

FINANCIAL ANALYSIS

A. Introduction

1. The financial evaluation of the proposed investments was carried out in accordance with the Asian Development Bank (ADB) Guidelines for the Financial Management and Analysis of Projects (2005)¹ and the Financial Analysis and Evaluation, Technical Guidance Note (2019).² The financial evaluation covers six subprojects of tranche 4: (i) subproject 1 is the turnkey contract for the design, supply, installation, testing, and commissioning of approximately 70 km of 220kV double circuit transmission line for looping in/out of the proposed Hala Road-Jamshoro single circuit transmission line at 220kV Mirpur Khas New substation; (ii) subproject 2 is the turnkey contract for the design, manufacture, supply, installation, testing, and commissioning of approximately 20 km of 220kV double circuit transmission line for looping in/out one circuit of the existing 220kV Jamshoro - T.M. Khan double circuit transmission line at Hala Road 220kV Substation; (iii) subproject 3 is the procurement of goods for the addition and augmentation of the six existing grid substations (GS) to remove NTDC system constraints (500kV Dadu GS, 500kV Faisalabad West GS, 500kV Lahore (Sheikhpura) GS, 500kV New Multan GS, 500kV Rahim Yar GS, 220kV Guddu GS); (iv) subproject 4 is the procurement of goods for the construction of a new 220kV Jamrud grid station and approximately 20 km of the associated 220V Jamrud-Sheikh Muhammadi transmission line in the south-western area of Pakistan; (v) subproject 5 involves the procurement of goods for the construction of about 105 km of 220kV Dharki – Rahim Yar and about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and the extension of 220kV Dharki, 500/220kV Rahim Yar Khan, and 220kV Bahawalpur substations for interlinking of 220kV Dharki – Rahim Yar Khan and Bahawalpur grid stations in the south-eastern area of Pakistan; and (vi) subproject 6 involves procurement of goods for operation and maintenance of NTDC assets to reduce the substations breakouts (550kV, 245kV, and 145kV circuit breakers and replacement of one 500/220 kV, 450 MVA Auto Transformer Bank (ATB) at the existing 500 kV Rawat grid station.

B. Methodology and Major Assumptions

2. Cost streams used to determine the financial internal rate of return (FIRR) include capital costs (excluding price contingencies and interest during implementation), O&M costs, and taxes and duties. The costs comprised land development, civil works, equipment, incremental O&M costs, engineering consulting and project management costs as applicable to the outputs and subprojects, contingencies, and taxes and duties. The weighted average cost of capital (WACC) was calculated and compared with the FIRR to ascertain financial viability. The anticipated capital mix of debt-to-equity was used for estimating the WACC. The sensitivity of the FIRR to adverse changes in the underlying assumptions was also assessed.

3. The financial benefits of the projects comprise the incremental electricity transmitted through higher capacity transmission assets. The incremental electricity transmitted has been valued at the applicable use of system charge.³

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

² ADB. 2019. *Financial Analysis and Evaluation, Technical Guidance Note*. Manila.

³ National Electric Power Regulatory Authority (NEPRA). *Tariff Determination TRF-533, November 4, 2021*. The NTDC filed a review motion and the NEPRA decision is awaited. For the purpose of the calculations in this report, an average of the current tariff (PRs176.16) and the petitioned tariff (PRs315.80) have been used.

C. Weighted Average Cost of Capital

4. The WACC was calculated in real terms, considering loans to the government from ADB's ordinary capital resources, which will be onlent to the NTDC on the same terms and conditions of that between ADB and the government. The domestic annual inflation rate was assumed to be 8.1% for the local currency components. The return on the NTDC equity and internal funds was estimated at 15.6%, equivalent to current 3M Kibor (as of September 2022). Table 1 shows the calculation of the WACC.

Table 1: Weighted Average Cost of Capital

Financial component	ADB Loan	NTDC Self-Financing	Total
A. Amount (US\$ million)	162.0	68.0	230.0
B. Weighting	70.4 %	29.6 %	100%
C. Nominal cost	6.5 %	15.6 %	
D. Income tax rate	29.0 %	29%	
E. Tax-adjusted nominal cost [D x (1 - E)]	4.6 %	11.1 %	
F. Inflation rate	2.6 %	8.1 %	
G. Real cost $[(1+F) / (1+G) - 1]$	1.9 %	2.8 %	
H. Minimum rate test (I = 0%)	1.9 %	2.8 %	
I. Weighted component of WACC	1.4 %	0.8 %	
Weighted Average Cost of Capital			2.2 %

ADB = Asian Development Bank, NTDC = National Transmission and Despatch Company Limited, WACC = weighted average cost of capital.

Source: ADB.

