The innovative low-temperature network

Green Urban Energy GmbH

Green Urban Energy GmbH is driving the heating transition to build a sustainable capital city: one of the largest urban development projects in Europe is being constructed in Berlin Tegel and consists of two areas: the Urban Tech Republic, a research and development hub with various commercial opportunities, and Schumacher Quartier, a car-free residential area. The new city district and its energy supply will be built within the next few years. Green Urban Energy GmbH provides heating and cooling via a twelve-kilometre two-piping network featuring the latest system technology. The first customers are scheduled to be supplied by 2026.

The innovative low-temperature network in brief: the LowEx Network, works with temperatures up to a maximum of 40 °C – far less than, for example, conventional district heating networks. Both heating and cooling are possible in a two-piping system. Decentralised heat pumps on-site at the customer's enable temperatures to be tailored entirely to requirements.

Green Urban Energy GmbH employs a consistent approach to sourcing renewable energy. Through the LowEx Network, Green Urban Energy GmbH is able to offer high-quality sustainable energy, with a primary energy factor of <0.1 and CO2 emissions of <55 g/kWh. With its mix of decentralised and centralised heat pumps, solar power, geothermal energy and waste water heat, the LowEx Network acts as an energy exchange hub. This energy concept provides the ideal blueprint for local sustainability in the urban districts of tomorrow.

This will benefit both the climate and the environment.

In order to be able to achieve these ambitious targets, it is important to approach the project from a holistic standpoint, from energy generation to end user. The LowEx Network provides the missing link here and features special requirements compared to classic district heating.

Innovative exchange place for heat and cold

The LowEx Network

The LowEx Network can absorb excess or self-generated energy, such as waste heat from production, at the customer's site. Customers become producers, or more precisely: prosumers.

The LowEx Network in Tegel is made up of three important components: the sustainable generator park, bidirectional house connection stations and intelligent networking via its own fibre optic network. The heating and cooling supply is provided by a combination of centralised and decentralised generation units. The LowEx Network is divided into three line rings (two supply areas). The first line ring supplies the industrial belt along the former runway. The second line ring heads south to serve the commercial zone of Urban Tech Republic (UTR) and the third serves the Schumacher Quartier (SQ) residential area to the east of the project area.

The comparatively low temperature of the network simplifies the integration of renewable energy generators and waste heat, which is naturally lower in most cases.

Power and communication networks are built into the LowEx Network. This enables the integration of decentralised energy generators such as photovoltaics (PV) and the supply of house connection stations with green, locally generated electricity. This is a key prerequisite for meeting sustainability goals.

Smart Grid

The most important core components of the LowEx supply system are the bidirectional house connection stations (HCS). Once connected to the LowEx Network, the HCSs are able to supply the customer with temperature levels of 6 °C to 55 °C all year round, regardless of whether the LowEx Network is in heating or cooling mode. Green Urban Energy GmbH provides tailor-made energy solutions for individual needs. To achieve this, the HCS features a modular design.

In contrast to most other heating and cooling networks, heat and cold generation is not routed through energy centres, but via prosumers and house connection station heat pumps, which supply heating/cooling in a decentralised manner. In other words, the goal is to exchange energy from where it is generated to where it is needed. The energy centres bridge the gap between supply and demand and help to create a balanced relationship.

The HCS internal communication network offers the advantage that all consumers can be controlled intelligently and optimised sustainably from the energy centre. The aim here is to integrate both the requirements and decentralised generation within the control system in such a way that the method of consumer connection prevents the customer from influencing his supply, yet ensures demand peaks are buffered. The control system will improve continuously during project development.

The Energy Centres (EC)

The primary energy centre, Energy Centre East, will be located behind the southern runway. The required area will be up to 18,000 m^2 in order to meet boundary conditions, which include noise emissions. The expansion of the energy centres (EC) follows project development and thus grows steadily over time.

Merit order is continuously adjusted in order to keep network sustainability at the high values agreed.

In the final stage, a heating capacity of 37 MW and a cooling capacity of 10.5 MW will be required.

The heating demand of the UTR will increase from 14 GWh to 58 GWh between 2027 and 2040 and the cooling demand from 22 GWh to 43 GWh. The Schumacher district will have a heating requirement of 40 GWh. Cooling only plays a very minor role in the residential zone.

What is special here, is that the large number of heat pumps - 40 units - creates a cluster that has never been implemented on this scale before. Two central questions arose here; the effect of the noise in the direction of the residential zone and the mutual interference among the internal machines. Our investigations show that the generation of noise can be eliminated by factory soundproofing measures and that even when all heat pumps are used under unfavourable conditions, only a slight reduction in the internal heat pumps can be expected.

Further prerequisites for the realisation of the energy centre and compliance with sustainability are the use of geothermal energy and photovoltaic systems.

Rainwater Treatment Plant

Integration of renewable energy sources forms an essential part of the Low-Ex Network. Within this context, the retention basin of the rainwater treatment plant (RWA-Ost) is analysed as a renewable source. It is planned to use the rainwater retention basin (RWB) as a thermal source and sink with a thermal extraction and input capacity of approx. 470 kW.

The semi-natural rainwater basin ("Loop-See") of the Ost rainwater treatment plant (SHEV) is a technical facility tasked with cleaning the precipitation run-off from the UTR and SQ districts. It should therefore be regarded as an artificial body of water that has been designed to fit in with the natural environment. The precipitation run-off from the surrounding districts (UTR TXL Ost) is puri-fied in a multi-stage process, meaning that it can be assumed that an unpolluted inflow reaches the basin. The annual inflow is expected to be around 124,200 m^3. The overflow of the basin percolates away or supplies industrial water. In the course of the ecological assessment and the description of the basin, the terms Loop-See or body of water may be used.

The aim was to analyse and evaluate both the thermal and ecological effects of thermal utilisation on the emerging ecosystem. It should be ensured that the thermal utilisation maintains the natural development and safe operation of RWB. A care and protection concept, in which operational limits and corresponding options for action are described, may be requested.

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