



Report and Recommendation of the President to the Board of Directors

Project Number: 53324-001
August 2020

Proposed Loan and Administration of Grants Kingdom of Cambodia: Grid Reinforcement Project

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Asian Development Bank

CURRENCY EQUIVALENTS

(as of 16 July 2020)

Currency unit	–	riel/s (KR)
KR1.00	=	\$0.00024
\$1.00	=	KR4,096

ABBREVIATIONS

ADB	–	Asian Development Bank
BESS	–	battery energy storage system
CEF	–	Clean Energy Fund
COVID-19	–	coronavirus disease
EDC	–	Electricité du Cambodge
EMP	–	environmental management plan
LARP	–	land acquisition and resettlement plan
MME	–	Ministry of Mines and Energy
PAM	–	project administration manual
SCF	–	Strategic Climate Fund
TA	–	technical assistance

WEIGHTS AND MEASURES

GWh	–	gigawatt-hour
ha	–	hectare
km	–	kilometer
kV	–	kilovolt
kWh	–	kilowatt-hour
MW	–	megawatt

GLOSSARY

Congestion relief	–	Benefit of using battery energy storage system by covering peak loads exceeding the load carrying capacity of an existing transmission and distribution equipment
Curtailement reserve	–	The capacity to provide power output in a given amount of time during power shortcuts and shortages
Output smoothing	–	The process of smoothing power output to provide more stability and reliability of fluctuating energy sources
Primary frequency response	–	A crucial system which fixes the effects of power imbalance between electricity supply and demand

NOTE

In this report, "\$" refers to United States dollars.

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^a Outposted to the Cambodia Resident Mission.

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PROJECT AT A GLANCE

1. Basic Data		Project Number: 53324-001	
Project Name	Grid Reinforcement Project	Department/Division	SERD/SEEN
Country	Cambodia	Executing Agency	Electricite Du Cambodge
Borrower	Kingdom of Cambodia		
Country Economic Indicators	https://www.adb.org/Documents/LinkedDocs/?id=53324-001-CEI		
Portfolio at a Glance	https://www.adb.org/Documents/LinkedDocs/?id=53324-001-PortAtaGlance		
2. Sector	Subsector(s)	ADB Financing (\$ million)	
✓ Energy	Electricity transmission and distribution		127.80
		Total	127.80
3. Operational Priorities		Climate Change Information	
✓ Addressing remaining poverty and reducing inequalities		GHG reductions (tons per annum)	84,138
✓ Accelerating progress in gender equality		Climate Change impact on the Project	High
✓ Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability			
✓ Strengthening governance and institutional capacity		ADB Financing	
		Adaptation (\$ million)	0.00
		Mitigation (\$ million)	6.04
		Cofinancing	
		Adaptation (\$ million)	0.00
		Mitigation (\$ million)	6.70
Sustainable Development Goals		Gender Equity and Mainstreaming	
SDG 1.4, 1.5		Some gender elements (SGE)	✓
SDG 5.5			
SDG 7.1, 7.a		Poverty Targeting	
SDG 8.5		Geographic Targeting	✓
SDG 10.2			
SDG 13.a			
4. Risk Categorization:		Low	
5. Safeguard Categorization		Environment: B Involuntary Resettlement: B Indigenous Peoples: C	
6. Financing			
Modality and Sources		Amount (\$ million)	
ADB		127.80	
Sovereign Project (Concessional Loan): Ordinary capital resources		127.80	
Cofinancing		6.70	
Clean Energy Fund under the Clean Energy Financing Partnership Facility - Project grant (Full ADB Administration)		2.00	
Strategic Climate Fund - SREP - Project grant (Full ADB Administration)		4.70	
Counterpart		59.15	
Government		28.95	
Others		30.20	
Total		193.65	
Currency of ADB Financing: US Dollar			

CAMBODIA
GRID REINFORCEMENT PROJECT



Project Location
National Capital
Provincial Capital
National Road
Other Road
Railway
River
Provincial Boundary
International Boundary
Boundaries are not necessarily authoritative.

0 25 50 75 100
Kilometers

This map was produced by the cartography unit of the Asian Development Bank. The boundaries, colors, denominations, and any other information shown on this map do not imply, on the part of the Asian Development Bank, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries, colors, denominations, or information.

I. THE PROPOSAL

1. I submit for your approval the following report and recommendation on a proposed loan to the Kingdom of Cambodia for the Grid Reinforcement Project. The report also describes the proposed administration of grants to be provided by (i) the Strategic Climate Fund (SCF)¹ and (ii) the Clean Energy Fund (CEF)² under the Clean Energy Financing Partnership Facility for the Grid Reinforcement Project, and if the Board approves the proposed loan, I, acting under the authority delegated to me by the Board, approve the administration of the SCF and CEF grants.

2. The project will support Electricité du Cambodge (EDC), the state-owned power utility, in improving the capacity and stability of its transmission network. It will (i) expand and reinforce the electricity transmission infrastructure by constructing four 115 kilovolt (kV)–230 kV transmission lines and 10 substations in Phnom Penh, Kampong Chhnang, Kampong Cham, and Takeo provinces; and (ii) introduce as a pilot the first utility-scale battery energy storage system (BESS) in Cambodia to understand the technology's performance and assess different business models with a view to providing combined services for (a) renewable energy integration, (b) primary frequency response, (c) curtailment reserve, and (d) transmission congestion relief. EDC will also receive institutional support to implement the project and strengthen its capacity for improving efficiency, inclusion, and gender equality.

II. THE PROJECT

A. Rationale

3. **Cambodia has achieved sustained economic progress.** Cambodia's per capita gross national income grew on average by 7.1% per annum from \$950 in 2013 to \$1,390 in 2018.³ Strong economic growth was driven mainly by urban-based industries such as garment exports and tourism, and, more recently, construction and real estate.

