

China, PR: Guangzhou Sewage Disposal

Ex-post evaluation

OECD sector	14020 / Water supply and sanitation– large systems	
BMZ project ID	1993 66 212	
Project-executing agency	Municipality of Guangzhou	
Consultant	Consulting Engineers Salzgitter / NCMEDI	
Year of ex-post evaluation	2004	
	Project appraisal (planned)	Ex-post evaluation (actual)
Start of implementation	Q 4 1993	Q 4 1993
Period of implementation	50 months	75 months
Investment costs	EUR 53.17 million	EUR 131.66 million
Counterpart contribution	EUR 43.71 million	EUR 122.20 million
Financing, of which Financial Cooperation (FC) funds	EUR 9.46 million	EUR 9.46 million
Other institutions/donors involved	None	None
Performance rating	2	
• Significance / relevance	3	
• Effectiveness	2	
• Efficiency	2	

Brief Description, Overall Objective and Project Objectives with Indicators

The project implemented in the city of Guangzhou (Guangdong Province) comprised the construction of a sewage treatment plant with a capacity of 220,000 m³/day (the first of a total of three planned expansion stages), the expansion of the main feeder canal (approx. 6.9 km) and the construction of a sewage pumping station. The aim was to dispose of the urban sewage of the city of Guangzhou, which has so far been discharged largely untreated into the Perl River, in an environmentally friendly manner. FC funds were used to finance the foreign currency costs of the supply and the installation of German technical equipment for the treatment plant as well as the costs of German consulting services.

The project objective was the sustainable and proper operation of the “Liede” sewage treatment plant. This was to contribute to a reduction in sewage-induced pollution in order to improve the living conditions of the flora and fauna in the Perl River and to ensure the drinking water supply (overall objective).

Originally the indicator for the achievement of the overall objective was to reduce the pollution of the Perl River (BSB₅ 25 t/day, solid matter 31 t/day, nitrogen 4 t/day). On the occasion of the final inspection the indicator for the achievement of the overall objective was modified. Instead of the ‘elimination of pollutants’ the ‘volume of waste water treated’ was determined as the new indicator. The goal was the reduction of BSB₅ and solid matter by 85% as well as the reduction

of total nitrogen by 50%. The reason for the change in indicator was the structural changes of the industrial polluters in the catchment area of the treatment plant.

Originally the indicators defined for the achievement of the project objective were as follows:

- a capacity utilisation of the treatment plant of at least 90% and
- compliance of the procedures of the treatment plant with Chinese discharge standards.

On the occasion of the final inspection the first indicator was modified to the effect that the required capacity utilisation was only 70%. This was due to the fact that at the time of the project appraisal the seasonal fluctuations in drinking water consumption had not been sufficiently taken in to account and, according to German experience, a capacity utilisation of 70% was an adequate achievement after a period of operation of three years.

Project Design / Major Deviations from the original Project Planning and their main Causes

The project is part of a comprehensive plan to expand the wastewater infrastructure in Guangzhou. With the completion of the first two construction sections of the Liede sewage treatment plant and three other treatment plants with a combined design capacity of 950,000 m³/day the city of Guangzhou now has treatment plants with a total capacity of 1.4 million m³/day. The further expansion of the Liede treatment plant from currently 440,000 m³/d to 640,000 m³/d and the construction of five more treatment plants until the year 2006 are important measures implemented by the project-executing agency in order to reduce the discharge of untreated sewage into the Pearl River.

The Guangzhou sewage disposal project comprised the following four main components:

- Construction and installation of the first expansion stage of the Liede sewage treatment plant (capacity of 220,000 m³/d) including a mechanical and a biological treatment stage and sewage sludge drainage,
- Construction of a sewage pumping station on the Donghaochong canal to lift the sewage to the required level of the main sewer,
- Construction of the main feeder canal from Donghaochong pumping station to Liede treatment plant with a total length of approx. 6.9 km,
- Supporting German consulting measures during the planning and construction stages and further training for the personnel at the treatment plants to be implemented in the context of a cross-project training measure.

Essentially all measures laid down during the project appraisal were implemented. In deviation from the original planning, however, the further expansion planning for the plant was taken into account in the dimensioning of all relevant parts of the plant.

A substantial deviation from the original planning occurred with regard to the investment costs, which increased by 146%. While the foreign exchange costs financed from FC were in line with the original planning, the domestic costs financed from Chinese counterpart funds increased dramatically. On the one hand the inflation rate rose disproportionately in the years 1993 – 1995 (between 15 – 20% annually) as compared with the project planning made at the beginning of the 1990s. On the other hand, due to the huge demand for construction services in Guangdong, the construction costs increased dramatically. In addition, property prices multiplied. Another reason was the expansion of the project to include further plant components – a measure which served the future capacity expansion of the plant.

The implementation of the project was delayed by around two years as compared with the original planning. The reasons for this were delays in the purchase of property and temporary financing bottlenecks on the Chinese side.

Key Results of the Impact Analysis and Performance Rating

The on-site ex-post evaluation revealed that the Liede treatment plant was in a very good operating condition. The volume of sewage treated at the plant was unobjectionable and the discharge values met Chinese discharge standards.

