



## Solar Quarter Gelsenkirchen-Bismarck

Gelsenkirchen is a former industrial city going through structural changes. Known as a city of 1000 fires (coal mining) a new sustainable mission (city of 1000 suns) has been created to support the structural change. Within this process of alteration a solar quarter is planned on derelict land from a former power station, close to a waterway. The area will include: residential and office buildings, trade, commerce and recreation with high requirements for energy efficiency, solar urban planning and applications of solar systems. The quarter is predicted to include 2000 working places and 700 dwellings. In an innovative approach the city is imposing solar requirements in the contract of land purchase. This approach was possible because the State Development Association (LEG) is the owner of the land.



*Area in the seventies*



*Area today*

## The Sustainable Mission – City of 1000 Suns

In 2001 the City Council of Gelsenkirchen, together with the Ministry of Urban Development, decided to create the mission of a solar city. The overall targets to reach this goal were expressed in the concept “Solar City Gelsenkirchen”, developed by the University of Wuppertal and Aachen in co-operation with Ecofys. The objective of this study was to identify future fields of activity and benchmark basic objectives.

Based on the structural change the City was undergoing a marketing strategy was created, which includes a voluntary commitment to sustainable and solar development. Within this development an overall emission target of 3.3 t CO<sub>2</sub> annual emissions per inhabitant should be reached by 2050. Through mutual co-operation of partners from industry, trade, science and solar associations, the research, development and appliance of solar technologies should be enhanced.

The City of Gelsenkirchen is the driver towards this development. As part of this mission the City provides and supports:

- Local agenda network (energy and environmental)
- Climate protection at schools (information and implementation)
- Solar urban planning
- Energy consultancy

- Installation of solar systems on communal buildings
- Solar round table
- Website

The mission has led to economic and education benefits for the city including:

- New research institutes targeting solar development
- Production plants of solar cells and modules
- Establishment of various solar systems on trade, industrial and residential buildings
- Education options with main focus on solar technologies

## Development of an urban plan for the solar quarter

The structural change the City was going through provided a useful background and reasons to create something new. A former industrial area was chosen to be converted into a solar quarter, in line with the commitment to become a solar city.

The LEG was asked by the City of Gelsenkirchen to develop the complete quarter in accordance with an urban master plan designed by Scheuven+Wachten, an urban planning office. In addition an energy concept was prepared by the Gertec engineers in co-operation with Ecofys. As a result an investor manual was published, which includes commitments to solar architecture and technical needs for the application of solar systems. The City Council is involved in the decision making process and is responsible for ensuring compliance with the primary targets of the project.

A review workshop was held with participants from the City Council, the LEG and the engineering office to gather information on the planning process; from the early stage of development and urban planning to the implementation of the project. This workshop focused on the identification of potentials and barriers for solar urban planning. To create an overview of the results of the different parts and phases of the project a questionnaire was generated and presented to the participants.

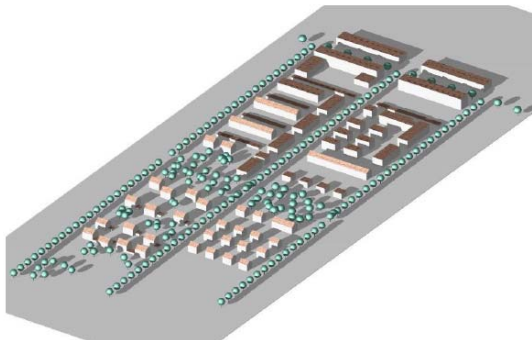
### Solar Requirements

The long-term climate protection target of 12.5 kg CO<sub>2</sub> annual emission per square meter floor area can be reached through low energy buildings and efficient and renewable energy supply. The main target in planning the solar quarter was to increase the proportion of building surfaces suitable for the use of passive and active solar energy. A holistic approach to solar architecture is then possible using the optimised surfaces for the application of PV and solar thermal systems and opening the buildings towards the sun.