4. **However, COVID-19 pandemic threatens to undermine progress.** Whereas Cambodia's economy was projected to grow by 6.8% before the coronavirus disease (COVID-19) pandemic, it is now expected to contract by 5.5% in 2020. It risks pushing an additional 1.3 million people into poverty. The government is implementing an assistance program to mitigate the adverse social and economic impacts.⁴ Moreover, financing and constructing needed infrastructure, including those that enables the provision of reliable and sustainable electricity supply, is important to create employment and support the country's post COVID-19 economic recovery. Cambodia aspires to attain middle-income status by 2030.

5. **Government prioritizes energy sector development.** In its Socio-Economic Policy Agenda, 2018–2023, the government recognizes the importance of developing the energy sector to increase competitiveness, ensure sustained economic growth, and thereby continue to reduce poverty.⁵ Its key policy objectives call for (i) extending the coverage of power supply, (ii) stepping up power reliability by expanding and upgrading the transmission network infrastructure, (iii)

¹ Under the Scaling Up Renewable Energy Program in Low-Income Countries.

² Financing partners: the governments of Australia, Norway, Spain, Sweden, and the United Kingdom.

³ Asian Development Bank (ADB). 2015. *Basic Statistics 2015*. Manila; and ADB. 2020. *Basic Statistics 2020*. Manila. Cambodia attained the lower-middle income country status in 2015.

⁴ ADB. 2020. *Proposed Countercyclical Support Facility Loan Kingdom of Cambodia: COVID-19 Active Response and Expenditure Support Program*. Manila.

⁵ Government of Cambodia. 2018. *Rectangular Strategy for Employment, Equity and Efficiency: Building the Foundation toward Realizing the Cambodia Vision 2050*. Phnom Penh.

further lowering systemwide costs to enable a tariff reduction, and (iv) providing access to electricity from 74.8% in 2019 to 95% of all households by 2030.

6. More robust electricity supply will enhance economic productivity. Electricity supply increased on average 19.1% annually from 2,515 gigawatt-hours (GWh) in 2010 to 12,015 GWh in 2019. Large investments in power generation help address rapidly growing demand for electricity that propels economic growth. Most (86.5%) of electricity is generated domestically from hydro (50.2%), coal (32.3%), renewable energy (0.7%), and diesel fuel (3.3%). In 2019, 98.5% of power generated domestically was provided by independent power producers. Power imports from neighboring countries contributed 13.5% to electricity supply.

7. However, electricity services are still unreliable with poor quality. One major pressing concern is that the existing transmission infrastructure is reaching capacity. At the end of 2019, Cambodia's transmission infrastructure consisted of 2,267 kilometers (km) of 115 kV and 230 kV transmission lines and 36 substations.⁶ Several substations serving the provinces of Phnom Penh, Kampong Chhnang, Kampong Cham, and Takeo are overloaded, resulting in transmission constraints and disproportionate transmission losses (2.3%). A large number of households still do not have access to electricity in Kampong Chhnang (32.3%), Kampong Cham (13.3%), and Takeo (9.2%) provinces, and those with access face frequent and unpredictable power shortages averaging 2 hours per day. It severely hampers the quality of life, erodes Cambodia's competitiveness and effort to diversify into a manufacturing destination. Both domestic firms and foreign investors name inadequate electricity supply, in addition to its high cost, as a main constraint to doing business in Cambodia.

8. Transmission infrastructure investment requirement of \$2.27 billion. EDC, a wholly state-owned limited liability company, is responsible for electricity supply, transmission, and distribution. It does not receive budgetary support from the government and finances power purchases and transmission infrastructure costs from its operational cash flow. Private domestic and foreign investors are encouraged to invest.⁷ Several have already done so and operate 41.7% of the total length of 115 kV–230 kV transmission lines (945 km) as well as 10 associated substations (27% of operational substations) under build–own–operate–transfer arrangements of 10 years or more.⁸ In addition, Cambodia's rural electricity enterprises represent an important private-sector-based framework for developing, operating, and maintaining the country's distribution network.⁹ However, the estimated transmission investment requirement of \$2.27 billion exceeds the financing available from any one partner. Concessional financing from development partners is therefore a critical supplement to EDC and private financing, and essential for accelerating the development of power infrastructure that can advance economic growth and poverty alleviation in Cambodia.

9. Project's role as an important economic and post-COVID-19 enabler. The reinforcement of EDC's infrastructure will enable reliable electricity transmission and thereby enhance economic productivity, competitiveness, and diversification. Also, the construction of four transmission lines and 10 substations under the project will create direct employment for 1,300 people over a period of 2 years, with nearly 27% of the jobs to be created accessible to unskilled workers. Because of the economywide spillover effects, the volume of indirectly generated employment is likely to be much larger. Direct and indirect jobs created in backward

⁶ 1,730 MVA of 115 kV / 22 kV substation transformer capacity and 1,330 MVA of 230 kV / 115 kV / 22 kV substation transformer capacity.

⁷ The promotion of private participation in electrification is anchored in Cambodia's Electricity Law (2001).

⁸ Electricity Authority of Cambodia. 2019. *Power Sector Report of the Kingdom of Cambodia*. Phnom Penh.

⁹ Rural electricity enterprises are private operators of small, isolated distribution systems in remote parts of Cambodia.

supply chain industries will add to household income, which will increase spending and in turn generate more jobs in other sectors.¹⁰ In parallel, however, the energy sector needs to become more inclusive. Gender-based stereotypes related to women's participation in sector activities and employment prevail. Women account for 17% of the 5,584 people employed by EDC and work mainly in accounting, finance, billing, and public relations. Only a few women hold senior and management positions. The project will focus on education and training activities to strengthen inclusion and gender equality at EDC.¹¹

10. Improvements in sector planning and efficiency. Substantial increases in transmission investment can cause small tariff increases, unless they are wholly offset by savings from low-cost generation, fewer transmission and distribution losses, and congestion cost control. EDC and the Ministry of Mines and Energy (MME) are making progress in strengthening sector development planning with direct support from ADB.¹² This includes technical assistance (TA) for project readiness, procurement, and financial management to improve probity, efficiency, and adequate service delivery, and avoid excessive costs.¹³ Concessional financing from development partners will also help minimize the impact of the substantial transmission investments on end-user tariffs.

