Completion Report

PUBLIC

Project Number: 44426-014
Loan Number: 2787
August 2022

India: National Grid Improvement Project

Asian Development Bank

CURRENCY EQUIVALENTS

Currency unit – Indian rupee/s (₹)

		At Approval	At Project Completion
		30 September 2011	14 January 2020
₹1.00	=	$0.0204	$0.0141
$1.00	=	₹48.96	₹70.72

ABBREVIATIONS

ADB	–	Asian Development Bank
CERC	–	Central Electricity Regulatory Commission
DMF	–	design and monitoring framework
EIRR	–	economic internal rate of return
EMMP	–	environmental management and monitoring plan
ESMD	–	environmental and social management department
ESPP	–	environmental and social policy and procedures
FIRR	–	financial internal rate of return
HVDC	–	high-voltage direct current
IEE	–	initial environmental examination
IPP	–	Independent power producer
LILO	–	line-in-line-out
O&M	–	operation and maintenance
POWERGRID	–	Power Grid Corporation of India Limited
WACC	–	weighted average cost of capita
WTP	–	willingness to pay

Weights and Measures

GW	–	gigawatt
ha	–	hectare
km	–	kilometer
kV	–	kilovolt
kWh	–	kilowatt-hour
MVA	–	megavolt-ampere
MW	–	megawatt

NOTES

(i) The fiscal year (FY) of POWERGRID ends on 31 March. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2022 ends on 31 March 2022.

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

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BASIC DATA

A. Project Identification

1.	Project number and project title	44426-014: National Grid Improvement Project
2.	Mode of financial assistance	Project loan
3.	Country	India
4.	Borrower	Power Grid Corporation of India Limited
5.	Executing agency	Power Grid Corporation of India Limited
6.	Product	Loan

Item	Approval Number	Financing Amount ($ million)	Financing Source	Product Modality and Nature of Activities
Loan	2787	500.0	OCR (Sovereign)	Project loan
Loan	2788	250.0	OCR (Nonsovereign)	Project loan
POWERGRID		1,500.1		
Project Total		**2,250.1**		

OCR = ordinary capital resources, POWERGRID = Power Grid Corporation of India Limited.

B. Milestone Dates by Product

Item	Loan 2787
Approval of concept clearance	
– Date started	28 April 2011
– Date completed	28 April 2011
Fact-finding mission	
– Date started	29 April 2011
– Date completed	13 May 2011
Loan negotiations	
– Date started	23 August 2011
– Date completed	24 August 2011
Date of Board approval	30 September 2011
Date of loan agreement	30 March 2012
Date of loan effectiveness	
– In loan agreement	28 June 2012
– Actual	22 October 2012
– Number of extensions	3
Project completion date	
– At approval	31 December 2016
– Actual	31 December 2019
Loan closing date	
– In loan agreement at approval	30 June 2017
– Latest revised	31 December 2019
– Number of extensions	2
Financial closing date	14 January 2020

C. Project Cost and Financing

1. Project cost ($ million)

Cost[a]	Estimate at Approval	Actual
Foreign exchange cost	874.8	750.0
Local currency cost	1,375.2	819.2
Total	**2,250.1**	**1,569.2**

2. Cost breakdown by Item of Expenditure ($ million)

Items			Estimate at Approval	Actual
A	**Project Expenditure**			
	1	**Output 1**: ±800 kilovolt (kV) high-voltage direct current (HVDC) transmission line and ±800 kV terminal stations at Champa and Kurukshetra	1,703.6	1,202.0[a]
	2	**Output 3**: Interregional System Strengthening Scheme for Western Region and Northern Region[b]	0.0	145.7
	3	**Output 4**: Establishment of ±800 kV, 6000 megawatts (MW) HVDC system between the western (Raigarh) and southern (Pugalur) regions and establishment of ±320 kV, 2000 MW voltage source converter-based HVDC system between Pugalur and North Trichur (Kerala)[c]	0.0	109.0
		Subtotal (A)	**1,703.6**	**1,456.7**
B	**Contingencies**			
	1	Physical contingency	51.1	0.0
	2	Price contingency	176.3	0.0
	3	Exchange rate variation	71.5	0.0
		Subtotal (B)	298.9	0.0
C	**Financing charge during implementation**		247.6	112.5[d]
		Subtotal (C)	247.6	112.5
		Total (A + B + C)	**2,250.1**	**1,569.2**

Note: Numbers may not sum precisely because of rounding.

[a] This includes physical and price contingencies.

[b] Additional scope approved in February 2015 to utilize the loan savings of $160.0 million under Loan 2787-IND (sovereign) and Loan 2788-IND (nonsovereign).

[c] Additional scope approved in April 2018 to utilize the further savings of $90.0 million under Loan 2787-IND, to partly finance the already awarded two contract packages of the project being funded under ADB Loans 3365-IND (sovereign) and 3375-IND (nonsovereign).

[d] Including the interest and commitment charges.

3. Financing plan and actual ($ million)

Cost	Estimate at Approval	Actual
Implementation costs		
POWERGRID and other financial institutions	1,252.5	706.7
ADB financed (sovereign guaranteed loan)	500.0	500.0
ADB financed (nonsovereign corporate loan)	250.0	250.0

Cost	Estimate at Approval	Actual
Total implementation cost (A)	**2,002.5**	**1,456.7**
Financing charge during implementation		
POWERGRID and other financial institutions	247.6	112.5
ADB financed (sovereign guaranteed loan)	0.0	0.0
ADB financed (nonsovereign corporate loan)	0.0	0.0
Total interest during construction cost (B)	**247.6**	**112.5**
Total (A + B)	**2,250.1**	**1,596.2**

ADB = Asian Development Bank, POWERGRID = Power Grid Corporation of India Limited.

4. Disbursements

a. Disbursement dates by product

	First Disbursement	Final Disbursement
Loan 2787	4 December 2012	21 November 2019

b. Loan disbursed amount ($ million)

Category	Original Allocation (1)	Increased/ (Decreased) during Implementation (2)	Canceled during Implementation (3)	Last Revised Allocation (4 = 1 + 2 - 3)	Amount Disbursed (5)	Undisbursed Balance (6 = 4 - 5)
01 Equipment	471.8	28.2	0.0	500.0	500.0	0.0
02 Unallocated	28.2	0.0	28.2	0.0	0.0	0.0
Total	**500.0**	**28.2** [a]	**28.2** [a]	**500.0**	**500.0**	**0.0**

[a] Overall loan amount was not increased. All contracts were awarded under category 01 Equipment. Reallocation was as of completion- accordingly, original earmarked amount under category 02 was shown under category 01. Hence, $28.2 million amount was shown under increased column.

5. Terms of loan

– Interest rate London interbank-offered rate (LIBOR) + 0.6%
– Maturity 25 years
– Grace period 5 years

E. Project Implementation

1. Project Schedule

Item	Estimate at Approval	Actual
I. **HVDC interregional transmission system between northern region (Haryana) and western region (Chhattisgarh)**		
Tendering and award of contract	Oct 2011–Sep 2013	Oct 2011–May 2013
Preparatory work, mobilization, civil work, supply and erection of equipment	Sep 2012–Jun 2015	Sep 2012–May 2017
Testing and commissioning	Dec 2015–Dec 2016	Feb 2017–Sep 2017
II. **Interregional system strengthening scheme for western and northern regional grids (part B)**		
Tendering and award of contract	Jun 2014–Jan 2015	Jun 2014–Apr 2016
Preparatory work, mobilization, civil work, supply and erection of equipment	Apr 2015–Feb 2018	Jun 2015–Mar 2018
Testing and commissioning	Mar 2018–Apr 2018	Feb 2018–Apr 2018
III. **Supply of equipment (partly) under already awarded and ongoing contracts**[a]	Apr 2018–Dec 2019	Apr 2018–Dec 2019

[a] Ongoing contracts are (i) ±800 kV, 6,000 MW HVDC terminal package and (ii) ±320 kV voltage source converter HVDC terminal and direct current cross-linked polyethylene cable system of 32 km package, of the project for an ±800 kV, 6,000 MW HVDC transmission system between the western and southern regions, being funded under ADB Loan 3365-IND (sovereign) and Loan 3375-IND (nonsovereign).

2. Project Implementation Indicators

Project Indicator	Description
Project readiness	None
Concept approval to first disbursement	586 days
Signing to first disbursement	337 days
Loan closing to financial closing	14 days

3. Project Performance Ratings

Implementation Period	Single Ratings
From 1 October 2012 to 31 December 2012	On Track
From 1 January 2013 to 31 December 2013	On Track
From 1 January 2013 to 30 June 2014	On Track
From 1 July 2013 to 31 December 2014	Potential Problem
From 1 January to 31 March 2015	On Track
From 1 April to 30 June 2015	Potential Problem
From 1 July to 31 December 2015	Actual Problem
From 1 January to 31 December 2016	On Track
From 1 January to 30 September 2017	On Track
From 1 October to 31 December 2017	Potential Problem
From 1 January to 31 March 2018	Potential Problem
From 1 April to 31 December 2018	On Track

Implementation Period	Single Ratings
From 1 January to 31 March 2019	Potential Problem
From 1 April to 31 December 2019	On Track
From 1 January to 31 March 2020	On Track

Year		Overall	Contract Awards	Disbursement	Financial Management	Technical /Output	Safeguards
2012	Q4	On Track	100%	100%	Yes	Yes	S
2013	Q1	On Track	100%	100%	Yes	Yes	S
	Q2	On Track	82.82%	100%	Yes	Yes	S
	Q3	On Track	86.10%	100%	Yes	Yes	S
	Q4	On Track	93.09%	100%	Yes	Yes	S
2014	Q1	On Track	100%	100%	Yes	Yes	S
	Q2	On Track	100%	91.93%	Yes	Yes	S
	Q3	Potential Problem	99.36%	83.02%	No	Yes	S
	Q4	Potential Problem	97.46%	74.03%	Yes	Yes	S
2015	Q1	On Track	96.01%	85.58%	Yes	Yes	S
	Q2	Potential Problem	100%	80.83%	No	Yes	S
	Q3	Actual Problem	100%	72.30%	No	Yes	S
	Q4	Actual Problem	100%	61.23%	No	Yes	S
2016	Q1	On Track	100%	99.99%	Yes	Yes	S
	Q2	On Track	100%	100%	Yes	Yes	S
	Q3	On Track	100%	100%	Yes	Yes	S
	Q4	On Track	99.74%	98.19%	Yes	Yes	S
2017	Q1	On Track	100%	99.92%	Yes	Yes	S
	Q2	On Track	97.15%	99.26%	Yes	Yes	S
	Q3	On Track	97.30%	100%	Yes	Yes	S
	Q4	Potential Problem	97.64%	71.91%	Yes	Yes	S
2018	Q1	Potential Problem	82.07%	71.91%	Yes	Yes	S
	Q2	On Track	97.12%	100%	Yes	Yes	S
	Q3	On Track	99.15%	100%	Yes	Yes	S
	Q4	On Track	99.67%	100%	No	Yes	S
2019	Q1	Potential Problem	99.34%	100%	Yes	No	S
	Q2	On Track	99.95%	100%	Yes	Yes	S
	Q3	On Track	99.50%	100%	Yes	Yes	S
	Q4	On Track	100%	100%	Yes	Yes	S
2020	Q1	On Track	100%	100%	For Attention	Yes	S

4. **Asian Development Bank Missions**

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members	Virtual Mission (Yes/No)
Consultation 1	29 Sep–4 Oct 2010	2	12	a, b	No
Consultation 2	9–12 Nov 2010	8	32	a, b, c, d, e, f, g	No
Consultation 3	14–16 Dec 2010	7	21	a, b, c, g, h, i, j	No
Consultation 4	23 Feb–1 Mar 2011	9	63	a, b, c, h, i, k, l, m, n	No
Fact-finding	29 Apr–13 May 2011	9	135	a, b, c, h, j, k, l, o, p	No
Consultation 5	19–21 Jul 2011	4	11	a, b, c, m	No
Loan Inception and Review	4–6 Jun 2013	2	6	h, q	No
Loan Review 1	10 Jul 2013	2	2	h, r	No
Loan Review 2	19–20 Nov 2013	3	6	h, r, s	No
Loan Review 3	4–7 Feb 2014	3	12	h, r, t	No
Special Project Administration 1	30 Apr–3 May, 15 May 2014	3	15	u, v, w	No
Loan Review 4	2–13 Jun 2014	5	60	h, t, x	No
Special Loan Administration 2	27-28 Oct 2014	2	4	u, y	No
Loan Review 5	18–20 Aug, 3–7 Sep 2015	2	16	u, y	No
Loan Review 6	5–7, 21 Oct, 8, 30 Nov 2016	4	24	u, y, z, aa	No
Loan Review 7	12–13, 16, 24 Oct, 8 Nov 2017	2	10	u, y	No
Loan Review 8	8–9 May 2019	4	8	h, k, r, z	No
Project Completion Review	4-8, 11-13, 19, 22 Apr, 2 May 2022	45	8	u, z, aa, ab, ac	No[a]

a = senior energy specialist, b = principal private sector development specialist, c = financial specialist (energy), d = administrative assistant, e = principal treasury specialist, f = lead professional (nonsovereign legal issues), g = guarantees and syndications specialist, h = energy specialist, i = lead professional (energy), j = energy economist, k = social development specialist, l = senior treasury specialist, m = deputy director general, n = director, o = senior counsel, p = senior financing partnership specialist, q = senior operations assistant, r = environmental specialist, s = principal energy specialist, t = social safeguard specialist, u = team leader (energy), v = head PMU, w = associate project analyst, x = portfolio management specialist, y = project analyst, z = senior environment officer, aa = senior social safeguard officer, ab = senior project assistant, ac = associate investment officer.

[a] A physical mission was conducted for field visits, and the meetings with POWERGRID HQ staff and the wrap-up meeting were held in virtual mode.

I. PROJECT DESIGN AND IMPLEMENTATION

A. Rationale

1. India is one of the fastest-growing economies, with consequent increasing demand for power. The country has a history of chronic shortages of electricity as the sector has not been able to grow commensurate with demand. The country had been at constant need of additional power supply as the sector had shortfalls in generation, transmission, and distribution capacities. At project approval in 2011, the peak power deficit was 12.7% and the average deficit 10.1%.[1] The deficit had been a significant impediment to sustainable development of the economy. The capacity of the overall power supply system urgently needed enhancement commensurate with overall improvements in system efficiency. To address these issues, the government had been scaling up investment in generation, transmission, and distribution. Achieving efficient delivery of the power that the growing economy needed was a national priority and critical to sustaining India's long-term development.

2. To alleviate the power shortage, the Government of India has traditionally focused on increasing power generation. The private sector has joined this effort and had planned to add 12,000 megawatts (MW) during the Eleventh Five-Year Plan, fiscal year (FY) 2008–FY2012, but its investment in transmission had lagged. The government determined that the country's unevenly distributed natural resources had led to unevenly distributed power generation projects, so that some regions had a surplus and others a deficit. To optimally utilize resources, the government aimed to integrate its five regional grids by establishing interregional transmission superhighways. As part of its five-year plans, the government sought to increase interregional transmission capacity from 23,800 MW to 27,950 MW by FY2012, to 57,000 MW by FY2015, and to 75,000 MW by FY2017.[2]

3. In 2005, the Central Electricity Authority published its National Electricity Plan[3] to develop the transmission capacity and envisaged an investment of up to $18.7 billion for development of the transmission system by FY2012. In parallel, sector reforms were instituted to optimize the use of power and address regional disparities in energy resources and generation sites. Although generation was catching up, establishing adequate transmission had always been a challenge. The growing generation capacity urgently required commensurate expansion in the transmission system. Strong grid connectivity is essential to efficiently navigate future energy pathways and achieve government targets of access to power for all. Strengthening the interregional transmission network was also planned, to promote open access to power supply, increase investment in both generation and distribution, help integrate the electricity market, and encourage power trading and competitive electricity prices.

