Report and Recommendation of the President to the Board of Directors

Project Number: 44426-016
November 2015

Proposed Loan
Power Grid Corporation of India Limited
Green Energy Corridor and Grid Strengthening Project
(Guaranteed by India)

This is the version of the document approved by ADB's Board of Directors that excludes information that is subject to exceptions to disclosure set forth in ADB's Public Communications Policy 2011.

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 20 October 2015)

Currency unit	–	Indian rupee/s (Re/Rs)
Re1.00	=	$0.0154037872
$1.00	=	Rs64.9191

ABBREVIATIONS

ADB	–	Asian Development Bank
GW	–	gigawatt
HVDC	–	high-voltage direct current
km	–	kilometer
kV	–	kilovolt
MNRE	–	Ministry of New and Renewable Energy
POWERGRID	–	Power Grid Corporation of India Limited

NOTES

(i) The fiscal year (FY) of the Government of India ends on 31 March. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2015 begins 1 April 2014 and ends on 31 March 2015.

(ii) In this report, "$" refers to US dollars.

Vice-President	W. Zhang, Operations 1
Director General	H. Kim, South Asia Department (SARD)
Director	A. Jude, Energy Division, SARD
Team leader	A. Jeffries, Principal Energy Specialist, SARD
Team members	K. Enomoto, Energy Specialist, SARD
	L. George, Energy Specialist, SARD
	J. Ghimire, Senior Counsel, Office of the General Counsel
	Y. Jang, Social Development Specialist, SARD
	Y. Zhou, Environment Specialist, SARD
Peer reviewer	A. Wanniachchi, Senior Energy Specialist, Southeast Asia Department

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PROJECT AT A GLANCE

1. Basic Data — **Project Number:** 44426-016

Project Name	Green Energy Corridor and Grid Strengthening Project	**Department /Division**	SARD/SAEN
Country	India	**Executing Agency**	Power Grid Corporation of India Limited
Borrower	Power Grid Corporation of India Limited		

2. Sector	**Subsector(s)**	**ADB Financing ($ million)**
✓ **Energy**	Electricity transmission and distribution	500.00
	Total	**500.00**

3. Strategic Agenda	**Subcomponents**	**Climate Change Information**	
Inclusive economic growth (IEG)	Pillar 1: Economic opportunities, including jobs, created and expanded	Climate Change impact on the Project	Low
Environmentally sustainable growth (ESG)	Eco-efficiency Global and regional transboundary environmental concerns Natural resources conservation		

4. Drivers of Change	**Components**	**Gender Equity and Mainstreaming**	
Private sector development (PSD)	Public sector goods and services essential for private sector development	No gender elements (NGE)	✓

5. Poverty Targeting		**Location Impact**	
Project directly targets poverty	No	Nation-wide	High

6. Risk Categorization: Complex

7. Safeguard Categorization **Environment:** B **Involuntary Resettlement:** B **Indigenous Peoples:** C

8. Financing

Modality and Sources	Amount ($ million)
ADB	**500.00**
Ordinary capital resources (loan) (sovereign guaranteed)	500.00
Cofinancing	**0.00**
None	0.00
Counterpart	**2,081.30**
POWERGRID (other sources)[a]	1,306.90
POWERGRID equity (internal sources)	774.40
Total	**2,581.30**

9. Effective Development Cooperation

Use of country procurement systems	No
Use of country public financial management systems	Yes

Note: Numbers may not sum precisely due to rounding.
POWERGRID = Power Grid Corporation of India Limited.
[a]Includes a $500 million nonsovereign loan from ADB, with the remainder expected to be POWERGRID's domestic bond issuance, and other corporate loan financing.

Source: Asian Development Bank

I. THE PROPOSAL

1. I submit for your approval the following report and recommendation on a proposed loan of $500 million to Power Grid Corporation of India Limited (POWERGRID), with a sovereign guarantee from India, for the Green Energy Corridor and Grid Strengthening Project.[1]

2. The project will finance power transmission system upgrades in India, including (i) a portion of the Government of India's Green Energy Corridor initiative to facilitate the transfer of power from renewable energy-rich areas to other parts of the country, through 765 kilovolt (kV) and 400 kV high-voltage transmission lines and an associated 765/400 kV substation and equipment; and (ii) four high-voltage direct current (HVDC) terminals (two at 800 kV and two at 320 kV) to increase interregional connectivity between India's western and southern regional power grids.[2]

