Republic of Turkey

FY2015 Ex-Post Evaluation of Japanese ODA Loan Project

"Istanbul Water Supply Project/Istanbul Water Supply Project (Phase II)"

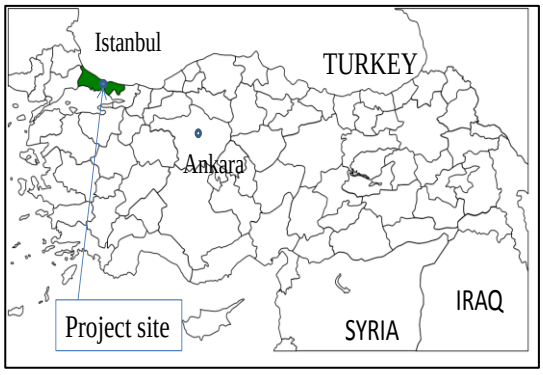
External Evaluator: Toshiyuki Katagiri, Japan Economic Research Institute Inc.

0. Summary

In this project, in order to provide a stable water supply to the residents of Istanbul, whose population had been increasing rapidly, the Melen intake weir was constructed to withdraw water from the Melen river, whose water source was in a mountainous region along the coast of the Black Sea 170 km east of Istanbul. In addition, a pipeline was constructed to the existing Kagithane Water Distribution Station and a treatment plant was also constructed. This project was consistent with the Turkish development plan and development needs, as well as with Japan's ODA policy, therefore the relevance of this project is high. With regard to the effectiveness of the project, the amount of water produced increased as well as the number of population to be served, and the percentage of population served became 100%, so the intended targets were achieved. In addition, an improvement in public hygiene was observed. As a whole, effectiveness and impact of the project are judged to be high. From the viewpoint of project implementation, the efficiency of the project is low because the project costs exceeded the plan due to inflation, and the project period significantly exceeded the plan due to a shortage in the budget, which was caused by the tight-financing policy of the Turkish government and the bankruptcy of a contractor influenced by the financial crisis triggered by Lehman's collapse. With respect to operation and maintenance (O&M), no major problems had been observed in the institutional, technical and financial aspects. Therefore sustainability of the project effects is judged to be high.

In light of the above, this project is evaluated to be satisfactory.

1. Project Description



Project Location

Melen Pumping Station

1.1 Background

At the time of project appraisal in 1993, Istanbul was the most populous city in Turkey, with about 7.6 million residents accounting for 12.4% of the total population of Turkey. The population of Istanbul had increased drastically through rapid urbanization and an inflow of migrants from rural areas (annual average rate of population increase was 4.6% from 1970 to 1990), while a delay in infrastructure improvement had been designated. Regarding waterworks, there were no big rivers in Istanbul nor its environs, and drinking water for the residents had been dependent upon supply from surrounding areas since long ago. As the development of water resource had not met the rapid water demand, residents suffered from a chronic shortage of water. The drought, which had continued for two years since 1989, caused the level of water in all reservoirs to go down to around 20% of the full storage level in autumn of 1990. The Istanbul Water and Sewerage Administration (ISKI) had to cut water supply from the usual 1.72 million m^3/day to 0.80million m^3/day. Since then, the shortage, in terms of the absolute total amount of water intake, as well as the conditions related to weather, had not changed at the time of project appraisal.

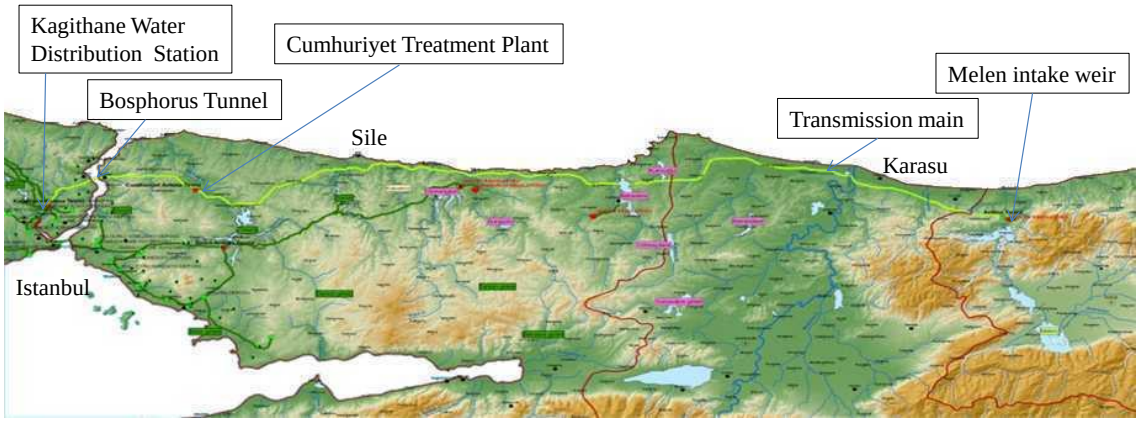


Figure 1 General view of the project

1.2 Project Outline

The objective of the project was to ensure a stable water supply and improve the water supply rate by developing the Melen intake weir and constructing a pipeline, treatment plant, Bosphorus Tunnel as well as other facilities, thereby contributing to the improvement of public hygiene for the residents in Istanbul.

