

# Ecological settlement development in Kassel-Oberzwehren



The objective of the development project is to optimise the CO<sub>2</sub> emissions caused by heating energy and hot water requirements by increasing energy efficiency and using renewable energy sources to balance the annual CO<sub>2</sub> emissions mathematically. The material and energy flows throughout the lifecycle are also to be reduced. These targets must be reached as cost-effectively as possible, using reliable construction and operation methods and standard market technology. The objective of the research project is to develop and implement the options of an exergetically-optimised heat supply for the new settlement area. The technologies developed as part of the "LowEx" energy-optimised building joint project are to be tested and examined in practice. Also, synergy effects for summer comfort must be implemented via highly-efficient cooling strategies and tested, various building concepts must be evaluated energetically and exergetically. The results should be transferable to similar projects in redensification settlement development.



Border of the settlement property towards the centre of Oberzwehren

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## Settlement summary

<b>Project status</b>	<div style="width: 20%; height: 10px; background-color: #90EE90; border: 1px solid #ccc;"></div> Planning
<b>Location of local community</b>	Stadt Kassel, 34109 Kassel, Regierungsbezirk Kassel, Hessen
<b>Developer, organizer</b>	Stadtplanungsamt Kassel
<b>Settlement</b>	New single family or semi-detached house settlement
<b>Utilisation type</b>	Purely residential
<b>Size development area</b>	8,5 ha
<b>Gross floor area</b>	2.900 m <sup>2</sup>
<b>Number of accomodation units</b>	16
<b>Age structure</b>	New buildings
<b>Heating system</b>	District heating
<b>Project themes</b>	New buildings, Urban concentration, Integrated energy concepts for buildings, Waste heat utilisation, Passive house construction method, Optimising building technology, Optimising building envelopes, Renewable energy sources, Centralised + decentralised energy supply, Energy management systems, Optimisation of operations, New urban land use planning, Project and process management

## Project description

The City of Kassel intends to zone a construction area for residential building with high ecological construction standards on the grounds of the former Horticultural Teaching and Experimental Institute of the University of Kassel in the Oberzwehren district, in order to attract potential construction investors to build environmentally-friendly buildings in the City of Kassel.

The objective is to develop an ecological construction area with a high urban development and architectural quality and to implement innovative energy solutions.

In 2005, the Planning Authorities of the City of Kassel held a workshop with eight architecture firms from Kassel and two landscape architecture firms to develop a concept for this. The workshop produced four alternative sophisticated urban development concepts, on the basis of which a structural concept was developed.

### Urban development context

The planning area is in the Oberzwehren district of Kassel, bordered in the east by Oberzwehrener Strasse, in the south by the footpath along the Dönchebach Stream and the railway line, in the west by private property, by Auf dem Angel street and Heinrich-Plett-Strasse and in the north by Entenbühl street and the footpath which opens into Heinrich-Plett-Strasse.

The area governed by the land-use plan is bordered by a mixed area in the north, by the Heinrich-Plett-Strasse

campus of the University of Kassel in the north-west, by apartment buildings in the west (Brückenhof), in the south-west and east by residential areas with primarily single and double-family houses and in the south by the flood plains of the Dönche. A bus and tram connection provides access from the construction area to the inner city. The ecological market garden, built on the grounds currently used as agricultural experimental grounds in 2006, is to remain in operation. The new construction complex originally was intended to be made in two construction areas, for which different urban development and energy concepts had to be developed. For reasons of noise protection the southern planned settlement area was no more part of the potential analysis. But spatial development and implementation of innovative energy solutions based on two neighbourhood energy concepts - for both northern and southern construction areas - will be continued.

#### **Settlement ecological aspects**

The stated ecological goal of the City of Kassel is the desire to implement a CO<sub>2</sub> neutral heat supply as a role model. To realise this, the CO<sub>2</sub>eq emissions caused by heating energy and hot water requirements are to be optimised via high energy efficiency and use of renewable energy sources, such that a mathematical compensation of the annual CO<sub>2</sub> balance is reached. The remaining material and energy flows throughout the lifecycle are to be reduced and these targets must be reached as cost-effectively as possible, with reliable construction and operation methods, using standard market technology. These measures are the first steps on the way to adapting the building and settlement structure to changing climatic conditions. Further aspects in this context, which are a reaction to more extreme weather conditions and changing precipitation quantities are to be studied and estimated as part of the German Federal Ministry of Education and Research "KLIMZUG" (Regions adapt to climate change) research programme.

#### **Objective of the research project**

The aim of the research project is to draw up a potential analysis for the Oberzwehren construction area for heat supply to the planned buildings with maximum energy efficiency and low exergy. Heat is to be provided at low system temperatures and be balanced both energetically and exergetically.

Energy is to be used at system temperatures close to the ambient and/or room temperatures; i.e. heating is to be very efficient and low-loss. Currently, high-quality energy sources such as natural gas or heating oil are generally used. These energy sources allow extremely high process temperatures to be reached, which means that they have great potential energy, which is unnecessary for low requirements of heating systems. On the other hand, we have sufficient renewable energy sources at a low temperature level, such as solar thermal energy or the heating and cooling potential of the soil. These energy sources are ideally suited to the requirements of buildings and can be used cost-effectively. In order to use these energy sources efficiently in buildings, the overall system must be designed for low process temperatures, following the so-called LowEx approach.

Low-exergy heat supply of settlements by using and expanding existing infrastructure can be studied as an example. The success of optimisation measures can be studied from the options to specify requirements in land-use plans, made possible by amendments to the German Federal Building Code (BauGB) in 2004, to the realisation of the building. The small size, the urban development orientation of the area (conversion of existing settlement structures) and the primary use of commercially available technologies lead us to expect that the results of the project will be highly transferable to other projects of this type.

#### **Objectives in detail**

To develop and implement the options for energetically and exergetically optimised heat supply for new settlement areas,

To test and examine the technologies developed as part of the LowEx joint project in practice,

To avail of and test synergy effects for summer comfort via high-efficiency cooling strategies,

To evaluate a range of building concepts both from energetic and exergetic points of view,

To make sure the results should be transferable to similar projects in redensification settlement development.

#### **Measures**

Building in the northern planned settlement areas with high-efficiency buildings in order to keep the heat and energy requirements as low as possible.

An efficient coverage of the remaining energy requirements with CO<sub>2</sub>eq-efficient heat provision.

The mathematical compensation of the remaining CO<sub>2</sub>eq emissions as part of the property-wide overall annual balance by offsetting the surplus solar energy.

Use of existing energy infrastructure in conjunction with innovative technologies, such as using the return line of existing district heating connections.

Integration of technologies developed from the LowEx joint project.

Use of the exergy concept to evaluate building and settlement structures and compare them with the results of the energetic evaluation based on CO<sub>2</sub>eq emissions.

The German Federal Ministry of Economics and Technology subsidises component development projects. The Kassel-Oberzwehren project's objective is to implement the LowEx approach in settlement development and building planning.

 **Website of deENet competence center on the ecological settlement development in Kassel-Oberzwehren**