11. Introducing the battery energy storage system. As costs fall, BESS are likely to become a valuable asset because it (i) can enable EDC to adapt to uncertain electricity demand and reduce the risk of overbuilding and overinvesting in power generation, (ii) is more modular and can be moved more easily than power plants, and (iii) helps integrate intermittent renewable power generation capacity and can thus contribute to achieving Cambodia's target of a 16% reduction in energy greenhouse gas emissions by 2030 from 2010 level.¹⁴ EDC and Cambodia's electricity regulator, Electricity Authority of Cambodia, must start now to understand how the large-scale deployment of low-cost battery energy storage can be used to (i) plan and operate Cambodia's future grid and (ii) reduce systemwide costs. A pilot project located at the ADB supported 100 MW National Solar Park and coupled with on-the-job training is ideal for understanding the performance of an emerging technology such as the BESS, and for assessing different business models.

12. ADB sector experience and lessons learned. Since 1994, ADB has awarded nearly \$200 million in loans and grants to Cambodia's energy sector and provided \$6 million in technical assistance. ADB funding has focused on (i) transmission and distribution network expansion and (ii) support for sector reforms and institutional capacity building.¹⁵ Experience from ADB's previously financed transmission infrastructure projects shows that implementation delays can be mitigated by (i) a high degree of project readiness, (ii) advance procurement, and (iii) project implementation support. ADB will apply this experience to the proposed project.

¹⁰ International Finance Corporation. [Linking power supply to jobs: estimating employment effects of Powerlinks Transmission Limited Project in India and Bhutan](#) (accessed 2 July 2020).

¹¹ Guidance Document on the Implementation of Gender Responsive Activities by EDC is incorporated in Project Administration Manual (accessible from the list of linked documents Appendix 2).

¹² ADB. 2018. *Technical Assistance for Southeast Asia Energy Sector Development, Investment Planning and Capacity Building Facility*. Manila.

¹³ ADB. 2019. *Technical Assistance for Strengthening Project Readiness, Procurement, and Financial Management in Southeast Asia*. Manila; and ADB. 2017. *Technical Assistance to the Kingdom of Cambodia for Strengthening Capacity for Improved Implementation of Externally Funded Projects*. Manila (financed by the Japan Fund for Poverty Reduction).

¹⁴ As set forth in the agreement with the United Nations Framework Convention on Climate Change (adopted at the Paris Climate Conference in 2015), which deals with greenhouse gas emissions, adaptation, and finance.

¹⁵ ADB. 2018. *Cambodia Energy Sector Assessment, Strategy, and Road Map*. Manila.

13. More recently, ADB has supported the development of solar PV generation. In 2017, at the government's request, ADB developed a national solar photovoltaic (PV) grid integration study and road map. It contributed to the government's plan to increase solar PV generation capacity from 155 MW in 2019 to 415 MW by 2022. The target includes the construction of a 100 MW National Solar Park which ADB helped to structure as a public-private partnership.¹⁶ This project also exemplifies the one-ADB approach. Sovereign financing has been provided to help reduce private investment risk by building the solar park and transmission infrastructure. ADB's Office of Public-Private Partnership helped EDC in designing and conducting a competitive tender for procuring the first private sector-led 60 MW solar power plant (Phase 1) within the park. It resulted in a competitive tariff of \$0.03877 cents per kilowatt-hour (kWh), the lowest tariff for a solar project so far recorded in Southeast Asia. ADB's Private Sector Operations Department is currently undertaking due diligence for a proposed investment in the project. The proposed BESS will store power generated from the National Solar Park to test the provision of combined services for (a) renewable energy integration, (b) primary frequency response, (c) curtailment reserve, and (d) transmission congestion relief.

14. **Alignment with operational priorities of ADB's Strategy 2030.** The project is aligned with several operational priorities of ADB's Strategy 2030 (Table 1).

Table 1: Alignment with ADB Strategy 2030

ADB Strategy 2030	Project Intervention
Addressing remaining poverty and reducing inequalities	Strengthening adequate electricity supply will improve quality of life and business environment, and encourage investment, leading to more job creation and reducing poverty
Accelerating progress in gender equality	Supporting Electricité du Cambodge in implementing activities that (i) promote inclusion and gender equality in the workplace, and (ii) dismantle gender-based stereotypes related to women's participation in energy sector activities and employment
Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability	Reducing transmission losses, thus reducing carbon emissions and enhancing the environmental sustainability of Cambodia's electricity system
Strengthening governance and institutional capacity	Introducing innovative technology and strengthening Electricité du Cambodge's capacity in project management, including procurement and financial management practices

Source: Asian Development Bank.

B. Project Description

15. The project is aligned with the following impact: adequate and reliable power supply from environmentally sustainable energy sources ensured (footnote 5). The project will have the following outcome: transmission network capacity and stability improved.¹⁷

16. **Output 1: 115-kilovolt and 230-kilovolt grid infrastructure expanded and reinforced.** The project will support the construction of four 115 kV–230 kV overhead and underground transmission lines and 10 substations in Phnom Penh, Kampong Chhnang, Kampong Cham, and Takeo provinces.¹⁸ It will add 13 circuit-kilometers of 230 kV transmission lines; 36.7 circuit-kilometers of 115 kV transmission lines; 1,475 megavolt-amperes of 230 kV–115 kV–22 kV

¹⁶ ADB. 2019. *Report and Recommendations of the President to the Board of Directors: Proposed Loan and Administration of Loan, Grant, and Technical Assistance Grant to the Kingdom of Cambodia for the National Solar Park Project*. Manila.

¹⁷ The design and monitoring framework is in Appendix 1.

