

FINANCIAL ANALYSIS

A. Introduction

1. The first-batch subprojects under the proposed Chemical Industry Energy Efficiency and Emission Reduction financial intermediary loan project were selected against a set of technical criteria.¹ The financial viability criteria were:

- (i) estimated subproject investment and operating costs, as well as cash inflows, that were clearly presented and reasonable;
- (ii) a financial internal rate of return (FIRR) greater than the weighted average cost of capital (WACC);
- (iii) a robust FIRR under various sensitivity scenarios, such as (a) a cost overrun of 10%, (b) an implementation delay of 1 year, (c) a 10% increase in operation and maintenance (O&M) costs, and (d) a 10% reduction in sales revenues;
- (iv) a payback period matching the repayment period; and
- (v) an average debt service coverage ratio of at least 1.2.

2. The financial analysis of the first batch of subprojects conformed to Asian Development Bank (ADB) guidelines for the financial management and analysis of projects.² Incremental financial costs and benefits were assessed through a comparison of with-project and without-project scenarios for each of the two subprojects and then for the project as a whole, to determine the ability to generate sufficient revenue from operations to recover project costs, and to provide adequate cash flows for debt service and a reasonable return on investment. Cost estimates based on the results of ADB's project preparatory technical assistance assessment in April 2015 were used. However, financial benefits will also accrue from similar future subprojects to be financed with the repayment flows from the first subprojects.

3. For subsequent batches of subprojects, the financial intermediary will conduct financial due diligence similar to that done for the first batch and apply the same selection criteria.

B. Key Assumptions

4. **Investment cost estimates.** Capital costs—civil works, equipment and materials, installation, and other related expenses (e.g., design and technical service)—were estimated on the basis of investment cost estimates from feasibility studies. Provisions were made for physical and price contingencies, as appropriate. Land acquisition and resettlement costs are estimated to be zero, since all subprojects will be implemented within the premises of existing facilities. The construction period for both subprojects is 3 years, from 2015 to 2017.

5. **Subproject 1.** The subproject will be implemented at Dezhou Shihua Chemical (DSC), a wholly owned subsidiary of the implementing agency, China Haohua Chemical Group (CHC), of which in turn China National Chemical Group is the majority shareholder with a share of 69.2%. The subproject will be located in Dezhou, Shandong Province, and will demonstrate a process transformation leading to more energy-efficient polyvinyl chloride (PVC) production, without using mercury as catalyst. The total investment cost, including adequate physical and price contingencies and financial charges, was estimated at CNY1,283.3 million, 84% of the investment cost of the first batch of subprojects. The subproject will be implemented over 3

¹ Selection Criteria are in Chapter X of the Project Administration Manual, which is accessible from the list of linked documents in Appendix 2 of the main text of the report and recommendation of the President.

² ADB. 2005. *Financial Management and Analysis of Projects*. Manila.

years in two phases: Phase 1 will be completed by the third quarter of 2016, and Phase 2 by the first quarter of 2018. DSC is expected to produce 360,000 tons of PVC by 2019, after the subproject is completed.

6. The incremental financial benefits from this subproject will therefore consist of (i) revenues of CNY1,769.5 million per year from the sale of mercury-free PVC, and (ii) O&M costs that will be lower (by 8% or by CNY338 per ton of PVC) in the base year as a result of the reduced consumption of feedstock, energy, and other raw materials.

7. For the projection of financial cash flows, costs were duly inflated in accordance with cost escalation factors developed by ADB for cash flow, sale price, and O&M cost projections. Even though mercury-free PVC is expected to be sold at a premium after the project, it was assumed that the PVC sales price would remain at the current level for 5 more years until the end of 2020 before it is expected to rise again. This projection reflects the current sluggish growth in the PVC industry of the People's Republic of China (PRC) due to persistent production overcapacity; analysts project that the market is likely to change only after 2020. Energy and utility costs were inflated on the basis of an energy cost escalation factor of 1% per year. Potential carbon offset incomes from a nationwide carbon market were not considered despite announcements that the market would be launched in 2016.

8. **Subproject 2.** Beijing Zhonghao Huatai Energy Technology (Huatai), CHC's wholly owned energy service company (ESCO), proposed the subproject, which will be implemented at Zhonghao Chenguang Research Institute of Chemical Industry (CGY), a wholly owned subsidiary of CHC in Zigong, Sichuan Province. The subproject will consist of the following: (i) plasma incineration of fluoroform (HFC-23), an unwanted by-product of CGY's fluoropolymer production and a powerful greenhouse gas; (ii) process optimization through the replacement of existing vacuum drying ovens with state-of-the-art dryers for CGY's fluoropolymer end products; (iii) the establishment of an automated, real-time energy management system combined with digital meters; and (iv) various retrofit and upgrading measures. This subproject's total investment cost, estimated at CNY245.5 million, will make up 16% of the total investment for the first batch of subprojects. Its implementation by Huatai through an ESCO model, will be based on Huatai's shared energy savings performance contract with CGY.³

9. The first component, plasma incineration of HFC-23, lacks financial viability as a stand-alone project. It requires a capital investment of CNY35.1 million—14% of this subproject's total investment cost—and O&M costs of about CNY7.0 million per year. The Government of the PRC has sent out a notice that it will subsidize up to 40% of capital costs, but has not issued specific implementation guidelines and has made no specific commitment. Therefore, no subsidy income was taken into account in the financial analysis of this nonrevenue-earning component, which may be considered as a proactive cost-hedging strategy of CGY in anticipation of the development of a nationwide carbon market to be launched in 2016.