II. THE PROJECT

A. Rationale

3. India suffers from an unreliable power supply that inhibits its economic growth potential by constraining commercial activities. About 300 million citizens have no access to electricity, while some areas face daily power outages due to a lack of supply and transmission bottlenecks.[3] The government is scaling up investments in the generation, transmission, and distribution subsectors to address these issues. India is also promoting increased use of clean renewable energy, universal electricity access, and energy self-sufficiency by supplementing conventional power-generation sources (oil, gas, and coal). This includes ambitious renewable energy targets in the electricity-generation mix. As of 31 July 2015, India had an installed generating capacity of 275.9 GW, of which 36.5 GW was renewable energy.[4] In 2015, the Ministry of New and Renewable Energy (MNRE) announced state-level renewable energy-capacity targets for 2022 with a national aggregate of 175 GW, with about 90% from solar and wind sources.[5]

4. **Green Energy Corridor initiative**. In 2012, MNRE and the Forum of Regulators[6] commissioned POWERGRID to conduct a green energy corridor study to identify nationwide transmission investments required to accommodate the additional renewable energy-generation capacity.[7] Almost 60% of this renewable energy capacity is located in six states—Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Rajasthan, and Tamil Nadu. To facilitate the transfer of power from these renewable energy-rich states to others, as well as the absorption of power and addressing renewable energy intermittency and timing differences, POWERGRID identified $7 billion in investments to be undertaken in phases, starting under the Twelfth Five Year Plan. These include (i) intrastate transmission investments of about $3.6 billion within renewable

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[1] The design and monitoring framework is in Appendix 1.

[2] Asian Development Bank (ADB). 2013. *Technical Assistance to India for National Green Corridor Investment Project.* Manila.

[3] Government of India, Planning Commission. 2013. *Twelfth Five Year Plan, 2012–2017.* New Delhi.

[4] Government of India, Central Electricity Authority. 2015. *All India Installed Capacity (In MW) of Power Stations (As of 31 July 2015).* New Delhi. Note: MW = megawatts.

[5] Government of India, MNRE. 2015. *Tentative State-wise break-up of Renewable Power target to be achieved by year 2022.* New Delhi.

[6] The Forum of Regulators, established in 2005, consists of the Central Electricity Regulatory Authority chairperson and the chairpersons from all state-level regulatory authorities.

[7] POWERGRID. 2012. *Report on Green Energy Corridors–Transmission Plan for Envisaged Renewable Capacity*. Gurgaon.

energy-rich states and (ii) phased interstate investments of more than $3.4 billion to enable power flows across states over long distances.

5. **Expanded interregional connectivity.** India's national transmission grid is divided into five regions.[8] Synchronous interconnectivity previously existed only between the northern, eastern, western, and northeastern regions. On 31 December 2013, POWERGRID commissioned an interconnection between the southern and western regions that enabled synchronous operation of an interconnected national power grid. This not only augmented the interregional power transfer capacity of southern states, but also relieved congestion in some transmission corridors. Southern states, including Andhra Pradesh, Karnataka, and Tamil Nadu, have been particularly troubled by power shortages. A more resilient regional and interregional grid is essential in facilitating power transfers among states and regions. Furthermore, daily peak power demand does not occur simultaneously in all regions. One state or region may have a power surplus while another faces a deficit. Hence, an integrated national grid facilitates (i) power transfers from areas with a surplus to those with a deficit, (ii) optimization of the power system by integrating the electricity market and encouraging power trading, and (iii) competitive electricity prices and improved power supply mix through greater use of renewable energy. Interregional power transfer capacity as of 31 December 2014 was 46.5 GW and is envisaged to increase to 72.3 GW by 2017.[9]

6. **Borrower.** POWERGRID, India's national power transmission company, is responsible for planning, developing, and operating the high-voltage interstate and interregional power transmission network.[10] POWERGRID operates about 90% of the country's interstate and interregional transmission networks—consisting of 117,679 circuit kilometers (km) of transmission lines and 197 transmission substations with a transformation capacity of about 239,424 megavolt-amperes as of 31 July 2015—and provides nondiscriminatory open access to its transmission system for any licensed utility or generating company.[11] POWERGRID has a sound implementation record in upgrading and strengthening the national high-voltage transmission network, with consistent good operational performance evidenced by transmission network availability of above 99% for the past 5 years.

