

The energy marketplace – Innovative energy concept for Berlin TXL

At an energy marketplace for heating and cooling Berlin TXL' users will be able to trade energy. The low temperatures of the Low-Exergy-Network mean the greatest possible efficiency and make it possible to use renewable heat sources at the same time.

Berlin wants to be climate-neutral by 2050. With an innovative combination of different technologies Berlin TXL will be an urban laboratory for a carbon-neutral city district. One of the biggest city development projects in Europe will be completed on the site of the former Tegel airport. The Berlin TXL research and industrial park – the Urban Tech Republic – provides space for up to 1,000 businesses and 20,000 employees. In the immediate vicinity of the Urban Tech Republic, a smart residential district – Schumacher Quartier – will be developed, with more than 5,000 homes for more than 10,000 people. The sustainable energy concept for the site is unique for its size in the world.

The future-oriented concept for the Urban Tech Republic and Schumacher Quartier goes far beyond just decarbonizing the energy supply. In particular it makes a future without fossil fuels possible for the heating and transportation sectors. The energy concept's guiding principle is a marketplace for heating and cooling.

This Low-Exergy-Network, as it is called, is operated at flow temperatures of up to 40 degrees Celsius. Compared with standard district heating with flow temperatures of at times more than 100 degrees, the losses in the Low-Exergy-Network are significantly smaller. Moreover, the low network temperatures now make it possible to use environmentally-friendly heat sources efficiently.

In the decentralized energy marketplace consumers can in addition feed waste heat from buildings, wastewater, server rooms, and industrial facilities into the Network's ducting system and receive some remuneration from this. The concept envisages for instance geothermal energy, solar energy systems, and wind power as sources of renewable energy.

An entirely newly-developed urban district offers ideal conditions for this innovative energy concept, as the concept can be incorporated at all planning stages. New and existing constructions are equipped with panel heaters for this purpose. Existing buildings such as the hexagonal former airport terminal from the 70s will be equipped with modern thermal insulation. The Low-Exergy-Network's low flow temperature of 40 degrees Celsius during the heating season is made possible only by a combination of low energy demand and panel heaters.

In summer on the other hand the buildings can be cooled via the same heating surfaces in the walls or floors. This works because in the warm season the Low-Exergy-Network runs at a

mere 20 degrees Celsius. During this time the ground serves as a natural cooling source. Furthermore, heat pumps can regulate the Network's flow temperature level rapidly and flexibly.

For this purpose, reversible heat pumps are installed in the energy centers that can switch from heating to cooling. Heat pumps installed at the users' premises and connected to the Low-Exergy-Network provide flow temperatures tailored to individual needs upon demand. The passive cooling works via the components of the buildings. The Low-Exergy-Network's liquid heating medium circulates in the heating panels where it absorbs heat in the summer. The Network conducts the heat via the injection wells of the aquifer storage facility into the ground. In effect the subsoil functions as seasonal storage. Surplus heat from summer can be used for heating during winter.

In winter cooling energy accrues as a waste product from the heat pumps and is conducted into the ground to cool the building during the hot season. This optimizes the operation of the heat pumps and increases the energy efficiency of the system still further.

In Berlin TXL's future data platform (FUTR Hub), all the data from the energy marketplace flow at the same time. A comprehensive control and information technology system regulates the complex interaction between many input sources and the consumption billing via smart meters. The Berlin Low-Exergy-Network thus becomes an exemplary model for digitalization of the heating sector. In the energy center's showroom interested parties can learn about the energy concept for Berlin TXL and find details regarding the Low-Exergy-Network.

Energy supply is also controlled intelligently through interaction with the data platform. For example, the electricity from the photovoltaic systems on tenants' roofs can be applied, depending on the situation, to charge electric vehicles or stationary storage batteries, to cover peak loads from businesses, or to provide control energy for the European power grid. At the same time data from weather forecasts and energy exchanges can be taken into account, as can forecasts of user demand.

The entire energy concept for Berlin TXL is structured in modules. In a first step high-efficiency co-generation units will supersede older, gas-fired heating stations on the former airport grounds that will only cover the peak load in future on particularly cold winter days. Together with the co-generation units, the photovoltaic and wind power systems located in the area will feed into the customers' own operating network and thus minimize the collection of so-called "gray power" from the German power grid for the operation of heat pumps. Thanks to the modular structure the energy supply can be extended step by step.

The co-generation units can be operated carbon-neutrally for example if they use biogas or what are called synthetic gases, such as methane or hydrogen, which are obtained through conversion from green electricity. Besides power-to-heat solutions such as heat pumps, this power-to-gas technology is an approach that is important for sector coupling and thus for the comprehensive decarbonization of the entire energy supply as well. By 2050 Berlin TXL's carbon emissions will thus be reduced to a minimum. At this point the central systems will, in



the best-case scenario, simply balance out excesses and shortages in the Low-Exergy-Network by the bundling of decentralized inputs.

The operation of the Low-Exergy-Network will be taken over by Berlin Stadtwerke and E.ON. In October 2018 the bidding consortium had prevailed in a Europe-wide invitation to tender for the concession for supplying heating and cooling to Berlin TXL.

The heating costs for renters at the site are expected to be lower than for district heating and with very good sustainability values. Developers can also implement their own plans for energy supply to their building if they can show that they are more sustainable than those of the operator.