

<b>Case Study</b>		
<b>Country:</b>	<b>City:</b>	<b>Key Sectors:</b>
China	Binhai (Weifang)	Energy plus house (Energy efficiency)
<b>Local Partner Organization</b>		<b>Geography and Population</b>
<b>Binhai (Weifang)</b> <b>Bureau of Housing and Urban-Rural Development</b> <b>BoHURD</b>		Coastal plain topography in the coast of Bohai Sea with total population of 96 600 and urban part ca. 60 000 - 70 000.
<b>Contact Information</b>		
Binhai Municipal Committee	Project Coordinator	
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### Summary

In order to find an adequate and sustainable solution for wastewater collection, transport and treatment as well to improve the energy efficiency of public or private housing, the GIZ Nexus Project promotes innovative waste water management as the key point of wastewater management and at the same time the basic concept of Nexus Energy Plus House in Weifang / Binhai Economic & Technological Development Area (thereafter called Binhai).

The vacuum sewer system allows the further usage of sludge combined with organic waste from households, restaurants, hotels and public resort for energy production. The treated grey water can be used for irrigation purposes (urban agriculture, green areas) and the remaining agricultural residues for organic fertilizer and night soil.

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.

### Rationale

Binhai is located in the northern part of Shandong Peninsula and southern coast of Bohai Sea – the largest inner sea in China. Established in August 1995, it is a national economic and technological development area approved by the State Council. Covering an area of 677 km<sup>2</sup>, it has a population of ca. 96,600 and convenient traffic. Three expressways and two railways are crossing this area. A High Speed Rail has been planned for the end of 2015. The coastline of Binhai stretches a distance of 69 kilometers with more than 133km<sup>2</sup> offshore lands. Meanwhile Binhai possesses a large state-owned industrial land with an area of 400 km<sup>2</sup> for use. The land can be transacted conveniently, which would guarantee the demand of any project construction and provide broad development space for the enterprises in this area.

Binhai is aiming to construct a modern new city with high quality and featured with well-equipped facilities, highly developed industries, multiple functions, well-maintained ecological environment which is good for both residing and investing. Its urban area would be further divided into 3 zones: Tourism Zone, Commercial and Residential Zone, Scientific and Educational Innovation Zone.

All these factors have contributed to the fast growth and prosperous expansion of a newly built urban and industrial area on the former coastal saline and alkaline soil.

So far in the villages to be integrated into the urban areas and the urban residential buildings as well, the traditional (open-air) septic tanks/holes are still being used. Septic tanks involve anaerobic bacterial environment which ideally decomposes waste discharged into the tank. However, it has enormous shortcomings:

- Preventive maintenance is required to remove irreducible solids that gradually fill the tank, reducing greatly its efficiency;
- Containing 90% of nitrogen, 80% of phosphorus and 40-75% of organic matter (BOD), black-water constitutes only around 10% of domestic wastewater being discharged;
- Still, this modest volume contains about approx.99% of pathogens (causing typhoid, bilharzias, and diarrhea).

Abandoning the existing septic tanks and avoiding its shortcomings, the vacuum sewer system collects and transports the household sewerage directly into its vacuum station or the local WTP. Combined with various flexible designs and adaptations according to local topography and climate conditions, it bears cost advantage up to 40% under certain conditions compared to the traditional gravity system. It is a completely tight/sealed system with PVC pipes of 90 mm, which ensures that the potable and the waste water pipes could be perfectly fitted into and maintained in one same trench while keeping the pipes from storm water drainage.

With the separated transportation of black- and grey-water, the black-water rich in BOD would not be diluted by grey or storm water anymore, ensuring the more efficient energy output through the processing in WTP.

The vacuum sewer collection system is for wastewater within low and medium dense residential, industrial, commercial or mixed areas. It is an ideal alternative to conventional gravity sewer systems, especially under special conditions such as:

- high water table
- flat costal terrain
- area with lakes, rivers, beaches, tidal ground or islands
- public resort places with population variations.

