Ministry of Foreign Affairs of Denmark
The Trade Council

Follow Up Report

The 2012 Denmark-Chongqing Water Days and the Industry Water in China Report of Sep. 1. 2012

Prepared for the Danish Environmental Protection Agency

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1. INTRODUCTION

The Trade Council (TC) is pleased to submit a follow up report for the Danish Environmental Protection Agency (DEPA) concerning the 2012 Denmark-Chongqing Water Days.

The purpose of this report is to provide the Danish Environmental Protection Agency with further information led from the meeting between Danish Environment Minister and Chongqing Municipal Government and raised questions from the Water Days. A feasibility analysis of Danish involvement within Chongqing's rural wastewater market and a detailed description for a pilot project in industrial water optimization are also included in this report.

2. RURAL WASTEWATER TREATMENT MARKET

In the bilateral meeting between the Danish Ministry for the Environment and Chongqing Municipal Government, the Vice Mayor of Chongqing mentioned about the rural wastewater treatment market in Chongqing, that Chongqing is going to build over one thousand centralized wastewater treatment facilities in the rural area. Chongqing Municipal Administration Commission[1] is responsible for steering this project.

The rural area in Chongqing is featured with dispersed households, different terrains and relatively low economic level. There are large differences between the urban sewage and rural household wastewater because the changes of water quality and quantity in the latter are more unpredictable. Therefore, the traditional urban sewage treatment process is not suitable for Chongqing's rural area.

Chongqing is located in the upper Yangtze river region, covering 40 districts and counties, 871 townships, 8,967 administrative villages, and more than 100 thousand villagers groups. The rural area of Chongqing is the core water resources protection area within the three gorges reservoir region, which is an important content in the national environmental strategy. By the end of 2009, Chongqing had built around 70 urban sewage treatment plants. However, the rural wastewater plants are still in the planning.

2.1 Features of domestic wastewater in Chongqing's rural area

Rural wastewater include contaminated water from bathing, laundry, vegetables washing and toilet flushing and so on. Generally, such wastewater do not contain toxic substances but abundant amount of nitrogen and phosphorus plus a lot of bacteria, virus and parasitic eggs. Because Chongqing's rural area has a comparatively low industrial development level comparing with other regions, there are mainly two sources of wastewater: discharges from farmers' daily life and sewage from livestock breeding.

[1] Website: www.cqsz.gov.cn, E-mail: cqsz@cqsz.gov.cn

In Chongqing's different rural region, as the result of different eating habits and usage of septic systems, wastewater quality varies. Therefore, when selecting wastewater treatment technology, wastewater quality should be tested and constantly monitored.

In rural China, per capita domestic sewage quantity are generally small. According to "2009 Chongqing Water Resource Bulletin", per capita water consumption in Chongqing's rural area is 53 L/d, which is around half of National rural average. At the same time, when considering sewage discharge coefficient and collection rate and other factors, Chongqing's per capita sewage discharge quantity is 30 L/d. For a typical village of 100 households with three people in each, the total quantity is only 9 m^3/d, which is quite a small amount. Due to the fact that a large portion of Chongqing's rural residents are working as migrant workers in the city, the amount of sewage water varies a lot during different seasons.

2.2 Features of wastewater collecting system

96 percent of China's villages have no system drainage ditch and sewage treatment facilities. In such villages, domestic sewage normally go directly into low-lying place. In Chongqing's rural area, wastewater collecting system is even more imperfect. Due to the mountainous topography in Chongqing, waste water mostly goes to low-lying surface water bodies, which results a far lower collection rate comparing to the city.

3. TREATMENT PROCESS SELECTION FOR CHONGQING'S RURAL WASTEWATER

Because of the lack of professional management personnel and the relatively weak economy in Chongqing's rural area, the basic requirement for wastewater treatment facilities are: low energy consumption, stable effect and convenient operation management. Below are some suggested treatment processes widely used in Southwest China's rural areas.