4. As the country's central transmission utility, the Power Grid Corporation of India (POWERGRID) has focused on creating a national electricity grid. At project approval, it planned to invest about $22.0 billion to more than double the size of its network by FY2017. It aimed to develop the interregional and interstate transmission network that would be critical to supporting development of power generation capacity by public and private utilities.[4] To support its ambitious investment, POWERGRID and the government had proposed to diversify sources of debt capital

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[1] ADB. 2011. *Report and Recommendation of the President to the Board of Directors: Proposed Loans Power Grid Corporation of India: National Grid Improvement Project.* Manila.

[2] Government of India, Planning Commission. 2007. *Eleventh Five-Year Plan, 2008–2012*. New Delhi. Government of India, Planning Commission. 2012. *Twelfth Five-Year Plan, 2013–2017*. New Delhi.

[3] Government of India, Ministry of Power, Central Electricity Authority. 2005. *National Electricity Plan, 2005*. New Delhi.

[4] India's tenth and eleventh five-year plans (FY2003–2012).

by tapping the international commercial lending market. POWERGRID predominantly relied on two sources of debt: domestic bond issuance and sovereign guaranteed loans of multilateral banks. To help diversify POWERGRID's ability to raise investment and finance this ambitious plan, the government asked the Asian Development Bank (ADB) to include a unique financing structure in the 2010 country program, combining a sovereign guaranteed loan and a nonsovereign loan in a single financing package. POWERGRID sought such assistance from ADB to finance the National Grid Improvement Project.

5. In September 2011, ADB approved two loans to POWERGRID—$500.0 million in Loan 2787-IND (sovereign) and $250.0 million in Loan 2788-IND (nonsovereign), to meet part of its investment needs. Both loans became effective on 22 October 2012. Loan 2788 was closed on 30 September 2017 and Loan 2787-IND was closed on 14 January 2020.[5] Both loans partially financed a project to help strengthen India's interregional connections for bulk electric power transmission by constructing 1,365.0 kilometers (km) of 800 kilovolt (kV) high-voltage direct current (HVDC) transmission lines and associated substations. The project would improve system reliability, smooth interstate and interregional power transfers by removing transmission bottlenecks, reduce losses, enable efficient use of existing and planned power plants, facilitate development of a national power trading market, and hence promote greater private sector participation through open access to the national transmission grid. The project design is consistent with ADB's Strategy 2030, which promotes quality infrastructure investments that are resilient and inclusive, and is aligned with operational priorities tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability (Appendix 15).[6]

6. Open transmission access and development of a national market for power trading, as provided under the Electricity Act 2003,[7] are policy developments that required a robust and reliable transmission grid to ensure smooth power flow within the entire power system. The project loan modality was appropriate, given the defined project investment components and the capacity of the executing agency (POWERGRID) to effectively implement a large-scale, state-of-the-art development challenge by adopting an HVDC transmission technology, which very few countries have used. The project's rationale remained unchanged throughout project implementation.

B. Project Impact, Outcome, and Outputs

7. The envisaged impact of the project was accelerated development of the interregional grid system to deliver greater power supply to sustain the country's economic growth. The expected outcome was greater reliability of power supply from private independent power producers (IPPs) and public utilities within the interconnected grid network. The specific outcome targets were (i) additional reliable power supply and trading (3,000 MW) through interregional transmission from 14 IPPs in Chhattisgarh to the northern region by 2017; (ii) maintained transmission system availability maintained at no less than 98% of the 2010 level; (iii) reduced interregional transmission loss by 3% of power supplied by 2017; (iv) a benchmark created for POWERGRID's funding source diversification from international capital and/or commercial bank markets; and (v) financial covenants in the loan agreements complied with. Achieving these outcomes would facilitate integration of electricity markets and create power trading opportunities through open access and competition among private and public utilities by expanding the number of potential sellers and buyers beyond their own regional grids. The project thus allows the IPPs to access

[5] A separate extended annual review report (XARR) is being prepared by the Private Sector Operation Department.
[6] ADB. 2018. *Strategy 2030: Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific*. Manila. Appendix 15 is *Contribution to Strategy 2030 Operational Priorities*.
[7] Ministry of Power. *Electricity Act 2003.* New Delhi.

wider geographical markets and help promote private investment in generation and distribution. The key performance target is establishing additional reliable power supply and trading (3,000 MW) through interregional transmission from IPPs in the western region to IPPs in the northern region. At completion, one impact target was exceeded and three were achieved (para. 48). Of the outcome targets, four were achieved and one was substantially achieved (para. 36).

8. At appraisal, the project had two planned outputs. Output 1 was the procurement, installation, and commissioning of a strengthened interregional transmission network between the northern and western regions. Output 2 was improvement of POWERGRID's corporate credit, access to nonsovereign borrowing, and risk management. During implementation (i) output 3 was included as a part of a minor change in scope on 2 February 2015 to use loan savings amounting to $101.0 million and $59.0 million under Loan 2788-IND, and (ii) output 4 was included as a part of another minor change in scope on 10 April 2018 to use additional savings amounting to about $90.0 million.[8] The inclusion of the additional scope increased the output indicators, and those changes were incorporated in the revised DMF, which is in Appendix 1. At completion, the outputs were fully achieved (para. 38).

9. **Output 1: Procurement, installation, and commissioning of strengthened interregional transmission network between the northern and western regions** was achieved with the construction of 1,288.05 km of ±800 kV HVDC transmission systems, against the target of 1,365 km, including terminals at Kurukshetra and Champa. The variance from the original target was due to actual site conditions. The second target, safeguards implemented in compliance with ADB's Safeguards Policy Statement (2009) and POWERGRID's environmental and social policy and procedures (ESPP), was achieved.

10. **Output 2: Improvements to POWERGRID's corporate credit, access to nonsovereign borrowing, and risk management** were achieved by promoting diversification of its funding sources through a combined nonsovereign loan and sovereign guaranteed loan from ADB.

11. **Output 3: Procurement, installation, and commissioning of a strengthened interregional transmission network** was achieved with the procurement of insulated buckets—financed from POWERGRID's own resources—and construction of 395.17 km of 765 kV and 400 kV transmission lines, against the target of 370 km in the state of Uttar Pradesh, consisting of (i) a 331.93 km, 765 kV, double-circuit transmission line between Orai and Aligarh; (ii) 10.87 km of line-in-line-out (LILO), 765 kV, single-circuit transmission line between Agra and Meerut at Aligarh; (iii) 10.55 km of LILO, 765 kV, single-circuit transmission line between Agra and Meerut at Aligarh (achieved); and (iv) 41.84 km of 400 kV, double-circuit transmission line between Orai and Orai (Uttar Pradesh Power Transmission Company Limited).

12. **Output 4: Transmission interconnection capacity between the western and southern regional grids expanded** was achieved with construction of two ±800 kV HVDC terminal stations at Raigarh, Chhattisgarh and Pugalur, Tamil Nadu; and ±320 kV voltage source

[8] The addition of output 3 was requested by POWERGRID to use loan savings amounting to $101.0 million under Loan 2787-IND and $59.0 million under Loan 2788-IND. ADB approved inclusion of output 3 in a minor change in scope. The addition of output 4 was requested by POWERGRID and approved by ADB to use loan savings amounting to $90.0 million to partly to finance the already awarded ADB-funded contract packages (under Loans 3365-IND and 3365-IND), namely (i) a ±800 kV, 6,000 MW HVDC terminal package and (ii) a ±320 kV voltage source converter HVDC terminal and direct-current XLPE cable system. The actual final amount financed—$109.0 million—amounts to just about 4.2% of the total estimated project cost of $2,518.3 million. A separate project completion review (PCR) and extended annual review report are being prepared for Loans 3365 and 3375.

converter HVDC terminal stations at Pugalur, Tamil Nadu and Trichur, Kerala and 27.21 km of direct-current, cross-linked polyethylene (XLPE) cable systems.[9]

C. Project Costs and Financing

13. The project cost at appraisal was estimated at $2,250.1 million, of which $750.0 million (33.3%) was to be financed from ADB's ordinary capital resources (through a $500.0 million sovereign loan and a $250.0 million nonsovereign loan), $825.1 million (36.7%) from other borrowings, and $675.0 million (30.0%) as POWERGRID equity. At completion, including the additional scope, the total cost was $1,569.2 million, comprising an ADB loan of $750.0 million ($500.0 million sovereign and $250.0 million nonsovereign), and other borrowings, and POWERGRID equity of $819.2 million. This was $680.9 million (30.2%) less than estimated.

14. The savings are primarily attributable to (i) award of contracts at lower-than-estimated costs, through international competitive bidding; (ii) substantial depreciation of the rupee against the dollar; (iii) reduction in transmission line length from 1,735.00 km to 1,683.24 km; (iv) the dropping of insulated buckets; and (v) substantial savings in contingency and financing charges.[10] Appendix 2 compares the estimated and actual project costs. Appendix 3 presents the project financing at appraisal and at completion. At appraisal, ADB financing accounted for about 33.3% of the total project cost, and at completion it accounted for about 47.8%.

D. Disbursements

15. At project completion, $500.0 million (100% of the loan amount) was disbursed. POWERGRID followed the reimbursement procedure for disbursements as per ADB's *Loan Disbursement Handbook* (2017, as amended from time to time). ADB approved advance procurement action and a retroactive financing facility. POWERGRID was able to effectively utilize the provisions by awarding major terminal packages and seeking disbursements for expenditures incurred before loan effectiveness under the retroactive financing facility. The actual disbursement was generally in line with the projected disbursement. However, owing to the inclusion of additional scope to utilize the loan savings and some minor delays in implementation of original project (paras. 16-17), actual disbursement was spread out over 8 years, from 2012 to 2019, instead of the originally envisaged period of 6 years, from 2012 to 2017. Loan disbursements were generally on track from the first disbursement on 4 December 2012 and made in shares of 7.7% in the initial year, increasing to 10.1% in the third year, increasing to 24.6% in the sixth year, and decreasing to 20.2% and 7.9% during the last 2 years.[11] POWERGRID encountered no problems in processing reimbursement claims. Annual and cumulative disbursements of loan proceeds are in Appendix 4, and those of contract awards are in Appendix 5.

E. Project Schedule

16. The project was approved on 30 September 2011, signed on 30 March 2012, and became effective on 22 October 2012. The original physical completion and loan closing dates were 31

[9] The outputs funded under the project were completed by the loan closing date.

[10] In the final route survey, the actual requirement for transmission line length was less than estimated.

[11] In accordance with the original arrangement, a disbursement ratio of 63:37 between the sovereign and nonsovereign loans was maintained on each withdrawal application submitted by POWERGRID until October 2015. From November 2015 to February 2016, 100% of disbursements were made from the nonsovereign loan account, as agreed by ADB to expedite the disbursements under that loan. From March 2016, disbursements were made in the ratio of 63:37 between the sovereign and nonsovereign loans until the closing of the nonsovereign loan. Subsequently, 100% of the disbursements were made from the sovereign loan.

December 2016 and 30 June 2017, respectively. The loan closing date was extended twice by a total of 30 months to 31 December 2019. The original loan closing date was extended from 30 June 2017 to 30 June 2018, on 31 May 2017, and from 30 June 2018 to 31 December 2019, on 10 April 2018. The loan financial closing date was 14 January 2020. The first 12-month extension was approved to complete (i) output 1, which was delayed by about 9 months, and (ii) output 3, which was added in February 2015 (para. 8) and scheduled for completion by April 2018. Though outputs 1, 2, and 3 were completed well before the first loan extension date of 30 June 2018, to accommodate the POWERGRID request to use the entire $500.0 million sovereign loan amount—and to fund the minor part of the equipment supplies under already awarded and ongoing contracts of Loan 3365-IND (sovereign) and Loan 3375-IND (nonsovereign), a second extension of 18 months was approved. Envisaged equipment supplies were completed as per the schedule, before the extended loan closing date of 31 December 2019.

17. A 9-month delay in completing output 1 was attributable to (i) a 6-month delay in obtaining land for the Champa terminal station—resulting in the delay of the commencement of contractor work from the original start date of November 2012 to May 2013; and (ii) a delay by the contractor in supplying converter transformers—caused by the longer-than-planned time taken in finalizing its technical detailed design and in completing the type tests at manufacturing site. POWERGRID's revised implementation schedule had no adverse impact on the expected outcomes of the project. Appendix 6 lists the chronology of main events. Appendix 7 compares planned and actual implementation of major project activities.

F. Implementation Arrangements

18. POWERGRID was the executing agency for the project. The implementation arrangements remained as envisaged at appraisal, and ADB found them adequate. Overall responsibility for project implementation was with the director of projects of POWERGRID, who was assisted by the corporate monitoring group. Construction supervision of each subproject was under the executive directors of the respective regions, assisted by the planning, engineering, finance, and personnel departments at regional headquarters. Engineering and contracting activities for all contract packages funded under the ADB loan component were carried out from the corporate headquarters in Gurgaon, Haryana. The company's executive director of corporate planning was in charge of overall coordination with ADB.

19. POWERGRID's computerized integrated project management system enabled (i) a master network schedule for each project; (ii) separate work schedules for each package with contractors to meet the master network schedule; and (iii) regular progress review and monitoring at the field, regional, and corporate levels. Project progress was periodically monitored by the respective regional executive directors through weekly and monthly review meetings. The implementation progress of each subproject was reviewed by top management at quarterly project review meetings. The POWERGRID's organization chart is in Appendix 8.

G. Procurement

20. As envisaged, the project was implemented without the services of consultants. POWERGRID prepared procurement plans with contract package details and obtained ADB approval. It carried out procurement in accordance with ADB-approved procurement plans. As part of advance procurement, POWERGRID awarded the largest contract package ($261.5 million for a ±800 kV HVDC terminal) before loan effectiveness. It awarded originally envisaged major contracts immediately after the loan became effective. Thus, POWERGRID had issued first invitation for bids for original scope in September 2011 and awarded all contracts by May 2014.

For the additional scope approved in February 2015, contracts were awarded during 2015–2016, the first contract in April 2015 and the last in April 2016.

21. POWERGRID carried out all procurement activities for ADB-financed contract packages in accordance with ADB's *Procurement Guidelines* (2010, as amended from time to time). As approved by ADB, POWERGRID has utilized the facility extended to it, exempting the need for ADB's prior approval of its subsequent bidding documents, which were prepared in compliance with the model bidding documents (first set of bidding documents) and were approved by ADB with prior review. Nevertheless, POWERGRID has obtained prior approval from ADB for all bid evaluation reports, even though it was allowed to award contracts of less than $10.0 million without seeking such prior approval.[12] Performance of the contractors and suppliers was rated satisfactory. POWERGRID reported that all goods and services procured complied with the specifications and performance standards specified in bidding documents. Appendix 5 presents the actual and cumulative contract awards, and Appendix 9 presents a summary of the contracts.

H. Safeguards

22. **Environmental safeguards**. The ADB-cleared environment category of the project is B, as per ADB's Safeguard Policy Statement (2009), which applies to this project. During project preparation, POWERGRID prepared the environmental planning documents—the initial environmental examination (IEE) reports, including the environmental management and monitoring plans (EMMPs)—on the basis of its ESPP (2009) and ADB's Safeguard Policy Statement. The utility selected the locations of substations and alignment of transmission lines by avoiding environmentally and ecologically sensitive areas to the extent possible and protecting monuments. Because of its careful selection of alignment, despite the linear nature and significant line length of about 1,680.0 km,[13] only 58.6 km (3.4%) passed through forests. POWERGRID ensured that the transmission line routes mainly passed through government-owned land, wasteland, and agricultural and grazing lands.

23. The IEE reports identified site-specific environmental impacts associated with these works during pre-construction, construction, and operation and maintenance (O&M). They reflected consultations with local residents and proposed detailed environmental mitigation measures and monitoring plans. These reports were disclosed on the ADB and POWERGRID websites. The bids and contract documents for the proposed scopes of work included the EMMPs, cleared by ADB. POWERGRID obtained the necessary forest clearances for the diversion of 404.3 hectares (ha) of forest land before implementing works in those specific stretches. It paid ₹764.4 million toward compensatory afforestation, net present value and other conservation measures as demanded by the forest authorities. The implementation of environmental safeguards was supervised and monitored by POWERGRID's Environmental and Social Management Department (ESMD), which has staff with the necessary academic training and professional experience in environmental management. The contractors designated their safety officers to look after implementation of environmental and safety aspects. POWERGRID submitted semiannual environmental monitoring reports regularly, which were disclosed on ADB and POWERGRID websites. The utility confirmed that it had a functional grievance redress management system throughout the implementation period, and no major complaints were received on environmental aspects or implementation of EMMPs.