<ODA Loan Project>

Loan Approved Amount/Disbursed Amount	(Phase I[1]) 52,473 million yen/51,573 million yen (Phase II) 42,310 million yen/42,259 million yen	
Exchange of Notes Date/Loan Agreement Sighing Date	(Phase I) June,1993/November,1993 (Phase II) May,1996/September,1996	
Terms and Conditions	(Phase I) Interest Rate 3.0% Repayment Period 25 years (Grace Period 7 years) Conditions for Procurement General Untied	(Phase II) Interest Rate 2.50% Repayment Period 25 years (Grace Period 7 years) Conditions for Procurement General Untied
Borrower/Executing Agency	The Government of the Republic of Turkey/General Directorate of State Hydraulic Work (DSI)	
Final Disbursement Date	(Phase I) May,2011 (Phase II) May,2012	
Main Contractor[2][3] (Over 1 billion yen)	Contract Package (CP)1: Hitachi (Japan)/Yüksel İnşaat A.Ş. (Turkey) (JV) CP2: Alsim Alarko Sanayi Tesisleri Ve Ticaret A.Ş. (Turkey)/Jsc Rosneftegazstroy (Russia) (JV) CP3: Ack İnşaat Sanayi. Tesisleri.Ve Ticaret A.Ş. (Turkey)/ Guriş İnşaat Ve Mühendislik A.Ş. (Turkey) (JV) CP3B: İMA Mühendislik İnşaat Ve Ticaret Ltd. Şti. (Turkey) CP4: Palet İnşaat Ve Ticaret A Ş.. (Turkey)/ Yertaş İnşaat Turizm Sanayi Ve Maden Ticaret Ltd. Şti. (Turkey) (JV) CP5: Otv Sa (France)/Emit Spa (Italy) /Marubeni(Japan)/ Limak İnşaat ve Ticaret Sanayi A.Ş. (Turkey) (JV) CP6: Alke İnşaat Sanayi Ticaret A.Ş. (Turkey)/ Ataç İnşaat Ve Sanayi A.Ş. (Turkey) (JV) CP7: Alke İnşaat Sanayi Ticaret A.Ş (Turkey)/ STFA İnşaat A.Ş.	

[1] In this report, "Istanbul Water Supply Project" is mentioned as "Phase I" and "Istanbul Water Supply Project (Phase II)" is mentioned as "Phase II".

[2] Phase I includes CP1, 2, 3, 3B, 4, 8, 11 and Phase II includes CP1, 5, 6, 7, 9, 10.

[3] CP3A is not subject to the Japanese ODA Loan. The Turkish side implemented CP3A on its own budget.

	(Turkey)/Ojsc Mosmetrostroy (Russia) (JV) CP8: Noksel Çelik Boru Sanayi A.Ş. (Turkey) CP9: Ümran Çelik Boru Sanayi A.Ş. (Turkey) CP10: Erciyas Çelik Boru Sanayi A.Ş. (Turkey) CP11: Areva Energietechnik GMBH (Germany)/ Mapa İnşaat Ve Ticaret A.Ş. (Turkey) (JV)
Main Consultant[4]	April,1996-August,2008: Nippon Koei (Japan) / Su-Yapı Mühendislik ve Müşavirlik A.Ş. (Turkey)/ Temelsu Uluslararası Mühendislik Hizmetleri A.Ş. (Turkey)/Gibb Ltd. (U.K)/Motto Macdonald Ltd. (U.K) (JV) January,2011-August,2012: IC Consulenten Ziviltechniker Gesmbh (Austria) / Coyne Ve Bellier Mühendislik Ve Müşavirlik Ltd. Şti.. (Turkey)/ Fugro-Sial Yerbilimleri Müşavirlik Ve Mühendislik Ltd. Şti.. (Turkey) (JV)
Feasibility Studies, etc.	"Greater Melen Project Feasibility Study" DSI, January,1991-October,1991
Related Project	[Technical cooperation project] Dispatched experts for "Greater Istanbul Water Supply Project" and "The Bosphorus Rail Tube Crossing Project", safety management system and construction supervision system, March,2009-July,2009

2. Outline of the evaluation Study

2.1 External Evaluator

Toshiyuki Katagiri (Japan Economic Research Institute Inc.)

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August, 2015 - October, 2016

Duration of the Field Study: January 3 - January 12, 2016, April 25 - May 30, 2016

2.3 Constraints during the Evaluation Study

Since October 2015, frequent terrorism has occurred in Turkey including Ankara and Istanbul. Under the circumstance, it was decided to conduct the second field study by

[4] As the first consultant contract expired during project implementation because of the lengthening of the project, the following consultant contract was concluded.

local consultants under the supervision of an external evaluator.

The water supply area of this project covered the whole of Istanbul, i.e., ISKI's service area, and the amount of water capacity in Istanbul increased through this project by 268 million m^3, which is 42 % of the amount increased for the total water capacity in Istanbul (639 million $m^{3)}$.[5] The project contribution was nearly half of the total increase, and the effect of this project was seen throughout the entire Istanbul area, but it was impossible to separate the water supply area and measure effects for just this project. Therefore, as the quantitative effects of effectiveness of this project, the indicators for the whole area of Istanbul were adopted.

3. Results of the Evaluation (Overall Rating: B[6])

3.1 Relevance (Rating:③[7])

3.1.1 Relevance to the Development Plan of Turkey

At the time of project appraisal, in Turkey's development plan "The Fifth Development Plan (1985-1989)" and "The Sixth Development Plan (1990-1994)", the water and sewerage/sanitation sector was an important field and the weight of this sector in terms of total public investment of "The Fifth Development Plan (1985-1989)" was over 10%.

At the time of ex-post evaluation, in "The Tenth Development Plan (2014-2018)" which was issued in 2013, the water and sewerage sector was continuously mentioned as one of the important fields for public investment, occupying 12.8% of the total amount of public investment during the plan's period. In the plan, "the need for treatment of drinking water has increased" is described, which indicates the importance of maintenance and expansion of waterworks.

3.1.2 Relevance to the Development Needs of Turkey

At the time of project appraisal, a continuous increase in population of urban areas in Turkey made water facilities an immediate necessity due to additional water demand. In Istanbul, the most populous city in Turkey, stable water supply was an especially urgent issue because the concentration of population had been growing.

The condition of waterworks in Istanbul had suffered a chronic shortage of water because the development of a water resource was not produced to meet the drastic increase in demand for water due to lack of big rivers in the area.

There had been no change to the condition of the waterworks influenced by weather,

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[5] The amount of the water capacity in Istanbul increased from 654 million m^3at the time of the project appraisal to 1,293 million m^3at the time of the ex-post evaluation.

[6] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[7] ③: High, ②: Fair, ①: Low

and from a viewpoint of risks from natural disasters such as drought, the stable supply of water remained a high priority.

