



**GEOKOAX**<sup>®</sup>  
geothermal systems

## New construction of a climate protection estate

67 condominiums in an area  
with drilling depth restrictions in  
the center of Troisdorf (190 kW)

As of March 2015



Figure 1: Schematic View. (Foto: Protec Futur 2001)

The flagship building project for contemporary climate protection was funded with over 6,000 square meters of living space by the Energy Agency of the State of North Rhine-Westphalia. The renewable energy concept, including the pioneering technology of the GEOKOAX probe, was awarded with the title of "climate protection estate". Given the drilling depth restriction for this area of 31 m, an installation using conventional probes would not have been possible. By using GEOKOAX probes however, 1.5 km of drilling meters could be saved (and corresponding drilling costs).

## Background: Climate Protection Estate

To achieve its climate targets, the federal government adopted a **program of measures** in December 2010. Sustainable building, halving CO<sub>2</sub> emissions by 2020 and the expansion of renewable energy for heat supply can be found at the top of the list. As part of the North Rhine-Westphalian energy and climate strategy, the project "**100 Climate Protection Estates in NRW**" was initiated with the goal of continuing to systematically reduce the heat-related CO<sub>2</sub> emissions in residential areas (new constructions and renovations).

As part of the pilot project, an "urban climate protection estate" with 67 residential units and commercial space was built in Troisdorf-center. The settlement in Troisdorf's center district (Kölnerstraße/Kronenstr.) is a flagship project for the sustainable development of so far largely untapped energy resources under the earth's surface.

Unique about this climate protection estate is the realization of a geothermal project in an urban area with drilling depth restrictions. The drilling depth limit of 31 m made it impossible to develop the virtually infinite geothermal energy source using conventional probes. In 2011, the regenerative heat concept was honored by the Düsseldorf Energy Agency with the award as "climate protection estate".

The first single-family homes in this district were built in 1922. The high level of aspirations to live in style found expression in then-revolutionary tent roofs with associated tent poles. Architect Hans-Werner Piel adopted this shape and devised one of the most ecologically innovative residential areas in recent decades.

The new buildings are three-story. Those facing towards Kölnerstrasse accommodate shops and boutiques on the ground floor, while the upper stories serve as residential units.

Another geothermal project in the process of planning is located at the nearby railway station and will feature a medical center with an adjacent living residence and nursing home.



Figure 2: Map of the climate protection estate.  
(Foto: tewag GmbH)

## Implementation

The successful execution of such a project demands that various crafts work together in close interaction. **Builder** of the innovative settlement is the project company Kölnerstrasse/Kronenstrasse GmbH. Protec Futur 2001 GmbH, which is headed by the **architect** Hans-Werner Piel, was commissioned with the **site management**. Architect Piel is a member of the BDB (German association for builders, architects and engineers) and specializes in modern methods of construction. Protec's low-energy houses meet the standards of the KfW-efficiency homes and are eligible for low-interest loans.

**Technical building services** were provided by Andreas Favier who helped with planning the details of the project. The company tewag GmbH, as an independent expert, supported the calculations of the size and position of the probe fields.



Figure 3: Installation of GEOKOAX probes below the building complex.  
(Foto: GEOKOAX GmbH)

## Realization

The residential units are equipped with underfloor heating. The thermal insulation conforms to the three liters standard (max. 35 kWh / m<sup>2</sup>a). The windows are suitable for passive houses. The domestic hot water is heated to 45° C by means of geothermal energy. The water temperature is further increased to 60° C by a gas condensing boiler in each building.

In order to provide the necessary heating energy for the 67 residential units, a total of 92 GEOKOAX probes à 30 meters have been installed in three distinct probe fields. The total probe length comes to 2,760 meters GEOKOAX. The three probe fields are located below the underground parking lot and supply different buildings:

- Probe field 1, buildings A-F: 32 x 30m probes
- Probe field 2, buildings G-J: 28 x 30m probes
- Probe field 3, buildings K-O: 32 x 30m probes

The thermal energy in the ground is provided by four brine-water heat pumps:

- 1 heat pump with 103 kW heat output
- 3 heat pumps with 29 kW heat output each

Calculations of tewag GmbH showed that 4,254 meters of double U-probes would have been necessary. However, the drilling depth restriction by the authorities was 31 meters. Since the limited space on the property precluded more drillings, this project could only be realized using the highly efficient GEOKOAX probes.

Overall, the savings in probe meters was approximately 1.5 kilometers.



Figure 4: The completed residential and commercial buildings with rounded tent roofs. (Foto: EnergieagenturNRW)

## Heating Costs

Since the inexhaustible geothermal energy is available all year round for free, costs are limited to the power consumption of the heat pump. Electricity providers usually offer discounted power rates for heat pumps.

## Summary

General Conditions		
Drilling-depth restriction in meters	31 m	
Area to be heated in m <sup>2</sup>	6,000	
Heat output in kW	190 kW	
No. of apartments	67	

Basic Parameters	geoKOAX	duplex probe
Length of all probes in meters	2,760	4,200
No. of boreholes x depth in meters	92 x 30	140 x 30
Volume of brine fluid in liters	37,250	8,400
Performance Parameters	geoKOAX	duplex probe
COP (Coefficient of Performance)	4.5	
Average flow temperature	7°C	

## Prospects

The partnership of GEOKOAX and Protec Futur 2001 will continue to represent innovative heating concepts in the field of near-surface geothermal energy.

In their survey on the climate protection estate in Troisdorf-Center the consultants of tewag GmbH write:

“Compared to conventional systems, the GEOKOAX volume probe also has a lower thermal resistance and a higher effective heat exchange surface. The individual points stated allow in their entirety an optimized design of volume probes compared to conventional probe systems”.

The volume of GEOKOAX probes is many times larger than that of conventional duplex probes. Its large volume gives the GEOKOAX probe the advantage of delivering a highly-efficient monovalent cooling of buildings during the summer, dispensing with the need for costly and environmentally harmful cooling units.

## The GEOKOAX company:

GEOKOAX GmbH, which is headquartered in Munich/Germany, is an innovative, international company with a branch office in Cologne/Germany and distribution partners in Serbia, Poland and in South Carolina/USA. GEOKOAX GmbH offers patented geothermal technology made in Germany. Using a highly qualified team consisting of business management graduates, chemists, planners, project managers and heating engineers, GEOKOAX offers complete solutions for close-to-surface geothermal energy. From site surveys to planning, testing, implementation and subsequent monitoring – the expert team of GEOKOAX has experience gained from more than 1,000 projects implemented in Germany, the Netherlands, Switzerland, Serbia and the Czech Republic.

## The GEOKOAX geothermal volume probe:

The GEOKOAX volume probe, as the highest performing geothermal probe system, enables reliable solutions for heating and cooling of residential and commercial properties. Everywhere, even in areas with drilling depth restrictions. Also on smaller properties with high energy demands, such as usage-intensive multi-story buildings in urban areas, GEOKOAX enables reliable planning and a safe implementation of projects that could not be developed with conventional systems. Its high level of performance and up to 60% less drilling meters predestine the GEOKOAX geothermal volume probe for large construction projects or demanding, complex EnEV 2014 building renovations.

## Participating Companies:

### Geothermal Volume Probes:

GEOKOAX GmbH, Am Kirchenhölzl 13, 82166 Gräfelfing, Germany, Phone.: 089-45 20 947-0, [www.geokoax.com](http://www.geokoax.com)

### Construction Management:

PROTEC FUTUR 2001, Company for modern building methods GmbH

### Architect:

Dipl.-Ing. Hans-Werner Piel

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