Turkey: (a) Treatment plant and (b) sewage collection Diyarbakir

Ex post evaluation report

OECD sector	14020 / Water supply, sanitation und sewage management	
BMZ project ID	(a) 1998 65 023 (Inv.), 1998 198 (training measure) (b) 2001 65 043 (Inv.), 2001 238 (training measure)	
Project executing agency	Diyarbakir Suve Kanalizasyon Idaresi (DISKI), municipal water and sewerage utility	
Consultant	(a) DAR (Inv.), HSE (training measure) (b) GIBB (Inv.), CES/ER-GE (training measure)	
Year of ex post evaluation	2010 (2010 sample)	
	Project appraisal (planned)	**Ex post evaluation (actual)**
Start of implementation	(a) I Q2 1998 (b) II Q1 2001	(a) I Q4 1998 (b) II Q1 2001
Period of implementation	(a) 32 months (b) 42 months	(a) 69 months (b) 37 months
Investment costs	(a) EUR 45.4 million (b) EUR 43.5 million	(a) EUR 47.1 million (b) EUR 39.6 million
Counterpart contribution	(a) EUR 7.3 million (b) EUR 6.6 million	(a) EUR 5.3 million (b) EUR 4.3 million
Financing, of which FC funds	(a) EUR 27.1 million (b) EUR 17.9 million	(a) EUR 27.1 million (b) EUR 17.9 million
Other institutions/donors involved	(a) EIB EUR 11.0 million (b) EIB EUR 19.0 million	(a) EIB EUR 14.7 million (b) EIB EUR 17.4 million
Performance rating	2	
• Relevance	2	
• Effectiveness	2	
• Efficiency	3	
• Overarching developmental impact	2	
• Sustainability	2	

Brief description, overall objective and project objectives with indicators

The overall objective of the treatment plant and sewage collection Diyarbakir project was to contribute to reducing health risks to the population of Diyarbakir and reducing the sewage load of the Tigris River. The project objective was the environmentally sound and hygienically safe disposal of the sewage from the city of Diyarbakir. The target group of both projects was the population of Diyarbakir (approx. 1.1 million inhabitants). Project executing agency was the Diyarbakir municipal water and sewerage utility Diyarbakir Suve Kanalizasyon Idaresi (DISKI). The project comprised measures

(a) for constructing and operationally/technically equipping a mechanical treatment plant for Diyarbakir and (b) constructing the sewer network including the main and subsidiary collectors in the city sections of Surici, Baglar, Yenisehir, Ali Pinar and Gözeli. In parallel to the FC project co-financed by the European Investment Bank (EIB), the project executing agency DISKI was provided with extensive technical and commercial support until the end of 2005 in the framework of the Technical Cooperation project "Capacity building DISKI".

The following indicators were defined to measure achievement of the objectives for the (a) treatment plant during project appraisal:

- The closure of the sewerage outlets along the edge of the city (no overflows);
- The quality of the effluents from the treatment plant in dry weather (< 10 ml/l settleable solids).

For a purely mechanical treatment plant, which greatly reduces the settleable solids but hardly affects the organic pollution load, the selected indicator is appropriate in principle. However, the target value is based on the assumption of a pure sewage discharge and not - as is actually the case - of a pollution load strongly diluted through infiltration/intake of extraneous water in the sewerage system. The following three indicators were defined during project appraisal for the (a) sewage collection project:

- Less than 5 standing water bodies;
- Less than 5 inundation areas in the city area;
- The volume of sewage fed to the treatment plant should be at least 50,000 m^3 per day.
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Project Design/Major Deviations from Original Planning and Main Causes

The Financial Cooperation project "Treatment plant Diyarbakir" comprised the following measures:

- Construction of the first stage (mechanical treatment) of the central treatment plant;
- Installation of the main collector and sewage connections;
- Construction of the sewage pumping station;
- Equipment for the operation of the plant;
- Services for initial operations;

In addition the EIB financed the main collector, the two pump stations, the electricity supply facilities and the remaining components of operating equipment.