Melen river system targeted in this project had the following advantages; 1) There were no problems of water quality in view of the land usage in the upper watershed, 2) Stable water flow including meltwater from snow during spring was expected, 3) The river had a broad catchment basin and high potential for increasing water volume (in the future it could enable intake of 1,077 million m^3/year by constructing a dam). From a viewpoint of future water resource development in Istanbul, there was no big development planned other than Melen river system. This project was the first stage of the Melen System[8] which was expected to entail a role to be the largest water supply facility in Istanbul designated for meeting future water demand.

At the time of ex-post evaluation, Istanbul had population of 14.16 million (in 2014) as the most populous city, and it occupied 18.5% of the total population of Turkey. The population of Istanbul had increased through rapid urbanization and an inflow of migrants from rural areas (from 7.47 million in 1990 to 14.16 million in 2014). So, the need for a stable water supply was continuously strong especially on the western side of Istanbul (the European side) where residents were concentrated.

Therefore, the implementation of this project met the needs of stably supplying good-quality water to an increasing population in Istanbul at the time of both project appraisal and ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

Although no country assistance policy or plan for Turkey had been made at the time of project appraisal, the "Implementation Status of Japan's Official Development Assistance" in 1995 stated that "the stability of the Middle and Near East Area is extremely important not only for Japan but also for world security and prosperity. Japan's ODA is implemented on the basis of this. "

In addition, the Government of Japan and the Government of the Republic of Turkey carried out an economic cooperation policy meeting in September 1998, confirming the role of Japan's ODA to emphasize on the following fields: environment (improvement of the urban environment and countermeasures for marine pollution), human resource development for the improvement of economic and social development, promotion of

[8] Because of the drought in Istanbul in 1989-1990, "Greater Melen Project Feasibility Study" was conducted by DSI in 1991 to solve future water supply problems. The whole plan of this FS is called the Melen System. In the plan of Melen System after completion of this project, by constructing the dam at the Melen River and adding a big water intake and transmission facilities, the water demand until 2035 is to be covered. This project is planned to take the consistency with the whole plan of the Melen System.

principle industries such as agriculture and fishery in order to reduce the disparity in economic power among regions, the improvement of basic human needs such as medical treatment for health, and South-South Cooperation. Therefore this project is thought to be consistent with Japan's ODA policy from the viewpoint of the improvement of the urban environment.

In light of the above, this project has been highly relevant to the Turkish development plan and development needs, as well as to Japan's ODA policy; therefore, its relevance is high.

3.2 Efficiency (Rating:①)

3.2.1 Project Outputs

As they are shown in Table 1, in this project, the intake weir, pumping station, treatment plant, energy supply and other facilities, as well as the pipeline and Bosphorus Tunnel were constructed.

The differences between the plan and the actual works were the integration of contract packages through the D/D process, changes of specifications, and a change of scope in the former CP[9]4 for the construction of Alacali Dam to the construction of the pipeline and water channel (see Table 1). The main reasons for these changes were 1) adopting proper / efficient routes and construction methods under the D/D process and 2) avoiding the increase of compensation for land and adopting measures to achieve a shortened construction period after cancelation of the construction of Alacali Dam. After D/D, there were no changes to the specifications and the outputs remained as planned.

[9] The former CP was from CP1 to CP 13 (in the first version, there was no CP 11). Phase I included the former CP1, 2, 3, 4, 8, 12 and consulting service. Phase II included the former CP5, 6, 7, 9, 10 and 13.

Table 1 Outputs of the Project

	Plan		Actual	
Phase I	CP	Contents	CP	Contents
	1	Melen intake weir (Amount of Water Intake 8.5 m^3/second)	1	Melen intake weir (Amount of Water Intake 8.5 m^3/second) Melen pumping station (4,500KW×6 units)
	2	Melen pumping station (4,500KW×6 units)	2	Pipeline installation between Melen and Kinchili (Total 69.2km)
	3	Pipeline installation between Melen and Cumhuriyet (Total 135.3km)	3A[10]	Pipeline installation between Kinchili and Agva (Total 35.3km)
			3B	Pipeline installation between Agva and Sile, and between Hamidiye and Cumhuriyet (Total 36.6km)
	4	Construction of Alacali Dam (Rockfill dam, height :63m)	4	Pipeline installation between Sile and Hamidiye and construction of water channel (Total 17.2km)
	8	Pipe production and supply, 50% of CP3	8	Pipe production and supply, 50% of CP3 (71.2km)
	12	Energy supply (154KV 2 circuit distribution lines)	11	Energy supply (154KV 2 circuit distribution lines)
	Consulting service	Tendering support, Detailed design, Construction management etc.	Consulting service	Tendering support, Detailed design, Construction management etc.
Phase II	CP	Contents	CP	Contents
	13	Cumhuriyet pumping station (1,450KW×5 units)	1	Cumhuriyet pumping station (2,500KW×6 units)
	5	Cumhuriyet treatment plant (Purification capability 700,000 m^3/day)	5	Cumhuriyet treatment plant (Purification capability 720,000 m^3/day)
	6	Pipeline installation between Cumhuriyet and Kagithane (28.4km)	6	Pipeline installation between Cumhuriyet and Kagithane (Total 20.4km)
	7	Bosphorus Tunnel (Total 3.0km)	7	Bosphorus Tunnel (Total 5.5km)
	9	Pipe production and supply, 50% of CP3	9	Pipe production and supply, 50% of CP3 (69.5km)
	10	Pipe production and supply of CP6	10	Pipe production and supply of CP6 (14.6km)

Source: Provided by JICA and the Executing Agency

[10] CP3A is not subject to Japanese ODA Loan.

3.2.2 Project Inputs

3.2.2.1 Project Cost

Regarding project cost, the actual project cost was 127,722 million yen and the planned cost was 126,377 million yen, revealing that the actual cost exceeded the planned one (101% in comparison). In the process of D/D, although more proper and efficient installation routes and measures were adopted to reduce costs, and the depreciation of the Turkish Lira (TL) made the cost in yen to decrease, high inflation in Turkey made labor costs and materials costs increase during the delay of the project. As a result of these issues, the actual project cost was somewhat higher than the planned cost (see Tables 3 and 4).