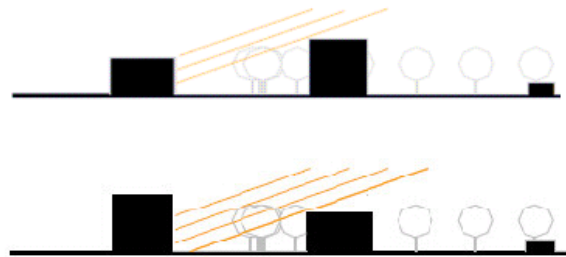
A preliminary evaluation of the solar potential of the quarter led to requirements for PV being specified in the investor manual. The solar potential was calculated for the different areas of the quarter. To simplify the specifications in the investor manual a fixed size of 1-2 kWp for residential buildings was established. Non-residential buildings are required to include installation of PV on surfaces visible by the public. A size between 1-2 kWp guarantees a cost effective PV system. The investment required for 1-2 kWp PV-systems are considered reasonable even for private investors. The decision to install a solar thermal system depends on the investor. There are no requirements for solar thermal systems at this stage.



The other main task related to solar energy during the preparation of the investor manual was the development of an urban plan which includes a simulation of shading and solar irradiation on building surfaces. The initial draft of the area plan, with building massing and layout, was evaluated and some modifications suggested regarding the height and distance between the buildings in order to provide each building with an ideal sun exposure.



*Shading visualisation*



*Primary planning and optimisation of building structure*

The resulting urban plan specifies the layout of the buildings in the area. Defining the orientation and spacing of buildings in this manner ensures the prescribed solar commitments can operate as intended. In addition requirements for heat protection and heat supply are set in order to reach a certain primary energy factor.



*Master plan*



*Urban plan*



*Detail plan*

As a result of this study the urban structure was adapted to suit the requirements of solar urban planning. Some suggested optimisations could not be implemented since they contradicted the overall structure of the area. In general, the height of the buildings increases to the north, which guarantees high density and at the same time high solar suitability.





*Sketches of the waterfront*

## Implementation

Legal conditions to prescribe solar requirements in local plans are theoretically possible but have not so far been tried out in Germany. Instead the contract of land purchase is used for this development, as an instrument under private law, to set the requirements of the solar quarter. Because the land is owned by the State Development Association (the LEG) the prohibition to install private heating systems (except solar thermal systems) and the requirement to connect to the local heating net can be accomplished by an easement on real estate. The commitments for PV systems and for low energy buildings are prescribed in the contract of purchase. PV systems for non-residential buildings have no specific size commitment set but must be installed on surfaces visible to the public with the aim of contributing to the sustainable appearance of the quarter. Together with solar applications in public spaces they will work as marketing instruments for the resident companies.

To avoid major shading of the building surfaces and to realise the concept of a solar quarter an advisory committee (experts from town planning, energy consultants etc.) was established. Their function is to adapt the solar requirements to the plans of each investor and to include plans for individual buildings into the overall plan. Investors in individual buildings have to include an



external energy consultant in their design teams in order to assure the quality of their detailed plans.

The current stage of development is primary negotiations with possible investors. The local heating net is also being designed with specific requirements concerning the primary energy factor.

## Barriers and Solutions

The acceptance of the solar concept by future investors is the main barrier expected. This barrier is exacerbated by the fact that the installation of a PV system on a building does not contribute to the overall energy performance of the building according to the calculation method applied under the current German energy saving directive (EnEV 07). This directive focuses on the thermal performance of a building so only solar heat contributes to the energy performance of buildings. As a result PV is not often installed on newly built low energy houses.

Given this background, some of the solar requirements have been kept flexible in order to leave space for individual planning of buildings. For instance, the requirements for large non-residential buildings to install visible PV systems do not define a size of PV system. The flexibility in the urban plan leads also to very general commitments regarding active and passive solar energy.

It is hoped that the advanced objectives of a quarter realised with solar architecture will be reached by working with investors, convinced of the potential of sustainable development and the growing public demand for corresponding living conditions. Within the framework of the sustainable mission of the City of Gelsenkirchen this outstanding project will become well known as a regional pilot project showing possibilities for future developments.

## Recommendations

Currently there are several Cities in Germany working with commitments under private law such as requirements imposed in the contract of purchase if the City is the owner of the land. In this case, commitments for PV systems can be implemented in many ways depending on the designated objectives. The economical effectiveness of PV plants is commonly accepted in Germany. To convince investors to approve a solar concept, which means primarily more planning complexity and higher investment costs, an incentive to invest could be the growing request for sustainable buildings with low maintenance costs.

## Sources of further information

Solar City Gelsenkirchen – [www.solarstadt-gelsenkirchen.de](http://www.solarstadt-gelsenkirchen.de)

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