

Case Study: Energy plus house (energy efficiency), Rizhao, China

Country:		City:	Key Sectors:
China		Rizhao	BUILDING ENERGY & SANITATION TECHNOLOGY
Local Partner Organization			Geography and Population
Rizhao Bureau of Housing and Urban-Rural Development BoHURD			Costal plain topography in the coast of Bohai Sea with total population of 96 600 and urban part ca. 60 000 - 70 000.
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Summary

In order to improve the energy efficiency of public and private buildings in Rizhao finding solutions to promote renewable energies, a basic concept study of the Nexus Energy Plus House is being elaborated. BoHURD and local real estate developers are advised how to elaborate climatically adjusted designs, thermal insulation and integration of photovoltaic into the walls and roofs to produce green energy feeding the electricity into the local grid. Combined with sanitation technologies the Nexus Energy Plus House would also innovatively reduce the energy for the sanitation devices as well as other household utensils. The Nexus Energy Plus house will produce more energy than it consumes over the year.

Rationale

Much of what China has achieved in the past three decades - its impressive economic growth, the rise of its global stature and the considerable improvement of living standards for hundreds of millions of people has brought about huge problems of net energy imports and environmental pollution. In north China coal-fired power plants and heat supply companies where electricity and heat for industrial and household use are produced, are the biggest source of human-made carbon dioxide emissions and air pollution. This makes burning coal the single greatest threat for the climate and winter air quality. If the consequences of climate change and air pollution are to be reduced, China must move away from coal to renewable energy.

The situation is aggravated by the rapid urbanization in China, which increased in speed following the initiation of the reform and opening policy. In the long term, China faces increasing urbanization; according to predictions, nearly 70% of the population will live in urban areas by 2035. Over the next two decades China will build 20,000 to 50,000 new skyscrapers.¹

Based on the facts that China has the increasing density of its urban population, a rising pressure

¹ http://en.wikipedia.org/wiki/Urbanization_in_China

has been exerted on its urban energy supply. How to find and put a clean and renewable energy resource into use to fill the energy gap and improve the energy efficiency is one of the major challenges facing Chinese urban construction planning and administration of public and private buildings.

Against this background the GIZ Nexus Project is partnering with Rizhao City utilizing German know-how on Nexus Energy Plus Houses.

With its total population of 2.9 million and central urban population 0.8 million in central area of 70km² Rizhao actually controls ca. 1.5 million urban inhabitants who partly live in 3 different county-leveled cities under direct administration of Rizhao Municipality.

As a pleasant costal city Rizhao has received yearly tourists over 31 million crowding to see the sea in 2013 and hence the tourism revenue reached 20.5 billion in CNY (2.9 billion in EUR) in the year.²

Rizhao also features two important commercial ports, Rizhao Port and Lanshan Port, with 46 productive berths and annual handling capacity of over 200 million tons.³ Rizhao is one of the maritime transportation and logistics centers. It has evolved to the major nexus point in North China since its groundbreaking in 1986 that connects the far western Chinese inland provinces to the Pacific Ocean. Moreover, an airport is under construction and a new high-speed railway to connect Rizhao to the Chinese metropolises Qingdao and Shanghai has been put on the agenda.

In the coming decades Rizhao will be facing enormous pressure to meet its energy needs from the inhabitants and industries.

Since October 2013 supported and guided by DENA Rizhao has begun with the building of a passive house. With the total floor area of 5,511.9m², the passive building locates in Rizhao Demonstration Area of New Pattern Building Materials. It is supposed to be completed with the construction in December 2015 and afterwards pass the combined check for acceptance by Shandong Provincial Building and Design Institute, DENA as well as Science & Technology and Industrialization Development Center of MoHURD.⁴

So far MoHURD has gained its experiences in building 11 passive houses in Shandong Provinces supervised by DENA, but none in building the more efficient Nexus Energy Plus House. Through the collaboration with GIZ Nexus Project, MoHURD will get its first Nexus Energy Plus House complying with the German standards.

The Nexus Energy Plus House produces more energy from renewable energy sources, over the course of a year, than it consumes. This is achieved by using a combination of micro-generation technology, innovative sanitation technologies developed by Nexus Project Team reducing energy for the sanitation devices as well as other household utensils and low-energy building techniques, such as: passive solar building design, insulation and careful site selection and placement etc.