7. **Project design.** POWERGRID's immediate investment plans consist of the Green Energy Corridor initiative's interstate portions, including a high-capacity transmission corridor connecting major renewable energy pockets from Gujarat in the western region through Rajasthan to Punjab state in the northern region. This project will fund a portion of these interstate investments, consisting of two 765 kV alternating current transmission lines, one 400 kV alternating current transmission line, and one 765/400 kV substation in Rajasthan state connecting to a 765/400 kV substation in Punjab state, including a real-time system for measuring and monitoring power flows. Other portions of the initiative are funded by the German development cooperation through KfW for €500 million (about $556 million equivalent) that will be recognized through a memorandum of understanding as parallel collaborative cofinancing.[12] A separate project component will further increase interregional transmission capacity between the western and the southern regional grids as part of a high-priority HVDC

[8] The five regions are the northern, eastern, southern, western, and northeastern regions.
[9] Government of India, Ministry of Power. *Creation of a National Grid*. New Delhi. (http://powermin.nic.in/transmission-0)
[10] As of 30 June 2015, the Government of India owned 57.9% of POWERGRID, which makes the company majority state-owned and therefore a public sector undertaking.
[11] POWERGRID. *Our Network*. http://www.powergridindia.com/_layouts/PowerGrid/User/ContentPage.aspx?PId=80&LangID=English.
[12] Development Coordination (accessible from the list of linked documents in Appendix 2).

transmission link, since the southern region has an 11.3% overall deficit and a 19.8% peak power deficit, while the western region is in surplus. The envisaged southern region generation-capacity additions are not sufficient, and increased transmission capacity is therefore required. This component consists of two 800 kV HVDC terminals—one in Chhattisgarh (western region) and the other in Tamil Nadu (southern region)—and two 320 kV HVDC terminals connecting Kerala and Tamil Nadu. This will expand western–southern interconnectivity from 10 GW to 16 GW between Chhattisgarh and Tamil Nadu, and the portion between Tamil Nadu and Kerala will have 2 GW capacity. The adoption of HVDC transmission technology improves power transfer efficiency and reduces transmission losses over long distances. It is thus a least-cost solution and low-carbon investment option well suited for high-capacity interregional power transfers.

8. **Alignment with ADB strategy and operations.** Supporting the Green Energy Corridor initiative and financing transmission networks to increase interregional power flows are consistent with the Strategy 2020 and Energy Policy, 2009 of the Asian Development Bank (ADB) that advocates the promotion of renewable energy, increased energy efficiency, improved energy security, and facilitation of the country's transition to a low-carbon economy.[13] It is also consistent with the India country partnership strategy, 2013–2017 that supports (i) clean and renewable energy expansion; (ii) enhanced energy efficiency; (iii) promotion of advanced high-voltage transmission technology, including HVDC transmission lines to increase transmission efficiency; and (iv) grid integration of renewable energy.[14]

9. Since 1995, ADB has provided POWERGRID seven sovereign-guaranteed loans and one nonsovereign loan to strengthen its transmission system nationally. The projects have a good implementation history and high ratings. Among these, ADB provided two loan facilities in 2011 consisting of a nonsovereign loan and a sovereign-guaranteed loan in a single financing package.[15] The nonsovereign loan represented POWERGRID's first transaction without sovereign support, and helped POWERGRID diversify its financing sources.

10. **Value added by ADB assistance.** Renewable energy-based power generation is still more expensive than conventional coal-fired power generation in India and poses an additional cost burden due to its power intermittency. The government's intervention through the Electricity Act, 2003, the National Action Plan on Climate Change, and the Jawaharlal Nehru National Solar Mission has created the necessary legal and regulatory frameworks and incentives to attract private sector investments into the sector, thereby capturing the environmental benefits of renewable energy projects. However, the public sector is responsible for ensuring timely investments in transmission networks to allow for increased renewable energy penetration. In this context, POWERGRID's near-term funding needs for the interstate green energy corridor exceed $3.4 billion, whereas for enhanced overall interregional connectivity—critical not just for renewable energy but for bulk power evacuation and power system optimization—it requires a further $10 billion.[16] The previous ADB sovereign and nonsovereign loans helped POWERGRID diversify its funding sources. POWERGRID will continue to access all available sources, including domestic and international banks, capital markets, and multilateral and other development financial institutions, including ADB to fund its capital investment plans. To maintain affordability, POWERGRID must more closely match its funding sources' tenors to the