¹⁸ Three transmission lines and five substations in Phnom Penh, one transmission line and two substations in Kampong Chhnang Province, two substations in Kampong Cham Province, and one substation in Takeo Province.

substation transformer capacity; and 350 megavolt-amperes of 115 kV–22 kV substation transformer capacity.¹⁹

17. **Output 2: First utility-scale energy storage system provided.** The project will support EDC in designing, procuring, and operating the first utility-scale BESS in Cambodia, capable of storing 16 megawatt-hours, and in analyzing its performance.²⁰ This is a desirable size to support multiple applications—a standard feature of BESS installations—such as (i) smoothing output at 80% from the phase 1, 60-megawatt (MW) ADB solar park in Kampong Chhnang Province (footnote 16); (ii) providing 0.5 hours of curtailment reserve to address daily power outages; (iii) providing primary frequency control; and (iv) providing congestion relief, which allows to defer upgrades in transformer capacity at Grid Substation 6 (a substation near the ADB solar park site).

18. Project implementation consultants will complement EDC staff to ensure a high degree of project management efficiency and provide on-the-job training to strengthen transparency and accountability. In addition, EDC will undertake activities that (i) promote inclusion and gender equality in the workplace, (ii) dismantle gender-based stereotypes related to women's participation in energy sector activities and employment, and (iii) inform communities about the safe use of electricity.

C. Value Added by ADB

19. ADB's validation of the country partnership strategy final review, 2014–2018, emphasized that limited power reliability is becoming a critical binding constraint on growth in Cambodia.²¹ Investment requirements, notably for transmission, exceed the financing available from ADB, bilateral development and private sector partners.²² With the proposed project, ADB will add considerable value to Cambodia's energy sector by (i) improving physical infrastructure that strengthens power transmission capacity and reduces losses, (ii) introducing the BESS as an innovative technology application, (iii) enhancing project management capacity, and (iv) supporting EDC in taking a leading role as an inclusive equal opportunity employer in Cambodia's energy sector. Coupled with ADB's ongoing assistance to EDC and MME with power system planning to ensure efficient and sustainable subsector growth, ADB's support underpins reforms to ensure that adequate, reliable, and environmentally sustainable power supply can be provided at reasonable cost, which in turn enables equitable development (footnotes 12, 13). ADB's energy sector strategy is integrated into ADB's country partnership strategy, 2019–2023 for Cambodia.²³

D. Summary Cost Estimates and Financing Plan

20. The project is estimated to cost \$193.65 million (Table 2). Detailed cost estimates by expenditure category and by financier are included in the project administration manual (PAM).²⁴

¹⁹ EDC would benefit from additional transmission lines and substations, which may be financed by ADB. This opportunity is being explored and may be processed as additional financing, with consideration given to cofinancing, such as from the Association of Southeast Asian Nations Infrastructure Fund.

²⁰ A first workshop on the design of the BESS was provided during project preparation.

²¹ ADB. 2019. *Cambodia: Validation of the Country Partnership Strategy Final Review, 2014–2018*. Manila.

²² Development Coordination (accessible from the list of linked documents in Appendix 2).

²³ ADB. 2019. *Country Partnership Strategy: Cambodia, 2019–2023—Inclusive Pathways to a Competitive Economy*. Manila.

²⁴ Project Administration Manual (accessible from the list of linked documents in Appendix 2).

Table 2: Summary of Cost Estimates
(\$ million)

Item	Amount ^a
A. Base Costs^b	
1. Output 1: 115 kV–230 kV grid infrastructure expanded and reinforced	160.24
2. Output 2: First utility-scale energy storage system provided	8.25
Subtotal (A)	168.48
B. Contingencies^c	21.22
C. Financial Charges During Implementation^d	3.95
Total (A+B+C)	193.65

kV = kilovolt.

Note: Numbers may not sum precisely because of rounding.

^a Includes taxes and duties of \$26.56 million to be financed by the government through exemptions as in-kind contribution.

^b Prices as of March 2020. During the 2008 financial crisis, the United States and the People's Republic of China producer price index for industrial goods declined. A similar impact can be anticipated as a result of COVID-19.

^c Physical contingencies computed at 10% of the costs of the engineering, procurement, and construction. Price contingencies reflect inflation expectations.

^d Includes interest and service charges. Interest during construction for the Asian Development Bank's concessional loan was computed at 1.00%. The service charge applied to the re-lending from the Ministry of Economy and Finance to Electricité du Cambodge is 0.65%.

Source: Asian Development Bank estimates.

21. The government has requested a concessional loan of \$127.8 million from ADB's ordinary capital resources to help finance the project. The loan will have a 32-year term, including a grace period of 8 years; an interest rate of 1.0% per year during the grace period and 1.5% per year thereafter; and such other terms and conditions set forth in the draft loan and project agreements. The proceeds of the loan will be re-lent to EDC under substantially the same terms and conditions, but with an interest of 1.65% per year during the grace period and 2.15% per year thereafter. The SCF (footnote 1) will provide grant cofinancing of \$4.7 million and the CEF (footnote 2) under the Clean Energy Financing Partnership Facility will provide grant cofinancing of \$2.0 million, both to be fully administered by ADB. The grant proceeds will be provided to EDC under the same terms and conditions, with no interest or other charges.

22. The summary financing plan is in Table 3. ADB will finance the expenditures in relation to goods and works for the construction of transmission lines and substations, and project implementation consultant services. The SCF and CEF grants will finance the goods and works for the construction of the pilot BESS, including 3 years of operation and maintenance services. The government will finance taxes and duties through exemptions and financial charges during implementation. EDC will provide counterpart funds for contingencies, land acquisition, and safeguard mitigation measures from their operating cash flows.