D. Financial Internal Rate of Return

5. The NTDC financial benefits are based on its transmission charge. The determination of transfer and wheeling charges by the National Electric Power Regulatory Authority (NEPRA) provides for a two-part tariff, comprising a fixed charge and a variable charge. The fixed charge (expressed in Pakistan rupees [PRs] per kilowatt [kW] per month) of PRs245.6/kW/month for the year 2022 is applicable on the maximum demand indicator value in kW for the billing period for the specific market participant. The use of the system variable tariff (expressed in PRs per kilowatt-hour [kWh]) is applicable to the energy transferred to the market participant during the billing period multiplied by a Losses and Load factor for adjustment of losses and load imposed on the market system. Benchmarks for the Losses and Load factor have not been determined, so the variable charges are currently not applied. NEPRA has determined that a Losses and Load of unity will be applied until it determines benchmarks.

6. **Subproject 1: 220kV double circuit transmission line for looping in/out of the proposed Hala Road-Jamshoro single circuit transmission line at 220kV Mirpur Khas New substation.** The project involves investments in the construction of a new 70 kilometer (km) long, 220 KV double-circuit transmission line on twin bundle rail conductor for looping in/out of the proposed Hala Road–Jamshoro 220 kV single-circuit transmission line at Mirpur Khas New. The project will uprate existing system voltage profile to acceptable conditions, meet growing demand of Hyderabad Electric Supply Company (HESCO) customers, improve system reliability and voltage profile, and reduce transmission loss. The financial benefits from the investments are the incremental electricity wheeled through the higher capacity created, estimated at 225 megawatts (MW) in 2026 and stabilizing at 274 MW in 2036, to which transmission losses of 3.0% have been applied.

7. Cash flows for subproject 1 were estimated assuming an O&M cost of 1.0% of total investment. The FIRR of subproject 1 is 11.75%.

8. **Subproject 2: 220kV double circuit transmission line for looping in/out one circuit of the existing 220kV Jamshoro - T.M. Khan double circuit transmission line at Hala Road 220kV Substation.** The project consists of construction of a 20 km long, 220 kV double-circuit transmission line for looping in/out of one circuit of the existing Jamshoro–T. M. Khan 220 kV double-circuit transmission line at Hala Road 220 kV substation. This line provides the second source to 220 kV Hala Road substation for improvement in reliability of transmission network in the area. Complimenting subproject 1, the project will uprate existing system voltage profile to acceptable conditions, meet growing demand of HESCO customers, improve system reliability and voltage profile, and reduce transmission loss. The financial benefits from the investments are the incremental electricity wheeled through the higher capacity created, estimated at 225 MW in 2026 and stabilizing at 274 MW in 2036, to which transmission losses of 3.0% have been applied.

9. Cash flows for subproject 2 were estimated assuming an O&M cost of 1.0% of total investment. The FIRR of subproject 2 is 12.46%.

10. **Subproject 3: procurement of goods for the addition and augmentation of the six existing grid substations (GS) to remove NTDC system constraints.** The project consists of the procurement of material for asset management (GSO) of the NTDC, like transformers and circuit breakers, etc., for the removal of system constraints. With increasing power demand of the distribution companies (DISCOs) in the recent years, a number of existing 500/220 kV and 220/132 kV transformers of the NTDC system have become overloaded. To enhance the NTDC system capacity, six of the existing grid stations have been planned to be augmented to meet the power demand of the DISCOs. A total of 2,680 megavolt-amperes (MVA) capacity will be added to provide quick relief to the overloaded transformers of the NTDC system. The augmentation will also help in reducing transmission losses. The augmentation will add around 720 MW in 2026 that will stabilize at 878 MW by 2036.

11. Cash flows for subproject 3 were estimated assuming an O&M cost of 1.0% of total investment. The FIRR of subproject 3 is 9.18%.

12. **Subproject 4: procurement of goods for the construction of a new 220kV Jamrud grid station and approximately 20 km of the associated 220V Jamrud-Sheikh Muhammadi transmission line.** The project involves investments in the construction of a new 220 KV switchyard at the existing 132 kV Jamrud substation with 2x250 MVA 220/132 kV transformers, extension of two 220 kV line bays at existing 500 KV Peshawar (Sheikh Muhammadi) and construction of a 20 km long, 220 KV double-circuit transmission, twin bundle, rail conductor lines from Jamrud to 500 kV Peshawar. The project will result in improvement in power supply position at/around 220 kV Jamrud Grid Station, improvement in voltage profile of existing 132 kV grid stations in the vicinity of 220 kV Jamrud Grid Station, increase in the system capacity to meet future load demand of Peshawar Electric Supply Company (PESCO) and Tribal Areas Electric Supply Company (TESCO), reduction in loading of 220/132 kV transformers at Peshawar and Shahibaug Grid Stations, reduction in the loading of 132 kV transmission lines in the vicinity of proposed 220 kV Jamrud, increase in the available system capacity to meet future load growth at/around proposed project and reduction in transmission system losses. The financial benefits from the investments are the incremental electricity wheeled through the higher capacity created, estimated at 353 MW in 2026 and stabilizing at 390 MW in 2036 and afterwards, to which transmission losses of 3.0% have been applied.