Table 2 Project Cost

Unit : million yen

	Plan		Actual	
	Total	Japanese ODA loan	Total	Japanese ODA loan
Phase I	69,964	52,473	69,217	51,573
Phase II	56,413	42,310	58,505	42,259
Total	126,377	94,783	127,722	93,832

Source: Provided by JICA and the Executing Agency

Table 3 Foreign Exchange Rate per US1$

Year	1997	2000	2005	2010
YEN	120.99	107.77	110.22	87.78
TL*	0.15	0.63	1.34	1.50

Source: IMF “International Financial Statistics; Yearbook”

Note*: New TL base after denomination in 2005

Table 4 Consumer Price Index in Turkey

Year	1997	2000	2005	2010
Index	21.2	100	341.6	518.3

Source: IMF “International Financial Statistics; Yearbook”

Note: Index is 100 in 2000

3.2.2.2 Project Period

The planned project period was 98 months (from November 1993, Loan Agreement signing date, to December 2001) in comparison with the actual one of 256 months (from November 1993, Loan Agreement signing date, to March 2015), resulting in the actual one substantially exceeding the plan (261% by comparison). Regarding project period, the main reason for the delay in the project period was that, as the construction for each contract are mutually related, the delay in one contract instigated delay for others. As for individual causes, the project consultant indicated the following causes;

1) the delay of consultant selection by introducing prequalification (P/Q), 2) the delay caused by a contract based on a low bidding price, making it difficult for the contractor to absorb the price inflation in Turkey and delayed construction, 3) the shortfall of budget due to the tight financing policy of the government of Turkey, 4) a cancellation of the construction of Alacali Dam and change of scope, 5) the bankruptcy of a contractor triggered by the Lehman collapse, resulting in cancelation of the contract, a process of re-tendering and change of the contractor.

3.2.3 Results of Calculations of Internal Rate of Return (Reference only)

As the Financial Internal Rate of Return (FIRR) was only calculated at the time of project appraisal in both Phase I and Phase II, it was re-calculated as closely as possible with the pre-conditions set in Phase II at the time of ex-post evaluation. The reason to compare only with the FIRR from the appraisal of Phase II was that because comparison was made against the calculation reflecting the newer budget and data (water charge and unaccounted-for water rate). The FIRR at the time of the ex-post evaluation was 8.58%, and profitability was acknowledged. Although the water charge in 2016 was twice as much as that at the time of project appraisal in Phase II, O&M costs at the time of ex-post evaluation were increased three times as much as those at the time of project appraisal in Phase II, resulting in a decrease of the FIRR.

Table 5 Precondition of Calculation of FIRR at the Time of Both Project Appraisal in Phase II and Ex-Post Evaluation

	At the time of project appraisal in Phase II	At the time of ex-post evaluation
FIRR	9.27%	8.58%
Cost	Construction costs, renewal costs, O&M costs	Construction costs, renewal costs, O&M costs
Benefit	Water charge	Water charge
Project Life	35 years	35 years
Precondition	Water charge was fixed at US1$/$m^3$ in 2002 at the start of operation.	・O&M costs were calculated based on the increase rate of consumer prices. ・Benefit was calculated from the tariff table of ISKI in January 2016((US2.04$/$m^3$)

Source: Provided by JICA

In light of the above, the project cost exceeded the plan and the project period significantly exceeded the plan. Therefore, efficiency of the project is low.

3.3 Effectiveness[11](Rating:③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

Although the operation and effect indicators had not yet been introduced at the time of appraisal of this project, substitute targets were set from various documents at the time of ex-post evaluation. As items for quantitative effects, operation indicators were the following; 1) population served in Istanbul, 2) the amount of water supply, 3) the amount of water supply capacity, 4) rate of facility utilization, 5) unaccounted-for water rate, 6) leakage rate. The effect indicators were the following; 7) percentage of population served, and 8) water supply per capita. Realizing a stable water supply through the achievement of these indicators was thought to be the project effects. Table 6 indicates the results of the effects.

[11] Sub rating for Effectiveness is to be put with consideration of Impact

Table 6 Operation and Effect Indicators

	Indicators	Baseline	Target	Actual
		1990	2004	2015
		Baseline Year	2 years after Completion	Completion Year
Operation Indicators	Population Served in Istanbul (million people)	5.97	11.13	14.16*
	Amount of Water Supply (million m^3/year)	397	867	965
	Amount of Water Supply Capacity (million m^3/year)	654	1,232	1,293
	Rate of Facility Utilization (%) ** (Cumhuriyet treatment plant only)	57	-	60 (61)
	Unaccounted-for Water Rate (%) ***	40	32	27
	Leakage Rate (%) ***	40	32	24
Effect Indicators	Percentage of Population Served (%)	80	100	100
	Water Supply per capita(ℓ/day)	182	227	187

Source: Provided by JICA and the Executing Agency

Note*: Istanbul population in 2014

Note**: Average water supply in Istanbul /day ÷ Total Purification capability /day

As a reference for the effectiveness of the rate of facility utilization of Cumhuriyet treatment plant, which was a facility constructed through this project, it is measured for the completion year, as shown. Because this project is old, the operation indicators were not set at the time of project appraisal.

Note***: As the figures for unaccounted-for water rate and leakage rate were the same at the baseline and target years, the forecast is suspected to have been falsely estimated because of shortage of data, therefore, the credibility of the data is not enough.

Upon evaluation of operation indicators and effect indicators, though there was a difference between the target and actual date of completion because of the drastic delay in the project, the comparison was conducted between the target year and completion year as operation was stabilized in the completion year.

Regarding operation indicators, population served in Istanbul, amount of water supply and amount of water supply capacity, it was confirmed that all of them drastically exceeded their targets. And improvements in rates of facility utilization, unaccounted-for-water and leakage were recognized.