[13] ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank, 2008–2020*. Manila; and ADB. 2009. *Energy Policy*. Manila.
[14] ADB. 2013. *Country Partnership Strategy*: *India, 2013–2017*. Manila.
[15] ADB. 2011. *Report and Recommendation of the President to the Board of Directors: Proposed Loans for the National Grid Improvement Project in India.* Manila.
[16] Government of India, Ministry of Power. 2015. *Transmission Overview*. New Delhi. http://powermin.nic.in/overview-1

transmission assets it constructs, owns, and operates, which have 35-year cost recovery periods inherent in transmission tariff regulations. ADB's assistance thus plays an important role in financing India's power transmission components that are critical in achieving the government's renewable energy targets, as well as increasing overall interregional interconnection capacity. Without this, (i) significant additional generation capacity cannot be transferred, (ii) renewable and conventional energy project bankability becomes a challenge, (iii) power trading will not expand, and (iv) continued increases in access to affordable power will not materialize.

B. Impact and Outcome

11. The impact will be increased overall efficiency of the Indian power system, expanded access to electricity, increased private investment in renewable energy, and enhanced energy security in India. The outcome will be improved and more reliable transmission system capacity in the northern, western, and southern regions of India.

C. Outputs

12. These will be achieved by 2020 through the following outputs: (i) green energy corridor transmission system expanded in the northern region and (ii) transmission interconnection capacity between the western and southern regions expanded. Investments are as follows:

(i) Green energy corridor system expansion in the northern region:
   (a) 765 kV double circuit transmission line from Ajmer to Bikaner (263 km);
   (b) 765 kV double circuit transmission line from Bikaner to Moga (366 km);
   (c) 400 kV double circuit (Quad) transmission line from Bikaner (new substation) to Bikaner (existing substation) (26 km);
   (d) 765/400 kV substation with 2x1500 megavolt-ampere transformers at Bikaner;
   (e) extensions of the existing Ajmer and Moga substations by adding two line bays to each; and
   (f) real-time measurement and monitoring equipment.

(ii) Transmission interconnection capacity expansion between the western and southern regions:
   (a) 800 kV HVDC terminal stations at Raigarh in Chhattisgarh and Pugalur in Tamil Nadu; and
   (b) 320 kV voltage source converter HVDC terminal stations at Pugalur in Tamil Nadu and North Trichur in Kerala.

D. Investment and Financing Plans

13. The project is estimated to cost $2,581.3 million (Table 1).

Table 1: Project Investment Plan
($ million)

Item			Amount
A.	**Base Cost**[a]		
	1.	Green energy corridor (ADB-funded portion of interstate)	624.0
	2.	Western–southern HVDC interconnection terminals	1,578.9
		Subtotal (A)	**2,202.8**
B.	**Contingencies**[b]		**165.9**
C.	**Financing Charges During Implementation**[c]		**212.6**
		Total (A+B+C)	**2,581.3**

Note: Numbers may not sum precisely due to rounding.
ADB = Asian Development Bank, HVDC = high-voltage direct current.
[a] In mid-2015 prices. Includes taxes and duties of $44.1 million, which are eligible for financing from ADB resources.
[b] Physical contingencies computed at 3% for substations and equipment, and 15% for transmission lines. Price contingencies computed at 1.5% on foreign exchange costs and 5.5% on local currency costs; includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.
[c] Includes interest and commitment charges. Interest during construction for ADB sovereign loan has been computed at the 5-year forward London interbank offered rate plus a spread of 0.5%, and a sovereign guarantee fee (payable by Power Grid Corporation of India Limited to the Government of India) of 1.2%. Commitment charges for an ADB loan are 0.15% per year to be charged on the undisbursed loan amount. Applicable rates for additional debt funds are included.
Sources: Power Grid Corporation of India Limited and ADB estimates.

14. POWERGRID has requested a sovereign-guaranteed loan of $500 million from ADB's ordinary capital resources to help finance the project. The loan will be made directly to POWERGRID, with a separate guarantee agreement with the government, and will have a 20-year term, including a 5-year grace period, straight line amortization, an annual interest rate determined following ADB's London interbank offered rate-based lending facility, a commitment charge of 0.15% per year, and other terms and conditions set forth in the draft loan and guarantee agreements. Based on this, the average loan maturity is 12.75 years. POWERGRID will bear the foreign exchange risk under this loan. The loan will include taxes and duties for the investment components.[17] The financing plan is in Table 2.

