

FINANCIAL ANALYSIS

A. Introduction

1. The financial analysis assessed the financial viability of the energy efficiency project in the Takhiatash thermal power plant (TPP) in accordance with Asian Development Bank (ADB) guidelines.¹ The analysis was carried out by comparing with-project and without-project scenarios in real terms using 2013 prices. The financial internal rate of return (FIRR) was determined using incremental annual cash flows over 25 years of operations, discounted by the weighted average cost of capital (WACC). Sensitivity analysis was conducted to assess the impact of variance in conditions.

B. Major Assumptions

2. The project involves (i) building two combined-cycle gas turbine (CCGT) units with an installed capacity of 255 megawatts (MW) each; (ii) decommissioning three inefficient power plant turbines; (iii) implementing a 2-year capacity development program at Uzbekenergo, the state-owned power utility; and (iv) building a social center in the community of Takhiatash. Peripheral infrastructure construction and switchgear expansion are part of the project, which will ensure adequate fuel supply as well as the evacuation of the power generated by the Takhiatash TPP. It is assumed that both CCGT units will be in partial commercial operation by 2017 and in full operation by 2018.

3. The TPP is the main power supply source for the Karakalpakstan and Khorezm regions. Consumption from these two regions accounts for about two-thirds of total power generated by the TPP. The remainder of the power is exported to the national grid for national consumption. The TPP currently houses five turbines. Table 1 indicates the key features of the five turbines and the proposed CCGT units. The CCGT units will replace turbines 1, 2, and 3 and will serve as base-load power supply; whereas turbines 7 and 8 will be used for peak, emergency, and reserve loads until they reach technical obsolescence.

Table 1: Takhiatash Power Plant Generation

Turbine/ Unit	Capacity MW	Commission Year	Plant Factor ¹
1	100	1969	18%
2	100	1969	18%
3	110	1974	11%
7	210	1987	35%
8	210	1990	36%
2 CCGT units	510	2017	86%

CCGT = combined-cycle gas turbine, MW = megawatt.

¹ Plant factor is the average percentage of full capacity of the plant used over a period of time.

Sources: Uzbekenergo statistics; and estimates by the Asian Development Bank and the project preparatory technical assistance consultant.

4. The project costs and benefits were computed by comparing with-project and without-project scenarios. The without-project scenario assumes that Uzbekenergo continues to generate power with the existing five turbines until they reach their technical obsolescence of 45 years, which is expected to result in decreased production, high operating deficiencies,

¹ ADB. 2005. *Financial Management and Analysis of Projects*. Manila.

and higher maintenance costs. Under that scenario, turbines 1 and 2 will be retired by 2017, and turbine 3 will cease operation in 2020. The other two will continue to operate until 2033 (turbine 7) and 2036 (turbine 8) at higher maintenance costs.

5. **Project revenue.** The project will generate financial revenues from the sale of electricity and heat supply. Power demand from the Karakalpakstan and Khorezm regions is expected to grow at 3% per annum as a result of increasing industrial activities in the oil and gas industry.² Given transmission constraints, power exported to the national grid is assumed to remain at the level of 2012, which was 736 gigawatt-hours (GWh) per annum. The two CCGT units will therefore be operated as base load at full net capacity with a plant factor of 86%, to satisfy the power demand from both regions as well as the national grid via existing transmission infrastructure.

6. Electricity sales are based on the assumption of a real rate of growth in the consumer tariff of 0.5% per annum.³ The Ministry of Finance adjusts the consumer tariff semiannually in line with inflation and the cost of fuel to ensure cost recovery.

7. Potential carbon-offset income from the sale of carbon emission rights under the Clean Development Mechanism (CDM) is excluded from the FIRR calculation, although it is considered in the sensitivity analysis.

8. **Project costs.** The total cost of the project comprises (i) capital expenditures incurred during the 6-year construction period; (ii) decommissioning works; (iii) implementation supervision throughout the life of the project; (iv) capacity and social development consulting services; (v) annual operation and maintenance (O&M) during the life of the project, excluding financing charges; (vi) taxes and duties contributed by the government; (vii) provision for physical and price contingencies for the project; and (viii) financing charges during implementation.

9. There is a 3-month gap between the construction of the first and the second CCGT units. Decommissioning of turbines 1 and 2 begins upon completion of the first CCGT unit, whereas decommissioning of turbine 3 begins after the second CCGT unit is built to ensure continued and adequate power supply throughout the construction period. The O&M costs comprise a fixed-cost portion and a variable-cost component which is proportionate to the amount of power generation and includes mainly (i) fuel cost; (ii) water consumption; and (iii) spare parts, and equipment and machinery maintenance. As a result of higher efficiency, the CCGT units consume less gas and water, which results in lower O&M costs.

