

# GEOHERMAL HEATING AND COOLING – AT CALCULABLE COSTS



*Geothermal energy for a whole urban district? In Whisper Valley in Austin/Texas the first drilling works are taking place.*

**“Our home is heated by the garden” – this sign in front of a new single-family house attracted attention. The use of geothermal energy for heating and cooling instead of fossil fuels is an ideal possibility to reduce significantly carbon dioxide emissions by the housing stock. Although geothermal energy is increasingly used for heating and cooling applications, the initial investment is much higher than with traditional systems based on fuels.**

Geothermal energy is thermal energy generated and stored in the Earth crust. The deeper you drill into the ground, the higher the temperatures are. In Central

Europe temperature is increasing on average by 3 °C per 100 metres depth. Experts assume that in the core of the Earth temperatures may reach 5,000 to 7,000 °C. A portion of the core’s thermal energy is transported towards the crust. Another source of geothermal energy is the radioactive decay of materials in the Earth’s mantle and crust. At least in terms of figures the geothermal energy stored in the upper 3,000 metres of the crust meets the current energy demand of the world for 100,000 years.

Thus geothermal energy is a long-term energy source that different to other renewable energies is for free. Depending

from the ground there are required drilling depths less than 150 metres to use geothermal energy for the heating and cooling of buildings. Technical solutions and systems to use geothermal energy for heating and cooling are available since long. Parts of the system are one or more borehole heat exchangers – mostly a u-tube – and one or more heat pumps in a parallel circuit.

However, the investment in a geothermal heating and/or cooling system is approximately two times higher than e.g. for a traditional gas heating system. On the other hand the operating costs are significantly lower.

The discussion about climate change and the continuously increasing energy costs have boosted the interest in geothermal heating. In 2004 in Germany approximately 9,500 geothermal heating systems have been installed, in 2013 the number has more than doubled to 20,000. Currently about 318,000 geothermal heat pumps are active in German households – given a total of nearly 40,000 households it means that less than one per cent uses geothermal energy for heating. In Switzerland the ratio is much better – there nearly 30 per cent of the households are provided with geothermal energy.

No wonder that geothermal energy and generally renewable energies in real estate developments are one of the main topics of Green Summit 2015 taking place on 9<sup>th</sup> and 10<sup>th</sup> June in Liechtenstein. It will not be about one- and two-family houses but about large-scale urban developments.

That it is possible to develop environmentally friendly quarters on a larger scale are showing two rather different examples from the US and Germany.

In the US, more exactly: in Austin/Texas Taurus Investment Holding is developing Whisper Valley, a new urban district on more than 800 hectares (this is nearly four times the area of HafenCity Hamburg) with 7,500 family and town houses as well as 185,000 square metres of office and retail space. Whisper Valley is completely based on the passive house concept. Part of the concept is the use of geothermal energy.

In Austin temperatures will go up to 35 °C during summer while during winter they are mostly over 0 °C, also in the nights. Given these climate conditions geothermal energy will not be used only for heating but for cooling as well. That means an optimal utilisation of the geothermal system: During winter heat is extracted from the underground reservoir and used to heat the buildings, while in summer the heat from cooling down



*Above the refurbished quarter in Rotenburg (Wümme), below the development area for the first of four construction phases in Whisper Valley.*

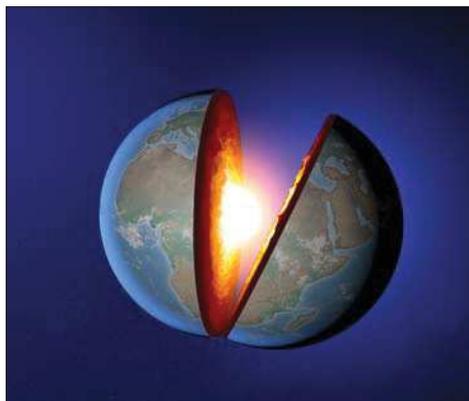
the buildings will be led back into the underground and be available again for the next chilly period. The energy consumption of the system is only the power needed for the heat pumps and produced by photovoltaic systems.

While Whisper Valley is completely a new development where Taurus in co-operation with the Swiss company Rehau and the German companies BASF and Bosch Group is applying state-of-the-art technologies, the German DGI Deutsche Geothermische Immobilien AG is focusing on energetic refurbishment of 'normal' multi-family houses.