Table 3: Summary Financing Plan

Source	Amount (\$ million)	Share of Total (%)
Asian Development Bank		
Ordinary capital resources (concessional loan)	127.80	66.0
Strategic Climate Fund (grant) ^a	4.70	2.4
Clean Energy Fund (grant) ^b under the Clean Energy Financing Partnership Facility	2.00	1.0
Government of Cambodia ^c	28.95	15.0
Electricité du Cambodge ^d	30.20	15.6
Total	193.65	100.0

^a Under the Scaling Up Renewable Energy Program in Low-Income Countries. Administered by the Asian Development Bank.

^b Financing partners: the governments of Australia, Norway, Spain, Sweden, and the United Kingdom. Administered by the Asian Development Bank.

^c Includes taxes and duties of \$26.56 million to be financed by the government through exemptions.

^d Includes land acquisition and resettlement costs, safeguards costs, contingencies, and financial charges during implementation. Contingencies of \$21.22 million will be confirmed as a condition to disbursement.

Source: Asian Development Bank estimates.

23. Climate mitigation is estimated to cost \$12.74 million. ADB will finance 47.4% of mitigation costs. The SCF grant will finance 36.9% and the CEF grant 15.7%. Details are in the PAM (footnote 24).

E. Implementation Arrangements

24. The implementation arrangements are summarized in Table 4 and described in detail in the PAM (footnote 24).

Table 4: Implementation Arrangements

Aspects	Arrangements		
Implementation period	December 2020–June 2025		
Estimated completion date	30 June 2025		
Estimated loan and grant closing date	31 December 2025		
Management			
(i) Oversight body	Ministry of Economy and Finance		
(ii) Executing agency	EDC		
(iii) Key implementing agencies	EDC		
(iv) Implementation unit	EDC, Phnom Penh		
Procurement ^a	Open competitive bidding (internationally advertised)	4 contracts	\$131.00 million
Consulting services	QCBS (80:20)	128 person-months	\$3.52 million
Retroactive financing and/or advance contracting	Advance contracting is contemplated for consultants and the EPC arrangements for substations and transmission lines. Retroactive financing will be available for up to 20% of the ADB loan amount for eligible expenditures, including advance payments for consultant and EPC contracts for substations and transmission lines.		
Disbursement	The loan and grant proceeds will be disbursed following ADB's <i>Loan Disbursement Handbook</i> (2017, as amended from time to time) and detailed arrangements agreed between the government and ADB.		

ADB = Asian Development Bank; EDC = Electricité du Cambodge; EPC = engineering, procurement, and construction; QCBS = quality- and cost-based selection.

^a Since the project will be cofinanced by ADB-administered grants from the Strategic Climate Fund and the Clean Energy Fund, universal procurement will apply to all procurement packages under the project following ADB. 2013. *Blanket Waiver of Member Country Procurement Eligibility Restrictions in Cases of Cofinancing for Operations Financed from Asian Development Bank Fund Resources*. Manila.

Source: Asian Development Bank.

III. DUE DILIGENCE

A. Technical

25. ADB project team assessed the project as technically viable. The transmission lines and substations will feature standard technology with which EDC is familiar. For the BESS, lithium-ion battery technology will be used.²⁵ The BESS, capable of storing 16 MWh of electricity, will be installed at a substation financed by ADB under the National Solar Park Project (footnote 16). The installation and commissioning of the BESS will be aligned with the construction of the solar park and associated transmission infrastructure. Project implementation consultants will ensure

²⁵ Lithium-ion battery technology is the most widely used battery energy storage technology for utility-scale applications because of its price competitiveness and high energy density.

coordination between contractors for planning, layout, and site formation to help synchronize the installation of the BESS with the construction of the new substation. The substations and the BESS will include remote monitoring and protection systems in line with international design standards and good practice.

B. Economic and Financial Viability

26. ADB project team assessed the economic viability for the project as a whole. The construction of the four transmission lines and 10 substations results in incremental benefits of meeting growing demand and non-incremental benefits of reducing losses. The pilot BESS provides multiple benefits to the transmission system, including (i) solar plant output smoothing, (ii) curtailment reserve, (iii) primary frequency response, and (iv) congestion relief to defer investment in transformer upgrades. The project is economically viable with an economic internal rate of return of 30.6%, which exceeds the economic hurdle rate of 9%.

27. The financial analysis was carried out separately for output 1 (construction of transmission lines and substations financed by the ADB loan) and output 2 (introduction of the BESS financed by the SCF and CEF grants). For output 1, the financial internal rate of return is 10.9% and exceeds the calculated weighted average cost of capital of 1.15%. For output 2, the financial internal rate of return does not exceed the weighted average cost of government borrowing of 3.6%. The average annual net revenues from the BESS, however, are sufficient to cover annual operating expenditures, ensuring the sustainability of the BESS throughout its operating life without any direct financial cost to EDC. The pilot project is essential for EDC to understand the performance of the technology and assess different business models that can enable large-scale deployment of low-cost battery energy storage in the future.

28. As a result of the COVID-19 pandemic, EDC forecasts electricity sales in 2020 to grow by 5% from the 2019 level, before rebounding to double-digit growth in 2021. Various stress tests were conducted. Even under a scenario of demand contraction in 2020 and slower-than-anticipated growth—at an average 10.8% per year, compared with the initially projected 17.6% per year—EDC and the project remain financially viable.²⁶

C. Sustainability

29. The BESS is a new technology for EDC. The lack of standardization can make its procurement difficult. Based on experience in other countries where ADB has financed such systems, the project team will look for evidence during the bid evaluation that the bidders already delivered several systems of the type being sought and that their operational data has been verified. A battery energy storage engineer was engaged to support EDC throughout the procurement process.²⁷ The engineering, procurement, and construction contractor will be required to provide 3 years of operation and maintenance services, including knowledge transfer to EDC to operate and maintain the system over its 10-year lifetime. This will create the foundation for EDC to scale up energy storage as part of future power system developments.

30. EDC has sufficient staff and expertise to support the operation of transmission lines and substations after commissioning. Consultants will support in ensuring that contracts are awarded to qualified bidders and that construction of transmission infrastructure complies with approved

²⁶ Economic Analysis and Financial Analysis (accessible from the list of linked documents Appendix 2).