C. Weighted Average Cost of Capital

10. The WACC is calculated based on the amounts and financing terms offered by the financiers: ADB, the Uzbekistan Fund for Reconstruction and Development (UFRD), Uzbekenergo, and the government. The cost of ADB's loan from its ordinary capital resources (OCR) is based on the 10-year US dollar-denominated London interbank offered rate (LIBOR) fixed swap rate, plus a spread of 0.40% and a maturity premium of 0.10% per annum. Repayment of the ADB loan is spread across 25 years, including a grace period of 5 years.

² Demand growth statistics from Uzbekenergo for the two regions assume 3% annual growth, from 2,293 GWh in 2012 to 4,319 GWh in 2040.

³ Uzbekenergo's official forecast assumes a 10% annual rate of growth in local currency. The historical average suggests an average real rate of growth in the consumer tariff of about 5% per annum.

The financing cost of the UFRD loan is based on the same interest rate that applies to ADB's OCR loan, but with a 15-year repayment requirement including a 3-year grace period. The opportunity cost of Uzbekenergo's and the government's contributions is assumed to be at the Uzbekistan Central Bank's refinancing rate of 12%. The WACC is 0.8%. The domestic inflation rate is 9.5%, the income tax rate is 16.3%.

Table 2: Weighted Average Cost of Capital of the Project

Description	ADB OCR Loan	UFRD Loan	Uzbekenergo Own Fund	Government Equity	Total
A Weighting	42.9%	38.6%	5.1%	13.4%	100.0%
B Nominal cost	2.8%	2.8%	12.0%	12.0%	
C Tax rate	16.3%	16.3%	0.0%	0.0%	
D Tax-adjusted nominal cost	2.3%	2.3%	12.0%	12.0%	
E Inflation rate	1.9%	1.9%	9.5%	9.5%	
F Real cost	0.4%	0.4%	2.3%	2.3%	
G Weighted cost	0.2%	0.2%	0.1%	0.3%	0.8%
				WACC real terms	0.8%

ADB = Asian Development Bank, OCR = ordinary capital resources, UFRD = Uzbekistan Fund for Reconstruction and Development, WACC = weighted average cost of capital.

Source: Asian Development Bank estimates.

D. Financial Internal Rate of Return

11. The financial analysis of the project indicates that it is able to generate sufficient revenue to meet all costs—including O&M, depreciation, and debt servicing—while providing a FIRR of 6.6%, which is higher than the project WACC of 0.8%.

Table 3: Financial Internal Rate of Return Estimates

(\$ million)

Year	Incremental Electricity	Fuel Savings	Capital Expenditure	Operational Outflow	Net Cashflow
2014	0	0	(1)	(3)	(3)
2015	0	0	(47)	(3)	(49)
2016	0	0	(71)	(3)	(74)
2017	58	2	(259)	(28)	(226)
2018	64	16	(104)	(48)	(72)
2019	62	17	(65)	(47)	(33)
2020	79	12	0	(52)	38
2021	79	12	0	(52)	39
2022	79	12	0	(64)	27
2023	79	12	0	(63)	28
2024	79	12	0	(62)	29
2025	80	12	0	(61)	30
2026	80	12	0	(60)	32
2027	80	12	0	(59)	33
2028	81	12	0	(58)	35
2029	81	12	0	(57)	36
2030	81	13	0	(56)	37
2031	82	13	0	(55)	39
2032	82	13	0	(54)	40
2033	131	6	0	(72)	65
2034	132	6	0	(71)	66
2035	132	6	0	(70)	68
2036	176	0	0	(86)	90
2037	176	0	0	(85)	92
2038	177	0	0	(84)	94
2039	178	0	0	(83)	96
2040	179	0	0	(82)	97
2041	180	0	0	(84)	96

FIRR**6.6%**

FIRR = financial internal rate of return.

() = negative

Source: Asian Development Bank estimates.

E. Sensitivity Analysis

12. A sensitivity analysis was carried out to examine the impact on the FIRR from adverse changes in key variables. Four variables were considered for the analysis: (i) a 20% increase in capital costs; (ii) a 20% increase in O&M costs; (iii) a 20% decrease in revenues; and (iv) inclusion of proceeds from the sale of CDM rights. In each scenario, the estimated FIRR exceeds the WACC, confirming the financial viability of the project.

Table 4: Financial Results of Sensitivity Analysis of the Project

Item	FIRR (%)
Base case	6.6%
Increase in capital costs by 20%	5.0%
Increase in O&M costs by 20%	5.6%
Decrease in revenues by 20%	1.7%
Including CDM Benefits	6.6%

CDM = clean development mechanism, FIRR = financial internal rate of return.

Source: Asian Development Bank estimates.