Regarding effective indicators, the percentage of population served was 100%, which was the same as the target. Though the absolute amount of water supply per capita was

under the target because of the drastic increase in population served in Istanbul, a calculation under the condition of population served in the target year (in 2004) would be 237 ℓ per day. As this is over the target amount (227ℓ per day), it could be said that the effect appeared sufficient against the target.

Furthermore, from the viewpoint of the demand and supply gap (see Table7), while there was an increase in population in Istanbul in terms of percentage of population served and water supply per capita, the result revealed an increase in amount of water supply capacity by the completion of this project, so it is judged that the supply balances the demand at the time of ex-post evaluation. According to the Executing Agency, the forecasted demand through 2035 will be covered mostly by the completion of the Melen System in its entirety.

The Melen System is divided into four stages and this project was the first stage (the amount of water supply capacity increased 268 million m^3/year). After the completion of the Melen System in its entirety, the supply of water will be increased to 1,077million m^3/year. As for the second stage, the Melen Dam is presently being constructed adjacent to the Melen intake weir by DSI and the pipeline is being constructed by ISKI. The Melen Dam is planned for completion in May, 2017. No major projects are being planned in the future in Istanbul, except for water resource development of the Melen River.

Furthermore this was a pioneering project at the first stage of the Melen System which was to essentially supply stable water to Istanbul into the future, and the effects of this project at the first stage were large.

As stated above, all of the indicators, except for water supply per capita were above the target; therefore the quantitative effects were mostly achieved.

Table 7 Demand-Supply Gap (Trial Calculation)

year	1990 (Actual)	2015 (Actual)	2035 (Estimation)
Amount of Water Supply Capacity (million m^3/year) (a)	654	1,293	2,102
Amount of water demand(million m^3/year) (b)	662	1,270	2,090
Demand-Supply Gap (a)-(b)	▲8	23	12

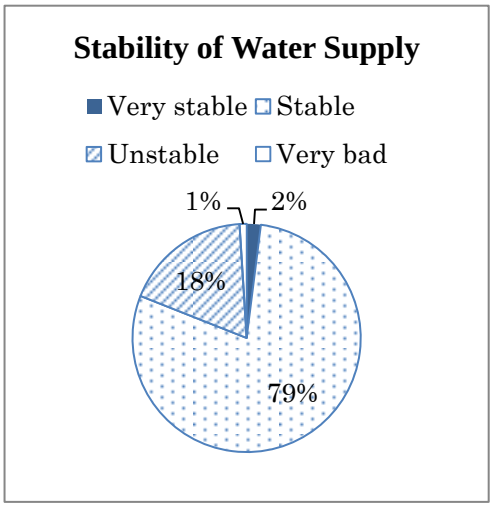
Source: Provided by JICA and the Executing Agency

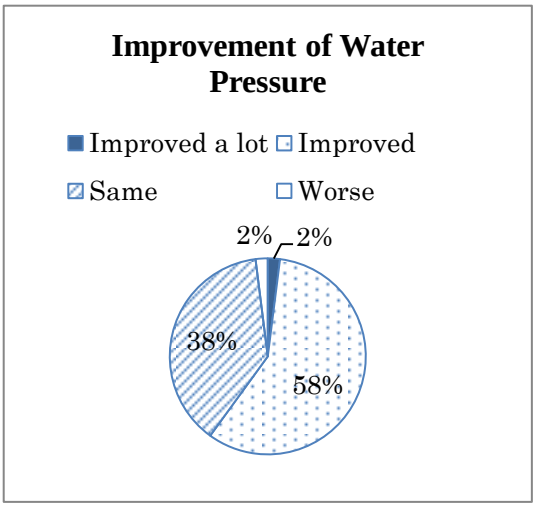
3.3.2 Qualitative Effects

The “Stability of water supply” as a qualitative effect, which means stable water

supply without suspension or lowering of water pressure, is interviewed in the beneficiary survey[12] and from its results one can conclude that the implementation of this project contributes to the stability of water supply.

From the beneficiary survey, 81% of interviewees responded that the water supply was "very stable" or "stable" (see Figure2), and as for the changes after this project, 61% of interviewees responded that there had been changes after the project. Furthermore, 93% of those who responded that there were changes claimed that the stability of the water supply had "improved a lot" or "improved". From these results it was confirmed that stability of water supply had improved through this project and it was stated that the project effect had been achieved.





Source: Beneficiary survey

Figure 2 Stability of Water Supply

Figure 3 Improvement of Water Pressure

Regarding water pressure, 60% of interviewees responded that it had "improved a lot" or "improved", whereas 38% responded that it remained the "same" (see Figure 3), and regarding the condition of water pressure, the total responses of "very good/excellent", "good", or "acceptable" comprised 91% of those interviewed. It was thought that even if there had been no change in the degree of improvement, the condition of water pressure is assumed to have been higher than the average level before the project.

[12] 100 interviewees by nonrandom selection of residents and shop owners (93 residents and 7 shop owners) who lived on the European side of Istanbul (4 areas: Fulya, Osmanbey, Kagithane, Besiktas) where water had been supplied by the Melen System were separately interviewed (25 interviewees from each area). The interviewees, i.e., residents and shop owners who lived there more than 20 years, were selected to ascertain the differences from before and after the project. The ratio of men to women was 60 to 40. The ages of interviewees were above 40 because they had lived there more than 20 years beyond adulthood. Examples of questions include the stability of water supply before and after the project implementation, the improvement and difference of water pressure, and the improvement of public hygiene.

