FINANCIAL ANALYSIS

1. **Approach.** The financial analysis was conducted for the eight core subprojects under Hanoi Power Corporation (EVN HANOI) and Ho Chi Minh City Power Corporation (EVN HCMC) in accordance with ADB's Financial Management and Analysis of Projects.[1] For the purposes of the analysis, the substation subprojects and the associated transmission line and cable subprojects have been grouped since one would not be constructed without the other.

2. The financial analysis of benefits from the subprojects is limited to the incremental energy sales resulting from the subprojects. This is a conservative approach. It does not consider the additional benefits from increased reliability, reduced losses and, in the case of rehabilitated substations, improvements in the safety of employees. It was not possible to determine the magnitudes of these additional benefits.

3. The analysis of the individual subprojects was supplemented by a summary analysis of the overall transmission and distribution investment program for EVN HANOI and EVN HCMC up to 2020. This is used to assess whether the program, of which the proposed subprojects form a part, is financially viable.

4. **Energy balance.** The energy balance was calculated for each subproject showing the with-project and without-project cases and, therefore, the incremental changes that can be attributed to the project and which are used in the calculation of its costs and benefits.

5. The common assumptions made in preparing the subprojects' energy balances (Table 1) were drawn from a review of the assumptions made by the consultants retained by the power corporations in the economic and financial analyses for the proposed subprojects and the separate analysis conducted for the World Bank-funded Distribution Efficiency Project.[2]

Table 1: Energy Balance Assumptions

Item		Value	Notes
Losses			
From exit from NPT system to entry into S/S		1.0%	
S/S losses		0.3%	
From exit from S/S to final customer	EVN HANOI	6.9%	2012 average loss,
	EVN HCMC	4.2%	less above
Power factor			
Power factor		0.98	
Normal rating		1.0	
Overload rating		1.2	
Electricity sales			
Maximum equivalent hours operating at full load		5,500	
Sales growth (per annum)	EVN HANOI	12.8%	2012–2020 average
	EVN HCMC	10.0%	projected growth

EVN HANOI = Hanoi Power Corporation, EVN HCMC = Ho Chi Minh City Power Corporation, NPT = National Power Transmission Corporation, S/S = substation.
Source: Asian Development Bank estimates.

6. For the purposes of calculating the energy balances, the subprojects have been classified into those that represent rehabilitation of existing substations (Son Tay, Tran Hung

[1] ADB. 2005. *Financial Management and Analysis of Projects.* Manila.
[2] World Bank. 2012. *Project Appraisal Document on the Distribution Efficiency Project.* Washington, DC.

Dao, and Phuong Liet subprojects of EVN HANOI), those that represent reinforcements to the existing transmission and distribution network (District 8 and Tham Luong subprojects of EVN HCMC), and one that is used to meet new loads (Noi Bai subproject of EVN HANOI).

7. For the rehabilitation subprojects, the capacity of the substations before rehabilitation is assumed to be "constrained" at its actual levels in 2012. After rehabilitation, the substations are assumed to be able to operate up to the equivalent of 4,121 hours at peak load annually (representing operation at full capacity during peak hours and 50% capacity during normal hours). Electricity supplied through the substations is assumed to grow from "constrained" to this new maximum level at the average sales growth rate applicable to the respective power corporation. For the new Noi Bai subproject, electricity supplied through the substation is assumed to immediately reach maximum capacity (equivalent to 5,500 hours annually operating at peak load). The customer for this substation is the new Noi Bai airport terminal, which will start full operation in 2015. Reinforcement subprojects are assumed to contribute to meeting overall demand growth in the areas served by the respective power corporation. To capture this, the average "contribution" of each megavolt-ampere of added transformer capacity (at each voltage level) to the ability to meet demand is calculated based on investment plans and demand projections up to 2020. The maximum demand served by the reinforcement subproject is then calculated as equal to the installed transformer capacity under the subproject multiplied by this contribution coefficient. Demand served is assumed to ramp up to meet this maximum demand by 2020 (the end of the investment planning period).The calculation of the contribution coefficient is in Table 2.

Table 2: Calculation of Contribution Coefficient for Reinforcement Subprojects

EVN HCMC

	Sales	**Transformer additions (cumulative)**			**Average Energy**	
		220 kV	**110 kV**		**220 kV**	**110 kV**
	GWh	MVA	MVA		GWh/MVA	
2010	15,409					
2015	26,755	2,500	3,566	2010-2015	4.5	3.2
2020	42,931	6,250	7,944	2016-2020	4.3	3.7
				2010-2020	4.4	3.5

	Capacity MVA	**Contribution coefficient** GWh/MVA	**Sales enabled** GWh pa
District 8	250	4.4	1,101
Tham Luong	126	3.5	437

EVN HCMC = Ho Chi Minh City Power Corporation, GWh = gigawatt-hour, kV = kilovolt, MVA = megavolt-ampere, pa = per annum.
Source: Asian Development Bank estimates.