The breakup of the German-Turkish consortium commissioned with construction, financial difficulties of the Turkish construction company and substantial construction defects led to the extension of the execution period. As a result the plant was not put into operation until 2004, in other words three years later than planned during project appraisal. For proper operation of the treatment plant and required maintenance and servicing measures, a basic and advanced training measure was implemented focusing on operational management - this was supplementary to the Technical Cooperation project "Capacity building DISKI".

The project "sewage collection Diyarbakir" comprises the following measures:

- Creation of sewage and drainage networks in priority parts of the city;
- Construction and/or continuation of main collectors and an intercepted water collector;
- Construction of the irrigation system for vegetable plots near the city;

- Operating equipment for the sewerage network department.

Additional canal networks were financed by the EIB.

Originally the Financial Cooperation funds were to be used to lay about 75 km of sewer networks and main collectors, thereby enabling about 5,200 new house connections to be installed. In actuality the DISKI sewerage network was expanded by 115 km and 15,770 new house connections were completed. This was due primarily to the reallocation of EUR 1.5 million residual funds from the treatment plant project for construction measures in the framework of the sewage collection project.

The irrigation system in areas for fruit and vegetable cultivation near the city was not built as planned using pumped water from the Tigris river. Instead two existing water sources were used in the city districts of Surici which had been previously used for drinking water supply. However, both these sources are not adequate for the irrigation. Therefore small amounts of river water will be pumped from the shoreline area of the Tigris for irrigating the fields. Waste water will no longer be used for irrigation. A small share of the areas previously irrigated with waste water are currently no longer being irrigated and are to be supplied with water from a tributary of the Tigris through a new project from DISKI.

The sewerage system was originally planned as a sewage separation system. Rainwater irrigation was not and is not the responsibility of the executing agency, but rather the municipality of Diyarbakir. As the municipality provided only insufficient investments for rainwater irrigation, much of the rainwater flows out through the sewerage. Accordingly the sewerage plans were adjusted and two rainwater overflows were built near the city and at the inlet to the treatment plant, so that the waste water system can in practice be operated as a mixed system (for rain and waste water).

Key results of the impact analysis and performance rating

The problem of water-induced diseases caused by serious sanitary deficits was able to be successfully resolved through the two projects (incl. EIB financed measures). The reduction of such diseases (overall objective) in 2009 compared to the high levels in the 1990s was clearly achieved for typhus (reduction by 99%), dysentery (no more cases) and hepatitis B (reduction by 84%). As the significant improvement of the health situation coincided with completion of the construction of the sewerage and treatment plant, there is probably a causal relationship. The local health authorities assume such a causal relationship.

Both of the Financial Cooperation projects had positive, unintended spillover effects on other enterprises and authorities in Diyarbakir. For example, camera inspections of the sewerage system were introduced in the framework of the project. DISKI also conducted these inspections for the sewerage networks, which had been built by the housing construction companies and then transferred to DISKI for their operation. In the process considerable deficiencies were often found in the construction. The housing construction companies then decided to perform a camera inspection in all future construction projects before the construction works were accepted. Another example of the project's broad effect is that the introduction of a geographic information system (GIS) at DISKI inspired the regional electricity supply company to purchase its own GIS. A third spillover effect impacted the district authorities. At the insistence of DISKI, apparently these now comply more strictly to zoning plans, halting the establishment of informal settlements.

Relevance: The starting point for both projects was the high incidence of waste-water induced diseases. The assumed chain of effects is also from today's perspective plausible and highly relevant in development policy terms. The projects were measures for social infrastructure and environmental protection in the area of sewage disposal in an economically disadvantaged region of Turkey, in harmony with both the development principles of the German Federal Government and the sectoral investment plans of the Turkish Government, as well as with the bilaterally agreed upon priority areas of German-Turkish Financial Cooperation. The priorities of German development cooperation with Turkey were and remain focused on the less developed east Turkish provinces and on promoting the urban infrastructure. The project supports efforts to achieve the Millennium Goal 7 (halving the share of people without access to adequate sanitary facilities) and Millennium Goals 4 and 5 (reducing child mortality and reducing the incidence of water-induced diseases). The relevance of both projects has consequently been assessed as good (rating 2).