[12] ADB. 2011. *Project Administration Manual: INDIA: National Grid Improvement Project.* Manila (para. 20).

[13] That is, 1,288.1 km of 800 kV HVDC line, 353.4 km of 765 kV line and 41.8 km of 400 kV line spread across the states of Chhattisgarh, Madhya Pradesh, Uttar Pradesh, and Haryana.

24. **Social Safeguards**. The project was classified as category B for involuntary resettlement and C for indigenous peoples, as per ADB's Safeguard Policy Statement. Resettlement plans for output 1 and additional scope were prepared and disclosed in 2011 and in 2015. In 2018, the surplus loan amount of $90.0 million from Loan 2787 was used for another ongoing project being partly financed under the two loans; the resettlement plans for this part of the project were prepared and disclosed as a part of these loans.[14] The utility did not envisage any negative impacts on indigenous peoples from the project at the time of processing; it continued with the same expectation until completion. The project submitted social monitoring reports regularly until the resettlement plan implementation was completed.

25. POWERGRID acquired 106.14 ha of land for the Champa substation and 47.22 ha for the Kurukshetra substation. Of the land for the Champa substation, 42.20 ha were private land, affecting 258 landowners, and the remaining 63.94 ha were encumbrance-free government land. The Kurukshetra substation was installed on encumbrance-free government land. Implementation of five transmission lines temporarily affected 7,896.6 ha of cropland and 181,796 trees and affected 49,158 persons.

26. The project minimized land requirements and social impacts by adopting new technologies such as (i) a dedicated metallic return conductor, (ii) gas-insulated substations instead of air-insulated switchyards, and (iii) a ±800 kV HVDC transmission system. POWERGRID paid ₹478.5 million in compensation for land acquisition for the Champa and Kurukshetra substations and another ₹104.3 million in restoration and rehabilitation (R&R) assistance to affected landowners for the Champa substation. For transmission lines, POWERGRID paid ₹879.6 million for tree and crop damage.

27. In addition, the project implemented community development activities in project areas as part of the ESPP. POWERGRID confirmed that no payment was pending for disbursement to affected people. The utility has a fully operational ESMD with experienced staff for safeguard management. The grievance redress management system at each site and regional offices enabled early responses to complaints and prompt facilitation of their resolution. POWERGRID confirmed there were no pending grievances. Details of safeguards are in Appendix 10.

I. Monitoring and Reporting

28. The project covenants were generally complied with. All covenants were reasonable and relevant for the sector, and for the utility's operations. At the request of POWERGRID one covenant was modified, and two covenants were waived during implementation.[15] Under the modified covenant, the definition of free cash flow was revised to match with the POWERGRID operations. Two covenants were waived because of separation of the central transmission utility function from POWERGRID, as per the Electricity Act 2003. ADB agreed to the changes in covenants as they did not materially affect the commercial operations of the POWERGRID. Appendix 11 provides the status of compliance with loan covenants.

29. The project generally met monitoring and reporting requirements, including the regular submission of quarterly progress reports, safeguard monitoring reports, audited project financial

[14] Details for Loan 3365 are not covered in the PCR, as only surplus funds from Loan 2787 were used.

[15] One covenant (Loan Agreement, Schedule 5, para. 6(a)) was modified as per the Loan Amendment of 14 May 2014, with the deletion at the end of sentence of "interest and other charges on debt, excluding interest capitalized." Two covenants (Loan Agreement, Schedule 5, paras. 4(b) and 11(a)) were waived as the role of central transmission utility was separated from POWERGRID responsibility. As per POWERGRID request letter of 7 September 2020, required changes in loan covenant amendments were effected through Loan Amendment of 24 December 2020.

statements, and auditor's certificates of POWERGRID's compliance with ADB's financial covenants.[16] Project accounts and records were maintained using sound accounting principles. The audited report included audited financial statements and detailed fund sources and expenditures. These project accounts were audited by external auditors acceptable to ADB. POWERGRID's financial management was adequate and in compliance with statutory requirements. The project financial reports submitted were of acceptable quality. POWERGRID's design, procurement, implementation, and financial capacities as assessed at approval were reasonable. Appendix 11 provides the status of compliance with loan covenants.

II. EVALUATION OF PERFORMANCE

A. Relevance

30. At approval and completion, the project was rated *relevant* to the government's development objectives and to ADB's sector strategy and country strategy for India. The project's intended outcomes were strategically aligned with the country's sector development priorities. The project was integral to the government's objective of improving efficiency in the power sector by removing transmission bottlenecks to facilitate better utilization of existing and planned generating stations, entry of IPPs, and development of a robust and reliable national transmission grid to ensure smooth power flow within the whole power system in the country. The government's successive five-year plans sought to increase interregional transmission capacity (para. 2).

31. At approval, the project was consistent with ADB's Strategy 2020 and the 2009–2012 India country partnership strategy.[17] ADB's country strategy was to fund infrastructure projects in key sectors that contributed to economic growth. The strategy included continued support for interstate and interregional transmission networks as part of the national-level sector development strategy. It also directed ADB to leverage the financing capacity of central public sector undertakings through its nonsovereign lending modality to help them meet substantial borrowing requirements under the government's five-year plans.[18] The sector strategy focused on (i) expanding the availability of and access to energy by reducing losses, (ii) strengthening infrastructure, and (iii) increasing energy efficiency. The project was also aligned with ADB's sector policy directive, highlighting the enhancement of energy efficiency in transmission systems.

32. At completion, the project remains consistent with ADB's Strategy 2030, which commits to promoting high-quality infrastructure investments that are green, sustainable, resilient, and inclusive, and prioritizing the acceleration of development of low greenhouse gas emissions. The project also supports the strategy's operational priorities under ADB Strategy 2030, including Operational Priority 3: Tackling Climate Change, Building Climate and Disaster Resilience, and Enhancing Environmental Sustainability, and Operational Priority 6: Strengthening Governance and Institutional Capacity. The project was also well aligned with ADB's country partnership strategy for India, 2018–2022, which aimed at addressing environmental degradation by mitigating negative impacts of climate change and promoting sustainable use of natural resources

[16] Except for (i) delay in submission of the audited project financial statement for FY2016 by 6.7 months and for FY2017 by 0.2 months; and (ii) lack of submission of the PCR by POWERGRID.

[17] ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank, 2008–2020.* Manila; ADB. 2009. *Country Partnership Strategy for India, 2009–2012—Abridged Version.* Manila.

[18] The 2010 country program for India confirmed the government's aim to graduate strong central public sector undertakings from the use of sovereign facilities in a phased manner, in favor of funding other development programs. The nonsovereign loan helped POWERGRID achieve its performance targets and served as a catalyst for POWERGRID's intent to diversify its funding sources.

in project design.[19] ADB's strategy and policy (Strategy 2030 and Energy Policy 2009) for the power sector in India align with the objectives of the government's subsequent plans, to develop infrastructure for economic growth and poverty reduction.[20]

33. The project will continue to be relevant, as the government estimates that peak demand for electricity is expected to increase from about 203 GW in FY2022 to 448 GW by FY2037, while electricity energy requirements are expected to increase from about 1,490 billion kilowatt-hours (kWh) in FY2022 to 4,049 billion kWh by FY2037.[21] Meeting this demand requires commensurate enhancement of capacity in generation, transmission, and distribution systems in the country. The transmission systems created under the project will continue to be optimally utilized, not only to evacuate the energy but also to integrate with the electricity grid.[22] The project is also in line with ADB's strategic objectives and priorities for India as indicated in the government's economic development plans.

34. The project design was appropriate for achieving the intended outcomes, and the DMF indicators and targets at impact, outcome, and output levels were logical, clear, and measurable. Minor scope changes occurred during implementation, resulting in additional scope, further enhancing the project outputs (paras. 8–12). There were no changes in the DMF, other than the inclusion of additional outputs through minor changes in scope to fully utilize the loan savings (para. 8). Due diligence was adequately undertaken during project preparation, including ownership by POWERGRID, safeguards, and stakeholder participation. The project did not overlap with other development partners' initiatives.

35. The project loan modality is deemed appropriate given the defined project investment components and the capacity of the executing agency. It reflected POWERGRID's capacity to effectively address a large-scale development challenge well within the energy sector's timeline for delivery. The project adopted advanced ±800 kV HVDC transmission lines that have so far been used only in very few countries. It is one of the most significant transmission line projects implemented in India. The project components supported the transmission of power surpluses to deficit regions, in turn helping achieve optimum utilization of natural resources and generating capacities, which are unevenly available in India. The project will also continue to facilitate the implementation of the open access policy under the Electricity Act, 2003. Thus, the project was and still is consistent with the government's objectives and with ADB's strategy for the Indian energy sector at appraisal and at completion.

B. Effectiveness

36. The project is rated *effective*. The target outcomes and outputs were fully achieved, except for one outcome target, which was substantially achieved (Appendix 1). The project achieved its outcome of increasing reliable power supply from private IPPs and public utilities within the grid network, as measured by its performance indicators: (i) additional reliable power supply and trading (3,000 MW) through interregional transmission from IPPs in Chhattisgarh to the northern region by 2017; (ii) maintained transmission system availability at no less than 98% of the 2010 level; (iii) reduced interregional transmission loss by 3% of power supplied by 2017; and (iv)

[19] ADB. 2017. *Country Partnership Strategy for India, 2018–2022—Accelerating Inclusive Economic Transformation.* Manila.
[20] ADB. 2009. *Energy Policy.* Manila.
[21] Government of India, Ministry of Power, Central Electricity Authority. 2019. *Long-Term Electricity Demand Forecasting, 2019.* New Delhi.
[22] Contribution to ADB Strategy 2030's operational priorities indicator: 1,683.3 km of transmission lines.

POWERGRID created a benchmark for diversifying its funding sources from international capital and/or commercial bank markets, including compliance with financial covenants.

37. By 2017, POWERGRID had further extended its interregional transmission network capacity to transmit up to 3,000 MW of power generated in the western region to power-deficit areas in the northern region.[23] The second outcome target, to maintain transmission availability at greater than 99.50%, was achieved in March 2018. The performance target of reducing interregional transmission loss by 3.00% of power supplied was substantially achieved, as interregional transmission loss is about 3.25%, which is at par with international standards. The target of creating a benchmark for diversification of POWERGRID's funding sources from international capital and/or commercial bank markets has likewise been achieved, though POWERGRID advised that ADB's nonsovereign terms were not used as a benchmark while sourcing other commercial foreign debt. The project's nonsovereign loan has spurred other diversified foreign funding sources for POWERGRID.[24]

38. All of the eight performance targets of the four outputs were fully achieved (paras. 8–12). The project's contribution to enhancing, strengthening, and expanding the interregional transmission network between the northern and western regions has been substantial. The project's output targets for (i) constructing HVDC terminals and associated transmission lines to increase transmission capacity to facilitate interregional power exchanges; and (ii) supporting POWERGRID in improving its credit risk, access to nonsovereign borrowing, and risk management were fully achieved. The project achieved its output targets of building (i) 1,288.1 km of ±800 kV HVDC transmission line, including terminals at Champa and Kurukshetra, and (ii) 353.4 km of 765 kV and 41.8 km of 400 kV transmission lines in Uttar Pradesh. In addition, the project partially funded the construction of (a) two ±800 kV HVDC terminal stations at Raigarh and Pugalur, and (b) two ±320 kV voltage source converter HVDC terminal stations at Pugalur and Trichur and a direct current XLPE cable system of 27.2 km. Through these outputs, the project helped enhance transmission network reliability and efficiency, in addition to facilitating the seamless exchange of power between regions. POWERGRID indicated that the project has improved the voltage profile and quality of power supply in the northern regional grid. The project contributed to meeting the increasing power demand of the northern capital region, Punjab, Haryana, Uttar Pradesh, and Rajasthan. POWERGRID was able to operate all the project components at very high levels of efficiency.

39. Implementation of the IEE and the resettlement plan was satisfactory (paras. 22–27). The project intervention has not resulted in environmental degradation. Safeguards monitoring was adequate. The outcomes have positively affected local communities. Compensation paid by POWERGRID as per the resettlement, was adequate. The adoption of new technologies such as metallic return conductors, gas-insulated substations, and HVDC transmission systems have minimized safeguards impacts. They also minimized land requirements and social impacts. The infrastructure facilities created under the project are expected to contribute positively to the welfare of communities in the beneficiary states.

[23] This capacity was further increased to 6,000 MW by connecting the HVDC transmission line to another set of 3,000 MW units at existing terminal stations of Champa and Kurukshetra in 2020, from POWERGRID's own funding.

[24] Subsequent to the project loan, POWERGRID was able to obtain two nonsovereign loans, thereby diversifying its loan financing portfolio, as follows: (i) a loan from the International Finance Corporation (World Bank Group) in July 2012; and (ii) issuance of foreign currency bonds in January 2013, which bore an annual fixed coupon rate of 3.875%. Despite the higher cost and the loan and bond issuance terms, the ADB nonsovereign loan has enabled POWERGRID's to obtain foreign funding without sovereign backing.

C. Efficiency

40. The project is rated *efficient* in achieving its intended outcome and outputs. It was implemented within budget and within the approved extended time frame. The delays in completing the original and additional scopes of work had no impact on project results (para. 16). Economic analysis of the project was undertaken following ADB guidelines.[25] The project's economic internal rate of return (EIRR) was recalculated at 16.25%, as compared with the estimate at appraisal of 22.10%. The EIRR at completion exceeds ADB's 12.00% hurdle rate. Thus, the project can be regarded as having achieved the expected efficiency. At approval, the EIRR was estimated considering the economic benefits attributable to the original scope of the project.

41. At completion, the EIRR was estimated considering the economic benefits attributable to the enhanced scope, consisting of the original scope and the additional scope included in February 2015. The recalculated EIRR was less than the estimated EIRR. Benefits at project completion are based on actual energy flows, whereas the energy flows estimated at approval assumed optimum capacity utilization by the third year of commissioning. The cost of reaching the project objectives was lower than envisaged during appraisal. The loan savings were mainly attributed to the benefits from competitive bidding and the depreciation of the rupee against the US dollar. As the project's benefits are realized only when power is consumed by final users in the northern region, a system approach was taken to calculating the EIRR, by identifying both benefits and costs of generation, transmission, and distribution.

42. As at approval, two types of project benefits were considered in the economic analysis at completion: direct consumer benefits (incremental) and resource cost savings and environmental benefits (non-incremental). Direct consumer benefits include increased electricity supply to meet demand. Resource cost savings are expected to occur when captive generation that would have been required to meet demand in the without-project scenario is replaced with energy flows from the project. Environmental benefits include impact from reducing CO_2 emissions – by reducing transmission losses – using an HVDC transmission line instead of an alternating current transmission system. Major assumptions used in the economic reevaluation and detailed calculations of the EIRR are in Appendix 12. Sensitivity analysis considered the following scenarios: (i) a 20% increase in project O&M costs, (ii) a 20% reduction in power flows, and (iii) a combination of those two scenarios. That analysis indicates that the risks would reduce the EIRR to 13.22%.[26]

D. Sustainability

43. The project is rated *likely sustainable*. The technical design of all the subprojects and the technology adopted are robust and appropriate, given the technical parameters, the requirements of the power sector, and the project's long-term sustainability.[27] Future funding for O&M is also not an issue, as transmission tariffs allow O&M costs to be passed through. The project revenue is insulated from actual power flows on the transmission line as project transmission tariffs are based on the cost-plus methodology, which ensures the recovery of costs incurred at normative availability of the transmission system at 99.5% and a return on equity of 15.5% per year.