Table 2: Financing Plan

Source	**Amount** ($ million)	**Share of Total** (%)
Asian Development Bank		
Ordinary capital resources (loan) (sovereign guaranteed)	500.0	19.4
POWERGRID (other sources)[a]	1,306.9	50.6
POWERGRID equity (internal sources)	774.4	30.0
Total	**2,581.3**	**100.0**

Note: Numbers may not sum precisely due to rounding.
POWERGRID = Power Grid Corporation of India Limited.
[a] Includes a $500 million nonsovereign loan from the Asian Development Bank, with the remainder expected to be POWERGRID's domestic bond issuance and other corporate loan financing.
Source: Asian Development Bank estimates.

[17] This includes taxes and duties of $44.1 million to be financed from government resources by cash contribution and ADB. The amount of taxes and duties to be financed by ADB (i) is within the reasonable threshold identified in the India country partnership strategy, (ii) does not represent an excessive share of the investment plan, (iii) applies only to ADB-financed expenditures, and (iv) is considered material and relevant to the project's success.

E. Implementation Arrangements

15. The implementation arrangements are summarized in Table 3 and described in detail in the project administration manual.[18]

Table 3: Implementation Arrangements

Aspects	Arrangements		
Implementation period	January 2016–December 2020		
Estimated completion date	31 December 2020 (loan closing date of 30 June 2021)		
Management			
(i) Oversight body	Coordination committee, POWERGRID		
(ii) Executing agency	POWERGRID		
(iii) Key implementing agencies	POWERGRID		
(iv) Implementation unit	POWERGRID's northern, western, and southern regional offices		
Procurement	International competitive bidding	28 contracts	$1.95 billion
Retroactive financing and/or advance contracting	All eligible contract packages and eligible expenditures agreed between ADB and the borrower have been approved for retroactive financing and advance contracting.		
Disbursement	The loan proceeds will be disbursed following ADB's *Loan Disbursement Handbook* (2015, as amended from time to time) and detailed arrangements agreed upon between POWERGRID and ADB.		

ADB = Asian Development Bank, POWERGRID = Power Grid Corporation of India Limited.
Sources: Asian Development Bank and POWERGRID estimates.

16. Procurement will follow ADB's Procurement Guidelines (2015, as amended from time to time). The loan proceeds will finance equipment procurement and installation. ADB finances eligible expenditures up to 100% of every claim it receives, as long as sufficient undisbursed loan amounts remain. If the remaining amount is not sufficient to cover 100% of the claim, only the remaining amount will be disbursed. The project team identified risks associated with the financing plan, and control mechanisms to address them (footnote 18).

III. DUE DILIGENCE

A. Technical

17. POWERGRID has in-house planning capabilities, including computer-aided facilities for transmission system planning, design, operation, and maintenance. POWERGRID's green energy corridor study (footnote 7) identified the required investments and estimated capital expenditure to ensure adequate capacity and system reliability to meet India's demand growth. The MNRE, the Forum of Regulators, and the Central Electricity Authority reviewed data from state transmission utilities and the Central Electricity Regulatory Commission. The study also included power demand projections taken from the 18th Electric Power Survey (2013) of the Central Electricity Authority.

18. The 800 kV HVDC transmission system is state-of-the-art, commercially proven technology, and is the most cost-effective means of transmitting bulk power over long distances. For high-capacity, point-to-point transmission, HVDC is economically preferable for system lengths exceeding 700–800 km. The project will enhance energy efficiency by reducing

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

transmission losses to about 3% below levels of typical conventional alternating current transmission systems. Screening for climate risks was conducted, and risks were assessed as low. Such risks are considered in the project design.

B. Economic and Financial

19. The project's financial internal rate of return, calculated on a real basis, is 5.76%—higher than the weighted average cost of capital of 3.66%—and remains such in the various adverse sensitivity scenarios.[19] Its economic internal rate of return is estimated to be 16.60%.[20] The project is thus financially viable and economically sustainable.

20. The government has awarded POWERGRID "Navratna" status, which gives public sector undertakings a degree of managerial and financial autonomy despite their majority-government ownership.[21] POWERGRID maintains an international long-term issue credit rating of BBB– (Outlook: Stable) from both Standard & Poor's and Fitch, and enjoys the highest domestic credit rating of AAA.[22] Based on the cost-plus nature of the tariff-setting process coupled with its operating efficiency, POWERGRID has increased revenues and net profits consistently, maintaining a robust financial position with stable cash flows to cover its costs, capital investment, and debt payments. Over the last three years, it achieved a post-tax return on net worth of over 10.0% and an average debt service coverage ratio of 1.5 times. In FY2015, the return on net worth rose to 13.1%[23] and the debt service coverage ratio improved to 2.0 times.[24] POWERGRID's debt–to–equity ratio has remained at approximately 70:30. Although POWERGRID has an aggressive investment plan and a large need for additional borrowings, financial projections show it has a sound financial position even under stress scenarios.