3.1 High Rate Algae Pond (HRAP) process

As early as in the 1950s, Oswald of UC Berkeley proposed using algae for the treatment of sewage[2]. The High Rate Algae Pond (HRAP) as a modified form of stabilization pond, the algae and bacteria within which, have more abundant biofacies than the former and a better removal effect for organic matter, nitrogen and phosphorus. The HRAP process has been widely used in the United States, Germany, Belgium and other countries.

[2] Gimez E, Casellas C, Picot B. Ammonia elimination processes in stabilization and high rate algae pond systems. WatSci Tech, 1995, 31(7): 303-312

Graph 1. HRAP Process Flow Diagram

Water inlet →Sedimentation tank →HRAP →Aquatic organism pond →Water outlet

By algae's assimilation and ammonia stripping, HRAP can remove the nitrogen from sewage; also by assimilation and phosphate precipitation, HRAP can remove phosphate.

Comparing with conventional stabilization ponds, HRAP features lower running costs and easier maintenance; while at the same time, it overcomes the disadvantage of long residence time and large area occupation for stabilization pond. Its water outlet can reach Type B of Class One emission standard in GB18918-2006 "Urban Sewage Treatment Plant Pollutant Discharge Standards". The initial investment for an HRAP pond is CNY 800-1,300/m^3, while the operation cost is CNY 0.08-0.10/m^3.

3.2 Composite Artificial Wetlands

By strengthening the physical, chemical and biological triple synergistic effects within the natural eco-system, and through processes such as filtration, adsorption, precipitation, ion exchange, plant absorption, microbial decomposition, composite artificial wetlands can simulate the natural wetland system.

Graph 2. Composite Artificial Wetlands Process Diagram

Water inlet →Stabilization pond →Baffling wetland →Lateral subsurface flow wetland →Water outlet

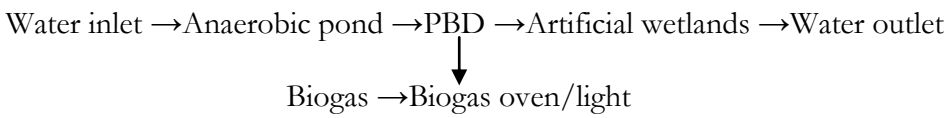
The initial investment for an HRAP pond is CNY 800-2,000/m^3, while the operation cost is CNY 0.08-0.15/m^3.

Comparing with ordinary artificial wetlands, composite artificial wetlands have higher efficiency because of strengthened natural oxidization effect. The water outlet can also meet Type B of Class One emission standard in GB18918-2006. This process is applicable to rural areas with greater terrain slope with wastewater processing capability at 10-2,000 ton per day.

3.3 Purified biogas digesters-artificial wetlands

Purified biogas digesters (PBD)-artificial wetlands process by using anaerobic fermentation technology decomposes organic matters in sewage into CH_4, CO_2, H_2O. In order to further degrade organic matter and strengthen the ability to remove nitrogen and phosphorus, artificial wetlands are usually attached to the digester.

Graph 3. Purified Biogas Digesters-Artificial Wetlands Process Diagram



In this process, the function of anaerobic pond is to intercept suspended substance colloidal and dissolved organic matter. The function of PBD is to further intercept contaminated substance. Artificial wetlands remove nitrogen through absorption by aquatic plants and nitrification/denitrification by microorganisms. Phosphorus was removed by plant roots.

In the rural areas, PBD-artificial wetlands are mostly buried underground with brick and concrete structures. No machinery or power equipment is needed to drive the sewage during this process. Also, no dedicated staff is required to monitor the operation. PBD-artificial wetlands are suitable for villages with decentralized households and far distance to municipal sewage system. The initial investment for such a treatment unit is CNY 30-1,000/m^3, while the operation cost is CNY 0.04-0.08/m^3.

4. Feasibility Analysis of Danish Involvement within Chongqing's Rural Wastewater Market

During the bilateral meeting between Chongqing Municipal Government and Danish Ministry of Environment, the latter with participating Danish water solution providers showed great interest in this market. The Danish Environmental Protection Agency thus requested the Trade Council to further invest into market with feasibility analysis of Danish business involvement.