[25] ADB. 2019. *Guidelines for the Economic Analysis of Projects.* Manila.
[26] The methodology for computing the EIRR was the same at completion and appraisal.
[27] HVDC transmission systems can be a great enabler in the transition to a low-carbon electrical power system; benefits include (i) transmission over long distances, (ii) higher transmission capacity and efficiency; (iii) reduced transmission losses and land use; and (iv) improved power quality, stability, and reliability.

44. The financial internal rate of return (FIRR) of 6.92% exceeds the weighted average capital cost (WACC) of 1.58%, so the project is financially viable, and its returns will contribute to POWERGRID's overall financial health.[28] The FIRR attributable to the project at completion includes the additional scope included in February 2015. The recalculated FIRR at completion was less than the FIRR estimated at approval. Revenues at project completion were calculated based on actual financial statements provided by POWERGRID, whereas revenues estimated at approval assumed varying years of commissioning. Given government forecasts (para. 33), there will be adequate demand for the evacuation of power from existing and future planned generating stations and for the transfer of power from regions with a surplus to regions with a deficit, ensuring the optimum utilization of the transmission systems established in the project.

45. The transmission lines and substations are static assets with operational life spans of 30–35 years and no adverse environmental impacts. The technical standards, quality of systems adopted, and material and equipment procured and installed were of the latest technology and are unlikely to become obsolete during their economic life. POWERGRID has in-house capacity to operate and maintain the project effectively and efficiently and is therefore capable of ensuring it meets all regulatory standards (such as availability of its assets at 99.5% during the economic life of the project). Hence, all the components are expected to be used optimally throughout the life of the project. The project outputs, benefits, and development impacts are technically, environmentally, and socially *likely sustainable*. Major assumptions used in the financial evaluation and detailed calculations of the FIRR are in Appendix 13. POWERGRID's historical financial performance is in Appendix 14. The methodology used for computing the FIRR was the same at appraisal and at completion.

46. The sustainability of the project also depends on the financial performance of POWERGRID. The utility has been consistently profitable since the start of its commercial operations. An assessment of the company's financial statements (income statement, balance sheet, and funds flow statement) for the last 5 years shows that POWERGRID generated between 27% and 29.9% net operating income, indicating the firm's strong financial health as a regulated business. Its return on equity during the same period rose steadily from 13.0% in FY2015 to 16.8% in FY2021 because of the expansion program undertaken by the company, and its assets grew 31% during the same period. Moreover, POWERGRID's institutional capacity to manage safeguards during O&M was enhanced. Its ESMD was strengthened through training, strong commitment, and coordination among ADB, contractors, affected people, and other stakeholders, which also enhanced its institutional capacity to manage safeguards during O&M.

E. Development Impact

47. The development impact of the project is rated *satisfactory*, as the project outputs have (i) contributed to building a robust national grid with enhanced interregional power transfer capacity, including facilitating the optimal utilization of unevenly located natural resources in the country; (ii) enhancing the investor's comfort level with investing in generation projects in the western region by providing access to the larger power markets in the country; (iii) directly and indirectly contributed to providing rural households in India with 100% access to electricity (achieved in March 2019);[29] and (iv) contributed to improving the quality of power supply in northern states, in

[28] At approval, the FIRR was 9.54%, based on estimates of capital and O&M costs using regulatory norms. At completion, the project capital and O&M costs provided by POWERGRID are based on actual costs incurred at completion, as well as O&M costs of the Power System Operation Corporation Limited, which are based on regulatory norms.

[29] The Saubhagya scheme launched by the Ministry of Power has successfully completed household electrification in the country (https://saubhagya.gov.in).

addition to enhancing the stability and reliability of the national grid.[30] The associated social benefits of electrification will have long-lasting positive development impacts.[31]

48. Three out of four impact indicators were fully achieved, and one was exceeded (para. 7 and Appendix 1). The project directly or indirectly contributed to (i) establishing the 40,000 MW high-capacity power transmission corridor between 2006 and 2018, which has supported private sector development in power generation by facilitating the access of IPPs to broader markets; (ii) attracting private sector investment in the transmission sector—with the private sector participating in more than 14 interstate transmission projects that were awarded under a tariff-based competitive bidding process—opening up the sector for more players and more competition; (iii) enhancing the interregional transmission capacity to 94,850 MW as of March 2018 from 23,800 MW in 2011, facilitating optimum utilization of resources, enhanced power availability in the power-deficit northern region, open access, and enhanced power trading (indicator exceeded); and (iv) establishing a fully functional enterprise risk management system in POWERGRID – enhancing the utility's institutional capacity to apply more advanced models to analyze risks associated with its operations, particularly in competitive market scenarios. POWERGRID's first nonsovereign loan from ADB served as a catalyst for diversifying its funding sources from international markets as well as reducing the strain on government finances.

49. Using the power flows through the energy-efficient technology of HVDC line, as of March 2022, POWERGRID estimates that the HVDC project has contributed to cumulative offsets equivalent to 0.298 million metric tons (MT) of CO_2 until FY2022, and during its lifetime will offset the equivalent of 2.77 MT. This is due to the reduction of transmission losses achieved by adopting HVDC technology instead of alternating current technology for transmission. Similarly, adoption of HVDC technology also helped in reducing ROW requirements from 276 m to 69 m (equivalent to a savings of more than 29,134 ha) for the transmission line corridor; this significantly minimized associated environmental and social impacts.

50. By supporting the construction of the state-of-the-art, ±800 kV, HVDC transmission line the project has contributed to further strengthening the institutional capacity of POWERGRID in formulation, design, engineering, project execution, and operation of HVDC lines, as well as seamless operation of the large and complex national grid. All the components of the project are currently operating satisfactorily with no problems since their commissioning. The project's contribution to the ADB Strategy 2030 Operational Priorities is detailed in Appendix 15.[32]

F. Performance of the Borrower and the Executing Agency

51. POWERGRID was both the borrower and the executing agency. Its overall performance in both roles was *satisfactory*. The related government agencies, including the Department of Economic Affairs, actively participated in coordinating and monitoring during project formulation and implementation. POWERGRID established a project management unit staffed by qualified and experienced personnel to coordinate project preparation, procurement, implementation of safeguards requirements, project implementation, and compliance with covenants. The entire

[30] Improved power supply quality will have a positive impact by reducing the failure of electrical equipment and appliances, and increasing productivity, income and economic competitiveness.

[31] It has been proven that when a rural community gains electricity, it leads to (i) improved education, communication, and medical facilities; (ii) cleaner drinking water; (iii) growth in cottage industries such as dairies and flour mills; (iv) a rise in average household income; (v) a reduction in migration to towns; and (vi) improved access to information and entertainment.

[32] ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank, 2008–2020.* Manila.

scope of the project has been completed. POWERGRID was able to operate and maintain all the subprojects at high levels of efficiency. At approval, the overall annual availability of POWERGRID's transmission system was 98% (2010 level). At completion, the availability of the national transmission grid was maintained at about 99.8% and above, which compares well with the best transmission utilities in the world. Overall, POWERGRID has demonstrated its capacity to formulate and appraise, arrange finance for, and carry out engineering, procurement, and construction of a variety of projects across the country, conforming to approved specifications and standards and to the satisfaction of ADB.

G. Performance of the Asian Development Bank

52. The performance of ADB is rated *satisfactory*. ADB closely and regularly monitored project progress through review missions, quarterly progress reports, and site visits. It provided useful advice in several areas, including procurement, safeguards, and project implementation. ADB accorded timely approvals that enabled project milestones to be achieved, which contributed to smooth project execution.

53. The South Asia Energy Division administered the project until 31 May 2017 and then delegated it to ADB's India Resident Mission on 1 June 2017. ADB was closely involved in identifying and resolving issues during implementation through tripartite portfolio review meetings with the Department of Economic Affairs and POWERGRID, and ADB, and through regular review missions, which helped make implementation of the project successful. ADB conducted an inception mission, eight review missions, and two special project administration missions. The project missions were adequate to address implementation issues and meet the project needs.

54. ADB analyzed implementation matters affecting the project and supported POWERGRID's request for extension of the loan closing date, as genuine reasons existed for the implementation delays and for full utilization of the ADB loan. The resident mission took timely corrective measures proposed on several occasions. Because of support from ADB, POWERGRID successfully completed the project and utilized the entire loan amount.

H. Overall Assessment

55. Overall, the project is rated *successful*. It was relevant to the government's overall development objectives and ADB's country strategies and policies at appraisal and remains so upon completion. The project was effective, as it achieved its outcome and output targets. It was efficient, with an EIRR of 16.25%. The project is likely to be sustainable, given the financial and institutional capacity of POWERGRID and its development impacts are rated satisfactory.

Overall Ratings

Criteria	Rating
Relevance	Relevant
Effectiveness	Effective
Efficiency	Efficient
Sustainability	Likely Sustainable
Overall Assessment	**Successful**
Development impact	Satisfactory
Borrower and executing agency	Satisfactory
Performance of ADB	Satisfactory

ADB = Asian Development Bank.
Source: Asian Development Bank.

III. ISSUES, LESSONS, AND RECOMMENDATIONS

A. Issues and Lessons

56. **Fund Utilization.** Cost savings during implementation necessitated two requests by POWERGRID to use available loan funds through minor scope changes during implementation, which positively affected project outcomes. Despite the minor scope changes, ADB and POWERGRID were able to swiftly fill the gap and provide timely support that enhanced the delivery of project results and outcomes. ADB's advance procurement facility enabled swift and timely utilization of cost savings. It is advisable, however, that the processing team adequately assess project cost estimates through due financial diligence and detailed consultations with stakeholders and suppliers. While designing the project, the processing team should account for possible delays and assess project risks.

57. **Advance Action.** To mitigate the risks of delays of transmission line and substation projects in India, advance action should be undertaken for (a) land acquisition, (b) forest clearances, and (c) anticipated safeguard issues related to resettlement, forest clearances, and potential grievances from community. Consideration of project- and site-specific issues and technical designs should be carefully assessed when finalizing project plans. These entail extensive consultations, adequate staffing, and strong commitment by POWERGRID.

58. **Financial Management.** To further enhance capacity and awareness of financial management and to ensure quality and timely reporting on project financial accounts, a financial management specialist should participate in project review missions and site visits.

59. The adoption of new technologies such as metallic return conductors, gas-insulated substations, and HVDC transmission systems have minimized safeguards impacts. The project minimized land requirements and social impacts through the adoption of new technologies.

B. Recommendations

60. **Future monitoring**. As POWERGRID has a long and successful track record of not only operating and maintaining the transmission system but also operating the regional grids on a real-time basis, no future project monitoring by ADB is required.

61. **Further action or follow-up.** No further follow-up action is required as future performance of the project components is being closely monitored by POWERGRID and the Central Electricity Authority.

62. **Covenants**. Covenants were formulated in close coordination with POWERGRID and the government to meet ADB requirements. Therefore, the covenants in the loan agreement should be maintained in the present form.

63. **Timing of Project Performance Evaluation Report.** A project performance evaluation report mission could be fielded in 2024.

DESIGN AND MONITORING FRAMEWORK

Results Chain	Performance Indicators	Revised DMF Indicator	Project Achievements
Impact Accelerated development of interregional grid system for increased power supply	a. Completion of the high-capacity power transmission corridor program to supply additional 40,000 MW (from 2006) of power from 55 IPPs by 2018		**a. Achieved** High-capacity power transmission corridor having capacity more than 40,000 MW has been constructed IPPs between 2006 and 2018
	b. Private sector participation in bidding of additional 14 interstate transmission projects by 2018		**b. Achieved** Under Tariff Based Competitive Bidding for construction of interstate transmission projects, private sector participated in more than 14 such bidding processes.[a]
	c. Interregional transmission capacity of 75,000 MW by 2018 from 23,800 MW (2011) to enhance power trading		**c. Exceeded** Interregional transmission capacity of 94,850 MW was achieved as of March 2018. [b]
	d. Functional enterprise risk management system of POWERGRID		**d. Achieved** POWERGRID has implemented a board approved Enterprise Risk Management (ERM) framework to manage the uncertainties and complexities associated with business operations and growth objectives since 2011. POWERGRID has duly constituted a Director Level Risk Management Committee and a designated Chief Risk Officer. ERM committee conducts quarterly review and monitors the critical risks associated with important business processes and prioritizes the risks based on their frequency of occurrence and significance of impact on various aspects like financial performance, availability of transmission network, reputation, health, safety and environment etc.
Outcome Increased reliable power supply from private IPPs and public utilities within the interconnected grid network.	a. Additional reliable power supply and trading (3,000 MW) through interregional transmission from 14 IPPs in Chhattisgarh to the northern region by 2017		**a. Achieved** Additional 3,000 MW interregional capacity has been established by September 2017 by commissioning first circuit of ±800 kV HVDC Interregional Transmission System between Northern and Western Regions from 5 IPPs.
	b. Maintained transmission system availability at no less than 98% at the 2010 level		**b. Achieved** Availability of transmission system is greater than 99% as of March 2018.

Results Chain	Performance Indicators	Revised DMF Indicator	Project Achievements
	c. Reduced interregional transmission loss by 3% of power supplied by 2017		**c. Substantially achieved** As per POWERGRID, interregional transmission loss is about 3.25%, though no official statement is available in case of interregional transmission lines.
	d. POWERGRID created a benchmark for its funding source diversification from international capital and/or commercial bank markets		**d. Achieved** As per POWERGRID after ADB approved first nonsovereign Loan 2788-IND in March 2012, it was able to avail two more nonsovereign foreign currency loans to diversify its loan books though the ADB first nonsovereign loan was not necessarily used as a benchmark.
	e. Financial covenants in the loan agreements complied with		**e. Achieved** POWERGRID complied with all the financial covenants in the loan agreement.
Outputs 1. Procurement, installation, and commissioning of strengthened Interregional transmission network between the northern and western regions	1a. Construction of about 1,365 km of 800 kV HVDC transmission systems including terminals at Kurukshetra and Champa by 2016		**1a. Achieved** POWERGRID has constructed 1,288.05 km ±800 kV HVDC transmission line by March 2017.[c]
	1b. Safeguards implemented in compliance with ADB Safeguard Policy Statement (2009) and POWERGRID"s environmental and social policy and procedures		**1b. Achieved** POWERGRID implemented safeguards requirements in compliance with ADB Safeguard Policy Statement (2009) and POWERGRID's environmental and social policy and procedures.
2. Improvements to POWERGRID"s corporate credit, access to nonsovereign borrowing, and risk management	2a. Funding plan and strategy agreed for ADB nonsovereign loan		**2a. Achieved** Based on the agreed funding plan and strategy for ADB, nonsovereign Loan 2788 for ($250 million) was signed in March 2012.
	2b. Financial risk management and system designed and implemented by 2012		**2b. Achieved** POWERGRID confirmed that financial risk management and system design implemented as a part of ERM. POWERGRID further confirmed that ERM was operationalized in FY2012.
3. Procurement, installation, and commissioning of strengthened interregional transmission network between the		3a. Construction of about 370 km of 765 kV, and 400 kV transmission systems in the state of Uttar Pradesh by 2017	**3a. Achieved** POWERGRID constructed 353.35 km of 765 kV transmission line and 41.84 km of 400 kV transmission line by April 2018 a. 765 kV D/C transmission line Orai – Aligarh (331.93 km)

Results Chain	Performance Indicators	Revised DMF Indicator	Project Achievements
northern and the western region			b. LILO of 765 kV S/C transmission line Agra – Meerut at Aligarh (10.87 km) c. LILO of 765 kV S/C transmission line Kanpur-Jhatikara at Aligarh (10.55 km) d. 400 kV D/C transmission line Orai-Orai at Aligarh (41.84 km)
		3b. Procurement of insulated buckets	**3b. Achieved** Procurement of insulated bucket package was dropped from ADB funding. Per POWERGRID procurement of insulated bucket package was implemented from its own resources in 2018.
4. Transmission interconnection capacity between the Western and Southern regional grids expanded		4a. Two ±800 kV HVDC terminal station constructed in Raigarh, Chhattisgarh and Pugalur, Tamil Nadu by 2020 4b. Two ±320 kV voltage source converter HVDC terminal stations constructed in Pugalur, Tamil Nadu and Trichur, Kerala and these two HVDC terminals connected through Direct Current XLPE cable system of 32 km by 2020	**4a. Achieved** POWERGRID constructed two ±800 kV HVDC terminal stations at Raigarh, Chhattisgarh and Pugalur, Tamil Nadu, by October 2021. **4b. Achieved** POWERGRID constructed ±320 kV voltage source converter HVDC terminal stations at Pugalur, Tamil Nadu and Trichur, Kerala and Direct Current XLPE cable system of 27.21 km, by June 2021.

