Federal Ministry
of Education
and Research

Future
Megacities
Megastädte von morgen

RECAST Urumqi: Meeting the Resource Efficiency Challenge in a Climate Sensitive Dryland Megacity Environment, Urumqi as a Model City for Central Asia

Overview and Findings to Date

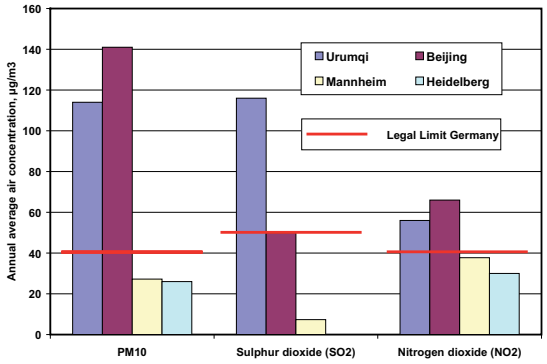
The consumption of energy and its effect on the local and global environment is an issue of growing importance in the development of metropolitan areas in China. Urumqi in the Xinjiang Autonomous Region is no exception. The per-capita primary energy consumption in the Province of Xinjiang has doubled from 1990 to 2005 and is expected to increase further in the future.

While China has adopted the general goal of improving energy efficiency of its economy, it has established policies and measures for greenhouse gas mitigation [NDRC 2007], while specific objectives respecting roles and demands of stakeholders have yet to be defined. In particular, competing interests have to be addressed in order to provide a sustainable framework for a sustainable energy system in China.

A reliable database with sound data on the past, current and future flows of energy in the greater Urumqi area has yet to be established. There are considerable uncertainties with respect to energy consumption in the province of Xinjiang and in Urumqi in particular. For example, information on the level of informal coal mining, the sector-specific uses and the conversion efficiencies are only rough estimates,.

Energy costs for buildings are high and mount up to one third of the average income per person. Given the low temperatures in winter, the energy insulation standard for new buildings translates into heat consumption of 16.4 kg of coal per m^2/year, which is equivalent to 125 kWh/m^2. More stringent standards are likely to be cost-effective accounting for the lower cost of energy in China. While China has adopted energy efficiency standards for buildings, enforcement and compliance is doubtful. While the specific energy consumption for heating of residential buildings is decreasing, the trend towards larger apartments and air conditioning during summer leads to increasing energy demands.

The annual combustion of about of 10 million Mg of coal in the Urumqi area with inadequate or non-existent pollution control leads to air pollution concentrations that result in adverse health effects, such as premature deaths and cardiopulmonary diseases. The situation is especially severe in winter during the heating season. The long-term average temperature in January is -15°C. Due to low wind speeds and atmospheric inversion layers, the concentration of PM10 often exceeds 600 µg/m^3.



Objectives of the Project

In the start-up phase, the German and Chinese team achieved a consensus on t the overall objectives of the work in the task group Energy Efficiency. Objectives are to identify, promote and implement:

- Strategies and technologies for an effective use of energy resources,
- strategies and technologies to expand the use of renewable energy,
- measures to reduce the emissions of air pollutants,
- options to reduce greenhouse gas emissions,
- suitable Sino-German projects, making use of CDM funding options.

The project is designed for a five-year period from 2008 to 2013.

Expected Contributions to an Energy and Climate Efficient Development of Future Megacities

Knowledge, Technologies and Performance

The project will be implemented interactively with our Chinese counterparts and be structured into the following major components:

Modelling and scientific analysis

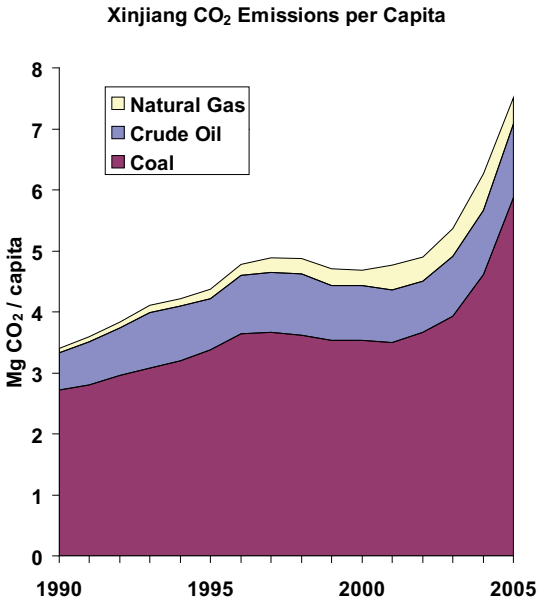
- Preparing a detailed and accurate model of current and future energy flows,
- analyzing technological options to improve energy efficiency and to utilize renewable energy,
- analyzing economic options (e.g. financing tools) to implement innovative solutions,
- marketing analysis for investments in energy and environmental sectors.

