “cold” roof covered with earth will prevent the house from overheating in summer. *“Because of my extensive knowledge in the field of modern heat pumps and ecological waste water treatment plants, I have been a ‘difficult’ partner for engineers and designers of internal installations and systems. In spite of decidedly higher prices, they tried to convince me that deep vertical boreholes for extraction of geothermal energy would be the best solution for my house. Finally, I decided to install horizontal collectors buried in 2 meter trenches. Such collectors are very long (several hundred meters) but they are considerably cheaper, and my building lot is large enough for installation of this type. After a long search and numerous consultations, even in Sweden, I selected a local company named MAST from Bełchatów run by Strączyński brothers who became the contractor responsible for heating systems.” - said Mr Bolanowski.*

The house has been equipped with Danfoss 10 kW DHP-H ground heat pump with integrated hot water tank and a floor heating system for distribution of thermal energy. The heat source has been made in the form of meandering horizontal collector with a total

length of 4 x 100 meters buried in deep trenches throughout the area of the building lot. *“Ground water is present at small depths and, frankly speaking, the building lot can be classified as waterlogged area. Such conditions are especially favorable for operation of heat pumps and will undoubtedly reduce the heating costs”- said Michał Strączyński, the heating systems contractor. “Additionally, a custom-made fireplace equipped with afterburner unit has been installed. The fireplace has been designed for higher combustion temperatures and, in consequence, all types of firewood can be used as a fuel. The burning process is very efficient and, after the fireplace has achieved its nominal temperature, very little smoke and soot will be emitted to the atmosphere.” - emphasized Mr Bolanowski, the home owner. Fresh air will be supplied by a mechanical ventilation system equipped with a catalyst unit that will recover the thermal energy contained in the exhausted air. As far as the lighting system is concerned, only LED bulbs with a marginal energy consumption will be used. Waste water will be processed by a small ecological water treatment plant located near the house.*

### **Architecture, surrounding area and costs**

The owners of the house decided not only to install contemporary energy saving equipment but also paid special attention to aesthetic aspects of the investment. The roof will be covered with various plants that will create a sense of the intimacy with nature. The attic wall will be adorned with sgraffito - an ancient technique of wet plaster ornamentation whose subject will be associated with the pine forest surrounding the house. The construction of this house will be more costly than construction of a typical single-family building. Because of relatively long underground heat collectors, the building lot must be greater than usual. Additionally, the prices



Photo 3 Special insulation of the roof



Photo 4 Horizontal heat collectors are installed in trenches

of modern equipment and preparation of nonstandard design documentation are an important factor influencing the overall cost of the investment. Have you encountered any formal problems with the construction of your house? - *“Fortunately, I have not had any problems with obtaining of building permit and other necessary documents. The attitude of authorities was very supportive and encouraging”* - emphasized Mr Bolanowski.

*“This house is our tribute to nature and to all God’s creations. It will be amalgamated with the Earth, will use its warmth and energy of solar rays and will be united with the nature in all its aspects: aesthetic and technical. It will allow us to live in comfort and to respect the Earth’s natural resources. Thanks to mass media we can show that even a single person can significantly participate in the protection of our planet.”* said Maria and Zdzisław Bolanowski

At the present time two short video clips that document the construction process of Bolanowski’s house are available at YouTube portal:

1. [„Extraordinary house for ordinary people”](#) - produced by NTL television network
2. [„Budowlane ABC”](#) - produced by Marzena Andrzejczak

## Fact box

Location: Brzezine village  
 Investors: Krystyna and Zdzisław Bolanowski  
 Designers: Zdzisław Bolanowski, Tomasz Bolanowski, Jerzy Gorgul  
 Usable area: 220 m<sup>2</sup>  
 Renewable energy sources:

- DHP-H 10 kW heat pump,
- custom made fireplace with 25-30 kW thermal capacity,
- mechanical ventilation system with energy recovery unit.

Heating system: floor heating  
 Ecological elements of project’s infrastructure:

- integration of the building with surrounding area, earth excavated from the foundation pit is reused for thermal insulation and creation of the ‘green’ roof, relatively small areas occupied by terraces and access road,
- additional accumulation of solar heat by appropriately selected windows and dark color of the floors,
- energy saving LED bulbs,
- local waste water treatment plant of ecological type.



Photo 5 Collector well of the geothermal energy



Photo 6 DHP-H 16 heat pump installed in the house

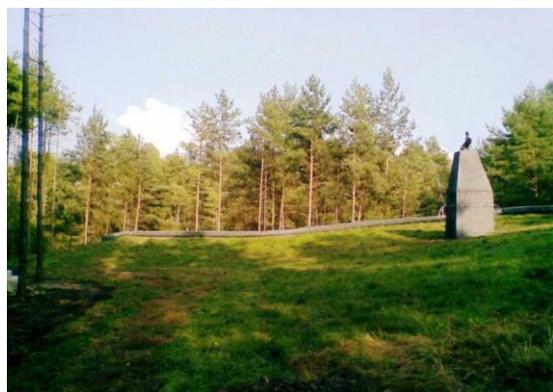


Photo 7 The house - rear view



Photos .8 The house - front view

**Danfoss Sp. z o. o.**, ul. Chrzanowska 5, 05-825 Grodzisk Mazowiecki, Tel (22) 755 09 00, Fax (22) 755 07 01  
 e-mail: [pompociepla@danfoss.com](mailto:pompociepla@danfoss.com), [http:// www.pompociepla.danfoss.pl](http://www.pompociepla.danfoss.pl), [http:// www.danfoss.pl](http://www.danfoss.pl)

Danfoss nie ponosi odpowiedzialności za możliwe błędy drukarskie w katalogach, broszurach i innych materiałach drukowanych. Dane techniczne zawarte w broszurze mogą ulec zmianie bez wcześniejszego uprzedzenia, jako efekt stałych ulepszeń i modyfikacji naszych urządzeń. Wszystkie znaki towarowe w tym materiale są własnością odpowiednich spółek. Danfoss, logotyp Danfoss są znakami towarowymi Danfoss A/S. Wszystkie prawa zastrzeżone.