ADB = Asian Development Bank, D/C = double circuit, ERM = Enterprise Risk Management, HVDC = high-voltage direct current, IPP = independent power producer, km = kilometer, kV = kilovolt, LILO = line-in-line-out, MW= megawatt, ROW = right of way, S/C = single circuit, XLPE = cross-linked polyethylene.

[a] Government of India, Ministry of Power, Central Electricity Authority, Monthly Progress Report of Transmission Projects awarded through Tariff Based Competitive Bidding. https://cea.nic.in/wp-content/uploads/2020/03/competitive-12-1.pdf

[b] Government of India, Ministry of Power, Central Electricity Authority, Executive Summary on Power Sector, December 2018. https://cea.nic.in/wp-content/uploads/2020/05/exe_summary-12-12.pdf

[c] Actual required length of line after detailed survey is only 1,288.05 km against estimated 1,365 km.

Sources: Asian Development Bank and POWERGRID.

PROJECT COST AT APPROVAL AND ACTUAL

Table A2.1: Project Cost at Approval and Actual

($ million)

	Items	At Approval			At Completion		
		Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total
A	**Project Expenditure**						
	Output 1: ±800 kV HVDC transmission line and ±800 kV terminal stations at Champa and Kurukshetra	706.8	996.8	1703.6	521.3	680.7	1,202.0[a]
	Output 2: Interregional system strengthening scheme for western region and northern region [b]	0.0	0.0	0.0	119.7	26.0	145.7
	Output 3: Establishment of ±800 kV, 6000 MW HVDC system between the western (Raigarh) and southern (Pugalur) regions and establishment of ±320 kV, 2000 MW VSC based HVDC system between Pugalur and North Trichur (Kerala) [c]	0.0	0.0	0.0	109.0	0.0	109.0
	Subtotal (A)	**706.8**	**996.8**	**1,703.6**	**750.0**	**706.7**	**1,456.7**
B	**Contingencies**						
	Physical	21.2	29.9	51.1	0.0	0.0	0.0
	Price	3.9	172.4	176.3	0.0	0.0	0.0
	Exchange rate variation	71.5	0.0	71.5	0.0	0.0	0.0
	Subtotal (B)	**96.6**	**202.3**	**298.9**	**0.0**	**0.0**	**0.0**
C	**Financing Charges during Implementation**						
	Interest and commitment charges	71.4	176.2	247.6	0.0	112.5	112.5
	Subtotal (C)	**71.4**	**176.2**	**247.6**	**0.0**	**112.5**	**112.5**
	Total (A+B+C)	**874.8**	**1,375.3**	**2,250.1**	**750.0**	**819.2**	**1,569.2**

HVDC = high-voltage direct current, kV = kilo volt, MW = megawatt, VSC = voltage source converter.

[a] This includes physical and price contingencies.

[b] Additional scope approved in February 2015 to utilize the loan saving of $160.0 million under Loan 2787-IND (sovereign) and Loan 2788-IND (nonsovereign).

[c] Additional scope approved in April 2018 to utilize the further savings of $90.0 million under the loan 2787-IND, to part finance the already awarded two contract packages of the project being funded under ADB Loans 3365-IND (sovereign) and 3375-IND (nonsovereign).

Sources: Power Grid Corporation of India Limited and Asian Development Bank's loan financial information system.

Table A2.2: Project Cost at Approval and Actual

($ million)

Items		At Approval			At Completion		
		Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total
A	**Output 1**: ±800 kV HVDC transmission line and ±800 kV terminal stations at Champa and Kurukshetra						
	Investment Costs						
1	Civil works, equipment, and others	706.8	792.3	1499.1	521.3	645.7	1,167.0[a]
2	Land acquisition and development, environment, and social mitigation costs	0.0	35.7	35.7	0.0	35.0	35.0
3	Inland freight and insurance	0.0	25.9	25.9	0.0	0.0	0.0
4	Project management	0.0	81.4	81.4	0.0	0.0	0.0
5	Taxes and duties	0.0	61.5	61.5	0.0	0.0	0.0
	Total Base Cost (A)	**706.8**	**996.8**	**1,703.6**	**521.3**	**680.7**	**1,202.0**[b]
B	**Output 2**: Interregional system strengthening scheme for western region and northern region [c]						
1	Equipment supplies	0.0	0.0	0.0	119.7	15.8	135.4
2	Civil works, erection and commissioning, environmental, social mitigation cost, inland and freight insurance	0.0	0.0	0.0	0.0	10.3	10.3
	Subtotal (B)	**0.0**	**0.0**	**0.0**	**119.7**	**26.0**	**145.7**
C	**Output 3**: Establishment of ±800 kV, 6000 MW HVDC system between the western (Raigarh) and southern (Pugalur) regions and establishment of ±320 kV, 2000 MW VSC based HVDC system between Pugalur and North Trichur (Kerala) [d]						
1	Equipment supplies	0.0	0.0	0.0	109.0	0.0	109.0
	Subtotal (C)	**0.0**	**0.0**	**0.0**	**109.0**	**0.0**	**109.0**
D	**Contingencies**						
1	Physical	21.2	29.9	51.1	0.0	0.0	0.0
2	Price	3.9	172.4	176.3	0.0	0.0	0.0
3	Exchange rate variation	71.5	0.0	71.5	0.0	0.0	0.0
	Subtotal (D)	**96.6**	**202.3**	**298.9**	**0.0**	**0.0**	**0.0**
E	**Financing Charges during Implementation**						
1	Interest and commitment charges	71.4	176.2	247.6	0.0	112.5	112.5
	Subtotal (E)	**71.4**	**176.2**	**247.6**	**0.0**	**112.5**	**112.5**
	Total Project Cost	**874.8**	**1,375.3**	**2250.1**	**750.0**	**819.2**	**1,569.2**

HVDC = high-voltage direct current, kV = kilo volt, MW = megawatt, VSC = voltage source converter.

[a] This includes civil works, equipment supplies, inland freight and insurance, taxes and duties, erection, and commissioning.

[b] This includes physical and price contingencies.

[c] Additional scope approved in February 2015 to utilize the loan saving of $160.0 million under Loan 2787-IND (sovereign) and Loan 2788-IND (nonsoverign).

[d] Additional scope approved in April 2018 to utilize the further savings of $90.0 million under Loan 2787-IND (sovereign), to part finance the already awarded two contract packages of the project being funded under ADB Loans 3365-IND (sovereign) and 3375-IND (nonsovereign).

Sources: Power Grid Corporation of India Limited and Asian Development Bank's loan financial information system.

PROJECT COST AT COMPLETION BY FINANCIER
Table A3.1: Project Cost at Approval by Financier
($ million)

Items		ADB-2787 (SO) Amount	ADB-2787 (SO) % of Cost Category	ADB-2788 (NSO) Amount	ADB-2788 (NSO) % of Cost Category	POWERGRID[a] Amount	POWERGRID[a] % of Cost Category	Total Amount
A	**Investment Costs**							
1	Civil works		0.0		0.0	297.2	100.0	297.2
2	Equipment and supplies							
	a. Foreign currency portion*	471.8	66.8	235.0	33.2	–	0.0	706.8
	b. Local currency portion		0.0		0.0	495.1	100.0	495.1
3	Land acquisition and development, environment and social mitigation costs		0.0		0.0	35.7	100.0	35.7
4	Inland freight and insurance		0.0		0.0	25.9	100.0	25.9
5	Project management[a]		0.0		0.0	81.4	100.0	81.4
6	Taxes and duties[b]		0.0		0.0	61.5	100.0	61.5
	Total Base Cost (A)	**471.8**	**27.7**	**235.0**	**13.8**	**996.8**	**58.5**	**1,703.6**
B	**Contingencies**	**28.2**	**9.5**	15.0	**5.0**	255.7	**85.5**	**298.9**
C	**Financing Charges during Implementation**		**0.0**		**0.0**	**247.6**	**100.0**	**247.6**
	Total Project Cost (A+B+C)	**500.0**	**22.2**	**250.0**	**11.1**	**1,500.1**	**66.7**	**2,250.1**

ADB = Asian Development Bank, POWERGRID = Power Grid Corporation of India.

[a] After the availability period of the nonsovereign loan, 100% will be funded by the sovereign loan.

Sources: Asian Development Bank and POWERGRID (ADB estimates for costs are based on a detailed project report submitted by POWERGRID and discussions with POWERGRID in 2011 and expressed in mid-2011 prices).

Table A3.2: Project Cost at Completion by Financier
($ million)

Items		ADB-2787 (SO) Amount	ADB-2787 (SO) % of Cost Category	ADB-2788 (NSO) Amount	ADB-2788 (NSO) % of Cost Category	POWERGRID[a] Amount	POWERGRID[a] % of Cost Category	Total Amount
A	**Investment Costs**							
1	Civil works, equipment and others	500.0	35.17%	250.0	17.58%	671.7	47.25%	1,421.7[a]
2	Land acquisition and development, environment and social mitigation costs	–	0.00%	–	0.00%	35.0	100%	35.0
3	Inland freight and insurance	–	0.00%	–	0.00%			
4	Project management	–	0.00%	–	0.00%			
5	Taxes and duties	–	0.00%	–	0.00%			
	Total Base Cost (A)	**500.0**	**34.32%**	**250.0**	**17.16%**	**706.7**[a]	**48.51%**	**1,456.7**
B	**Contingencies**	–	**0.00%**	–	**0.00%**	–	**0.00%**	–
C	**Financing Charges during Implementation**	–	**0.00%**	–	**0.00%**	**112.5**	**100.00%**	**112.5**
	Total Project Cost (A+B+C)	**500.0**	**31.86%**	**250.0**	**15.93%**	**819.2**	**52.20%**	**1,569.2**

ADB = Asian Development Bank, POWERGRID = Power Grid Corporation of India Limited.
Numbers may not sum precisely because of rounding.
[a] Includes civil works, equipment supplies, inland freight and insurance, project management, taxes and duties, erection, and commissioning.
Sources: Power Grid Corporation of India Limited and Asian Development Bank's loan financial information system.

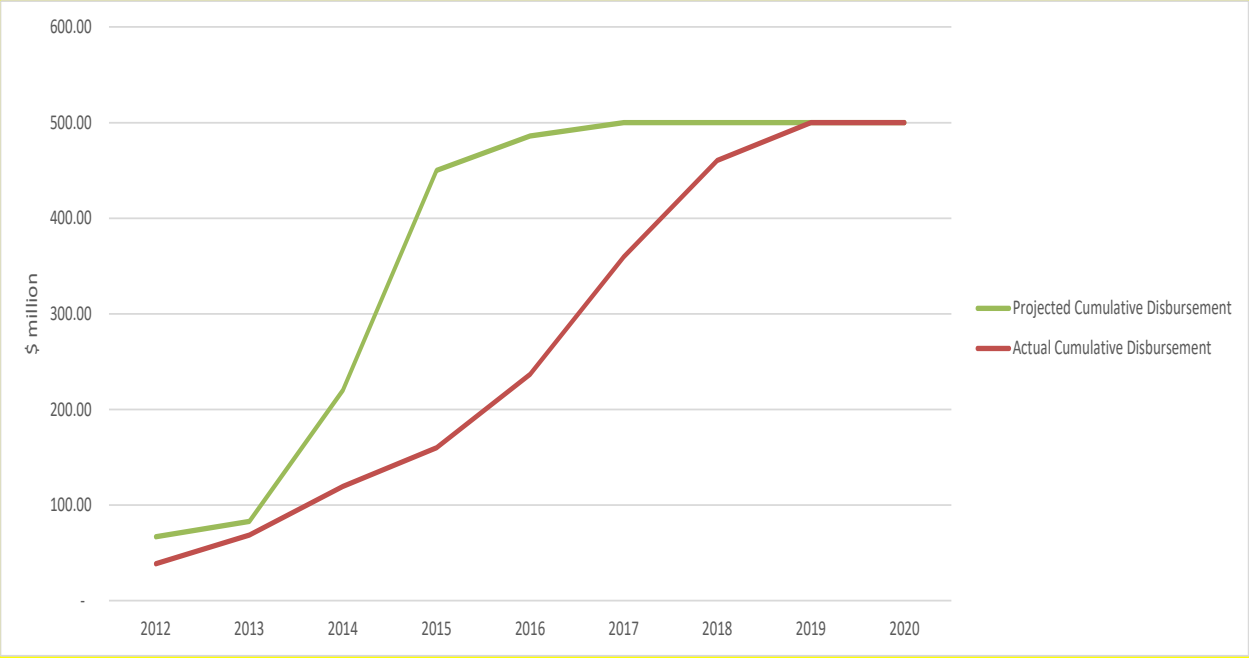
DISBURSEMENT OF ADB LOAN PROCEEDS

Table A4: Annual and Cumulative Disbursement of ADB Loan Proceeds

	Annual Disbursement		Cumulative Disbursement	
Year	Amount ($ million)	% of Total	Amount ($ million)	% of Total
2012	38.72	7.7	38.72	7.7
2013	29.99	6.0	68.71	13.7
2014	50.74	10.1	119.45	23.9
2015	40.59	8.1	160.04	32.0
2016	76.66	15.3	236.70	47.3
2017	122.86	24.6	359.56	71.9
2018	100.85	20.2	460.41	92.1
2019	39.59	7.9	500.00	100.0
2020	–	–	500.00	100.0
Total	**500.00**	**100.0**	**500.00**	**100.0**

ADB = Asian Development Bank.
Source: Asian Development Bank.

Figure A4: Projected and Actual Cumulative Disbursement of ADB Loan Proceeds
($ million)



ADB = Asian Development Bank.
Source: Asian Development Bank estimates.

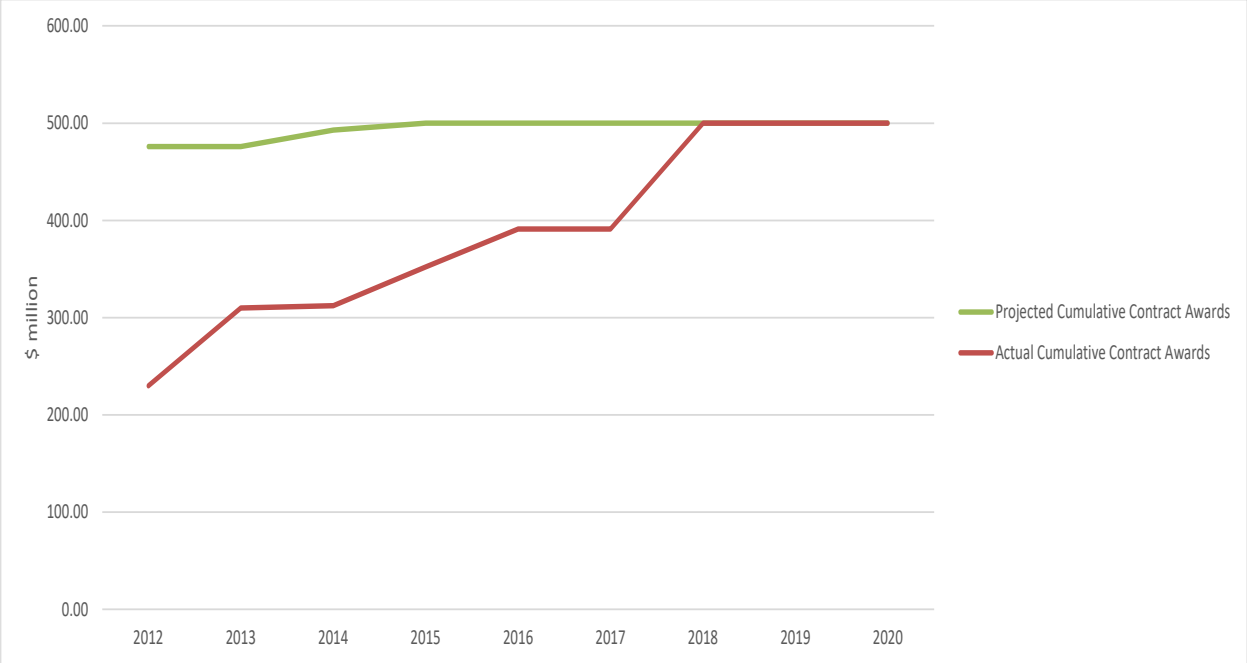
CONTRACT AWARDS OF ADB LOAN PROCEEDS

Table A5: Annual and Cumulative Contract Awards of ADB Loan Proceeds

	Annual Contract Awards		Cumulative Contract Awards	
Year	Amount ($ million)	% of Total	Amount ($ million)	% of Total
2012	229.84	46.0	229.84	46.0
2013	80.04	16.0	309.88	62.0
2014	2.33	0.5	312.21	62.4
2015	39.82	8.0	352.03	70.4
2016	39.08	7.8	391.11	78.2
2017	0.00	–	391.11	78.2
2018	108.89	21.8	500.00	100.0
2019	0.00	–	500.00	100.0
2020	0.00	–	500.00	100.0
Total	**500.00**	**100.0**	**500.00**	

ADB = Asian Development Bank.
Source: Asian Development Bank.