²⁷ Financed through ADB. 2018. *Technical Assistance for Southeast Asia Energy Sector Development, Investment Planning and Capacity Building Facility*. Manila.

technical specifications. The project is assessed as financially viable and is expected to generate positive cash flow contributing to EDC's long-term financial sustainability. Climate adaptation measures identified in accordance with the project's climate change assessment are incorporated in EDC's standard designs for transmission lines and substations.²⁸

D. Governance

31. EDC has experience in managing externally financed projects and has satisfactorily implemented previous ADB projects. A procurement capacity assessment was conducted in accordance with the Guidance Note on Procurement-Procurement Risk Framework, the Guidance Note on Strategic Procurement Planning, and the ADB Procurement Policy (2017, as amended from time to time) and Procurement Regulations for ADB Borrowers (2017, as amended from time to time).²⁹ The project procurement arrangements were decided with attention to value for money. To achieve value for money and ensure competitive tension, the procurement is split into four large packages for the transmission lines, substations, and BESS, which will be procured through open competitive bidding with international advertisement. The pre-mitigation procurement risk is assessed as *moderate*, mainly because the capacity of EDC staff for transparent open competitive bidding needs to be strengthened.

32. The financial management assessment of EDC was conducted in accordance with ADB's Guidelines for Financial Management and Analysis of Projects, and Financial Due Diligence: A Methodology Note.³⁰ The pre-mitigation financial management risk is assessed as *moderate*, mainly because the capacity of EDC staff leaves room for improvement when it comes to financial management, accounting, budgeting, internal controls, internal auditing, and financial reporting; as do the still relatively weak public financial management systems in the institutional environment in which the utility operates.

33. Project implementation consultants will be engaged to give EDC staff on-the-job-training in project management, including procurement, financial management, and safeguards. These activities will be complemented by ongoing TAs to reform the procurement and financial management practices of public sector entities in Cambodia (footnote 13).

34. ADB project team conducted integrity due diligence. An integrity risk was found to arise from adverse media in relation to one of EDC's managing directors, who was assigned to oversee the implementation of this project.³¹ ADB's Anticorruption Policy (1998, as amended to date) was explained to and discussed with the government and EDC. The specific policy requirements and supplementary measures are described in the PAM (footnote 24).

E. Poverty, Social, and Gender

35. The poverty and social analysis assessed the impacts from a sector perspective, since identifying specific categories or groups of consumers is difficult in the context of transmission network expansion. About one-third of the population in Kampong Chhnang, Kampong Cham, and Takeo provinces is considered poor. People are mainly engaged in agriculture, cattle raising, handicraft production, and small-scale services. The average monthly household income of KR1,303 (\$320) in these provinces is 10% lower than the national average. A large number of

²⁸ Climate Change Assessment (accessible from the list of linked documents in Appendix 2).

²⁹ Project Procurement Risk Assessment (accessible from the list of linked documents in Appendix 2).

³⁰ Financial Management Assessment (accessible from the list of linked documents in Appendix 2).

³¹ Details discussed in Integrity Due Diligence Disclosure (accessible from the list of linked documents in Appendix 2).

households still do not have access to electricity in Kampong Chhnang (32.3%), Kampong Cham (13.3%), and Takeo (9.2%) provinces, and those with access face frequent and unpredictable power shortages averaging 2 hours per day. A further expansion of the transmission infrastructure is urgently needed to (i) provide reliable electricity supply to consumers and (ii) connect remaining unserved households to the grid. Better service will contribute to improving people's quality of life, productivity, and diversification of sources of income; and will also improve the provision of school and health services. In addition, many households, especially outside of Phnom Penh, are often not aware of the dangers of electricity, such as shock, burns, and fire. Also, gender-based stereotypes toward women's participation in energy sector activities and employment make it difficult to achieve more gender equality in the sector and within EDC. The project is categorized as having *some gender elements*. Consultants will support EDC in implementing specific activities as described in the PAM (footnote 24) to inform communities about the safe use of electricity, dismantle gender-based stereotypes related to women's participation in energy sector activities and employment, and promote inclusion and gender equality within EDC.

F. Safeguards

36. In compliance with ADB's Safeguard Policy Statement (2009), the project's safeguard categories are as follows.

37. **Environment (category B).** EDC conducted an initial environmental examination and prepared an environmental management plan (EMP), which cover the environmental impacts and risks of the four transmission lines, 10 substations, and the BESS.³² The transmission lines' right-of-way and the substations are in urban, peri-urban, and rural settings that include a combination of agricultural land (paddy, plantation, and economic trees), shrubland, and mixed-use land (residential, commercial, industrial, and educational). No protected areas, significant bird and bat species and flyways, or other particularly sensitive environmental receptors were found in the areas of influence. The identified impacts are site-specific and can be reduced to an acceptable level through mitigation measures. Adverse environmental impacts will primarily occur during the construction phase from solid waste and vegetation clearance, some earthworks and site levelling, dust and noise, disposal of construction spoils, occupational and community health and safety hazards, increased traffic, and disruption because of power outages (e.g., during towers erection and stringing of conductors). The EMP includes (i) mitigation measures during both construction and operation, such as the preparation of construction management plans; and (ii) identification of responsible parties and budget for implementation and monitoring. These measures and plans will be included in the bid documents and conditions of contracts.