A desktop research was conducted in November to gather knowledge on the technical perspective and this was followed by several dialogues with Chongqing authorities (e.g. Municipal Administration Commission, Environmental Protection Bureau). Lastly, a fact finding field trip was arranged to Bishan County to the west of Chongqing metro part.

Graph 4. Bishan County in Chongqing Municipality

In Longjingwan Village of Bishan County, there is a 300 m^2 pond with lush growing plants such as Canna and Orchids. These plants have well-developed root system. Sewage discharged from village households become very clear from the other end of the outflow through the pond. According to the introduction by the head of the village, by using this PBD-artificial wetlands process, household wastewater discharged within this village has been effectively treated. "Previously, our direct discharged wastewater penetrated into the fields and affected the growth of crops and contaminated Binan River. Now the wastewater looks so clear and clean after the artificial wetland treatment. In this way, our crop field and Binan River can be kept free from contamination", an interviewed villager said.

According to Bishan County Environmental Protection Bureau, there are 200 hectares of artificial wetlands in total within the boundary of Bishan County for rural wastewater treatment purpose.

Bishan is just one of the 30 counties within Chongqing Municipality apart from the 9 districts within the metro part of Chongqing. Due to the short distance to the city, the social economic development of Bishan is relatively higher comparing with other counties. With the release of the State's No.1 decree concerning water, the rural wastewater treatment market is huge.

Denmark ranks No.1 in clean-tech in the world according a report by WWF in 2012. Danish water solution providers have the advanced technical know-how in water treatment. However, as to the rural areas, traditional urban wastewater treatment technologies are featured with high technical standard and complex operation, and most importantly, huge initial investment in infrastructure. All these are incompatible with the current economic development and management level in rural areas. The three treatment processes mentioned in Chapter 3 are all featured with small investment, low operation and maintenance costs. According to Mr. Zhang Wen, Vice Director General of Chongqing Municipal Environmental

Protection Bureau[3], recommended specific processes to be applied in Chongqing's rural wastewater treatment market are: digesters, septic tanks, artificial wetlands, biological filters, stabilization ponds, etc.

Also because of the low required technical contents, Danish water treatment solution providers have no advantages comparing with local counterparts in the cost-benefit analysis.

On the open procurement notice for 2012 Chongqing rural wastewater treatment[4], under Section 3 Bidder Qualification Requirements, the bidder must have general contractor qualification in environmental engineering or municipal civil engineering, with registration capital of CNY 3 million at least. This directly indirectly requires Danish water treatment companies to be localized in China (preferably in Chongqing), while all Water Days participating companies are not at this stage yet.

There are chances that Danish companies such as AVK and Groundfos to be appliances providers in this huge market, but this leaves to them to proactively approach the local general contractors. Although the Danish Embassy in China had signed MOU with Chongqing Municipal Government in the areas of Environmental Protection and as it is clearly said, the latter should "facilitate Danish government's access to local authorities, including timely access to information about projects at municipal and district levels", general contractors (local companies) have no obligations to favor Danish solutions when it comes to partner or supplier search, especially that it is unlikely Danish companies can easily beat the local offers in price.

5. Liangtan River Phase Three?

In June 2009, the Standing Committee of Chongqing Municipal Government has examined and adopted "Liangtan River Watershed Comprehensive Treatment Master Plan", within this document as it says, "Liangtan River must be a clear and clean stream within three years". The Danish Ministry of Environment funded CNY 700,000 and cooperated with Chongqing Municipal Environmental Protection Bureau for the phase one and two of the treatment project. In September 2009, a "Liangtan River Report" jointly released by DHI and COWI, it mapped out five major treatment solutions. COWI further conducted field trips to major pollution source (factories and mines) along Liangtan River on their raw materials and waste. Cleaner production recommendations were given afterwards.

