House on the lake in Kalkar

Name of project:	**House on the lake in Kalkar**
Typology:	Single-family house
Location:	Birgelfeld gravel pit lake in Kalkar-Hönnepelh, Germany
Completion:	2011
Area:	120 m²
Technology:	14 kWh/m²a heating energy
Energy concept:	• geoTHERM plus brine/water heat pump with 3 kW • Use of heat from the lake water via thermal basket • 500 l multi-function tank • Heat distribution via a surface heating system and special heat pump elements • Photovoltaic systems on 40 m² for self-sufficient power supply
Vaillant products:	**• geoTHERM plus brine/water heat pump** **• 500 l multi-function tank**
Building owner:	**Kieswerk Maas-Roeloffs GmbH & Co. KG** **47546 Kalkar, Germany**
Architect:	**Architekturbüro Hülsmann & Thieme** **47533 Kleve, Germany** **www.huelsmann-thieme.de**
Facilities planner:	BASCON Engineering GmbH 47574 Goch, Germany www.bascon-eng.de
Copyright:	Drawings: Architekturbüro Hülsmann & Thieme

The good feeling of doing the right thing.

In 2011, on a gravel pit lake in the vicinity of Kalkar, building owner Maas-Roeloffs and architects Hülsmann & Thieme, in cooperation with RWE Effizienz GmbH and the Fraunhofer ISE Institute for Solar Energy Systems implemented the pilot project "Living with Vision". The floating research building is exemplary with respect to innovative housing development and energy efficiency. The geoTHERM plus brine/water heat pump from Vaillant uses the heat from the lake, therefore contributing to the success of the plus-energy house.

The pilot project "Living with Vision", a 120 square metre research building with plus-energy standard, originated in 2011 on the banks of the Birgelfeld gravel pit lake west of the Lower Rhine city of Kalkar. The simple cube-shaped building, which floats on pontoons, plays a vanguard role with respect to energy efficiency and innovative housing development.

A lake as a housing area

An initial housing concept was developed by the architects Hülsmann & Thieme. In view of the fact that spatial resources in many cities are exhausted, the gravel pit in Kalkar provided a potential "plot" as an eco-friendly alternative. The goal was to create four concentrated building zones with one- and two-storey houses on and around the lake. For the final construction as a zero-energy community the Fraunhofer ISE Institute conducted a simulation study in the spring of 2014.

Pilot house as floating research station

The pilot house represents one of the bungalows on the lake. Designed as a floating research station, the cube-shaped building is used for simulating and analysing the technical data from the life of a family of four. For this purpose the SmartHome automation system from RWE was integrated for networking and control of everything related directly or indirectly to energetic loads. The building itself was erected on a steel pontoon as a timber stud construction with a large living room, kitchen, bath and a room for the HVAC technology; additional buildings are planned. To adapt the construction to the energy requirements, the first step was to optimise the building shell with high-quality insulation and triple glazed windows.

"Where the transmission losses are low," explains architect Friedhelm Hülsmann, "less heat has to be generated in the first place. That is why the cubic shape is ideal for energy-saving building and in this case is visually enhanced with stylistic elements at the entrance and windows, which however have no negative effect on the enclosing surface area." This made it possible to reduce the heating energy requirement for the house to less than 14 kWh per square metre per year

Heat from the lake

To cover the heating energy requirement, a modified geoTHERM plus brine/water heat pump from Vaillant was installed with an output of only 3 kW. Technical planner Andreas Schwalger of Bascon Engineering in Goch explains: "With an expected requirement of only 2 kW the conversion of the heat pump to half the standard length was necessary to demonstrate the competitiveness of this technology in comparison with the standard gas-fired heating systems as a heat source." The system is supplied by a thermal basket at a depth of about four metres in the gravel pit lake, with about 150 metres of coiled plastic tubing. This coil functions just like a heat exchanger: the brine liquid from the heat pump flows through the tube, collects the heat from the lake water and converts it to room heat. The system is configured for a water temperature of 7° Celsius, since the temperature level hardly ever falls below this mark even in cold winters, due to the lake being connected to the nearby Rhine. **The heat is stored in a 500 litre multi-function tank, which is also used for supplying the hot water and drinking water.** The downstream heat distribution is achieved optionally by a surface heating system or special heat pump elements. Designed as conventional convection heaters, they are equipped with additional small fans to ensure the convection necessary for heat distribution despite the low supply temperatures. The use of the different systems for heating is monitored by a series of tests to determine the most efficient version.

Passive cooling in summer

For the summer months the planners developed a "passive cooling" system. If the floating building becomes too warm, the heating circuit of the heat pump is automatically bypassed. As opposed to winter operation, the thermal basket diverts the excess heat from the rooms directly into the lake water. To prevent the temperature from falling below the dew point during cooling of the house, the controller integrated in the heat pump ensures a minimum supply temperature of 18° Celsius.

Self-sufficient power supply via PV modules

The energy concept is supplemented by three different photovoltaic systems for power generation. On an area of 40 square metres, in addition to conventional PV modules on the roof, collectors are used that automatically follow the movement of the sun, in addition to modules installed vertically on the terrace for utilisation of the light reflected by the water. Through the use of solar power and lake water, the building not only covers its own energy requirements, but also generates additional energy, making the floating single-family home a symbol for a sustainable future through the conservation of resources.

Vaillant GmbH
Berghauser Str. 40 ▮ 42859 Remscheid, Germany
Phone +49 21 91/18-0 ▮ www.vaillant.com