38. **Involuntary resettlement (category B).** The construction of the four transmission lines, 10 substations, and the BESS is expected to have minor involuntary resettlement impacts. The construction of the 11.1 km long 115 kV transmission line in Kampong Chhnang Province could impact 107 households (539 persons). It is estimated that 0.615 hectares (ha) will be required permanently for the construction of tower footings. The permanent loss of land could affect 28 households (142 persons), including four severely affected households (16 persons) and 16 vulnerable households (83 persons). Land use restrictions (15.835 ha) within the right-of-way might affect 79 households (395 persons) and might result in two households (10 persons) having to relocate. A draft land acquisition and resettlement plan (LARP) was prepared for this transmission line in accordance with government laws and ADB's Safeguard Policy Statement. The three remaining transmission lines and four of the 10 substations will be constructed on public

³² The BESS will be constructed at the site of the National Solar Park substation financed by ADB (footnote 16) Initial Environmental Examination (accessible from the list of linked documents in Appendix 2).

land in Phnom Penh. The land is free of encumbrances (with no adverse permanent or temporary impacts on households), encroachment, or squatters. EDC prepared a resettlement due diligence report for these subprojects. For the remaining six substations to be constructed in Kampong Chhnang, Kampong Cham, and Takeo provinces, EDC will acquire 16.6 ha of privately owned land from 58 households through negotiated settlement. EDC prepared a due diligence report for these substations. EDC will engage an independent external party to document the negotiation and settlement processes. The third-party verification report will be submitted to ADB for clearance. EDC prepared a land acquisition and resettlement framework in case negotiations fail or result in expropriation, and to guide any unexpected land acquisition and resettlement impacts.³³

39. **Indigenous peoples (category C).** Based on a social impact assessment, the project will neither directly nor indirectly affect indigenous peoples or ethnic minorities. Members of the Cham ethnic group were found to be residing within 2 km or more of the project-affected area but will not be affected by the project.

40. EDC organized four public consultations and focus groups (disaggregated by sex) involving 184 people, including 76 women, to discuss the safeguards that will inform the project design and to assess the environmental and social impacts and risks. EDC will continue these consultations during project implementation and will set up a project-specific grievance redress mechanism to receive, record, and facilitate the resolution of any concerns. EDC will also prepare a project brief in local language and make it available at field offices. The initial environmental examination, the EMP, the resettlement due diligence reports, the land acquisition and resettlement framework, and the draft LARP were disclosed on ADB's website. Project implementation consultants will support the staff of EDC's Social, Environment and Public Relation Office in implementing and monitoring the EMP and LARP.

G. Summary of Risk Assessment and Risk Management Plan

41. Significant risks and mitigating measures are summarized in Table 5 and described in detail in the risk assessment and risk management plan.³⁴

Table 5: Summary of Risks and Mitigating Measures

Risks	Mitigation Measures
Unforeseen changes in projected electricity demand undermine the project's financial and economic viability.	Even under a scenario of demand contraction in 2020 and slower-than-anticipated growth at an average 10.8% per year, compared with initially projected 17.6% per year, the project remains viable given the long-term development constraints in Cambodia and the continued underinvestment in the sector (footnote 26).
Unforeseen global events such as the COVID-19 pandemic delay the construction of transmission lines, substations, BESS, and associated facilities.	The 5-year project implementation time frame takes into account potential construction delays.
Lack of technical capacity to ensure quality design and sustainable operation of the BESS.	Consultants will support EDC in procuring the EPC contract and supervising installation. The EPC contract will include 3 years of operation and maintenance and provisions for training to EDC staff.

³³ Resettlement Plan: Land Acquisition and Resettlement Plan, Resettlement Framework: Land Acquisition and Resettlement Framework, Resettlement Due Diligence Report: Subprojects, and Resettlement Due Diligence Report: Substations (accessible from the list of linked documents in Appendix 2).

³⁴ Risk Assessment and Risk Management Plan (accessible from the list of linked documents in Appendix 2).

Risks	Mitigation Measures
Pilot BESS is not financially viable.	The BESS is a grant-financed pilot. The average annual net revenues from the BESS are sufficient to cover annual operating expenditures, ensuring the system's sustainability throughout its operating life without any direct financial cost to EDC.
Country-specific weak public financial management systems may lead to contract payment errors and irregularities.	Capacity will be further improved through training, with assistance from ADB under ADB technical assistance (footnote 13). Review missions will perform random checks on expenditures.
Climate change impacts undermine the sustainability of transmission lines, substations, and BESS.	Climate adaptation measures are incorporated in the design of transmission lines, substations, and BESS, and will be reflected in bidding documents and contracts.

ADB = Asian Development Bank; BESS = battery energy storage system; COVID-19 = coronavirus disease; EDC = Electricité du Cambodge; EPC = engineering, procurement, and construction.

Source: Asian Development Bank.

IV. ASSURANCES AND CONDITIONS

42. The government and EDC have assured ADB that the implementation of the project shall conform to all applicable ADB requirements, including those concerning anticorruption measures, safeguards, gender, procurement, consulting services, financial management, and disbursement as described in detail in the PAM and loan and grant documents. The government and EDC have agreed with ADB on certain covenants for the project, which are set forth in the draft loan and grant agreements and project agreement, including disbursement conditions requiring EDC to demonstrate that (i) adequate funds have been allocated to cover contingencies; and (ii) prior to civil works, land acquisition activities have been completed for subprojects to be constructed on private land.

V. RECOMMENDATION

43. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Asian Development Bank (ADB) and recommend that the Board approve the loan of \$127,800,000 to the Kingdom of Cambodia for the Grid Reinforcement Project, from ADB's ordinary capital resources, in concessional terms, with an interest charge at the rate of 1.0% per year during the grace period and 1.5% per year thereafter; for a term of 32 years, including a grace period of 8 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft loan and project agreements presented to the Board.