[3] Ministry of Environmental Protection, http://www.zhb.gov.cn/ztbd/rdzl/yjcz/dfjz/cq/201111/t20111108_219703.htm, in Chinese
[4] China Central Government Procurement, Ministry of Finance, http://www.ccgp.gov.cn/cggg/dfbx/gkzb/201207/t20120724_2242052.shtml, in Chinese

In the recent years, Chongqing Municipal Government had required three districts where Liangtan River flows to treat Liangtan River. By June 2012, three years since the publish of Master Plan, all three district had claimed to have treated the river meeting level V water quality. News coverage concerning their claims can be found in the link below in footnote 5.

6. A Pilot Project in China for Industrial Water Optimization

The Danish Environmental Protection Agency (DEPA), funding body of the 2012 Denmark-Chongqing Water Days, would like to see a pilot project in China for industrial water optimization which involves Danish governmental and business stakeholders. A small separate Water Days report had been submitted to DEPA which included a full list of local participants. Local key industrial players, such as Chongqing Iron & Steel, Southwest Aluminium, Chongqing Brewery, etc. had participated in the first full day forum. Local government agencies, such as the supervision authority of industry – Chongqing Economic & Information Committee, had also helped to bring the message of Danish industrial water optimization solution to other non-participating companies in Chongqing, but as far as the Trade Council knows, there has been no leads of contracts or orders involving Danish participating companies in this area. This is either due to the fact that local industrial giants had done water usage upgrading works or SMEs saw no drives in doing so with relatively high initial investment and long pay back term.

It is also worth mentioning that, although in the first report by the Trade Council on industrial water usage in China, Chongqing has very strong political wills in water savings in both short and long term; the water shortage situation in Chongqing is much better comparing with other provinces in China. Over 99 per cent of Chongqing's water withdraw is from surface water with thousands kilometres of two major rivers (i.e. Yangtze and Jialing) flowing within its territory. The Trade Council thus suggests choosing another one or two provinces as mentioned in the previous report for a pilot project.

Based on the result generated from the first report, it is safe to draw a conclusion that Jiangsu and Guangdong provinces both can be ideal places to carry out the pilot project. In connection with the environment protection trip jointly initiated by the Trade Council and DEPA in Jiangsu Province from the 21st to 22nd November, the Trade Council conducted a survey to all Danish invested companies in Jiangsu Province in October on their industrial water optimization.

[5] Shapingba District: http://zt.cqxhw.net/2011/spbcm/2011-11/29/content_1829976.htm
Jiulongpo District: http://www.zhb.gov.cn/zhxx/gzdt/201209/t20120924_236686.htm
Beibei District: http://cq.cqnews.net/html/2012-09/26/content_20026841.htm

Initial survey questions:

1. Do you have any production in China and what is the annual production in quantity?

2. Is this production very water consuming?

3. If so, how much water used annually?

4. The water price and waste water tariff in your region?

5. Are you interested in a pilot project on Industrial Water Optimization (with possible funding opportunity)?

Positive feedbacks had been collected from a company in the food production sector. The Trade Council managed to have this company participated in the seminar held on 22nd November.

Follow up questions as follows had been sent to the company:

6. Could you describe your production process?

7. Could you describe the existing water/wastewater equipment used?

8. How much electricity do you use for running your production annually and how much is related to the water usage?

The Trade Council is optimistic on having an industrial water optimization pilot project to be held in Jiangsu Province in 2013 and would like to suggest the following project implementation phases:

A. Collecting basic info on the company and its production

B. Information gathering of the water/wastewater consumption of the company and their excising water equipment set-up

C. In-dept information gathering on Jiangsu's regulation and policies on industry water and key stakeholder mapping

D. Definition of a pilot project together with the Danish Ministry of Environment (The Nature Agency), CCC and other key stakeholders and attracting potential seed subsidies for the pilot

E. Fact finding to the plant of the key stakeholders

F. A project description delivered

G. Implementation

H. Marketing of the solution by the establishment and implementation of a marketing plan

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