Effectiveness: Two of the three indicators for achieving the project objective in terms of sewage collection were fulfilled. Thus there are no longer sewage outlets on the outskirts of the city and after strong rainfall hardly any flooded areas are identifiable (<5). The indicator for the minimum amount of channelled waste water was not achieved. The consumption trend that served as a basis for planning overestimated water consumption. On the other hand, the current design of the treatment plant in connection with the two co-financed rainwater overflows (as part of the mixed water system) ensures the functionality of the treatment plant even in times of strong rainfall. Regarding the treatment plant, the following project objective indicator is fulfilled: "sewage outlets which feed raw sewage into the receiving waters no longer exist along the city outskirts". Furthermore, to measure the fulfilment of the project objective, the indicator "concentration of settleable solids in the treatment plant outflow during dry weather is less than 10 ml/l" was defined. The concentration of settleable solids in the treatment plant outflow into the Tigris in dry weather was 0.6 - 0.9 ml/l in 2008/09. Thus the measurements are much lower than the target indicator of < 10 ml/l, which was however defined for a separate system and not a combined system - as it was then operated. The additional indicator "biological oxygen requirement", which was not taken into consideration during project appraisal, was also within the range of expected values for mechanical treatment facilities. Overall, the effectiveness (sewage collection and treatment) is rated as good (rating 2).

Efficiency: The capacity utilisation of the treatment plant five years after being put into operation is about 75% in terms of dry weather flow. If the fast growth of the city is taken into account, the plant is still sized appropriately. The specific investment costs of EUR 175/inhabitant are cost-efficient compared to other mechanical-biological treatment plants and the associated sewer networks. There were delays during construction of the plant. During project appraisal it had been assumed that the treatment plant would go into operation in 2001, while it actually did not go online until 2004. The operating cost recovery rate in 2009 was 147% (129% when debt service is taken into consideration) and thus considerably higher than the short-term minimum requirement of the sector concept (100% recovery of operating costs). For the collection system with a collection rate of only 81% (2009) there is still room for improvements. Despite the tariff increases in 2010, additional revenue increases do not appear to be sufficient to achieve further consolidation of operations. In light of the significant real tariff increases in past years and the already high tariff levels in international comparison, the still insufficient collection rate and the continuing high water losses (2009: 51%) present DISKI with an obstacle to development. Overall, the efficiency of both projects is rated as satisfactory (rating 3).

Overarching developmental impacts: Both projects contributed to reducing the health risks to the population of Diyarbakir and reducing the sewage load of the river Tigris. All the usual health indicators related to sewage improved drastically. The improvement coincides with the commissioning of the expanded sewage network and the discontinuation of the use of untreated sewage for irrigation in 2004. The data provided at different points in time by the health authorities were in part contradictory, but the overall trend was clear. According to statements of the health authorities, the improvement of the water supply and sewage disposal system was the main reason for the improvement in the health indicators. Certainly the gradual qualitative and quantitative improvement of the drinking water supply since the drinking water connection from the Tigris dam was commissioned in 2001 also contributed to improving the health situation. A classification of both factors relative to the improvements was not possible in the framework of the evaluation. If the processing through the mechanical treatment plant leads to eliminating even only about 35% of the COD load (chemical oxygen demand), it actually reduces the pollution load of the Tigris considerably. This leads to a noticeable improvement of the river water, as quality measurements from water samples of the Tigris showed before and after implementation of the measure. In addition, deposition of organic sludge on the river bed is avoided. As a result, the fish stock in the Tigris has recovered compared to the period before implementation of the construction work. In addition, the positive spillover effects on other enterprises and authorities in Diyarbakir are also to be considered. A negative development, despite considerable efforts made by the executing agency, is the unsatisfactory storage of the sewage sludge even 6 years after the treatment plant went into operation. As the positive impacts of both projects on health and the environment clearly exceed the possible negative effects, the overarching development impact is rated as good (rating 2).