In 2014 DGI acquired a portfolio of 76 mostly three-storey buildings with 382 residential units, located in the northern German towns Celle and Rotenburg

(Wümme). The majority of buildings has been constructed during the 60s. In Celle the first buildings are already refurbished, while for the remaining houses and those in Rotenburg (Wümme) construction works will be completed at the end of 2015. In this case energetic refurbishment does not mean only thermal insulation, but includes also the change of the heating system to geothermal energy.

However, technical possibilities are one side, the other is financing. If new developments or refurbishment of existing buildings – the investment costs for geothermal heating and cooling are high. Normally developer's higher investments precipitate in respective higher prices or rents that often exceed end-user's budget. Therefore the developers in Austin/Texas as well as DGI in Germany have chosen an-



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other way to facilitate payment: they both work with fixed and calculable costs. "For Austin EcoSmart as part of Taurus has developed a financing programme that provides every house with the whole technical equipment and geothermal energy without any initial investment for the house owner. Instead of that special investment the house owner pays a monthly energy and service fee to EcoSmart. This fee amounts approximately to the energy costs currently saved by the house owner", explains Axel Lerche, Partner of EcoSmart. Also if in future energy prices will be rising – what is very probable – the fee remains unchanged, so that every home owner can clearly calculate the costs.

In Celle und Rotenburg the 'Trautsch model' has been chosen, so called because of his 'author', the Member of the DGI Board Christoph Trautsch: Here again energy costs remain constant for tenants – they pay a permanent fixed fee for heating and warm water on the base of the last energy consumption bill before the change to geothermal energy. Only the costs for power needed for the heat pumps will be allocated to the tenants. That this model pays off DGI has extended the attic floors of the buildings by a total of 126 apartments. Furthermore, before the refurbishment many apartments could not find no tenants – the vacancy rate amounted to 20 per cent. After the refurbishment and modernisation tenant demand increased significantly so that meanwhile the apartments are nearly fully let.

And still another point is important: Especially with the 'smart' homes in Austin, but as well with the refurbished apartment houses of DGI users have concerns about the service and the service costs they have to pay for the more complicated technical equipment. In Austin there will be an extended warranty and service period. Furthermore the developers hope that the name Bosch, a company with a tradition of nearly 130 years, will contribute to confidence in the service. In the refurbished apartments of DGI the company is taking the service costs for the geothermal system for ten years without charging the tenants.

Every developing company is also a commercial enterprise that has to finance its activities and also wants to gain some profit. Sustainability and climate protection are often-mentioned and sometimes overstressed slogans that meet everybody's full approval, but nearly nobody wants to pay the additional costs. This attitude is quite common among all stakeholders. In both examples the developers have made concessions to the end-users; but what about the developing companies themselves? Investment costs for large-scale urban developments like Whisper Valley or the refurbishment of a significant residential stock cannot be payed out of the petty cash.

Taurus is financing Whisper Valley by the issue of bonds. And as Lorenz Reibling, Chairman and Founding Partner of

Taurus, is stating, it is easier to attract investors by sustainable projects because these projects are more profitable and in the long run investments are more secure. "The more complex a product, the harder to duplicate it. Moving up complexity means moving up yields", he explains. However, what is important is scalability.

For sure Christoph F. Trautsch will not contradict this statement. Because Deutsche Geothermische Immobilien AG, founded in 2010 as an equity investment company, secured financing for the acquisition of the residential portfolio located in Celle and Rotenburg (Wümme) from DG HYP Deutsche Genossenschafts-Hypothekenbank AG (a German cooperative and mortgage bank). RiverRock Opportunities European Funds Ltd. acted as mezzanine investor providing the necessary private equity. Already at the end of 2014 DGI has been able to refinance RiverRock's mezzanine capital by investments of two pension funds. And as it is generally known pension funds are very conservative investors because they are mainly interested in long-term revenues.

Although far apart from each other both examples are demonstrating that it is possible to keep the financial burden limited for the end-user and to meet the requirements of sustainability also with large-scale residential developments. And especially with residential buildings there is still much to do to reduce carbon dioxide emissions. | **Marianne Schulze**