Innovative wastewater disposal and water reclamation – China

Unique in Financial Cooperation: underground wastewater treatment plant in Kunming

In the southwestern city of Kunming KfW, on behalf of the Federal Ministry for Economic Cooperation and Development, has financed an underground wastewater treatment plant as an alternative for classic urban drainage systems. The implemented infrastructure will also help Kunming to increase the level of water re-usage significantly by reclamation of water out of treated wastewater. The project is a continuation of the long-term financial cooperation with China in the wastewater sector and within Kunming in particular.

Context

Kunming is the capital of Yunnan province in Southwest China with a total population of about 6.6 million. Statistically the province has the severest droughts in Southwest China and in the context of global warming the situation became even more severe. Similar to many Chinese cities, Kunming is facing the challenges of rapid urbanization. The infrastructure had not grown at the same pace as the economy. The Dianchi Lake for example, China’s sixth largest fresh water lake, was seriously affected from untreated wastewater discharges.

Project approach

Kunming is facing the challenge that the areas necessary for providing the required infrastructure facilities are scarce. Due to this, the City of Kunming made the political decision to construct all future wastewater treatment plants (WWTPs) as underground WWTPs within the respective catchment area. The area above the WWTP will be used for urban development facilities, in this project as a recreation park. Furthermore, the project aimed at increasing the level of water recycling in Kunming by (i) implementing a reclaimed water distribution network for an existing WWTP incl. reclaimed water treatment plant and (ii) construction of new water reclamation plant as part of the new Puzhao WWTP.

The project included the following components:
- about 98 km of sewers DN 300 - 1500
- about 113 km of reclaimed water distribution network for the existing Nijiaying WWTP

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<th>Project name</th>
<th>Environmental Comprehensive Treatment Project of KETDZ (Kunming Economic and Technical Development Zone)</th>
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<tr>
<td>Commissioned by</td>
<td>Federal Ministry for Economic Cooperation and Development (BMZ), Germany</td>
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<tr>
<td>Country/Region</td>
<td>China</td>
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<td>Lead executing agency</td>
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• about 18 km river engineering measures
• Puzhao WWTP with a treatment capacity of 50,000 m³/d (phase 1) including a water reclamation plant with a capacity of 40,000 m³/d

Impact
1. Environmental protection
Quickly after the commissioning, the Puzhao WWTP reached its design capacity and the KETDZ is already preparing its extension. The WWTP complies with the highest level “1A” of the national treatment standard GB 18918 – 2002, which is even higher than the German or the European standard for WWTPs of the same size. Thus, the project contributes to the protection of the surface waters, in particular the Dianchi Lake, by collecting and treating the wastewaters within the catchment area.

2. Conservation of resources
The project provided the necessary infrastructure for increasing the level of water recycling in Kunming by using reclaimed water, mainly for watering of urban green areas but potentially also for industrial purposes, thereby contributing to the conservation of water as a limited resource. The WWTP Nijiaying now produces ~ 5,000 m³/d reclaimed water, which is then distributed by the new distribution network financed under this project. The water distribution network for the Puzhao WWTP was not part of this project and still under construction at the time of project completion; the reclaimed water was only being used for WWTP-internal purposes.

Outlook
The underground WWTP represents an alternative for classical drainage systems. The cost for civil works are, however, significantly higher (> factor 2). Thus, the economic application depends on a variety of criteria such as topography, land availability, cost for land acquisition etc., something which has to be analysed in a detailed cost-benefit analysis.

2. Water reclamation
The project contributes to the national target of a utilization ratio of reclaimed water (ratio of the utilized reclaimed water quantity and the total treated wastewater quantity) of about 20 to 30% as defined in the national “Water Pollution Control Action Plan”.

There are, however, several challenges to make full use of the reclaimed water treatment plants such as (i) acceptance of the reclaimed water by potential consumers, (ii) willingness to pay the tariffs for reclaimed water and (iii) “competition” with existing groundwater wells or other water sources. Nevertheless, we are confident that the level of water reclamation will grow within the not too distant future.

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