Preparation of a sustainable energy concept

- Determining the stakeholders for the identified measures
- Assisting in organizing roundtables to inform and discuss measures to increase the efficient use of energy
- Assisting in the set-up of workshops with members of the public

Lighthouse projects

- Covering a variety of technologies (from low-tech to high-tech)
- Providing a local focus on specific areas for technological development
- Providing a platform for German companies in investment projects
- Offering the opportunity for trade shows and exchange programs



Applicable Instruments, Tools and Methodologies

A benchmark system will be developed and tested in order to interpret the effects of the above mentioned activities. This requires the definition of basic conditions such as system boundaries, analytical approaches, an activity profile to scan the present state of a city's climate protection activities in the categories climate policy, energy, transport, water supply and waste; and a tabulation and display of energy use and CO_2 emissions including the historic development.

A set of maximum 17 indicators will complete the comparison and gathering of hard facts about the city's climate impact and will reveal in which fields the city has achieved significant progress.

Five lighthouse projects will serve as a focus of the project, covering a variety of technologies (from low-tech to high-tech), providing a local focus on specific areas for technological development.

1) Increasing energy efficiency in an existing building complex

This project will be carried out in collaboration with the Construction Committee of the City of Urumqi. It involves the energy efficient conversion of a residential complex with about 100.000 m^2 living space currently supplied by a coal-fired heating plant in the Midong district.

2) Planning and building of a low energy high-rise apartment building (Green Home in the Skies)

This project will be realized in the Midong district in collaboration with the Xinjiang Construction Science Research Institute and the City of Urumqi. Assistance will be provided by the China Architecture Design and Research Group, Beijing. This lighthouse project will also be in the focus of activities by other task groups like water and waste management.

3) Enhancing renewable energy use (solar, wind, biomass)

There is a large potential for wind energy, which is already under development. In addition, there is a significant potential for biomass production using plants adapted to the semi-arid environment.

4) Improving efficiency of combined heat/power generation (CHP) and distribution

Natural gas is used as a heating source in an increasing number of residential areas, generating a large potential for suitable small-scale CHP systems.

5) Developing energy efficient transportation system

The mobility requirements of the population in Urumqi are increasing at a rapid pace. The resulting challenges for a sustainable and energy efficient transportation system are substantial.

Capacity Building, Integration and Networking of Institutions

Capacity building will be provided by the training of trainers in Urumqi (e.g. for architects, construction companies), by training in Germany (PhD candidates, junior officials from the City of Urumqi) and by supporting the exchange of high school students between Germany and Urumqi.

Workshops and training seminars will be developed and conducted (e.g. for architects and developers) utilizing third part material (e.g. handbook on energy efficient construction in China by dena - (Deutsche Energieagentur) as well as material prepared by the project. Internships for junior Chinese experts in Germany will be organized. A friendship project between the Urumqi Middle School No. 8 and the Internationale Gesamtschule Heidelberg has already been initiated.

Socio-Economic, Integrative and Overall Sustainability Aspects

A detailed energy model will be based on the local government's climate partnership benchmark and take into account experiences from similar activities in other areas of China and elsewhere (e.g. dena, GTZ, IER). Indicators to measure the success of the implementation of a sustainable energy use concept will be described and selected, utilizing the concepts developed by the UN Commission on Sustainable Development, (CSD).

For each sector stakeholders will be defined (e.g. lawmaker, administration, developer, construc-tion company, architect, resident), and their roles and positions will be analyzed. Also a stakeholder dialogue

will be started or intensified.
Potential measures to improve energy efficiency (by means of technology, planning, policy, management, or financing) will be identified, described in detail, evaluated and ranked by cost, benefit, speed of implementation, identification of problems in realization.
Potential options for Clean Development Mechanisms (CDM) will be identified.

The project will assist in the development and continuous update of a sustainable energy master plan for the City of Urumqi. This plan will be closely related to the development of the master plan for a sustainable city development.

German Partners

RECAST Urumqi is a collaborative project of three partners:

- University of Heidelberg, Faculty for Chemistry and Earth Sciences, Heidelberg, Germany
- Institute for Eco-Industrial Analysis (IUWA), Heidelberg, Germany
- Institute for Energy and Environmental Research (IFEU), Heidelberg, Germany

The sub-project "energy efficiency" is supported by sub-contractors:

- ebök-Energieberatung, Haustechnik und ökologische Konzepte
- GGH, Gesellschaft für Haus- und Grundbesitz Heidelberg
- Culturebridge Architects Manheim/Beijing
- Dr. Rainer Kniehl, CES Heidelberg

Further input will be provided by

- City of Heidelberg
- Metropolitan Region Rhine-Neckar (MRN Mannheim)
- Centre of Environmental Expertise Heidelberg Rhine-Neckar (UKOM Heidelberg)

Cooperative Partners in Host Country

- Environmental Protection Bureau (EPB), Xinjiang, Urumqi
- City Planning Bureau of Urumqi
- Academy of Urban Planning and Design of Urumqi
- Urumqi Municipal Commission of Construction
- Urumqi Municipal Commission of Construction, Urumqi
- Xinjiang Construction Science Research Institute, Urumqi
- Energy Division at Xinjiang Development and Reform Commission, Urumqi

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