C. Governance

21. As a publicly listed company, POWERGRID is subject to several strong governance measures imposed by India's Securities and Exchange Board, which enhance accountability, transparency, and predictability of its financial governance through information disclosure to shareholders, investment professionals, and the general public. POWERGRID has an advanced accounting system using computerization with confidentiality and integrity at various levels. The financial management risk is thus low.

22. ADB's Anticorruption Policy (1998, as amended to date) was explained to and discussed with the government and POWERGRID. The specific policy requirements and supplementary measures are described in the project administration manual (footnote 18).

D. Poverty and Social

23. The power sector is a key driver of India's economic growth and development. Access to reliable, stable, and adequate electricity supply increases agricultural, industrial, and

[19] Financial Analysis (accessible from the list of linked documents in Appendix 2). The nominal financial internal rate of return is 10.72%, higher than the nominal weighted average cost of capital of 7.78%.
[20] Economic Analysis (accessible from the list of linked documents in Appendix 2).
[21] Navratna-status public sector undertakings may invest up to less than (i) Rs10 billion or (ii) 15% of net worth on a single project or 30% of net worth in a single year, without having to seek the government's permission.
[22] Since 2001, POWERGRID's domestic bonds have been rated AAA by the Credit Rating Information Services of India Limited and AAA by the Investment Information and Credit Rating Agency of India Limited. Since 2008, the Credit Analysis and Research has also given these bonds an AAA rating.
[23] POWERGRID. 2015. *FY2014–2015 Press and Analysts Meet Announcement.* Mumbai.
[24] POWERGRID. 2015. *Audited Annual Financial Results for the year ended 31March 2015.* Gurgaon.

commercial productivity, and enhances economic growth. Economic growth helps reduce poverty and improve quality of life, particularly for the most vulnerable segments of society. The project will avoid or minimize negative impacts on affected people.[25] Social design features include (i) compensation for loss of crops and trees at market value, (ii) additional assistance for affected vulnerable households, and (iii) equal opportunities to access employment and equal pay for men and women under civil works contracts.

E. Safeguards

24. The project is classified as category B for environment, category B for involuntary resettlement, and category C for indigenous people. In accordance with ADB's Safeguard Policy Statement (2009), the project's potential environmental and social impacts and risks have been identified. Measures to avoid, mitigate, and compensate for adverse environmental impacts are incorporated in the initial environmental examination, which includes the environmental management plan.[26] Environmental impacts of transmission lines can be minimized by careful route selection. One of the lines passes through about 0.7 km of degraded forest land. Compensatory afforestation required by the government to offset this impact is budgeted. Private land will be required for the HVDC terminal in Pugalur, Tamil Nadu, and is being acquired on a willing-buyer, willing-seller basis and through negotiated settlement.[27] The remaining substations are on government or POWERGRID-owned land, for which due diligence has confirmed there are no encroachers or informal settlers and that the land is free of claims and disputes. For the transmission towers and lines, impacts are temporary and will occur during construction in loss of crops and trees, which will be compensated. Measures to avoid, mitigate, and compensate for adverse impacts are incorporated in a compensation plan for temporary damages, analogous to ADB's resettlement plan.[28] This contains basic elements of a resettlement plan, as required by ADB's Safeguard Policy Statement for category B projects, and is based on the principles of the Safeguard Policy Statement; the Indian Telegraph Act, 1885; and the Electricity Act, 2003. POWERGRID has the commitment and ability to manage the social and environmental risks.[29] Information disclosure to and consultations with affected people will be conducted following ADB requirements.

F. Risks and Mitigating Measures

25. Major risks and mitigating measures are shown in Table 4 and further described in the risk assessment and risk management plan.[30] The risks are manageable, and appropriate mitigation measures are incorporated. Integrated benefits are expected to outweigh the costs.