Sustainability: Due to the high operating cost recovery rate of 147% and the overall positive development of DISKI during and after implementation of both projects, there are currently no major risks to the financial sustainability. The debt service on the loans from KfW and EIB will burden finances of the project executing agency. However, by itself this does not pose a major risk to the financial sustainability of the executing agency due to the high operating cost recovery rate. The operating costs associated with the planned expansion of the treatment plant with a biological treatment stage may present a risk to the financial sustainability. If neither the tariffs are raised nor the collection rate is improved, these factors could raise the risks for the sustainable achievement of the objective. However the risks will be considered as acceptable. The project executing agency was strengthened considerably through staff support (among others also through the Technical Cooperation) and staff fluctuation is low. Therefore inadequately qualified staff poses no major risks to sustainability. Preventive maintenance is being largely performed, even if it could be systemised more strongly. Overall, the treatment plant is being properly operated despite isolated weaknesses. The sewage sludge is removed from the plant while it’s running and therefore presents no risk for sustainable operation, unlike with pond treatment plants. The sustainability of both projects is thus rated as good (rating 2).

Overall evaluation: Overall both projects are rated as good (rating 2).

General conclusions and recommendations

Groundwater infiltration in the sewage network: During high ground water levels it is important during planning and construction of the sewage networks to implement measures that prevent groundwater from infiltrating these networks, avoiding diluting the sewage too strongly which in turn impairs the functionality of the treatment plant.

Tariff indexing and adjustment: The common practice in Turkey of indexing tariffs to the consumer price index is an effective instrument for avoiding erosion of tariffs through inflation. The autonomy of municipalities to determine their own tariffs and the desire of municipal decision-makers to ensure the financial sustainability of the executing agencies also made regular real tariff increases possible. In the framework of sector reforms it makes sense to support municipal autonomy to determine tariffs as well as tariff indexing.

Notes on the methods used to evaluate project success (project rating)

Projects are evaluated on a six-point scale, the criteria being relevance, effectiveness, overarching developmental impact and efficiency. The ratings are also used to arrive at a final assessment of a project's overall developmental efficacy. The scale is as follows:

1	Very good result that clearly exceeds expectations
2	Good result, fully in line with expectations and without any significant shortcomings
3	Satisfactory result – project falls short of expectations but the positive results dominate
4	Unsatisfactory result – significantly below expectations, with negative results dominating despite discernible positive results
5	Clearly inadequate result – despite some positive partial results, the negative results clearly dominate
6	The project has no impact or the situation has actually deteriorated

A rating of 1 to 3 is a positive assessment and indicates a successful project while a rating of 4 to 6 is a negative assessment and indicates an unsuccessful project.

Sustainability is evaluated according to the following four-point scale:

Sustainability level 1 (very good sustainability) The developmental efficacy of the project (positive to date) is very likely to continue undiminished or even increase.

Sustainability level 2 (good sustainability): The developmental efficacy of the project (positive to date) is very likely to decline only minimally but remain positive overall. (This is what can normally be expected.)

Sustainability level 3 (satisfactory sustainability): The developmental efficacy of the project (positive to date) is very likely to decline significantly but remain positive overall. This rating is also assigned if the sustainability of a project is considered inadequate up to the time of the ex post evaluation but is very likely to evolve positively so that the project will ultimately achieve positive developmental efficacy.

Sustainability level 4 (inadequate sustainability): The developmental efficacy of the project is inadequate up to the time of the ex post evaluation and an improvement is very unlikely. This rating is also assigned if the sustainability that has been positively evaluated to date is very likely to deteriorate severely and no longer meet the level 3 criteria.

The overall rating on the six-point scale is compiled from a weighting of all five individual criteria as appropriate to the project in question. A rating of 1 to 3 indicates a "successful" project while a rating of 4 to 6 indicates an "unsuccessful" project. It should be noted that a project can generally only be considered developmentally "successful" if the achievement of the project objective ("effectiveness"), the impact on the overall objective ("overarching developmental impact") and the sustainability are considered at least "satisfactory" (rating 3).