FINANCIAL ANALYSIS

A. Introduction

1. The financial analysis assessed the financial viability of the Jamshoro Power Generation Project in Sindh province of Pakistan in accordance with Asian Development Bank (ADB) guidelines.[1] The analysis was conducted in real terms using 2013 prices. The financial internal rate of return (FIRR) was determined using incremental annual cash flows over 30 years, discounted by the weighted average cost of capital (WACC). A sensitivity analysis was conducted to assess the impact of changes in conditions.

2. Pakistan suffers from continuing power shortages and relies heavily on expensive imported oil for power generation. The gap between the supply and demand for electricity reached about 6,620 megawatts (MW) in 2012.[2] One cause of the power deficit is the unsustainable power generation mix, with 34% of power generated using imported oil, which results in high generation costs. Acute load shedding has directly impacted the national economy, constraining annual gross domestic product (GDP) growth by at least 2%.

3. The project aims to address the existing and anticipated gap between the demand for and supply of power in Pakistan by introducing more efficient generation infrastructure that will lower generation costs. The project comprises (i) construction of one 600-MW supercritical coal-fired power unit with adequate emission control devices at the Jamshoro thermal power station (TPS)[3]; (ii) a training program for coal-fired power plant operation; (iii) a fixed-term 5-year operation and maintenance (O&M) service contract for O&M (inclusive of spare parts) of the 600-MW supercritical coal-fired power unit; and (iv) installation of emission control devices for existing power units at Jamshoro TPS, and remediation of the site. Existing peripheral infrastructure, including transmission capacity and access to transportation, have been reviewed and are considered sufficient for power evacuation.

B. Major Assumptions

4. The company Jamshoro Power Company Limited (JPCL) operates the Jamshoro TPS and Kotri gas thermal power station (GTPS) with a total installed capacity of 994 MW; of this, 850 MW are contributed by the four Jamshoro TPS units. Although units 2–4 were designed as dual-thermal power generation units, heavy fuel oil (HFO) has been the main input for power generation as a result of a shortage of gas that began in 2010.

Table 1: Jamshoro Thermal Power Station Power Generation

Jamshoro TPS	Installed Capacity (MW)	Commission Year	Thermal Efficiency (Design)	Fuel Input
Unit 1	250	1990	36.6%	HFO
Unit 2	200	1990	33.9%	Natural Gas/HFO
Unit 3	200	1990	33.9%	Natural Gas/HFO
Unit 4	200	1991	33.9%	Natural Gas/HFO
1 supercritical unit	600	2019	40.9%–41.5%[a]	Coal
Total	**2,050**			

HFO = heavy fuel oil, MW = megawatt, TPS = thermal power station.
[a] Efficiency is 40.87% for a coal blend of 80% sub-bituminous and 20% lignite, and 41.5% for 100% bituminous.
Source: Jamshoro Power Company Limited data and Asian Development Bank estimates.

[1] ADB. 2005. *Financial Management and Analysis of Projects.* Manila.
[2] National Transmission and Despatch Company. 2013. *Electricity Demand Forecast. 2013*. Islamabad.
[3] The Government plans to install another 600-MW unit with identical specifications as the project in Jamshoro TPS.

5. The 600-MW supercritical unit will use a blend of imported sub-bituminous coal and domestic lignite (when available) to generate power. The new unit will be more efficient and have a lower generation cost, and is expected to increase the amount of reliable power supplied to the national grid, and alleviate JPC's financial burden. The design of the supercritical unit will allow for the use of a blend of indigenous (Thar) and imported coal. Thar coal can make up to 20% of total fuel input if unprocessed, and can account for a higher percentage if processed.

6. The project costs and benefits were computed by comparing the "with-" and "without-project" scenarios. The without-project scenario assumes that JPCL continues to generate power with the existing four units until they become technically obsolete. The with-project scenario includes the new supercritical unit. It is assumed that JPCL will continue to rely on HFO as a fuel input for the existing units; as the facilities age, maintenance cost will increase, while operating efficiency decreases.

7. **Project revenue**. Incremental revenues to be generated by JPCL as a result of the project include sales of electricity to the National Transmission and Despatch Company (NTDC). Given the significant gap between power demand and supply, the analysis assumed that there would be demand for the additional power generated by the new supercritical unit, excluding system losses, and that it would be consumed.