In the year 2003 the average volume of sewage treated in the first expansion stage of the Liede treatment plant was approximately 228,000 m³/day. The trial operation of the second expansion stage was started in spring 2004. The combined mean volume of sewage treated in both expansion stages in the first nine months of the year 2004 was approx. 500,000 m³/day and, thus, was 14% higher than the planned capacity of 440,000 m³/day. This was possible due to the fact that the sewage which reaches the treatment plant is strongly diluted. In most parts of the project the canal system is designed as a mixed system and in consequence the sewage contains a great deal of extraneous water. In this context excessive consumption of drinking water also plays a role. Since the pollutant loads in the sewage are much lower than planned at the time of the project appraisal, the actual reduction of pollutants in the Perl River is lower than expected.

In Guangzhou sewage fees are charged together with drinking water fees by the Guangzhou Water Supply Company. Currently sewage fees amount to RMB 0.7 (EUR 0.07) per m³ uniformly for all user groups. This fee is charged for 90% of the water consumption actually measured (though the sewage of only 30% of the population is actually purified in treatment plants). In absolute terms these sewage fees are low, but still they are among the highest fees in comparison with other FC projects in China. The last tariff increase was implemented in mid-2002. Until then the invoiced fee had been RMB 0.3 per m³. Total revenue from sewage fees continuously increased in the last few years. In 2001 the revenue amounted to RMB 220 million, in 2002 to RMB 365 million and in 2003 to approx. RMB 510 million. This revenue flows into the general budget of the city, which means that is not earmarked for a specific purpose. Since the sewage administration is operated by a municipal company, which does not require separate accounting, the question whether the sewage fees are adequate to fully cover all sewage-related operating costs cannot be answered conclusively. As far as the total volume of revenue is concerned it is currently estimated to be sufficient to finance at least the operation and maintenance of the urban sewerage system at the current stage of expansion. However, the tariffs will be raised gradually in the course of the further expansion of the sewage treatment capacities since otherwise, if tariffs remained constant, the higher costs would not be matched by corresponding revenues.

In summary, it can be said that the project objectives have been achieved to the extent expected. The capacity of the treatment plant is fully utilised and the pollutants reduction values defined at project appraisal were achieved for BSB₅, CSB, solid matter and total nitrogen without exception in the last few years. Moreover, the plants are in an excellent operating condition. Overall, we classify the **effectiveness** of the project as **satisfactory (rating 2)**.

The specific investment costs of the project are low despite the considerable cost increases that occurred. The operation of the project plants is conducted efficiently. All required operating resources are available. Thus, the production efficiency is good. Currently the allocation efficiency is only sufficient due to the fact that the operating and maintenance costs, and presumably also a part of the depreciations, are covered by revenues from sewage fees that

have to be paid by consumers who have not even been connected to a functioning sewage treatment plant. Overall, we classify the **efficiency** of the project as **satisfactory (rating 2)**.

Basically, the relevance of the project is given because the sewage treatment contributes to keeping the Perl River clean. However, reservations have to be made as to the significance of the project because the contribution to improving the water quality in the Perl River is substantially lower than expected upon project appraisal. Due to the positive trend to avoid the discharge of pollutants into the receiving waters, which has been observed in recent years, we still consider the **relevance and significance** of the project as **sufficient (rating 3)**.

After considering the above mentioned developmental sub-criteria, we classify the project Guangzhou Sewage Disposal overall as **having satisfactory developmental effectiveness (rating 2)**.

General Conclusions

When preparing the conceptual design of sewage treatment projects attention should be paid to the fact whether water consumption levels are adequate and whether the tariff system actually has an impact on consumption.

In the event that the sewage treatment plants are operated as force-account works it would be advisable upon project appraisal to see to it that the operation is conferred to a municipally-owned operator in order to ensure the necessary transparency in terms of efficiency and profitability.

Legend

Developmentally successful: Ratings 1 to 3	
Rating 1	Very high or high degree of developmental effectiveness
Rating 2	Satisfactory developmental effectiveness
Rating 3	Overall sufficient degree of developmental effectiveness
Developmental failures: Ratings 4 to 6	
Rating 4	Overall slightly insufficient degree of developmental effectiveness
Rating 5	Clearly insufficient degree of developmental effectiveness
Rating 6	The project is a total failure

Criteria for the Evaluation of Project Success

The evaluation of the "developmental effectiveness" of a project and its classification during the ex-post evaluation into one of the various levels of success described in more detail above concentrate on the following fundamental questions:

- Are the project objectives reached to a sufficient degree (aspect of project effectiveness)?
- Does the project generate sufficient significant developmental effects (project relevance and significance measured by the achievement of the overall development-policy objective defined beforehand and its effects in political, institutional, socio-economic and socio-cultural as well as ecological terms)?
- Are the funds/expenses that were and are being employed/incurred to reach the objectives appropriate and how can the project's microeconomic and macroeconomic impact be measured (aspect of efficiency of the project conception)?
- To the extent that undesired (side) effects occur, are these tolerable?

We do not treat **sustainability**, a key aspect to consider for project evaluation, as a separate category of evaluation but instead as a cross-cutting element of all four fundamental questions on project success. A project is sustainable if the project-executing agency and/or the target group are able to continue to use the project facilities that have been built for a period of time that is, overall, adequate in economic terms, or to carry on with the project activities on their own and generate positive results after the financial, organisational and/or technical support has come to an end.