8. **Financial costs and benefits.** Investment costs are obtained from the detailed cost estimates. Physical contingencies are included. Price contingencies and financing charges during implementation are excluded. Operating and maintenance costs are assumed to equal 2% of base investment costs. Bulk power purchases from Vietnam Electricity (EVN) are assumed to be made at the average bulk supply tariff (BST) paid in 2012, and retail sales at the

average retail tariff received in 2012, both inflated at 7.6% annually (representing two increases of 5% at 6-monthly intervals[3]) from 2013 onward.

9. The new Noi Bai 110 kilovolt (kV) substation will supply electricity at 22 kV. The current retail tariff applicable to commercial customers connected at this voltage significantly exceeds average retail tariffs. After the August 2013 increases the average 22 kV commercial tariff is about D2,210 per kWh (¢10.5/kWh). The financial analysis assumes that this difference is not sustained over the project life and, therefore, applies the same average retail tariff for sales from this subproject as from other subprojects.

10. The financial analysis of the rehabilitation and reinforcement subprojects incorporates an allowance for the costs of infrastructure at voltages lower than that of the subproject. In the case of Noi Bai, the consumer is responsible for constructing the necessary lower-voltage infrastructure, so no allowance was made for its cost in the financial analysis.

11. **Weighted average cost of capital.** The weighted average cost of capital (WACC) is calculated for the project as a whole, rather than for individual subprojects (Table 3).

Table 3: Calculation of Weighted Average Cost of Capital

	ADB OCR	AIF	Counterpart
Amount ($ million)	172.7	100.0	147.4
Weighting	41.1%	23.8%	35.1%
Base rate ($, LIBOR 30-year swap)	3.70%	3.70%	n/a
Contract spread	0.50%	1.40%	n/a
Funding cost margin (July–December 2013)	0.00%	0.00%	n/a
Maturity premium	0.00%	0.00%	n/a
Onlending margin	0.25%	0.25%	n/a
Nominal cost of funds	4.5%	5.4%	13.2%
Tax rate (2014 rate)	22.0%	22.0%	n/a
Tax-adjusted nominal cost	5.7%	6.9%	13.2%
Weighted component of nominal WACC	2.3%	1.6%	4.6%
WACC (nominal, after-tax)	**8.6%**		
Inflation rate (US / Viet Nam, projected 2014)	1.5%	1.5%	7.2%
Tax-adjusted real cost	4.1%	5.3%	5.6%
Weighted component of real WACC	1.7%	1.3%	2.0%
WACC (real, after-tax)	**4.9%**		

ADB = Asian Development Bank, AIF = ASEAN Infrastructure Fund, LIBOR = London interbank offered rate, OCR = ordinary capital resources, US = United States, WACC = weighted average cost of capital.
Source: Asian Development Bank estimates.

12. A loan maturity of 20 years including a 5-year grace period and equal repayments has been assumed. The average loan maturity calculated according to Asian Development Bank

[3] Prior to November 2013, EVN was permitted, in theory, to increase retail tariffs by up to 5% each quarter to reflect increasing costs, without the need for higher-level approvals. In practice, such approvals continued to be required, and tariff increases in the last 2 years have been limited to 5% twice a year. New regulations issued by the Ministry of Industry and Trade in November 2013 (Decision 69/2013/QD-TTg) raised the level of increases not subject to approval to 10% but limit this to 6-month intervals. The practical impacts of this change have yet to be observed.

(ADB) guidelines for this loan would be 12.75 years and, therefore, the maturity premium equals zero. The nominal cost of counterpart funding is estimated using the capital asset pricing model.

13. **Financial internal rate of return.** The calculated financial internal rate of return (FIRR) and the financial net present value (FNPV) for each core subproject is shown in Table 4. A project life of 20 years has been assumed. Calculations are undertaken in real terms using December 2013 prices. All the core subprojects are estimated to be financially viable (FIRR in excess of WACC and a positive FNPV). The FIRR for subprojects proposed by EVN HCMC is lower than that for subprojects proposed by EVN HANOI, primarily because of the lower distribution margin between the retail tariff and bulk supply tariff (BST) earned by EVN HCMC.