[25] Summary Poverty Reduction and Social Strategy (accessible from the list of linked documents in Appendix 2).
[26] Initial Environmental Examination (accessible from the list of linked documents in Appendix 2).
[27] The private land is being acquired through negotiated settlement between willing buyer and willing seller, such that there is no expropriation required. The negotiation is being done through meaningful consultation with affected persons and POWERGRID's committee dealing with the land purchase, and will aim to offer a fair price. POWERGRID will ensure any negotiations with affected persons are transparent, and an appropriate expert will validate the transaction. POWERGRID will document the processes of negotiation, such as the consultation processes, policies, and laws applicable to such transactions and third-party validation, and will submit to ADB after the completion of negotiations and payment.
[28] Compensation Plan for Temporary Damages Plan (accessible from the list of linked documents in Appendix 2).
[29] POWERGRID developed a comprehensive environmental and social management system in 1998 and revised it in 2009. This integrated guidance and best practices from the World Bank through a multistakeholder and participatory consultation process.
[30] Risk Assessment and Risk Management Plan (accessible from the list of linked documents in Appendix 2).

Table 4: Summary of Risks and Mitigating Measures

Risks	Mitigating Measures
Project completion delayed	Completion delays largely result from issues related to land acquisition and right-of-way approvals. Land for the project has been identified, and the risk of delays is expected to be low. POWERGRID has a strong in-house technical, legal, and management team that monitors implementation, and their project implementation has historically been good. In the case of delays and ensuing cost overruns, tariff regulations allow the regulator to approve an increase in cost, based on which the transmission tariff is calculated, such that POWERGRID can recover cost increases outside its control through the standard tariff methodology.
Lower revenue	Due to its business profile, regulated nature of capital expenditure, predictable tariff-based revenues, and full cost recovery from a supportive regulatory environment, POWERGRID revenue risk is considered to be low. The essential nature of power transmission has resulted in a good collection record with customers and low overdue receivables. Tariff regulations allow cost recovery of regulator-approved cost overruns.
Regulatory changes	The regulator has historically avoided making sudden or significantly adverse regulatory changes. Major regulatory decisions have been made on the basis of objective criteria and input from stakeholders via a public and transparent process. The regulator provides detailed explanation in support of new or amended regulations. The tariff structure and components have remained largely unchanged in past regulatory periods.
Foreign exchange variations	A majority of POWERGRID's long-term debt is denominated in Indian rupees, and there is no foreign exchange risk with this. For foreign currency debt, POWERGRID has not undertaken any foreign exchange hedging, since foreign exchange-related costs or losses are permitted as a pass-through in the POWERGRID tariff, without further regulatory approval.

POWERGRID = Power Grid Corporation of India Limited.
Source: Asian Development Bank estimates.

IV. ASSURANCES

26. The government and POWERGRID have assured ADB that implementation of the project shall conform to all applicable ADB policies including those concerning anticorruption measures, safeguards, gender, procurement, consulting services, and disbursement as described in detail in the project administration manual and loan documents.

27. The government and POWERGRID have agreed with ADB on certain covenants for the project, which are set forth in the loan agreement and guarantee agreement.

V. RECOMMENDATION

28. 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 $500,000,000 to the Power Grid Corporation of India Limited, to be guaranteed by India, for the Green Energy Corridor and Grid Strengthening Project, from ADB's ordinary capital resources, with interest to be determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility; for a term of 20 years, including a grace period of 5 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft loan and guarantee agreements presented to the Board.

Takehiko Nakao
President

10 November 2015

DESIGN AND MONITORING FRAMEWORK

Impacts the Project is Aligned with

Increased overall efficiency of the Indian power system, expanded access to electricity, increased private investment in renewable energy, and enhanced energy security in India. (Electricity for All, Twelfth Five Year Plan)[a]

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting	Risks
Outcome Improved and more reliable transmission system capacity in the northern, western, and southern regions of India	By 2020: Additional 3,000 MVA of transmission capacity installed to accommodate renewable energy flows via Bikaner, Rajasthan in the northern region. (2015 baseline = 0)[b] Interregional capacity between Chhattisgarh in the western and Pugalur in the southern region increased by 6,000 MW. (2015 western–southern baseline: 5,720 MW)[b]	National Load Dispatch Center and Power System Operation Corporation annual reports	Expected growth in renewable energy-generation capacity does not match the increase in transmission capacity.
Outputs 1. Green energy corridor transmission system expanded in the northern region	By 2020: 1a. About 629 km of 765 kV double circuit transmission lines constructed. (2015 baseline: 0)[b] This consists of about 263 km line from Ajmer to Bikaner and about 366 km line from Bikaner to Moga. 1b. About 26 km of 400 kV double circuit (Quad) transmission line from Bikaner (new substation) to Bikaner (existing substation) constructed. (2015 baseline: 0)[b] 1c. 765/400 kV substation with 2x1,500 MVA transformers at Bikaner constructed. (2015 baseline: 0)[b] 1d. Existing Ajmer and Moga substations extended by additional two line bays each. (baseline: 0 extensions) 1e. Real-time measurement and monitoring equipment installed. (2015 baseline: 0)	POWERGRID annual reports	Rights-of-way issues cause delays. Completion of associated transmission lines (external to the project) is delayed. Increases in the prices of equipment and materials exceed contingency and inflation forecasts.
2. Transmission interconnection capacity between the western and	By 2020: 2a. Two 800 kV HVDC terminal stations constructed in Raigarh, Chhattisgarh, and Pugalur, Tamil	POWERGRID annual reports	