Figure A5: Projected and Actual Cumulative Contract Awards of ADB Loan Proceeds
($ million)



ADB = Asian Development Bank.
Source: Asian Development Bank

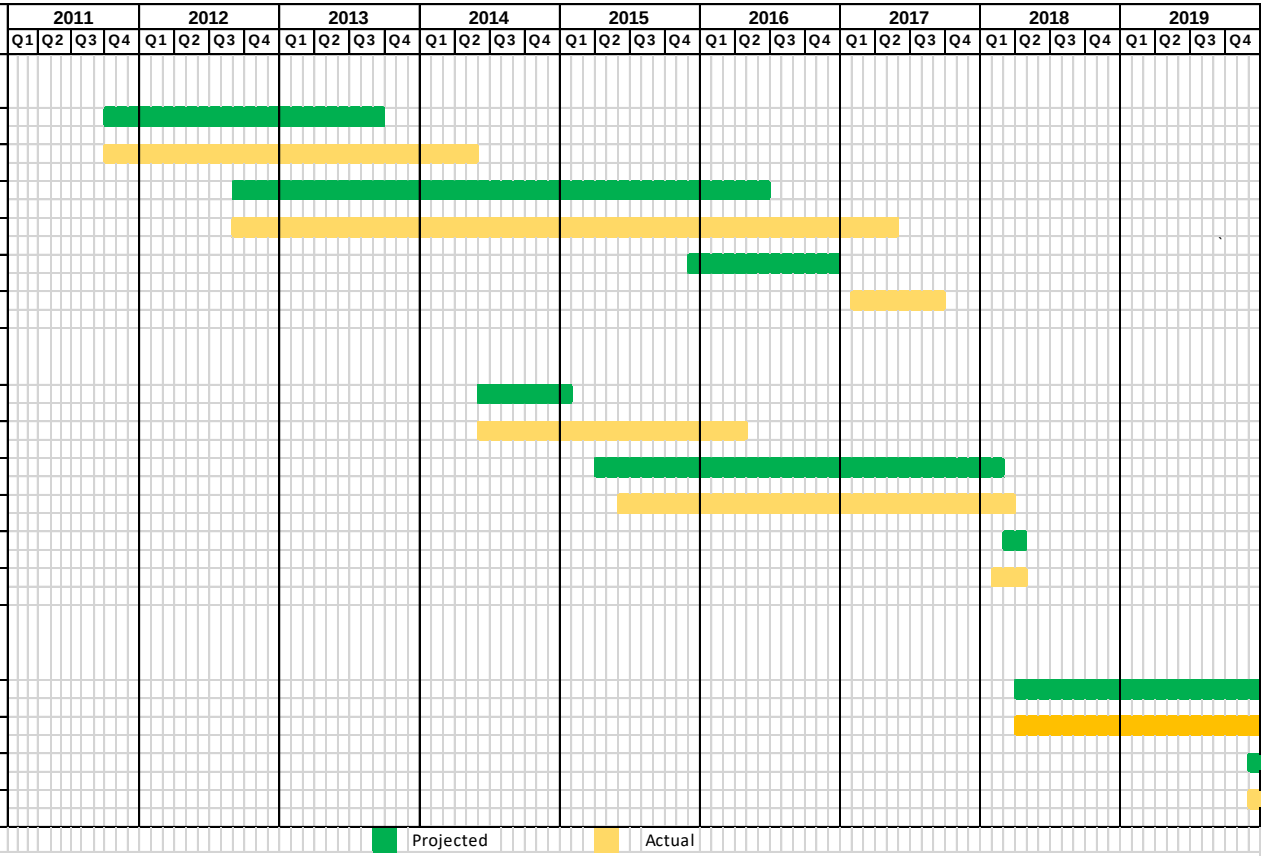
CHRONOLOGY OF MAIN EVENTS

Year	Date	Main Event
2010	29 September–4 October	ADB consultation mission (1)
	9–12 November	ADB consultation mission (2)
	14–16 December	ADB consultation mission (3)
2011	23 February–1 March	ADB consultation mission (4)
	29 April–13 May	ADB fact-finding mission
	19–21 July	ADB consultation mission (5)
	27 July	ADB Management review meeting
	23–24 August	Loan negotiations
	30 September	ADB approval of loan
2012	30 March	Signing of agreement
	21 June	First contract award
	22 October	Actual loan effectiveness
	4 December	First disbursement
2013	4–6 June	ADB loan inception and review mission
	10 July	ADB loan review mission (1)
	19–20 November	ADB loan review mission (2)
2014	4–7 February	ADB loan review mission (3)
	30 April–3, and 15 May	ADB special project administration mission (1)
	2–13 June	ADB loan review mission (4)
	27–28 October	ADB special project administration mission (2)
2015	18–20 August, and 3–7 September	ADB loan review mission (5)
2016	5–7, 21 October, 8, and 30 November	ADB loan review mission (6)
2017	22 March	Last contract award
	1 June	Loan was delegated to India Resident Mission
	30 June	Original loan closing date
	12–13, 16, 24 October, and 8 November	ADB loan review mission (7)
2019	8–9 May	ADB loan review mission (8)
	21 November	Last disbursement date
	31 December	Loan closing date (revised)
2020	14 January	Actual loan closing date
2022	4–8, 11–13, 19, 22 April, 2 May 2022	ADB project completion review mission

ADB = Asian Development Bank.
Source: Asian Development Bank.

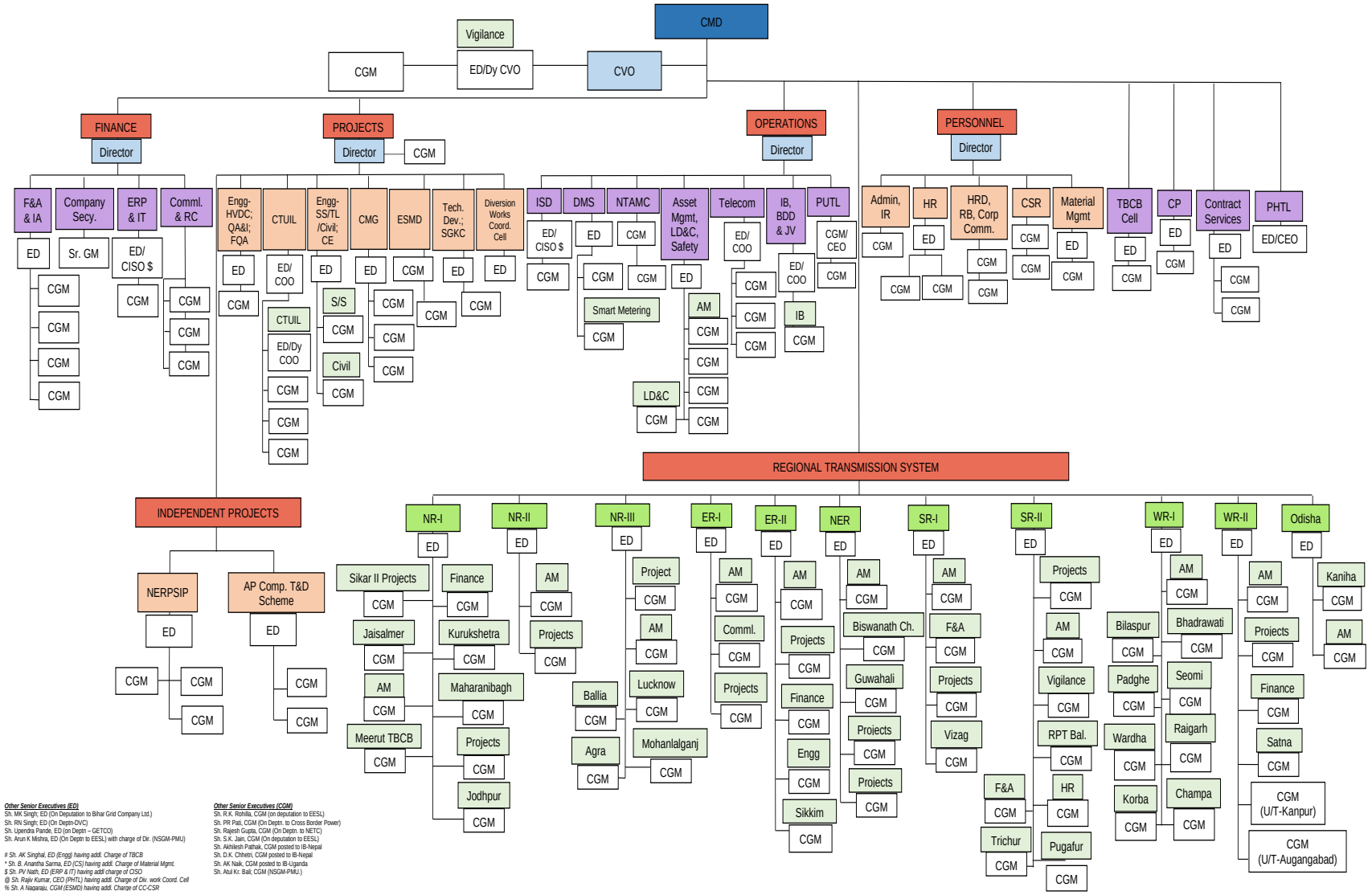
PROJECT IMPLEMENTATION SCHEDULE

S.No	Particular	Start	End
1	800 KV HVDC Inter-Regional Transmission System between Northern and Western Region		
a	Tendering Award	Oct-11	Sep-13
		Oct-11	May-14
b	Preparatory Work, Mobilization, Civil Work, Supply and Erection of Equipment	Sep-12	Jun-16
		Sep-12	May-17
c	Testing and Commissioning	Dec-15	Dec-16
		Feb-17	Sep-17
2	Inter Regional System Strenghtning Scheme for WR and NR (Part-B)		
a	Tendering Award	Jun-14	Jan-15
		Jun-14	Apr-16
b	Preparatory Work, Mobilization, Civil Work, Supply and Erection of Equipment	Apr-15	Feb-18
		Jun-15	Mar-18
c	Testing and Commissioning	Mar-18	Apr-18
		Feb-18	Apr-18
3	Supply of equipment (partly) under already awarded and ongoing contract being funded under ADB Loans		
	Supply of Equipment	Apr-18	Dec-19
		Apr-18	Dec-19
4	Project Completion	Dec-19	
		Dec-19	



* Part financed contracts are of (i) ±800KV, 6,000 MW HVDC Terminal package and (ii) ±320 kV voltage source converter HVDC terminal and direct current XLPE cable system of 32 Km package, of Project ±800KV, 6,000 MW HVDC Transmission System between the Western and Southern regions

POWERGRID ORGANIZATION CHART



Other Senior Executives (ED)
Sh. MK Singh; ED (On Deputation to Bihar Grid Company Ltd.)
Sh. RN Singh; ED (On Deptn-DVC)
Sh. Upendra Pande, ED (on Deptn – GETCO)
Sh. Arun K Mishra, ED (On Deptn to EESL) with charge of Dir. (NSGM-PMU)

 # Sh. AK Singhal, ED (Engg) having addl. Charge of TBCB
** Sh. B. Anantha Sarma, ED (CS) having addl. Charge of Material Mgmt.*
$ Sh. PV Nath, ED (ERP & IT) having addl charge of CISO
@ Sh. Rajiv Kumar, CEO (PHTL) having addl. Charge of Div. work Coord. Cell
% Sh. A Nagaraju, CGM (ESMD) having addl. Charge of CC-CSR

Other Senior Executives (CGM)
Sh. R.K. Rohilla, CGM (on deputation to EESL)
Sh. PR Pati, CGM (On Deptn. to Cross Border Power)
Sh. Rajesh Gupta, CGM (On Deptn. to NETC)
Sh. S.K. Jain, CGM (On deputation to EESL)
Sh. Akhilesh Pathak, CGM posted to IB-Nepal
Sh. D.K. Chhetri, CGM posted to IB-Nepal
Sh. AK Naik, CGM posted to IB-Uganda
Sh. Atul Kr. Bali, CGM (NSGM-PMU.)

SUMMARY OF CONTRACTS

PCSS No.	Item Description	Contract Amount ($)	Contract Disbursed ($)
0001	Offshore contract for +/-800kV, 3000 MW HVDC terminal package with western/ northern region interconnector for IPP projects in Chhattisgarh	145,143,084	145,143,084
0002	Onshore supply for +/-800kV, 3000 MW HVDC terminal package with western/ northern region interconnector for IPP projects in Chhattisgarh	72,922,984	72,922,984
0003	Onshore services for +/-800kV, 3000 MW HVDC terminal package with western/ northern region interconnector for IPP projects in Chhattisgarh	11,771,353	11,771,353
0004	CD01: ACSR lapwing conductor, 2355km WR-I portion	10,258,833	10,258,833
0005	CD02: ACSR lapwing conductor, 3703km WR-II portion (part-1)	15,245,941	15,245,941
0006	CD03: ACSR lapwing conductor, 3703km WR-II portion (part-2)	13,531,863	13,531,863
0007	Supply of hexagonal spacer damper & rigid spacer damper packages (SD01)	307,964	307,964
0008	Hexagonal spacer damper & rigid spacer damper packages (SD02)	784,012	784,012
0009	Hardware fittings & accessories package HF01	2,373,138	2,373,138
0010	Hardware fittings & accessories package HF02	2,826,776	2,826,776
0011	Insulator package associated with transmission system	391,736	391,736
0012	Insulator package associated with transmission line	1,363,915	1,363,915
0013	Insulator package associated with transmission line	1,922,689	1,922,689
0014	CD06: ACSR lapwing conductor, 3,638km NR-II portion (part 1) & NR-II portion	9,116,103	9,116,103
0015	CD04: ACSR lapwing conductor, 3,866km NR-I portion (part-1)	10,474,101	10,474,101
0016	CD05: ACSR lapwing conductor, 3,866km NR-I portion (part 2)	11,448,551	11,448,551
0017	CIS01: composite long rod insulator package	880,668	880,668
0018	CIS02: composite long rod insulator package	536,090	536,090
0019	CIS03: composite long rod insulator package	910,068	910,068
0020	Tower package for interregional strengthening	9,250,061	9,250,061
0021	Tower package for interregional strengthening	10,469,555	10,469,555
0022	TS08: tower package for LILO Agra–Meerut line	7,289,746	7,289,746
0023	TS09: tower package for LILO Kanpur–Jhatikara line	12,808,621	12,808,621
0024	CD 10 for 30% of 765 kV double circuit Orai–Aligarh transmission line, part1 100% of Orai–Orai (UPPTCL) 400 kV double circuit quad line ASO W/ inter regional system strengthening for WR&NR part B	4,694,741	4,694,741
0025	CD 11 for 70% of 765kV double circuit Orai–Aligarh transmission line, part1 ASSO W/ inter regional system strengthening scheme for WR & NR part B	3,872,120	3,872,120
0026	CD12 Supply of ACSR zebra conductor for 50% 765kV double circuit Orai–Aligarh transmission line part II ASSOC W inter-regional system strengthening scheme for WR & NR part B	3,854,369	3,854,369
0027	CD13 for supply of ACSR zebra conductor for 50% of 765kV double circuit Orai–Aligarh transmission line, PARTII ASSO W inter-regional system strengthening scheme for WR & NR part B	3,858,243	3,858,243
0028	CIS-1 Insulator package CC-CS/421-NR1/INS-2717/7/G2/CA/5653 Dated 22/02/2016	3,832,243	3,832,243
0029	CIS-2 Insulator package CC-CS/421-NR1/INS-2719/7/G2/CA-1/5627 Dated 05/02/16CC-CS/421-NR1/INS-2719/7/G2/CA-II/5268 Dated 05/02/2016	1,309,815	1,309,815
0030	CD14: Conductor (km)	4,686,226	4,686,226
0031	CD15: Conductor (km)	4,402,074	4,402,074
0032	1D16: Conductor (km)	4,170,766	4,170,766
0033	CD17: Conductor (km)	4,402,249	4,402,249
0034	Local supply BHEL India 800kV HVDC L3365:0033 5818	23,909,228	23,909,228
0035	Local supply ABB India 800kV 6000MW HVDC L3365:0034 5819	44,542,251	44,542,251
0036	Services BHEL India 800kV HVDC L3365:0035 5820	0	0
0037	Services ABB India 800kV HVDC L3365:0036 5821	11,020,930	11,020,930
0038	Foreign supply Siemens Germany 320kV VSC HVDC L3365:0041 7213	8,630,691	8,630,691
0039	Foreign supply Sumitomo Japan 320kV VSC HVDC L3365:0042 7214	8,877,606	8,877,606
0040	Local supply Siemens India 320kV VSC HVDC L3365: 0043 7215	6,680,303	6,680,303
0041	Services Siemens India 320kV VSC HVDC L3365:0045 7217	3,380,861	3,380,861
0042	Services Sumitomo Japan 320kV VSC HVDC L3365:0046 7218	1,847,432	1,847,432