3.4 Impacts

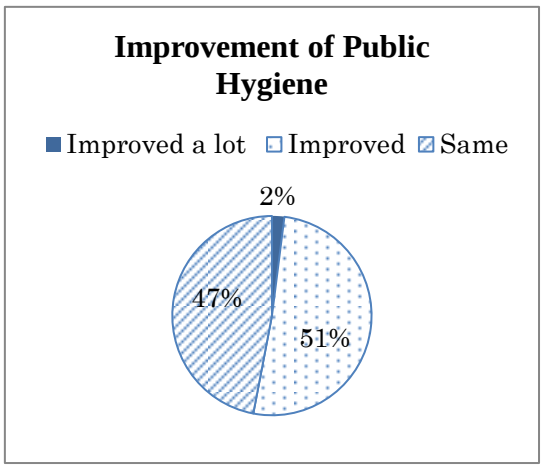
3.4.1 Intended Impacts

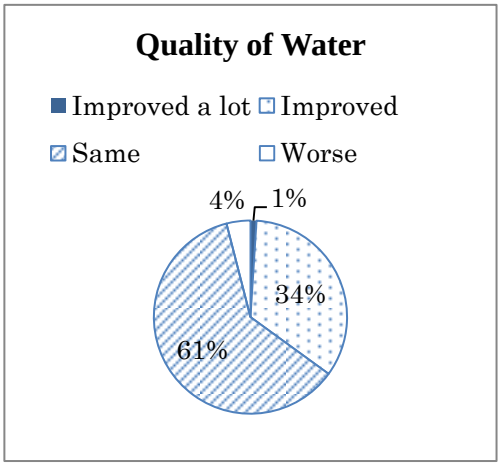
At the time of project appraisal, the intended effect of "improvement of public hygiene" was expected to be the impact of this project, so, the beneficiary survey was conducted to confirm the situation.

Regarding the improvement of hygiene, 53% of interviewees responded that hygiene conditions at home and in the community had "improved a lot" or "improved" whereas the rest of the respondents answered "same" (see Figure 4), and regarding the decrease of infections from waterborne diseases, 52% of interviewees responded that they had "decreased", 37% responded "don't know", and 11% responded that they had "not decreased".

Regarding the supply of safe water, 35% of interviewees responded that the quality of water had "improved a lot" or "improved" whereas 61% responded "same" (see Figure 5), and regarding the condition of the quality of water, the total responses of "very good/excellent", "good", or "acceptable" comprised 89% of those interviewed.

From these results it was thought that the improvement of public hygiene had been achieved and the improvement of water quality had also progressed.





Source: Beneficiary survey

Figure 4 Improvement of Public Hygiene

Figure 5 Quality of Water

Inferring a judgement of "hygienic status" for supplied water based on water conditions at the time of ex-post evaluation, the quality of Istanbul's water was within the standards set forth by Turkey and the Europe Community, and had no problems.

Table 8 The Condition of Water Quality in Istanbul

Parameter	Turkish Standard Value (TS 266) and the Europe Community's Standard Value	Kagithane Water Distribution Station	Cumhuriyet Treatment Plant
Turbidity	1.0	0.2	0.17
Total Trihalomethanes (μg/ℓ)	100	38.4	64.3
Aluminum (mg/ℓ)	0.200	0.123	0.045
Nickel (mg/ℓ)	0.02	0.001	0.004
Copper (mg/ℓ)	2.0	0.001	0.002
Iron (mg/ℓ)	0.2	＜0.005	0.059
pH	6.5-9.5	7.13	7.02

Source: Istanbul Water Quality Report (June 2015)

Cumhuriyet Water Treatment Plant

3.4.2 Other Impacts

3.4.2.1 Impacts on the Natural Environment

Although sediment outflow was suspected at the time of project appraisal and partial landslides occurred during the construction period, the project was completed without hindrance by making adjustment to the inclination of pipelines and using the foundation piles. As a countermeasure for underground water when burying pipes in the ground, a well-point method, which drained underground water by using vacuum pumping, was adopted and managed efficiently. According to DSI, there were no negative impacts to the natural environment neither during nor after construction. Also, no negative impacts to the natural environment were found during the site visit at the time of ex-post evaluation.

3.4.2.2 Land Acquisition and Resettlement

The resettlement of 517 residents and land acquisition for the construction of Alacali Dam were supposed at the time of project appraisal; however, the construction of the dam was canceled because of 1) the sudden rise of price in both the area surrounding the dam construction site and new lands resulted in difficulties for resettlement although fundamental agreements on the resettlement with the residents had already been arranged through public hearing and 2) the claim on the rights of clay-mining traders made it difficult to use the planned dam construction site due to the revised mining law. As a consequence of these results, although some sections of the grassland were acquired, there was no land acquisition accompanied by resettlement. Neither was there a resettlement without land acquisition. These were reconfirmed during the visit to all project sites at the time of ex-post evaluation.

3.4.2.3 Decrease of the Burden of Drawing Water for Women

At the time of project appraisal, communal wells, where women often drew water, were used depending on areas, including Istanbul, and water wagons came to some areas because of unstable water supply. Therefore the effect of decrease of burden for women drawing water was confirmed in the beneficiary survey. For the decrease of burden after the project, 53% of interviewees responded “yes”, 28% of them responded “don’t know” and 19% of them responded “no”. Considering the beneficiary survey, it was judged that there had been a positive impact on decreasing the burden for women drawing water.

Regarding the impacts of the project, the improvement of public hygiene and the supply of safe water were confirmed in the beneficiary survey. There were no negative impacts on the natural environment and there was no land acquisition accompanied by resettlement. The decrease of the burden for women drawing water was also achieved.

In light of the above, this project has largely achieved its objectives. Therefore effectiveness and impacts of the project are high.

3.5 Sustainability (Rating:③)

3.5.1 Institutional Aspects of Operation and Maintenance

DSI, the Executing Agency of this project, was established in 1954 as a government agency under the Ministry of Forestry and Hydraulic Works in order to develop and manage water resources and implement construction. ISKI was established in 1981 as a municipal agency of Istanbul in order to operate and maintain water and sewerage services in Istanbul. After completion of this project, facilities and equipment such as

the pumping station, the treatment plant and pipeline were transferred from DSI to ISKI, and ISKI has been in charge of O&M.

The O&M section of ISKI is divided into three departments, the Water Treatment Department, Water Distribution Department and Electric and Electronics Maintenance Department. The staff of each is 43, 20 and 51 respectively, totaling 114.