10. The energy savings performance contract makes the plasma incineration component financially feasible, with Huatai packaging the investment in this component together with revenue-earning energy efficiency measures. The contract stipulates that capital investment costs of the plasma incineration component will be recovered from financial benefits of the other components, and that O&M costs for incinerating HFC-23 must be covered by CGY and charged to the net profits from the sale of fluoropolymer. This business model developed during

³ Huatai-the ESCO-is deemed to have mobilized ADB funding and will provide equity contributions of 20% of the total investment cost. Commercial cofinancing will be mobilized by CGY, the host company.

project preparation (i) ensures that the combined package is financially viable, even under a very weak incentive structure; (ii) can overcome the nonrevenue investment and energy penalty for HFC-23 emission abatement; and (iii) serves as a model for other fluoropolymer industries in the PRC.

11. The energy efficiency measures will generate financial benefits from a reduction in CGY's expenditure on fuel, power, steam, brine, and utilities, as well as chemicals, amounting to CNY25.0 million per year in the base year.

C. Financial Performance Indicators

12. To derive the FIRR for each subproject and for the two first batch subprojects combined, annual incremental cash flows over the 15-year technical useful life of the plants were used. The FIRR was computed on an after-tax basis in real terms: (i) physical contingencies, but no price contingencies and financial charges, included in investment cash flows; and (ii) nominal operating cash flows converted to real terms, without considering the impact of inflation. Each FIRR was compared with the WACC for the subproject or for the first batch of subprojects.

13. The respective WACCs were calculated after tax in real terms using the actual structure and costs of capital. The subloan interest rate from the revolving escrow fund, established with ADB loan proceeds, will be fixed at 90% of the prime rate set by the People's Bank of China for commercial bank loans with the same terms as the subloans.⁴ The cost of the domestic commercial loan has been assumed at the regulated interest rate of 5.90% per annum for long-term investment loans (equal to 5.9% per annum as of April 2015). The cost of equity is assumed to be 13.0% per annum for subproject 1 and 10.0% per annum for subproject 2. The corporate income tax rate is 25.0% for subproject 1 and 15.0% for subproject 2.⁵ The average domestic cost escalation factor rate was assumed as 3.0% per year in accordance with ADB projections.

14. Key results of the financial analysis, including the FIRR, financial net present value, and simple payback period, are presented along with each subproject's WACC in Table 1.

Table 1: Projected Financial Indicators

Subproject	FNPV (CNY million)	FIRR (%)	WACC (%)	Payback Period (years)
Subproject 1	1,673.6	18.0	3.3	6.5
Subproject 2	135.5	10.2	2.5	8.0
Consolidated Project	1,798.0	17.0	3.3	6.6

FIRR = financial internal rate of return, FNPV = financial net present value, WACC = weighted average cost of capital. Source: Asian Development Bank estimates.

Table 2: Projected Cash Flow for the Project

⁴ The reference rates for loans of commercial banks published by People's Bank of China include a 1-year, an up to 5-years and a beyond 5 years interest. Depending on the loan term of a subloan, CHC and CCB will choose the applicable reference rate. For example, for subloans with a longer term than 5 years, the beyond 5 years reference rate will apply. This is a progress compared to previous ADB financial intermediation loans in support of energy efficiency and emission reduction in the PRC which applied 90% of the 1-year reference rate as benchmark. ADB. 2011. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Hebei Energy Efficiency Improvement and Emission Reduction Project*. Manila; and ADB. 2011. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Shandong Energy Efficiency and Emission Reduction Project*. Manila.

⁵ CGY has a reduced income tax rate of 15%, compared with the generally applied income tax rate of 25%, because of its awarded status as a high-tech company in the western part of the PRC.

(CNY million)

Year	Cash Flow				Net Cash Flow after Tax
	Capital Cost	O&M Cost ^a	Revenue	Income Tax	
2015	(493.48)	0.00	0.00	0.00	(493.48)
2016	(788.51)	(266.20)	392.34	(5.29)	(667.66)
2017	(102.48)	(659.89)	870.24	(9.66)	98.21
2018		(1,351.99)	1,681.99	(37.83)	292.18
2019		(1,607.73)	1,806.68	(33.67)	165.28
2020		(1,553.83)	1,806.90	(38.43)	214.63
2021		(1,526.32)	1,807.12	(47.07)	233.72
2022		(1,509.02)	1,807.34	(51.46)	246.86
2023		(1,491.35)	1,807.57	(55.95)	260.27
2024		(1,474.54)	1,807.80	(60.20)	273.07
2025		(1,458.15)	1,808.04	(64.35)	285.54
2026		(1,442.10)	1,808.28	(68.58)	297.61
2027		(1,426.40)	1,808.53	(72.56)	309.57
2028		(1,411.02)	1,808.78	(78.07)	319.69
2029		(1,395.97)	1,809.04	(83.06)	330.01
2030		(1,381.23)	1,809.30	(88.31)	339.76
2031		(1,037.52)	1,345.90	(64.98)	243.39
2032		(649.07)	892.37	(46.93)	196.37
			Financial Net Present Value (CNY million):		1,798.0
			Financial Internal Rate of Return (%):		17.0
			Weighted Average Cost of Capital (%):		3.3