SAFEGUARDS ASSESSMENT

1. **Safeguards categorization.** The Loan 2787-IND was classified as B for the environment and involuntary resettlement, while C for indigenous peoples. A surplus amount of $90.0 million from loan 2787 was used in another ongoing ADB Loan 3365-IND, and the project completion report (PCR) does not cover the details of Loan 3365.[1]

2. **Environmental and Social Policy and Procedures (ESPP).** POWERGRID developed a comprehensive and written "Environmental and Social Policy and Procedures (ESPP)" in 1998 to manage its environment and social issues. The basic principles of the ESPP are avoidance, minimization, and mitigation, and it outlines procedures and protocol to deal with environmental and social issues relating to its projects and lays out management to address them. The ESPP was revised in 2005 and 2009 according to the changed government rules and guidelines and multilateral funding agencies policies. The World Bank in 2009 and Asian Development Bank in 2017 have accepted the ESPP under their Use of Country System (UCS) and Country Safeguard System (CSS), respectively.

3. **Safeguard implementation arrangements.** POWERGRID has established the Environment and Social Management Division (ESMD) at the corporate level to manage environmental and social matters. The ESMD is headed by a Chief General Manager (CGM) and reports to the Director of Projects. Two Sr. General Managers (Environment and Social), four Chief Managers (two environmental, one social, and one electrical engineer), and a Deputy Manager support CGM ESMD. POWERGRID has ten regional offices (RO) across the country, and each RO has a department named Planning, Environment, and Social Management (PESM). The PESMs report to the head RO, and one officer from the PESM is responsible for environment and social aspects. The responsible officers from PESMs are provided training internally and externally in the environment and social management. The field/project offices are headed by the project in-charge and responsible for managing the environment and social matters at the project level. The project in-charge reports PESM at RO, including safeguards matters. The PESM, in turn, reports to ESMD at the corporate level for environmental and social issues. The ESMD provides the necessary guidance and support to the ROs and field office teams. Overall institutional arrangements for managing safeguards are assessed as adequate and robust.

A. Environmental Safeguards

4. The ADB-cleared environment category of the Project is B as per ADB's Safeguard Policy Statement (2009). During project preparation, the environmental planning documents {initial environmental examination (IEE) reports including environmental management and monitoring plans (EMMP)} were prepared by POWERGRID based on its Environmental and Social Policy and Procedures (ESPP), 2009 and Safeguard Policy Statement. The proposed scope of works included HVDC interregional transmission systems between the Western and Northern regions comprising transmission lines, augmentation of substations, and establishment of HDVC terminals. In line with its ESPP-2009, POWERGRID selected the locations of substations and alignment of transmission lines by avoiding environmentally and ecologically sensitive areas (to the extent possible) keeping in mind the limitations due to peculiarity of the demography and

[1] The components under Loan 3365 include: (i) Establishment of Raigarh ±800kV HVDC Station with 6000 MW HVDC terminals; (ii) Establishment of Pugalur ±800 kV HVDC Station with 6000 MW HVDC terminals; (iii) ± 320 kV, 2000 MW VSC based HVDC terminal at Pugalur; (iv) ±320 kV, 2000 MW voltage source converter (VSC)-based HVDC terminal at North Trichur; (iv) Establishment of ±320 kV VSC-based 2000 MW HVDC link between Pugalur and North Trichur (Kerala) - ±320kV Underground cable – 28 Km.

terrain. POWERGRID ensured that the transmission line route mainly passed through government-owned land, wasteland, agricultural and grazing lands. POWERGRID based its routing of transmission lines on the published data such as the Forest Atlas, topographic maps of Survey of India and other associated documents of the state and central government departments and agencies. POWERGRID ensured that the route: (i) minimized damage to the existing forest resources in consultation with local forest officials; (ii) did not affect protected monuments of archeological, cultural, and historical importance; and (iii) did not affect any public utility services like playgrounds or schools. As a policy, the alignments were located 5–10 kilometer (km) away from major towns, whenever possible, to account for future urban expansion. The transmission towers and conductors being the prominent features leading to residual impacts in the project areas, POWERGRID also ensured that there were no important landmarks whose aesthetics would be affected. POWERGRID identified three alternative alignments during its preliminary investigation, conducted detailed geographic information system (GIS) based survey and finalized the optimum alignment that was environmentally responsible.

5. Upon finalization of locations and alignments, POWERGRID undertook detailed environmental assessments of the proposed works as per its ESSP-2009 and developed IEE reports. The IEE reports identified site-specific environmental impacts associated with these works during pre-construction, construction, and operation and maintenance (O&M) phases considering the type and scale of development proposed and the nature of the surrounding environment around substation sites and along the alignment and proposed detailed environmental mitigation measures and monitoring plans. POWERGRID also conducted public consultations in some of the villages along the alignment and at substation sites, and the details were included in the IEE reports. These IEE reports were disclosed on ADB and POWERGRID websites. POWERGRID ensured that necessary ground clearances were maintained as per Central Electricity Authority's Measures relating to Safety and Electric Supply Regulation, 2010 as well as international standards/designs to address the impacts due to electromagnetic field (EMF) associated with high voltage lines. Further, studies carried out with respect to EMF by reputed institutions like Central Power Research Institute (CPRI), Bengaluru, Power Technologies Inc. (PTI), United States of America have also found that designs considered by POWERGRID are safe and follow the international standards.

6. The bids and contract documents for the proposed scope of works included the EMMPs cleared by ADB. POWERGRID confirmed that none of the equipment procured for the substations and transmission systems contained Polychlorinated Biphenyl (PCB) and Chlorofluorocarbons (CFC). It further confirmed that the substation locations remained unchanged, and no major route realignment was undertaken during implementation except for slight deviations within the originally envisaged right-of-way (ROW) on account of local site conditions, and no stretch of the transmission line passed through or traversed along the boundaries of any environmentally and/or ecologically sensitive areas such as national parks, sanctuaries, biospheres, and protected wetlands. Because of careful selection of alignment, despite linear nature and significant line length of about 1,680.0 km,[2] only 58.6 km (3.4%) passed through forests. One of the examples of POWERGRID's efforts towards conservation of natural resources (forest and wildlife) was complete avoidance of the Achanakmar Wildlife Sanctuary[3] and minimization of forest and tree feeling requirements in the Kodri Forest Range, Marwahi Division of Chhattisgarh State (tower locations 298-307) involving 7.6 ha (about 2.55 km) of dense forest while optimizing the alignment of 800 kV HVDC. Additionally, POWERGRID used extended towers in these forest stretches to

[2] 1,288.05 km of 800 kV HVDC, 353.35 km of 765 kV and 41.84 km of 400 kV spread across states of Chhattisgarh, Madhya Pradesh, Uttar Pradesh and Haryana.
[3] In Chhattisgarh and Madhya Pradesh states.

reduce the tree felling requirement to the extent possible. Out ten towers in these forest stretches, eight towers were provided with an extension from 3 m to 25 m. As a result, tree felling was greatly reduced and was restricted to inevitable tree felling in tower footing area only. Due to this initiative, only 590 trees were affected in place of 1953 trees estimated to be felled by the State Forest Department, resulting in saving 1,363 fully grown matured trees. POWERGRID confirmed of having obtained necessary forest clearances for the diversion of 404.3 ha of forest land in the states of Chhattisgarh, Madya Pradesh, Uttar Pradesh, and Haryana prior to implementation of works in those specific stretches. POWERGRID paid ₹764.44 million towards compensatory afforestation, net present value and other conservation measures as demanded by the forest authorities. There were no other environmental permissions required under India's environmental legislative framework for the substations and transmission line works.

7. The implementation of environmental safeguards was supervised and monitored by POWERGRID's ESMD having staff with necessary academic training and professional experience in the areas of environmental management. The contractors designated their safety officers to look after implementation of environmental and safety aspects. POWERGRID did not engage any environmental consultants. It submitted semi-annual environmental monitoring reports regularly that were disclosed. POWERGRID reported several informal consultations on environmental aspects with locals during implementation. POWERGRID confirmed that it had functional grievance redress management system throughout the implementation period and no major complaints were received on environmental aspects or implementation of EMMPs.

8. The ±800 kV Champa–Kurukshetra HDVC line was the first in the world to deploy Dedicated Metallic Return (DMR) conductor in place of conventional earth electrode stations, resulting in saving precious land resources at both ends (about 80–85 acres saved at each end). It is also the second ±800 kV HVDC line in the country (after ±800 kV Biswanath–Chariyali transmission line) and Champa substation being the largest electric substation in the country in terms of area covered, being built on 276 acres of land and also housing 765/400 kV HVAC substation.

9. Further, the implementation of a technologically advanced ±800 kV HVDC bipole system and 765 kV lines having high power carrying capacity of 6,000 MW and 2,400 MW respectively under the project had a lower environmental and social footprint particularly with respect to forest and biodiversity, tree and vegetation cover, aesthetic appeal, land use restriction, project affected persons, loss of agricultural production. This was achieved through a significant reduction of ROW width requirement when compared with lower voltage lines that would have been needed for the transfer of the equivalent amount of power. For example, the transfer of 6000 MW power would require at least six 400 kV lines thus requiring 276 m (6 x 46 m) of ROW which is approximately four times of ROW requirement of 800 kV HVDC. Similarly, three 400 kV lines with ROW of 138 m would have been required to transfer equivalent power against one 765 kV line which is again two times of ROW width of 765 kV. Accordingly, additional 26,640 ha and 2,494 ha area would have been affected had only 400 kV lines been constructed to transfer the equivalent power in place of 1,288.05 km 800 kV HVDC and 353.35 km of 765 kV lines under the project.

10. HVDC transmission system is considered a highly energy efficient technology not only for its high-power carrying capacity over a long distance but also due to reduced transmission losses when compared with alternating current transmission systems. POWERGRID informed that transmission losses are about 2.5% in 800 kV HVDC transmission system against 3.25% in case a conventional alternate current 765 kV transmission system were to be established for evacuation of power. Based on the power flows through the energy efficient technology of HVDC

line as of March 2022, it is estimated that the HVDC project has contributed to cumulative offsets equivalent to 0.298 million metric ton (MT) of CO_2 until FY2022, while during its lifetime equivalent to 2.77 MT. Overall, the project has reduced environmental impacts and degradation.

B. Social Safeguards

11. Two resettlement plans were prepared under the project covering output 1: HVDC Interregional Transmission System between the Western and Northern Regions (Chhattisgarh and Haryana) and output 2: Interregional System Strengthening Scheme for Western Region and Northern Region (Part-B). The components under output 1 include (i) Champa – Kurukshetra ±800 kV, 6000 MW HVDC Bipole – 1365 km; (ii) Establishment of ±800kV HVDC terminals at Champa and Kurukshetra; and (iii) Establishment of 2×500 MVA, 400/220 kV Kurukshetra substation (GIS) along with 125 MVAR Bus Reactor. The components under output 2 include (i) Orai – Aligarh 765 kV D/c line – 300 km; (ii) Orai -Orai (UPPTCL) 400 kV D/c (Quad) line – 38 km; (iii) LILO of Agra–Meerut 765 kV S/c line at Aligarh substation – 35 km; and (iv) LILO of Kanpur–Jhatikara 765 kV S/c line at Aligarh substation – 35 km.

12. **Resettlement impacts.** The project acquired 262.27 acres of land for the Champa substation and 116.70 acres for the Kurukshetra substation. Of the 262.27 acres for the Champa substation, 104.27 acres were private land, impacting 258 landowners, and the remaining 158.00 acres were encumbrance-free government land. Kurukshetra substation was implemented on encumbrance-free government land. The Champa–Kurukshetra HVDC Bipole line affected 34,756 persons, 5,334.73 ha of cropland, and 167,528 trees. The Interregional System Strengthening Scheme for Western Region and Northern Region (Part-B) transmission lines affected 2,561.90 ha of cropland, 14,268 trees, and 14,402 persons. Overall, the five transmission lines temporarily affected 7,896.64 ha of the cropland, 181,796 trees, and 49,158 affected persons.

13. POWERGRID paid ₹227.20 million for private land acquisition and R&R assistance to 258 landowners and ₹71.1million for government land for the Champa substation; and (ii) ₹284.5 million towards the land cost for the Kurukshetra substation. Further, POWERGRID paid ₹184.7 million for trees damages for the implementation of transmission lines, ₹105.5 million for crop damages during tower foundations work, ₹135.3 million during tower erection works, and ₹212.2 million during stringing works. Overall, POWERGRID spent ₹582.8 million for the Champa and Kurukshetra substations and ₹879.57 million on transmission lines as compensation and R&R. Apart from payment of compensation, POWERGRID carried out community development activities such as the construction of interlocking paths within the village, community centers, sheds, walls, toilets, etc., costing about ₹23.23 million in the villages around Champa and Kurukshetra substations.

14. For the Champa substation in Chhattisgarh, the market value of land as per LA act, 1894, including 30% solatium and interest, ranged from ₹390,515 to ₹486,081 per acre. The project followed the “Adarsh Punarvas Neeti”, 2007 of Government of Chhattisgarh and paid land compensation at ₹10,000,00 per acre to the affected landowners. Following the same policy, the project also paid an additional ₹10,000,00 per acre as supplementary land compensation, financial support in lieu of employment, and rehabilitation assistance. Overall, ₹2.0 million per acre was paid to the affected landowners, fulfilling the Safeguard Policy Statement requirements of replacement cost for assets and R&R.