Masatsugu Asakawa
President

14 August 2020

DESIGN AND MONITORING FRAMEWORK

Impact the Project is Aligned with Adequate and reliable power supply from environmentally sustainable energy sources ensured (Rectangular Strategy for Employment, Equity and Efficiency, Phase, IV: Building the Foundation toward Realizing the Cambodia Vision 2050) ^a			
Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
Outcome Transmission network capacity and stability improved	By 2026: a. Transmission losses reduced to an average of 1.75% (2019 baseline: 2.3%) b. None of the existing transformers is overloaded, which could otherwise lead to load shedding (2019 baseline: 32% of transformers overloaded and 61% used at almost 90% capacity) c. Construction of the 10 transmission lines and substations enables direct employment of 1,300 people, with nearly 25% of jobs accessible to unskilled workers (2019 baseline: 0%) d. The BESS provides services for (i) 80% output smoothing of the co-located 60 MW solar park, (ii) 15–30 minutes of curtailment reserve, (iii) primary frequency response, and (iv) deferral of transformer upgrades at substation 6 (2019 baseline: 0)	a.–d. EDC operations data and reports	Unforeseen changes in projected electricity demand undermine the project's financial and economic viability.
Outputs 1. 115 kV and 230 kV grid infrastructure expanded and reinforced	By 2025: 1a. 115 kV transmission line expanded by 36.7 cct-km (2019 baseline: 1,532 cct-km) (RFI A) 1b. 230 kV transmission line expanded by 13 cct-km (2019 baseline: 2,376 cct-km) (RFI A)	1a–1d. Quarterly progress reports and project completion reports by EDC	Unforeseen global events such as COVID-19 pandemic delay the construction of transmission lines, substations, BESS, and associated facilities.

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
	<p>1c. 115 kV–22 kV substation capacity expanded by 350 MVA (2019 baseline: 1,730 MVA) (RFI A)</p> <p>1d. 230 kV–115 kV and 230 kV–22 kV substation capacity expanded by 1,475 MVA (2019 baseline: 2,611 MVA) (RFI A)</p> <p>1e. Inclusive and equitable human resource strategy developed for EDC, including gender provisions for all departments (2019 baseline: no strategy)</p> <p>1f. The share of women among all EDC staff (both in Phnom Penh and the other project provinces) increases to 22%, disaggregated by age, job function, and job site (2019 baseline: 17%)</p> <p>1g. At least one public consultation occurs in each subproject location to communicate safe use of electricity, and challenge gender bias by exploring gender roles and employment opportunities (2019 baseline: 0)</p> <p>1h. At least 50% (at least 2,317 men and at least 475 women) of 5,584 EDC employees (4,635 men, 949 women) report increased knowledge about project management within their area of expertise (2019 baseline: 20%)</p>	<p>1e–1f. Semiannual gender and social development progress reports</p> <p>1g. Knowledge, attitude, and perception survey results deployed at project start, midterm, and completion to assess behavioral changes related to the roles and employment opportunities for women and men in the energy sector</p> <p>1h. Training manuals and knowledge test results on project management, procurement, financial management, safeguards, and stakeholder engagement</p>	

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
2. First utility-scale energy storage system provided	<p>2a. 16 MW/16 MWh BESS operational (2019 baseline: no BESS)</p> <p>2b. Training provided to 6 EDC staff, of which at least 2 are women, on designing, implementing, operating, and maintaining the BESS (2019 baseline: NA)</p>	<p>2a. Quarterly progress reports and project completion reports by EDC</p> <p>2b. Training manuals and knowledge test results</p>	

Key Activities with Milestones

1. 115 kV and 230 kV grid infrastructure expanded and reinforced

- 1.1 Procure and award contracts (April 2020–February 2021).
- 1.2 Prepare detailed engineering design, construct, and commission (February 2021–June 2024).
- 1.3 Implement environmental management plan and resettlement plan (April 2020–June 2024).
- 1.4 Provide project management training; implement gender-responsive activities (April 2021–June 2025).

2. First utility-scale energy storage system provided

- 2.1 Procure and award contract (April 2020–February 2021).
- 2.2 Prepare detailed engineering design, construct, and commission (February 2021–July 2022).
- 2.3 Implement environmental management plan and resettlement plan (April 2020–July 2022).
- 2.4 Provide training to female and male staff of EDC on system procurement, construction oversight, operation and maintenance, and information analysis (April 2021–June 2025).

Inputs

Asian Development Bank: \$127,800,000 (loan)
 Strategic Climate Fund: \$4,700,000 (grant)
 Clean Energy Fund under the Clean Energy Financing Partnership Facility: \$2,000,000 (grant)
 Government of Cambodia: \$28,951,502
 EDC: \$30,201,519

Assumptions for Partner Financing

Not applicable

BESS = battery energy storage system, cct-km = circuit kilometer, COVID-19 = coronavirus disease, EDC = Electricité du Cambodge, kV = kilovolt, MVA = megavolt-ampere, MW = megawatt, MWh = megawatt-hour, NA = not applicable, RFI = results framework indicator.

^a Government of Cambodia. 2018. *Rectangular Strategy for Employment, Equity and Efficiency: Building the Foundation toward Realizing the Cambodia Vision 2050*. Phnom Penh.

Contribution to the ADB Results Framework:

RFI A: Transmission lines installed (km). Target: 49.7 km. 115 kV–22 kV substation capacity expanded. Target: 350 MVA. 230 kV–115 kV–22 kV substation capacity expanded. Target: 1,475 MVA.

Source: Asian Development Bank.

LIST OF LINKED DOCUMENTS

<http://www.adb.org/Documents/RRPs/?id=53324-001-3>

1. Loan Agreement
2. Grant Agreement: Strategic Climate Fund
3. Grant Agreement: Clean Energy Fund
4. Project Agreement
5. Sector Assessment (Summary): Energy
6. Project Administration Manual
7. Financial Analysis
8. Economic Analysis
9. Summary Poverty Reduction and Social Strategy
10. Risk Assessment and Risk Management Plan
11. Climate Change Assessment
12. Initial Environmental Examination
13. Resettlement Plan: Land Acquisition and Resettlement Plan
14. Resettlement Framework: Land Acquisition and Resettlement Framework

Supplementary Documents

15. Environmental Management Plan
16. Financial Management Assessment
17. Integrity Due Diligence Disclosure
18. Project Procurement Risk Assessment
19. Resettlement Due Diligence Report: Subprojects
20. Resettlement Due Diligence Report: Substations