O&M = operation and maintenance.

() = negative.

^a Includes O&M cost after adjusting for refund of value-added tax on equipment, and for working capital investment, depreciation, and residual value.

Source: Asian Development Bank estimates.

D. Sensitivity Analysis

15. A sensitivity analysis considering various adverse scenarios showed that the subprojects would remain financially viable, with FIRRs exceeding the subprojects' WACCs (Table 3). However, in the worst case, with adverse developments in all parameter values compared with the projected base case, the project would no longer be feasible.

Table 3: Sensitivity Analysis of Financial Internal Rates of Return (%)

Subproject	WACC	Project Cost		Financial Benefits ^a	O&M Cost +10%	1-Year Delay
		+10%	-10%	-10%		
Subproject 1	3.3	16.1	5.9	7.8	15.1	
Subproject 2	2.5	8.6	9.0	9.9	9.1	
First batch of subprojects	3.3	15.1	6.2	8.0	14.1	

O&M = operation and maintenance, WACC = weighted average cost of capital.

^a Energy and fuel savings achieved.

Source: Asian Development Bank estimates.

16. The analysis of switching values⁶ showed that for subproject 1 to become financially unviable, there should be (i) an increase exceeding (a) 13.6% in O&M costs, (b) 32.5% in calcium carbide prices and 37.3% in dichloroethane prices, or (c) 152.0% in capital investment costs; or (ii) a decrease exceeding (a) 11.7% in the PVC sale price, or (b) 70.0% in load utilization, compared with full capacity in all years throughout the economic useful life of the plant. Even with a 2-year implementation delay, the subproject would still have a solid FIRR of 13.6%. For subproject 2 to become financially unviable, there should be (i) an increase exceeding (a) 63.8% in capital costs, or (b) 218.5% in maintenance costs, compared with the projected costs in the base case; or (ii) a decrease of more than 56.4% in energy savings. The subproject's FIRR would still be significantly higher than its WACC even if implementation were to be delayed by 2 years.

17. The financial operations of China National Chemical Group, CHC, DSC, CGY, and Huatai, in 2015–2020 were projected.⁷ The financial projections indicated that DSC and Huatai would maintain a debt service coverage ratio of at least 1.3, and a debt–equity ratio of no more than 80:20.

E. Performance of the Revolving Escrow Fund and Projected Interest Differential

18. The financial analysis covered an assessment of (i) the total investment amount to be leveraged with ADB funding through the revolving escrow fund, (ii) the interest differential and the extent to which ESCO projects could be leveraged through that amount, and (iii) the total increase in equity achieved through the implementation of this project.

19. The analysis showed that ADB loan proceeds may be revolved at least 1.2 times. For future subprojects, ADB funding is expected to be no more than 40% of total investment cost and to be matched 1:1 by collaborative commercial cofinancing. Subborrowers are likely to contribute at least 20% in equity. Therefore, it is expected that an overall investment of \$565 million can be implemented. This assessment was based on the following assumptions: (i) DSC's subproject will have a loan term of 10 years, and CGY's subproject a loan term of 8 years, including a 3-year grace period; (ii) subloans will be repaid through the annuity repayment method; (iii) investments can be made as soon as repayment flows enter the escrow account; (iv) the ADB loan does not exceed 40% of the subproject investment and is matched with an equal share of commercial cofinancing; and (v) future subprojects have a loan term of 5 years.

20. One objective of the proposed project is to strengthen Huatai's financing capacity by using part of the interest differential to increase its equity capital. At least 40% of the interest differential will be allocated to Huatai. A total interest differential of about CNY67.2 million was projected through a comparison of the US dollar London interbank offered rate 10-year fixed swap rate with 90% of the currently prevailing 6-month prime lending rate. Adding CNY26.8 million (40% of CNY67.2 million) to Huatai's equity capital would increase it by 50%, making the ESCO one of the PRC's largest in terms of equity capitalization, and improving its capacity to serve as a platform for promoting energy efficiency investments in the chemical industry.

⁶ A switching value is the percentage change that should take place in a given parameter for the project investment decision to change and for the project to be on the verge of becoming financially unviable (i.e., for FIRR to be equal to WACC).

⁷ Supplementary Document 15, which is accessible from the list of linked documents in Appendix 2 of the main text of the report and recommendation of the President.