13. Cash flows were estimated assuming an annual O&M cost of 1.0% of the investment. The FIRR of subproject 4 is 7.42%.

14. **Subproject 5: Interlinking of 220 kV Dharki–Rahim Yar Khan and Bahawalpur Grid Stations.** The project involves procurement of goods for the construction of about 105 km of 220kV Dharki – Rahim Yar and about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and the extension of 220kV Dharki, 500/220kV Rahim Yar Khan, and 220kV Bahawalpur substations for interlinking of 220kV Dharki – Rahim Yar Khan and Bahawalpur grid stations. The proposed project will provide an alternate source of supply during contingency conditions and will also provide the facility for resynchronization during system collapse on 500 kV transmission network between north and south. The NTDC experienced partial power system collapse in the southern region, whereby all 500 kV links experienced disconnection because of severe weather conditions resulting in isolation of the NTDC network. The collapse of the 500 kV towers in some of the southern wind corridors has also been reported in the past, leading to islanding of the system in two parts. The isolation normally causes a lot of fluctuations in system frequency in both the islands. Normally, the northern part experiences low frequency requiring reduction in demand, whereas the southern area experiences high frequency due to less connected demand. The NTDC has also faced issues in resynchronizing the grid. The link will be useful for system operational needs under severely degraded conditions of the network and islanding cases, where it will support in resynchronizing requirements between northern and southern links at this specific location. Based on the recommendations of the system studies, the NTDC has planned incumbent 220 kV links to overcome these technical problems and constraints. The new line will increase the transmission capacity from 561 MW in 2026 to 620 MW in 2036, and stay constant thereafter at 620 MW. These are important circuits that provide back-up to 500 kV transmission lines from the southern power generation hub of the transmission system to the mid-country load centers. Regardless of their financial viability, these lines are essentially required in the system to provide network safety, stability, and security; maintain power quality and voltage profiles; promote grid code compliance for reliability (N-1 and N-2 contingencies); and remove system constraints such as transmission lines and transformation bottlenecks for feeding into the DISCOs network.

15. Cash flows were estimated assuming an annual O&M cost of 1.0% of the investment. The FIRR of subproject 5 is 5.14%, above the WACC of 2.2%.

16. **Subproject 6: procurement of goods for operation and maintenance of NTDC assets to reduce the substations breakouts (550kV, 245kV, and 145kV circuit breakers and replacement of one 500/220 kV, 450 MVA Auto Transformer Bank (ATB) at the existing 500 kV Rawat grid station.** The project consists of the procurement of a 450 MVA 500/220 kV transformer at 500 kV grid station at Rawat, Rawalpindi. The 500 kV Rawat Grid Station is a very critical component of the NTDC transmission system, feeding into the twin cities of Rawalpindi and the Federal Capital Islamabad. The existing installed 500/220 kV transformer was damaged beyond repair and this refurbishment was necessary. The benefits of the subproject will start at 724 gigawatt-hours (GWh) in 2026 to gradually increase to 955 GWh by 2036 and stabilizing at 936 GWh afterwards.

17. Cash flows for subproject 6 were estimated assuming an O&M cost of 1.0% of total investment. The FIRR of subproject 6 is 9.49%.

18. **Overall evaluation of tranche 4.** Tranche 4 is financially viable, with the FIRR of 8.13% exceeding the WACC of 2.2%. The net present value is PRs57,625 million. The project is on the high priority for government for its objective of improving the economic conditions in the current underprivileged state of the feeding area.

19. **Sensitivity analysis.** Sensitivity analysis was carried out on the FIRR by changing the values of key variables. Since the FIRR values easily exceeded the WACC rate for the tranche as a whole, only adverse changes were considered. A 10% increase in investment cost, a 20% increase in production and O&M costs, and a 10% decrease in benefits were tested. Table 2 shows the effects on the FIRR. The financial performance of subproject 1, subproject 2, subproject 3, subproject 4, subproject 5, and subproject 6, and the tranche as a whole are robust for all the sensitivities tested.

Table 2: Sensitivity Analysis

Sensitivity Parameters	Change in Variable	NPV	FIRR	SV
Base Case		57,625	8.13 %	
Decrease in Revenue	-10%	43,197	6.85 %	2.50
Construction Delay	1 year	50,627	7.08 %	1.21
Increase in Project Cost	+10%	52,872	7.30 %	0.82
Increase in O&M Cost	+10%	56,566	8.04 %	0.18

FIRR = financial internal rate of return, NPV = net present value, O&M = operation and maintenance, PRs = Pakistan rupee, SV = schedule variance.

Source: Asian Development Bank.

20. **Conclusion.** The financial evaluation was carried out as per ADB's Guidelines for the Financial Management and Analysis of Projects, and Technical Guidance Note on Financial Analysis and Evaluation. The project is financially viable with an FIRR of 8.1%, which is higher than the WACC of 2.2%. A sensitivity analysis found that the project's financial viability remained robust despite (i) decrease in revenue of 10% (FIRR 6.9%), (ii) 1 year construction delay (FIRR 7.1%), and (iii) a 10% increase in project cost (FIRR 7.3%).