The roles of Water Treatment Department are to operate and maintain the treatment plan. Water Treatment Department is undertaking disinfection; maintenance of machines; repair and supplying parts for machines and equipment; maintenance of the water cleaning system.

The Water Distribution Department, which has a branch on both the Asian side and European side of Istanbul, takes charge of the maintenance and repair of the pipeline.

The Electric and Electronics Maintenance Department takes charge of the maintenance and repair of power transmission, machinery, and electric equipment.

Table 9 The Organization of Water Treatment Department, Water Distribution Department and Electric and Electronics Maintenance Department

As of December, 2015

Department	Breakdown of Engineers	Number of Persons
Water Treatment	Environmental engineer	2
	Electric and electronics engineer	2
	Mechanical engineer	1
	Machine technician	1
	Electrical technician	1
	Mechanical expert	10
	Electrical expert	8
	Electrical master	2
	Chlorine master	5
	Operator	11
	Subtotal	43
Water Distribution	Civil engineer	2
	Mechanical engineer	2
	Mechanical technician	2
	Electrical technician	2
	Management master	2
	Business worker	6
	Operator	4
	Subtotal	20
Electric and Electronics Maintenance	Engineer	3
	Technician	3
	Expert	14
	Qualified staff	31
	Subtotal	51
	Total	114

Source: Provided by the Executing Agency
Note: Breakdown of engineers is classified by the Executing Agency.

It was learned in the interview with ISKI that maintenance is performed through proper staff organization, so it could be concluded that staff organization for facility operations is suitable.

Control Room in the Treatment Plant

Sile Control Center

3.5.2 Technical Aspects of Operation and Maintenance

ISKI had already been operating and maintaining many treatment plants and pipelines, and had enough experience of operation, repair and maintenance for civil engineering facilities and electric facilities.

Through the interviews from ISKI and DSI, it was revealed that there were no technical problems with O&M among the technical staff members. They operated facilities by using manuals and were trained through OJT.

A categorized table of engineers for the Water Treatment Department, Water Distribution Department and Electric and Electronics Maintenance Department are shown in table 9, and each expert is arranged to each department according to its technical level. During the site visit at the treatment plant, several staff members were performing operational management properly through the use of the computer system, and the situation of it was confirmed to be stable.

Therefore, the standard skill level is judged to be good.

3.5.3 Financial Aspects of Operation and Maintenance

To evaluate the financial aspect, the revenues and expenditures of ISKI were analyzed.

The water tariff of ISKI (monthly by household) changes per every ten cubic meters of water used (0-10m^3: 3.90TL/m^3, 11-20m^3: 5.80TL/m^3, more than 21m^3: 8.30TL/m^3); thus, for example if an individual household used 22m^3 of water the tariff will become 113.6 TL[13]excluding VAT (equivalent to about 5,055 Japanese yen[14]) in January 2016.

The water tariff is applied for every year by ISKI to the Istanbul City Congress, the entity which imposes the tariff. Furthermore, it is adjusted every month to be consistent with the inflation rate reported by the State Statistics. The tariff recommended by ISKI

[13] 10 m^3x3.90+10 m^3x5.80+2 m^3x8.30=113.6TL

[14] 1TL=44.5Yen (average rate of 2015), Source: IMF ”International Financial Statistics; Yearbook”

to the congress was calculated with consideration for total costs, including maintenance costs, investment and an appropriate annual profit. Therefore stable revenue has been maintained every year.

The total revenues were 4.4 billion TL (196 billion yen) in 2015, an increase of 4.7% compared to the revenue of the previous year.

On the other hand, the contents of expenditures were capital investment and ordinary expenditures which met the revenue. Though the increase of loans granted temporarily created a balance deficit in 2015, there was no anxiety about cash-flow because the amount of current assets was ten times as much as the deficit.

After analysis of three years of balance sheets from 2013 to 2015, stable financial conditions were confirmed (in 2015 capital adequacy ratio was 84%, current ratio was 700% and fixed assets ratio was 78%), and it was thought that there would be no problems for future O&M (see Table 11).

Table 10 Revenues and Expenditures of ISKI

Unit : Million TL

Contents		2014	2015
Revenues	Operating income	3,802	3,930
	Other income	415	487
	Total	4,217	4,417
Expenditures	Personnel and Social Security	534	579
	Purchase of Goods and Services	771	878
	Capital Expenditures	1,884	1,848
	Loans Granted	400	800
	Other expenditures	455	609
	Total	4,044	4,714
Balance		173	-297

Source: Provided by the Executing Agency

Table 11 The Balance Sheet of ISKI

Unit: Million TL, %

	End of December,2013		End of December,2014		End of December,2015	
	Amount	Ratio	Amount	Ratio	Amount	Ratio
Current Assets	2,087	19.8	2,457	23.0	2,891	21.9
Fixed Assets	8,441	70.2	8,203	77.0	10,320	78.1
Total Assets	10,528	100.0	10,660	100.0	13,211	100.0
Current Liabilities	282	2.7	286	2.7	413	3.1
Fixed Liabilities	1,563	14.8	1,673	15.7	1,749	13.2
Net Assets	8,683	82.5	8,701	81.6	11,049	83.7
Total Liabilities and Net Assets	10,528	100.0	10,660	100.0	13,211	100.0

Source: Provided by the Executing Agency

A total of the annual budget for the Water Treatment Department, Water Distribution Department and Electric and Electronics Maintenance Department is described in Table 12. The amount is 71 million TL (about 3.2 billion Yen) for 2015. There is no problem with the amount, judging from ISKI's budget, and from a financial aspect, it can be inferred that O&M is stable.

Table 12 The Budget for Three Departments

Department	Amount of money (TL)*	Amount of money (Million Yen)**
Water Treatment	26,000,000	1,157.0
Water Distribution	1,400,000	62.3
Electric and Electronics Maintenance	44,000,000	1,958.0
Total	71,400,000	3,177.3

Source: Provided by the Executing Agency

Note*: Including labor costs

Note**: Converted rate 1 TL=44.50 Yen

3.5.4 Current Status of Operation and Maintenance

At the time of ex-post evaluation, current situations and issues of the facilities constructed through this project were checked through interviews and site visits, to confirm if the facilities are properly maintained. Regarding the condition of operational management, the facilities constructed through this project were being run well during the site visits from the Melen intake weir to Kagithane Water Distribution Station.