Table 2: Key Assumptions and Parameters in Tariff Calculation for a 600 Megawatt Coal-Fired Power Generation Unit

Component		Assumptions and Parameters	
		NEPRA	The project
A.	**Capital Cost**	$702 million	$1,173 million
B.	**Construction Period**	48 months	60 months
C.	**Financing Terms**		
	Debt–Equity Ratio	75:25	70:30
	Financial Charges (local)	KIBOR 11.91% plus 350 basis points	Different rates assumed[a]
	Financial Charges (foreign)	LIBOR 0.45% plus 450 basis points	
	Repayment Terms	10 years (from commissioning)	Repayment Schedule in line with respective loan terms[b]
	Repayment Mode	Annuity	Customized
	Return on Equity	Local coal: 20% Imported coal: 17% Mix: weighted avg	17.6%[c]
D.	**Efficiency**	42%	40.30%
E.	**Coal Price**		
	Imported (weighted avg)	$119.6/mt	$120.6/mt[d]
	Local	$103.2/mt	
F.	**O&M Costs**		
	Fixed O&M	Rs0.287/kWh	Local: Rs0.287/kWh Foreign: Rs0.287/kWh
	Variable O&M	Rs0.114/kWh	Local: Rs0.114/kWh Foreign: Rs0.035/kWh
	Insurance	1% of CAPEX	1% of CAPEX
G.	**Other Operating Parameters**		
	Plant Factor	60%	80%

ADB = Asian Development Bank, CAPEX = capital expenditure, LIBOR = London Interbank Offered Rate, mt = million tons, NEPRA = National Electric Power Regulatory Authority, O&M = operation and maintenance.

[a] LIBOR (1.198%) plus 4.50% for ADB OCR loan amounting $840 million (OCR Loan 1) and IDB loan; 15% for ADB OCR loan amounting $30 million (OCR Loan 2) and ADF loan.

[b] 30 years inclusive of 5-year grace for OCR Loan 1 and 20 years inclusive of 10-year grace for OCR Loan 2; 25 years with 5-year grace for ADF loan; and 20 years with 5-year grace for IDB loan.

[c] Assumes an 80:20 blend of imported and local coal as input fuel.

[d] The price of local coal is estimated to be equal to the price of imported coal, in $ per million British thermal units.

Source: National Electric Power Regulatory Authority data and Asian Development Bank estimates.

8. A separate tariff would be proposed and a petition filed for the new unit(s) based on the recently announced National Electric Power Regulatory Authority (NEPRA) guideline on the upfront tariff calculation methodology for coal-fired power plant projects. The new guideline provides for projects of 200 MW, 600 MW and 1,000 MW net capacity, with a menu of predetermined assumptions including construction period, financing terms, project costs and other operational parameters, and this calculation methodology was used in the analysis. However, because the project differs from NEPRA's predetermined parameters in several ways—for example, it has a higher interest rate and a longer construction period—the blended tariff of PRs8.88 per kWh is higher than NEPRA's upfront tariff (Table 2).

9. The proposed tariff schedule and formula was applied to the 25-year operating period, with the assumptions that (i) NEPRA will approve the proposed tariff for the 25-year period; and (ii) the government will agree to, for the main construction cost of the project apply an on-lending interest rate of LIBOR plus 450 basis points (bps) instead of the standard government on-lending interest rate of 15%, because NEPRA has allowed the interest rate of LIBOR plus 450 bps to be passed through as part of the approved tariff. This will allow for JPC to compete with independent power producers.[4]

10. **Project costs**. The cost of the project includes: (i) preparation of the land for the new supercritical unit, (ii) capital costs incurred during the construction period, (iii) installation of bioremediation and emission control measures, (iv) implementation consulting services, (v) out-sourced O&M costs in the form of a 5-year O&M service contract, (vi) capacity development and training for JPC staff, (vii) taxes and duties contributed by the government, and (viii) physical and price contingencies.

11. The project has an implementation period of 10 years. Land preparation and environmental remediation of the site will take place prior to the construction of the supercritical unit. Emission control devices are to be installed for both the new unit and existing units (the latter as a retrofit), with costs covered by the new unit and the existing unit tariffs, respectively. JPC will enter into a 5-year O&M service contract for the O&M work of the supercritical unit, from commissioning, to ensure the optimal operation of the new unit and generation of the desired benefits.

C. Weighted Average Cost of Capital

12. The weighted average cost of capital (WACC) is calculated based on the contributions and financing terms of the various financiers, including ADB, the Islamic Development Bank (IDB), and the Government of Pakistan. ADB financing comprises two components: ordinary capital resources (OCR) and special capital resources from the Asian Development Fund (ADF). The OCR financing is split into two loans ($840 million as OCR Loan 1 and $30 million as OCR Loan 2). Interest on the ADB OCR Loan 1 and IDB financing was calculated based on the London Interbank Offered Rate 10-year fixed-swap rates plus 450 bps. The interest amount of ADB OCR Loan 2 and the ADF loan was calculated based on the government on-lending rate of 15%. The government's opportunity cost for its equity contribution is assumed to be the government required rate of return for energy generation projects of 17.5%. The WACC is 6.7%. The domestic inflation rate is 8.5%, and the international inflation rate 1.9%. No tax rate was assumed as for JPC taxes are passed through onto customers of electricity under the reimbursement arrangement with the Central Power Purchasing Agency.