Table 4: Calculation Results – Financial Internal Rate of Return and Net Present Value

Subproject	FIRR (real, after-tax, %)	FNPV (real, $ million)
EVN HANOI		
Son Tay 110 kV S/S rehabilitation	21.6	7.0
Tran Hung Dao 110 kV S/S rehabilitation	32.3	17.3
Phuong Liet 110 kV S/S rehabilitation	14.0	11.6
New Noi Bai 110 kV S/S	37.0	36.3
EVN HCMC		
District 8 220 kV S/S + T/L + U/C	12.2	48.0
Tham Luong 110 kV S/S + T/L + U/C	21.9	38.0

EVN HANOI = Hanoi Power Corporation, EVN HCMC = Ho Chi Minh City Power Corporation, FIRR = financial internal rate of return, FNPV = financial net present value (at WACC), kV = kilovolt, S/S = substation, T/L = transmission line, U/C = underground cable, WACC = weighted average cost of capital.
Source: Asian Development Bank estimates.

14. **Sensitivity analysis.** The major uncertainties associated with the proposed core subprojects have been assessed as relating to the capital investment cost, the rate of demand growth, and the rate of tariff increases and, in particular, where increases in the BST outstrip increases in the retail tariff. To reflect this, the following sensitivities have been assessed: (i) an increase of 10% in investment costs, (ii) a slowdown in annual demand growth by one-third from that assumed in the base estimates, and (iii) a reduction in the rate of increase in retail tariffs from 2016 onward to 1 percentage point annually below that of the rate of increase in the BST. The combined effect of all three sensitivities has also been investigated.

15. The estimated FIRR under these sensitivity cases is shown in Table 5. The financial viability of the subprojects is most sensitive to a failure of retail tariff increases to keep pace with BST increases. However, all subprojects with the exception of the District 8 substation and accompanying transmission lines and underground cables remain viable even in this sensitivity. If all sensitivities are combined, the Tham Luong substation and the Phuong Liet substation rehabilitation also are no longer viable.

16. Overall, the financial viability of the subprojects is reasonably robust to changes in key assumptions. However, there is a risk that some subprojects may not be viable if retail tariff increases fail to fully track BST increases (as has occurred on past occasions, notably in 2011) and particularly if this is accompanied by slower than projected demand growth, further reducing revenues earned from the subprojects.

Table 5: Financial Sensitivity Analysis

		FIRR				
		Base case	**Sensitivity 1** investment costs increased by 10%	**Sensitivity 2** demand growth reduced	**Sensitivity 3** retail tariffs increase more slowly than BST	**Combined**
EVN HANOI						
1	Son Tay 110 kV S/S rehabilitation	21.6%	19.6%	18.9%	11.1%	6.7%
2	Tran Hung Dao 110 kV S/S rehabilitation	32.3%	29.9%	26.7%	21.8%	14.3%
3	Phuong Liet 110 kV S/S rehabilitation	14.0%	12.5%	11.4%	3.3%	-0.9%
4	New Noi Bai 110 kV S/S	37.0%	33.3%	37.0%	31.8%	28.1%
EVN HCMC						
1	District 8 220 kV S/S + T/L + U/C	12.2%	10.9%	10.3%	0.4%	-3.9%
2	Tham Luong 110 kV S/S + T/L + U/C	21.9%	20.1%	18.6%	10.7%	5.4%

BST = bulk supply tariff, EVN HANOI = Hanoi Power Corporation, EVN HCMC = Ho Chi Minh City Power Corporation, FIRR = financial internal rate of return, kV = kilovolt, S/S = substation, T/L = transmission line, U/C = underground cable.
Source: Asian Development Bank estimates.

17. **Overall investment program.** The financial viability of the overall transmission and distribution investment program of the two power corporations has also been investigated. This analysis uses the most recently planned investments up to 2020 along with the corresponding incremental demand met.

18. Insufficient information is available to break out price contingencies and financing charges from this program and they are therefore included in the investment costs. The O&M costs associated with these investments are assumed to be equal to 2% of the incremental capital expenditures. From 2021 onward, demand and investments are assumed to remain unchanged for the remainder of the project period. Average retail tariffs, average BSTs, and losses are all as assumed in the analysis of individual subprojects.

19. The resulting FIRRs and FNPVs of the two power corporations' investment programs up to 2020 are in Table 6. Both programs have a FIRR exceeding the WACC and a positive FNPV. Therefore, even if some subprojects within a program have lower returns, higher returns on other subprojects in the same program should offset this.

Table 6: Power Corporations' Investment Programs

Power Corporation	**FIRR (real, post-tax)**	**FNPV (real, $ million)**
EVN HANOI	17.9%	938.9
EVN HCMC	21.0%	1,175.4

EVN HANOI = Hanoi Power Corporation, EVN HCMC = Ho Chi Minh City Power Corporation, FIRR = financial internal rate of return, FNPV = financial net present value.
Source: Asian Development Bank estimates.