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting	Risks
southern regional grids expanded	Nadu. (2015 baseline = 0)[b] 2b. Two 320 kV voltage source converter HVDC terminal stations constructed in Pugalur, Tamil Nadu and Trichur, Kerala. (2015 baseline = 0)[b]		

Key Activities with Milestones

1. Green energy corridor transmission system expanded in the northern region
1.1 Identify and technically appraise subprojects (Q1–Q3 2015) [G/CD]
1.2 Prepare engineering designs (Q1–Q3 2015)
1.3 Conduct financial and economic assessment (Q3 2015)
1.4 Prepare bid documents (Q1–Q4 2015)
1.5 Award contracts for goods, works, and services (Q3 2015–Q1 2016)
1.6 Construct assets (Q1 2016–Q4 2020)
1.7 Make assets operational (Q4 2018–Q4 2020)

2. Transmission interconnection capacity between the western and southern regional grids expanded
2.1 Identify and technically appraise subprojects (Q1–Q3 2015) [G/CD]
2.2 Prepare engineering designs (Q1–Q3 2015)
2.3 Conduct financial and economic assessment (Q3 2015)
2.4 Prepare bid documents (Q1–Q3 2015)
2.5 Award contracts for goods, works, and services (Q3 2015–Q1 2016)
2.6 Construct assets (Q4 2015–Q4 2020)
2.7 Make assets operational (Q4 2018–Q4 2020)

Inputs

ADB (loan): $500.0 million
POWERGRID (other sources):[c] $1,306.9 million
POWERGRID equity (internal sources): $774.4 million

Assumptions for Partner Financing

POWERGRID raises the requisite debt funding from other sources for the project.

Parallel, related investments that are aligned with the project outcome, and further contribute to the impact include: German development cooperation through KfW is providing €500 million (about $556 million equivalent) parallel cofinancing for the Green Energy Corridor Initiative's component that includes transmission lines and substations connecting Gujarat with Rajasthan up to a new substation in Ajmer, Rajasthan.

ADB = Asian Development Bank, G/CD = governance and capacity development, HVDC = high voltage direct current, km = kilometer, kV = kilovolt, MVA = megavolt-ampere, MW = megawatt, POWERGRID = Power Grid Corporation of India Limited.
[a] Government of India, Planning Commission. 2013. *Twelfth Five Year Plan, 2012–2017*. New Delhi.
[b] As of 31 July 2015, POWERGRID owns and operates about 117,679 circuit km of high-voltage transmission lines and 197 substations with transformation capacity of about 239,424 MVA, and total interregional power transfer capacity is 47,450 MW. Source: http://www.powergridindia.com/_layouts/PowerGrid/User/ContentPage.aspx?PId=150&LangID=English.
[c] Includes a $500 million nonsovereign loan from ADB, with the remainder expected to be POWERGRID's domestic bond issuance and/or parallel financing from the commercial banking sector and/or other financial institutions.
Source: ADB.

LIST OF LINKED DOCUMENTS

http://www.adb.org/Documents/RRPs/?id=44426-016-3

1. Loan Agreement
2. Guarantee Agreement
3. Sector Assessment
4. Project Administration Manual
5. Contribution to the ADB Results Framework
6. Development Coordination
7. Financial Analysis
8. Economic Analysis
9. Country Economic Indicators
10. Summary Poverty Reduction and Social Strategy
11. Initial Environmental Examination
12. Compensation Plan for Temporary Damages
13. Risk Assessment and Risk Management Plan

Supplementary Documents

14. Project Technical Description
15. Project Climate Risk Assessment and Management Report
16. Full Economic Analysis