[4] If the onlending rate remains at 17%, this would result in a tariff of PRs14/kWh.

Table 3: Weighted Average Cost of Capital of the Project

Description	ADB OCR Loan 1	ADB OCR Loan 2	ADB ADF Loan	IDB Loan	Government Equity	Total
Weighting	56.0%	2.0%	2.0%	10.0%	30.0%	100.0%
Nominal cost	7.7%	15.0%	15.0%	7.7%	17.5%	
Tax rate	0.0%	0.0%	0.0%	0.0%	0.0%	
Tax adjusted nominal cost	7.7%	15.0%	15.0%	7.7%	17.5%	
Inflation rate	1.9%	1.9%	1.9%	1.9%	8.5%	
Real cost	5.6%	12.9%	12.9%	5.6%	8.3%	
Weighted cost	3.2%	0.1%	0.1%	0.6%	2.5%	**6.7%**

ADB = Asian Development Bank, OCR = ordinary capital resources , IDB = Islamic Development Bank.
Source: Asian Development Bank estimates.

D. Financial Internal Rate of Return

13. The project FIRR is 8.7%, which is higher than the project WACC of 6.7%.

Table 4: Financial Internal Rate of Return Estimates ($ million)

Year	Capital Cost	Fuel Cost	O&M	Total Revenue	Net Benefit
2014	(1.7)	0.0	0.0	0.0	(1.7)
2015	(275.4)	0.0	0.0	64.0	(211.4)
2016	(373.5)	0.0	0.0	64.0	(309.5)
2017	(457.9)	0.0	0.0	32.0	(425.9)
2018	(172.8)	0.0	0.0	0.0	(172.8)
2019	(1.9)	(190.0)	(20.4)	356.2	143.8
2020	(1.9)	(190.0)	(20.4)	353.8	141.4
2021	(1.9)	(190.0)	(20.4)	351.4	139.1
2022	(1.9)	(190.0)	(20.4)	349.0	136.7
2023	(1.9)	(190.0)	(20.4)	346.6	134.3
2024	0.0	(190.0)	(20.4)	350.7	140.3
2025	0.0	(190.0)	(20.4)	348.3	138.0
2026	0.0	(190.0)	(20.4)	346.0	135.6
2027	0.0	(190.0)	(20.4)	343.6	133.2
2028	0.0	(190.0)	(20.4)	341.2	130.8
2029	0.0	(190.0)	(20.4)	335.9	125.5
2030	0.0	(190.0)	(20.4)	333.2	122.8
2031	0.0	(190.0)	(20.4)	330.6	120.2
2032	0.0	(190.0)	(20.4)	327.9	117.5
2033	0.0	(190.0)	(20.4)	325.3	114.9
2034	0.0	(190.0)	(20.4)	314.7	104.3
2035	0.0	(190.0)	(20.4)	312.6	102.2
2036	0.0	(190.0)	(20.4)	310.5	100.1
2037	0.0	(190.0)	(20.4)	308.4	98.0
2038	0.0	(190.0)	(20.4)	306.3	95.9
2039	0.0	(190.0)	(20.4)	261.9	51.6
2040	0.0	(190.0)	(20.4)	259.9	49.5
2041	0.0	(190.0)	(20.4)	257.8	47.4
2042	0.0	(190.0)	(20.4)	255.7	45.3
2043	213.5	(190.0)	(20.4)	253.6	256.8
	(1,077.4)	(4,749.8)	(510.0)	8,140.9	1,803.8
Financial Internal Rate of Return					**8.7%**
Financial Net Present Value@Weighted Average Cost of Capital ($ million)					**802.4**

( ) = negative, O&M = operation and maintenance.
Source: Asian Development Bank estimates.

E. Sensitivity Analysis

14. A sensitivity analysis was carried out to assess the robustness of the FIRR (Table 5). In each scenario, the estimated FIRR exceeds the WACC, confirming the financial viability of the project. However, the financial net incremental benefit of the project is highly sensitive to revenue variation, mainly because the determined tariff allows only for cost recovery and a minimal profit margin. The analysis shows the project may not recover costs with a 10% decrease in assumed revenues, making it vital to secure a cost-recovery tariff to ensure the project's financial sustainability. The FIRR for two coal-fired power units is 10.4%.

Table 5: Financial Results of Sensitivity Analysis of the Project

Item	FIRR (%)
Base case	8.7%
Increase in capital costs by 10%	7.6%
Increase in operation and maintenance costs by 10%	8.5%
Decrease in revenues by 10%	5.5%
Two supercritical coal-fired units built	10.1%

FIRR = financial internal rate of return.
Source: Asian Development Bank estimates.