What is crucial to develop a renewable resource like photovoltaic is Rizhao's favorable climate conditions. On average, there are 2,530 hours of bright sunshine annually and the relative humidity is 70–74 %. Winter is cool to cold and windy, but generally dry, with a January average of -0.3 °C

² <http://money.163.com/14/0105/10/9HQMFVLF00254TI5.html>

³ <http://en.rzport.com/idx/rzportIndexAction!newsQuery.action?parentType=10000000520>

⁴ MoHURD: Chinese Ministry of Housing and Urban-rural Development

(31.5 °F). Summer is generally hot and humid, but very hot days are rare, with an August average of 25.7 °C (78.3 °F).⁵ This makes the easy access to implement the photovoltaic technic and concept study of a plus energy house in Rizhao.

Rizhao / BoHURD and the local real estate developers will ensure the project implementation financially.

Project Description

Pilot Project I

Through the close collaboration with Rizhao / BoHURD GIZ Nexus Project will consult the local real estate developers on the designing and construction of the first 4-storey Plus-Energy House as one of the initial pilot units of building energy after BoHURD has reported the Urban Nexus Project to the local Communist Party Committee or People's Parliament and received their approval as a successful case of Sino-German technical cooperation.

During the two meetings with BoHURD and local developers on Jan. 29-30 and May 5-6, 2015 in Rizhao, the 3 phases in the process of developing Plus Energy house have been agreed upon:

I: conceptualizing phase
II: planning and building phase
III: monitoring phase

- In Phase I: clarification the definition of Plus Energy house, stipulation of its boundary conditions and concrete building purposes according to the basic technical details such as dimension and size as well as ambient data etc. provided by BoHURD. It is crucial for BoHURD and local developers to provide the basic technical details to GIZ in the first place. Only by the introduction of them could the Phase I be started.
- In Phase II: designing and building of the Plus Energy house. BoHURD organizes the local experts to design and build. GIZ assists in the process by supervising the criteria-compliances, guarding the boundary conditions and training the local experts etc. to ensure the transfer of German Know-how to the Chinese Peer.
- In Phase III: by completion the constructing is to be tested and inspected to the German standards by GIZ and Fraunhofer Institute together with other possible Chinese institute(s) before the acceptance. After the acceptance a German certification would be awarded.

As the Phase I has been started, the part of a four-story building with basements and an extra lofts is to be transformed into the Nexus Energy Plus House containing four two-story town houses.

Stakeholders / Target groups

Stakeholders:

- Rizhao Bureau of Housing and Urban-Rural Development (Rizhao Municipality)
- Rizhao Chinese Communist Party Commission
- Rizhao People's Parliament
- Rizhao Huaxin Tiandi Real Estate Co. Ltd.
- Rizhao Antai Real Estate Co. Ltd.

⁵ <http://en.wikipedia.org/wiki/Rizhao>

Target groups:

Inhabitants and users of public and private buildings in Rizhao City as well as the decision-makers.

Methodology

As the Nexus Energy Plus House and PV technic is a comprehensive concept involving innovative technologies a step by step approach is recommended in order to avoid risks. It should be accompanied by an M&E system and on-job training for Rizhao BoHURD and real estate company staff to understand the designing details and maintenance of the building.

As a first step, several on-site surveys will be conducted, a Project Feasibility Report and primary layout will be available.

Following that the discussion and consultation meetings with the local Municipalities and developers will be held. The details such as how to get the necessary supplies – local or abroad – will be clarified in the process.

During construction regular assessment and supervision will be conducted.

Costs / Financing

A preliminary cost estimation is to be made by the local developers.
The project will be financed by local developers and will be supported by Rizhao Municipality.

Results (Impact)

Nexus Energy Plus House produces more energy from renewable energy sources, over the course of a year, than it imports from external sources. The innovative adoption of sanitation technology puts more weight on the side of energy efficiency. The PV power generation system features high reliability, durability, no pollution and has broad prospects. It offers a clean, climate-friendly, very abundant and in-exhaustive energy resource to mankind.

With the accomplishment of pilot projects they will expand access of city residents in public and private buildings to renewable energy resources and new life style with more energy efficiency consciousness and thermal comfort. The official acknowledgement and support of Chinese MoHURD will produce the effect of disseminating the know-how acquired in Rizhao to other Chinese cities.