According to the interview with ISKI, the provision and improvement of the water distribution system such as the replacement of deteriorated water pipes had been conducted continuously and the actual unaccounted-for water rate and leakage rate had been improved. On top of that, it was said that a maintenance plan had been formulated and implemented. At the time of the site visit, it was confirmed that a constant provision of stable water, devoid of troubles, was realized. Regarding maintenance, it was performed referring to each manual daily, monthly and yearly, while action for needs of temporary repair was suitably taken.

The management of chemicals used at the treatment plant was confirmed to have been implemented properly according to the external evaluator's warehouse visit.

From the information provided through interviews and site visits, it was judged that proper O&M for the facilities of this project were implemented.

Based on the above, no major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance systems. Therefore sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

In this project, in order to provide a stable water supply to the residents of Istanbul, whose population had been increasing rapidly, the Melen intake weir was constructed to withdraw water from the Melen river, whose water source was in a mountainous region along the coast of the Black Sea 170 km east of Istanbul. In addition, a pipeline was constructed to the existing Kagithane Water Distribution Station and a treatment plant was also constructed. This project was consistent with the Turkish development plan and development needs, as well as with Japan's ODA policy, therefore the relevance of this project is high. With regard to the effectiveness of the project, the amount of water produced increased as well as the number of population to be served, and the percentage of population served became 100%, so the intended targets were achieved. In addition, an improvement in public hygiene was observed. As a whole, effectiveness and impact of the project are judged to be high. From the viewpoint of project implementation, the efficiency of the project is low because the project costs exceeded the plan due to inflation, and the project period significantly exceeded the plan due to a shortage in the budget, which was caused by the tight-financing policy of the Turkish government and the bankruptcy of a contractor influenced by the financial crisis triggered by Lehman's collapse. With respect to O&M, no major problems had been observed in the institutional, technical and financial aspects. Therefore sustainability of the project effects is judged to be high.

In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Presently at the second stage of the Melen project, Melen Dam, which is adjacent to the Melen intake weir, and the second pipeline parallel to the previously installed one are under construction. It is important to advance the construction effectively and efficiently by utilizing the experience such as the construction method used for countermeasures against groundwater during excavation of ground as was learned during the construction phase of laying pipes during the first stage of the project.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

"Considerations for information sharing and feedback for cases in which information from the executing agency and the implementing agency are different"

In this project, the executing agency was DSI and the implementing agency was ISKI, the entity to which water supply facilities were transferred from DSI; and, the information/data sharing and feedback systems for implementation management of this project between DSI, as a national agency, and ISKI, as a regional agency, were not conducted sufficiently because these two agencies were different organizations. Therefore the issues faced by ISKI in the O&M stage could not be made use of in the planning and construction of the facilities by DSI. If the sharing of information among related agencies were available, it would be useful for increasing learning opportunities and knowledge sharing for effective and efficient operation and management. Moreover, it could be expected that grasping and sharing the project's condition, could be beneficial for future policy-making, facilities construction and O&M. Actually, DSI and its competent authority, the Ministry of Forestry and Hydraulic Works, are aware of these issues, and are trying to solve them.

Therefore when JICA plans a similar project, it should confirm or try to support the creation of a system premised on the sharing of information and feedback between the competent authority and among related agencies when implementing a project.

The realization of jointly conducting monitoring and feedback of the progress, issues and effects of a project being implemented by related agencies, describing them thoroughly in progress reports, and evaluating them properly is thought to contribute to the improvement of human resource development and the capacity building in the policy-making and O&M of each agency.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1.Project Outputs		
Melen Intake Weir	Amount of Water Intake 8.5 m^3/second	As planned
Melen Pumping Station	4,500KW×6 units	As planned
Pipeline installation between Melen and Cumhuriyet	135.3km	158.3km
Cumhuriyet pumping station	1,450KW×5 units	2,500KW×6 units
Cumhuriyet treatment plant	Purification capability 700,000 m^3/day	Purification capability 720,000 m^3/day
Pipeline installation between Cumhuriyet and Kagithane	28.4km	20.4km
Bosphorus Tunnel	Total 3.0km	Total 5.5km
Energy supply	154KV 2 circuit distribution lines	As planned
Pipe production and supply	Pipeline between Melen and Cumhuriyet, and Pipeline between Cumhuriyet and Kagithane	As planned
Construction of Alacali Dam	Rockfill dam, height :63m	Canceled
Consulting Service	Tendering support, Detailed design, Construction management etc.	As planned

2.Project Period	November 1993- December 2001 (98 months)	November 1993- March 2015 (256 months)
3.Project Cost[15] Amount Paid in Foreign Currency	72,939million yen	93,832million yen
Amount Paid in Local Currency[16]	53,438million yen (Phase I: 1,664,874 m TL Phase II : 10,268,114m TL)	33,890million yen (526.7million TL)
Total	126,377million yen	127,722million yen
Japanese ODA Loan Portion[17]	94,783million yen	93,832million yen
Exchange Rate[18]		1TL ＝145.58yen (Average between January, 1997 and December, 2015[19])
Phase I	1US$ ＝126.35yen＝ 6875.1 TL (As of September 1992)	
Phase II	1US$ ＝106.30yen＝ 47,786.9 TL (As of February 1996)	

[15] Actual amount paid in foreign currency was calculated annually.
[16] The plan was before denomination and the currency was former TL
[17] The plan of the amount of Japanese ODA loan included local currency portion.
[18] The exchange rate of the plan is before denomination and the former TL. The exchange rate of the actual is used and calculated by annual average rate from 1997 to 2015, reflecting denomination for the whole period. Source: IMF ”International Financial Statistics; Yearbook”
[19] According to the Executing Agency materials, the payment of the project cost was paid from 1997 to 2015.