Binhai is a location that meets all the requirements to implement the vacuum sewerage system, especially in its Tourism Zone. Flat and having a very high groundwater table, this area is located on the seashore with a large sandy artificial beach, a hotel, a World EXPO Malaysian Hall and parking places for the seasonal tourism. Still there is no wastewater network existing at present for the tourists, workers and staff who flood in in hot summers and during the day. Binhai Municipality intends to build a separate wastewater system for this area enabling them to collect and treat the wastewater locally, i.e. this makes it unnecessary to direct the wastewater to the treatment plants nearest ca. 3km away in the neighboring Commercial and Residential Zone.

As one of the 12 “Green Ecological Urban Areas” promoted by provincial BoHURD<sup>1</sup> in Shandong Province, Binhai has received 10 million RMB of total 20 million RMB (ca.2.9 million €) to carry out the pioneering experiment on buildings energy efficiency.

<sup>1</sup> BoHURD: Bureau of Housing and Urban-Rural Development

Supported and guided by DENA Binhai has already built a passive house. With the total floor area of 2,287m<sup>3</sup>, the passive house 'Future Home' is a 3-storey building with an extra storey of basement. On Feb. 2, 2015 the house was finished with its construction. On Feb. 18, 2015 it passed the air tightness test by Shandong Provincial Building and Design Institute. On March 2015 it passed the combined check for acceptance by DENA and Science & Technology and Industrialization Development Center of MoHURD<sup>2</sup>.

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 Plus Energy House. Through the collaboration with the Nexus Project, MoHURD will get its first Nexus Energy Plus House complying with the German standards.

Binhai Municipality is to ensure the project implementation financially.

### Project Description

#### Wastewater Management:

In Binhai there are a series of possibilities to implement the vacuum sewer system and hence the wastewater management. As the first step of collaboration these possibilities should be clarified. The initial onsite studies and feasibility report including the cost calculations are crucial.

Through the close collaboration with Binhai Municipality GIZ Nexus Project will participate with advisory service in the concretization of the project concept with regard to designing and implementation of the vacuum system, energy and fertilizer production.

The following possibilities will be sorted out where and how the vacuum system/pipes to be laid:

- inside a large public building like in the newly-built office building of the Binhai Municipality "Future Building" (vacuum sanitation system) to collect the toilet waste onsite;
- outside all smaller buildings and houses within 5 Kilometer radius to collect their indoor wastewater, such as for the new residential blocks under construction in the northern part of Binhai's Commercial and Residential Zone or for the possible renovation of village houses;
- in the Tourism Zone to meet the beach-visitor's seasonal needs and in the end coming up with a decentralized wastewater treatment system in this seashore area.

#### Nexus Energy Plus House

Based on the close collaboration between Binhai BoHURD and GIZ Nexus Project, Binhai receives advisory service of GIZ with respect to the designing and construction of a Plus Energy House combined with the innovative sanitation technologies reducing energy for the sanitation devices.

- There will be 3 phases in the process of developing a Nexus Energy Plus house:
  - I: conceptualizing phase
  - II: planning and building phase
  - III: monitoring phase.

### Stakeholders / Target groups

#### Stakeholders:

- Binhai BoHURD
- Weifang City Communist Party Committee
- Weifang People's Parliament
- Weifang BoHURD
- Department of Building Energy and Science & Technology, MoHURD

<sup>2</sup> MoHURD: Chinese Ministry of Housing and Urban-Rural Development

**Target groups:**

Residents and industrial sectors of Weifang Binhai Economic & Technological Development Area.

**Costs / Financing**

A preliminary cost calculation is to be made within the framework of a Feasibility Study. A comparison between gravity sewer and vacuum sewer will be part of the feasibility study. Financially the projects will be supported by Binhai Municipality and local developers.

**Studies / Reports / Training**

- Semi-decentralized concept for wastewater management in Binhai (Weifang, China)/Fraunhofer IGB/Stuttgart/November 2014;
- Vacuum Sewer System Training on Oct. 29-30 in Rizhao, China by Bilfinger Water Technology and GIZ Nexus Project, organized by Rizhao BoHURD.

**Results (Impact)**

The project is to demonstrate to Binhai Municipality, city residents and the industrial sectors an economically feasible and energy saving system to collect and transport the wastewater, producing energy (electricity and heat), irrigation water and fertilizer for non-food crops (“close the loop”), as well as an efficient way to strengthen and further develop their achievement with regard to the building energy techniques.

With the support of MoHURD, the Nexus Initiatives is also aimed at disseminating the know-how acquired in Binhai to other Chinese areas and cities.