thermowave
PHE for process and industry

Where ecology and economy go hand in hand

Newly built properties in Germany fulfill the most stringent energetic norms and make use of renewable primary energy. For a new public building in Berlin that we are not allowed to mention for competitive reasons, a ground-breaking energy interconnection combining ecology and economy in a smart and efficient way was realised. Ten thermowave plate heat exchangers contribute to the energy production which is mainly decentralised with cold sinks and heat sinks.

The government invested about €190m in its new 44,000 m² office and event building in Berlin. In addition to 300 new offices next to the Spree river, a prestigious entrance area, a café with 50 indoor seats and another 150 seats outside were created.

The hall is available for public events and offers space for about 1,200 guests. The innovative energy concept of this property connecting a CHP (combined heat and power plant) with a heat and cold accumulator proves that ecology and economy are everything but contradictory.

Self-sufficient in terms of energy

Part of the primary energy for the group of buildings is obtained from biodiesel via a cogeneration unit which generates thermal, electrical and mechanical energy. The thermal energy produced by four motors is sufficient to provide the minimum heat supply for the entire group of buildings. Four ther-

Overview

Line of business:	HVAC/Power energy
Application:	Renewable energies Air Conditioning
Country/City:	Germany/Berlin
Refrigerant:	Ethylen glycol, water
Product:	thermolineVario TL 500, TL 650, TL 850, thermolineEco EL 250

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The thermowave plate heat exchangers are located at a depth of 12 metres below the 44,000 m² construction section which is the latest of the building ensemble.

The German heating system regulation stipulates that plate heat exchangers are to be jacketed.

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mowave plate heat exchangers of type EL 250 EBGL-500 each absorb the motor heat of the CHP and transfer it to the heating circuit and drinking water circuit respectively.

In case of downtime, four redundant hot-water vessels can fully replace the four CHP biodiesel motors and can be put into operation rapidly to cover peak loads.

Also with regard to power supply, the property is almost self-sufficient as the power obtained from the CHP and from a photovoltaic installation covers the average demand of the property. Peak loads are covered via green electricity from the public network.

Heat sink at a depth of 300 metres

Especially during spring and autumn, the CHP of the group of buildings generates more heat than immediately required. This is why the porous ground below the property serves as geothermal reservoir. The excess heat from the CHP is injected into a water-bearing rock layer approx. 300 m deep (heat sink) by means of two drill holes.

For this purpose, the hot water stored in deep porous rocks at a temperature of approx. 20 °C, is first pumped to the machinery room by means of the mechanical energy obtained from the CHP. The cold source water heats up to about 60 °C because of the heat transfer and is then injected into the rock with a maximum capacity of 100 m³/h via a second drilling approx. 280 m away.

The geological heat sink stores the heat (the heated source water) with hardly any loss in temperature. In the subsequent heating period, pumps transport the warm water with a temperature of about 55 °C back to the machinery room.

Thermowave plate heat exchangers

A thermowave EL0250 EBGL-500 first transfers the intermediately stored heat of the source water to the water of the heating circuit which is heated, in a second step, to 113 °C for the central heating circuit of the property. The source water, cooled down by the heat exchange, is returned to the ground. The thermowave plate heat exchangers are located at a depth of 12 metres below the 44,000 m² construction section which is the latest of the building ensemble.

The continuous removal of the hot water from the geothermal reservoir results in decreasing delivery temperatures. The stored heat can be used economically up to approx. 30 °C.

Winter cold for summer

Besides, during winter, a thermowave heat exchanger of type EL0250 EBGL-500 cools water obtained from the groundwater well behind the building down to about 6 °C ab (dry cooler). This water is then directed back to the about 60 m deep wells in front of the building (cold sink). In case there is cooling demand in summer, the stored cold water from the well in front of the building serves as cold source for the refrigeration cycle. A one-way thermowave TL 850 KBIL-1750 with a capacity of 4,500 kW transfers the cold to the internal refrigeration cycle.

In the course of summer, the source water temperature increases again to the natural source water temperature of about 11 °C due to removal. The temperature equalisation depends on the utilisation intensity of the geological cold water reservoir. .

If the cooling demand inside the building is higher than the cold accumulators can actually provide, conventional refrigerating machines quickly set themselves into operation. In case the demand continues to increase for a longer period of time, three absorption refrigerating machines driven by the waste heat of the CHP set themselves into operation.

Energy interconnection

An energy interconnection placed between all the building sections ensures the economic operation of the property. The distribution of heat, cold and power (e.g. via a 10 kV power line and the central heating circuit with 110 °C) to the individual parts of the building is centrally controlled according to demand.

Another thermowave plate heat exchanger EL 250 EBGL-500 operates as emergency cooler in an emergency power system (fourth CHP) which – independent from the public grid – guarantees the availability of electric energy for the entire group of buildings in case of power failure.

ThermolineVario

A two-way thermowave plate heat exchanger TL850 of the thermolineVario series (TL0850 KBIL-2250) forms one part of the core piece of the supplied thermowave apparatuses; this TL 850 PHE integrates the new construction into the heating circuit and the hot water circuit of the existing building. The other part of the core piece is a two-way TL0850 (TL0850 KBIL-1750) supplying another group of the building with hot water.

Due to different capacity requirements in summer and winter operation, the two-way plate heat exchanger TL0850 KBIL-2250 is designed for different mass flows and for two loading cases (750 kW/6,000 kW). With its 302 plates, this apparatus boasts an enormous capacity as 180 m² of heat transfer surface are available.

If the plate heat exchangers are used for transferring heat for heating purposes, they have – in line with the German heating system regulation – an insulated sheet metal jacket easily removable for maintenance measures.

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