15. **Minimization of impacts.** The project took several steps to minimize the land requirements and social impacts through the adoption of new technologies such as (i) DMR

conductor and (ii) Gas-insulated Switchyard (GIS) instead of Air Insulated Switchyard (AIS), and (iii) ±800 kV HVDC bipole system and 765 kV lines as opposed to 400 kV lines. For the ±800 KV Champa–Kurukshetra HDVC line, the project deployed the DMR conductor instead of conventional earth electrode stations, avoiding about 80–85 acres of additional land at each end. Further, implementing technological advances ±800 kV HVDC bipole system and 765 kV lines having a high-power carrying capacity of 6,000 MW and 2,400 MW respectively reduced the project footprint, particularly the land use restriction, project affected persons, loss of agricultural produce due to the significant reduction in ROW. For example, transferring 6,000 MW power would need at least six 400 kV lines, thus, requiring 276 m (6 x 46 m) of ROW, which is approximately four times of ROW requirement of ±800 kV HVDC line. Likewise, three 400 kV lines with ROW of 138 m would have been required to transfer equivalent power against one 765 kV line, which is again two times the ROW width of 765 kV. An estimated 29,134 ha had been avoided by implementing ±800 kV HVDC and 765 kV lines under the loan. Furthermore, adopting a GIS-based switchyard at the Kurukshetra substation saved about 40 acres of land compared to an AIS-based switchyard.

16. POWERGRID followed the principles of avoidance, minimization, and mitigation while designing and implementing the project and ensured that no land was acquired from scheduled castes or tribes, and no one became landless while acquiring land for the substations. The construction of transmission lines was phased to defer construction in the cropped area to facilitate crop harvesting or undertake construction activities during the lean period or post-harvest season. However, where it was inevitable, and the delay was likely to affect the project schedule, works were implemented judiciously, and compensation was given at the market rate for damages caused during implementation. The loss of crops was paid based on the actual assessment of damage during foundation work, tower erection and stringing work separately. POWERGRID field unit did the check surveys that capture the details such as the area affected, village name, plot number, landowner name, bank details, type of crop, rate of the crop from local government market, the yield of produce per acre from the state agriculture department, etc. The check survey details were submitted to the district revenue authority for verification and approval. With the help of relevant departments such as revenue, forest, horticulture, agriculture, public works, etc., the district revenue authority verifies the details in the check survey and prepares valuation statements. Upon approval of the valuation statements by the district authority, POWERGRID transfers the compensation amounts online to the APs bank account, avoiding any third-party involvement in the payment process. The field units and the PESM kept track of the payments credited to the Affected Persons account, and care was taken to minimize the time gap between the damage caused and payment into the account.

17. **Indigenous Peoples.** At the project appraisal, no impacts on indigenous peoples were identified, and the same continued throughout the project cycle.

18. **Information disclosure and grievance redress.** Information disclosure and consultation activities for implementing safeguards were effectively carried out. Such activities included (i) regular consultative meetings with affected persons and other stakeholders during project preparation, substations land finalization, and transmission line alignment finalization, (ii) disclosure of safeguards documents and the summary, (iii) at the time of transmission line foundation, erection and stringing, continuous consultations with Affected Persons for assessment of the affected area, crop valuation, payment of compensation, (iv) monitoring of payments, and (v) consultations for community development activities around substation sites. A grievance redress mechanism was set up in accordance with the agreed frameworks to address

any project-related grievances from affected people. POWERGRID reported that there were no outstanding grievance cases left unresolved.

19. **Monitoring and reporting.** Internal safeguards monitoring reports adequately captured the status of impacts, payment to Affected Persons, and community development activities implementation and were submitted periodically.

20. **Conclusion and lessons learned.** Successful adoption of new technologies significantly reduced the land requirements and impacts on the people. This resulted in minimizing the project footprint and facilitating the completion of the project on time. Extensive consultations with Affected Persons and a flexible approach during implementation also helped prompt redressal of grievances. A dedicated ESMD with experienced staff within the institutional structure shows POWERGRID's commitment to the environment and social policy. Moreover, POWERGRID is reviewing its ESPP to align with changing legal and multilateral agencies' safeguard policy requirements, further emphasizing the agency's commitment to the safeguards cause. ADB's suggestions and guidance from time to time also supported the implementation in meeting the safeguard policy requirements.

21. Overall, safeguard compliance has been satisfactory and safeguard compliance management was assessed to be generally effective.

STATUS OF COMPLIANCE WITH LOAN COVENANTS

Project Specific Covenants	Reference	Status of Compliance
Implementation Arrangements The Borrower shall ensure that the Project is implemented in accordance with the detailed arrangements set forth in the PAM. Any subsequent change to the PAM shall become effective only after approval of such change by the Borrower and ADB. In the event of any discrepancy between the PAM and this Loan Agreement, the provisions of this Loan Agreement shall prevail.	LA, Schedule 5, para. 1	**Complied with.** The projects were implemented in accordance with the detailed arrangements set forth in the PAM.
Accounting The Borrower shall ensure that its financial accounts are maintained in accordance with Indian generally accepted accounting principles, i.e., accounting standards issued by the Institute of Chartered Accountants of India. The Borrower shall inform ADB within 60 days of adoption of any changes in accounting practices, but in no case later than the date of any financial reporting required under this Loan Agreement.	LA, Schedule 5, para. 2	**Complied with.** The Borrower ensured that its financial accounts are maintained in accordance with Indian GAAP i.e., accounting standards issued by the Institute of Chartered Accountants of India.
In addition to the requirements of Section 4.05 of this Loan Agreement, the Borrower shall continue the existing practice of engaging independent chartered accountants as statutory auditors to audit its annual financial statements and annual Project accounts, together with the memorandum on issues identified during the audit process	LA, Schedule 5, para. 3	**Complied with.** The Borrower engaged an independent chartered accountant as statutory auditor to audit its annual financial statements and annual Project accounts.
Financial Except as ADB may otherwise agree, the Borrower shall, in relation to the transmission operations undertaken directly by it or by its subsidiaries for the Financial Year commencing 1 April 2012 and for each Financial Year thereafter during the term of this Loan Agreement, ensure that it:	LA, Schedule 5, para. 4	
a. maintains corporate accounts receivables (excluding such amounts for which billing has not been approved by CERC but including for those assets for which a provisional tariff approval has been granted and allowed by CERC) not exceeding the previous 3 months invoicing amounts;	LA, Schedule 5, para. 4 (a)	**Complied with.** Accounts receivables is less than three months' invoicing amounts.
b. obtains and holds irrevocable letters of credit from all customers in an aggregate amount equivalent to 105% of the average monthly billings of the previous Financial Year, in a form deemed acceptable by the Borrower and as allowed by CERC; and	LA, Schedule 5, para. 4 (b)	ADB waived the covenant during implementation at the request of POWERGRID in September 2020 as role of CTU was separated from POWERGRID responsibility to comply with the Electricity Act 2003 requirements.
c. exercises, inter alia, its rights promptly to effect the reduction/stoppage in supply, reallocation of charges, and/or replacement of defaulting customers as permitted under its commercial agreements with generators, state transmission utilities, state electricity boards, bulk consumers, and any other entity or person benefitting from the Borrower's transmission services as well as under the tripartite agreements with the Guarantor, the state governments and the Reserve Bank of India.	LA, Schedule 5, para. 4 (c)	**Complied with.** The Borrower has stated that such a situation did not arise.

Project Specific Covenants	Reference	Status of Compliance
Except as ADB may otherwise agree, the Borrower shall for the Financial Year commencing 1 April 2012 and for each Financial Year thereafter during the term of this Loan Agreement, generate cash from internal sources equivalent to not less than 20% of the average of the Borrower's capital expenditures incurred, or expected to be incurred, for the current Financial Year, the previous Financial Year, and the next Financial Year. For the purposes of this paragraph:	LA, Schedule 5, para. 5	**Complied with.** The Borrower has generated cash from internal sources from 1 April 2012 onwards, which was not less than 20% of the average of the expenditure incurred. The same was maintained during the previous years as well.
a. the term "cash from internal sources" means the difference between (i) the sum of cash flows from all sources related to operations, plus cash generated from consumer deposits and consumer advances of any kind, sale of assets, cash yield of interest on investments, extraordinary gains, and net non-operating income, decrease in working capital other than cash, and other cash inflows; and (ii) the sum of all expenses related to operations, including administration, adequate maintenance, and current taxes and payments in lieu of taxes (excluding provision for depreciation, other non-cash operating charges and taxes), debt service requirements, extraordinary losses, all cash dividends paid and other cash distributions of surplus, increase in working capital other than cash and other cash outflows other than capital expenditures;	LA, Schedule 5, para. 5 (a)	
b. the term "net non-operating income" means the difference between (i) revenues from all sources other than those related to operations, after making adequate provisions for uncollectible debts; and (ii) expenses, including taxes and payments in lieu of taxes, incurred in the generation of revenues in (i) hereinabove;	LA, Schedule 5, para. 5 (b)	
c. the term "working capital other than cash" means the difference between current assets excluding cash and current liabilities at the end of each Financial Year;	LA, Schedule 5, para. 5 (c)	
d. the term "current assets excluding cash" means all assets other than cash which could in the ordinary course of business be converted into cash within 12 months, including accounts receivable, marketable securities, inventories and prepaid expenses properly chargeable to operating expenses within the next Financial Year;	LA, Schedule 5, para. 5 (d)	
e. the term "current liabilities" means all liabilities which will become due and payable or could under circumstances then existing be called for payment within 12 months, including accounts payable, customer advances, debt service requirements taxes and payments in lieu of taxes, and dividends;	LA, Schedule 5, para. 5 (e)	

Project Specific Covenants	Reference	Status of Compliance
f. the term "debt" means any indebtedness of the Borrower maturing by its terms more than 1 year after the date on which it is originally incurred;	LA, Schedule 5, para. 5 (f)	
g. the debt shall be deemed to be incurred: (i) under a loan contract or agreement, or conditional sale or transfer or financing lease agreement or other instrument providing for such debt or for the modification of its terms of payment on the date of such contract, agreement or instrument; and (ii) under a guarantee agreement, on the date the agreement providing for such guarantee has been entered into. Financial liabilities incurred by the Borrower who is a lessee under finance leasing agreements may also be included as debt;	LA, Schedule 5, para. 5 (g)	
h. the term "debt service requirements" means the aggregate amount of all repayments (including sinking fund payments, and lease payments under finance leases if any), whether or not actually paid, and interest and other charges on debt. Interest charges which are incurred in financing capital expenditures during development are excluded, if such charges are capitalized;	LA, Schedule 5, para. 5 (h)	
i. the term "capital expenditures" means all expenditures incurred on account of fixed assets including interest charged to construction, related to operations;	LA, Schedule 5, para. 5 (i)	
j. the projections for the "next Financial Year" will be based on the Borrower's 10-year financial projections, updated at least annually, and will include its investment program, financial plan, income statements, cash flow and balance sheets with all its assumptions, provided annually to ADB as of 30 September of each Financial Year;	LA, Schedule 5, para. 5 (j)	
k. the terms "operations" or "operating" refers to all the businesses of the Borrower, including without limitation its transmission operations, telecom operations, consultancy operations and any other businesses in which the Borrower is engaged; and	LA, Schedule 5, para. 5 (k)	
l. in the event cash from internal resources is less than 20% as required hereinabove, any grant provided by the Guarantor or additional equity capital raised by the Borrower (including any share premium) in the current and/or the previous Financial Year to the extent paid up but not utilized for capital expenditures, may also be added to the cash from internal resources for purposes of computing such financial ratio; provided further that for purposes of computing such financial ratio for the Financial Year 2012-13, any additional equity capital raised by the Borrower (including any share premium) in the previous 2 Financial Years to the extent paid up but not utilized for capital expenditures, may also be added to the amount of cash from internal sources.	LA, Schedule 5, para. 5 (l)	

Project Specific Covenants	Reference	Status of Compliance
Except as ADB may otherwise agree, the Borrower shall for the Financial Year commencing 1 April 2012 and for each Financial Year thereafter during the term of this Loan Agreement, ensure that the free cash flows of the Borrower: (a) for the current Financial Year shall be at least 1.2 times the debt service requirements of the Borrower for the same period on all debt; and (b) for the current Financial Year, the previous Financial Year, and the next Financial Year shall on average be at least 1.3 times the debt service requirements of the Borrower for the current Financial Year on all debt. For the purposes of this paragraph:	LA, Schedule 5, para. 6	**Complied with.** The Borrower has ensured that its 'free cash flows' (a) for the current FY has been at least 1.2 times the debt service requirements of the Borrower for the same period on all debt, and (b) for the current FY, the previous FY, and the next FY was on average be at least 1.3 times the debt service requirements of the Borrower for the current FY on all debt.
a. the term "free cash flows" means the difference between: (i) the sum of revenues from all sources related to operations, after making adequate provisions for uncollectible debts, adjusted to take account of the Borrower's rates, dues or other such receivables accrued at the time of the incurrence of debt, and net non-operating income; and (ii) the sum of all expenses related to operations including administration, maintenance, current taxes and payments in lieu of current taxes (but excluding provision for depreciation, other non-cash operating charges, and deferred taxes), movements in working capital other than cash; and	LA, Schedule 5, para. 6 (a).	The definition of free cashflow was revised to match with POWERGRID operations. As per Loan Amendment of 14.05.2014, in schedule 5 para 6 (a) *"interest and other charges on debt, excluding interest capitalized"* at the end of sentence was deleted.
b. the terms "net non-operating income", "working capital other than cash", "debt", "debt service requirements", "next Financial Year", and "operations", shall have the same meanings as defined in subparagraphs 5(b), 5(c), 5(f), 5(h), 5(i), and 5(k) hereinabove, respectively.	LA, Schedule 5, para. 6 (b)	
The Borrower shall maintain a corporate debt to equity ratio of not more than 3 to 1 during the term of this Loan Agreement. For purposes of this paragraph:	LA, Schedule 5, para. 7	**Complied with.** As per auditor's certificate for audit reports, long-term debt equity ratio of the Borrower has been maintained at around 70:30.
a. the term "equity" means the sum of the total unimpaired paid-up capital, retained earnings and reserves of the Borrower not allocated to cover specific liabilities; and	LA, Schedule 5, para. 7 (a)	
b. the term "debt" shall mean any outstanding indebtedness of the Borrower, but excluding any amount due for payment within 1 year of the date as of which this ratio is computed.	LA, Schedule 5, para. 7 (b)	
a. Before 28 February of each Financial Year, the Borrower shall, on the basis of forecasts prepared by the Borrower, satisfactory to ADB, review whether it will meet the requirements set forth in paragraphs 4 to 7 of this Schedule 5 in respect of such Financial Year and the following Financial Year, and shall furnish to ADB a copy of such review.	LA, Schedule 5, para. 8 (a)	**Complied with.** Prior to 28 February of each FY, POWERGRID, based on its forecasts prepared, satisfactory to ADB, met all the requirements set forth in paragraphs 27–30 of Schedule 5 in respect of such FY and next following FY, and has furnished to ADB a copy of such review.
b. The Borrower shall forward to ADB, with each set of audited annual financial statements, a compliance certificate signed by its statutory auditors and/or director-finance setting out	LA, Schedule 5, para. 8 (b)	**Complied with.** The Borrower has submitted audited financial statement for each year including compliance certificate. The Borrower has submitted

Project Specific Covenants	Reference	Status of Compliance
computations as to compliance with the financial covenants described above.		audited project financial statements to ADB within a time frame of 6 months to end of each financial year except two years. Certified copies of such audited accounts, financial statements, report of the auditors including the auditors' opinion on the use of the Loan proceeds and certificate for compliance with the financial covenants. FY2016 audited project financial statements was received with 6.9-months delay and for FY2017 audited project financial statements was received with 6-days delay. • All audited financial statements are complete, contain all components and are in compliance with standard accounting practices; • Audit opinions issued were mostly unqualified. Specific opinion on the use of funds were issued and certifications were likewise issued that the statement has been verified from the books of accounts and other records presented to the auditors.
c. Whenever for the purposes of this Loan Agreement, it shall be necessary to value, in terms of the currency of the Guarantor, debt payable in another currency, such valuation shall be made on the basis of the prevailing lawful rate of exchange at which such other currency is, at the time of such valuation, obtainable for the purposes of servicing such debt, or, in the absence of such rate, on the basis of a rate of exchange acceptable to ADB.	LA, Schedule 5, para. 8 (c)	**Complied with.** The Borrower confirmed that it did not obtain any other loan in another currency under the project.
Governance The Borrower shall comply with all statutory requirements and the provisions of the listing agreement with the Securities and Exchange Board of India relating to corporate governance.	LA, Schedule 5, para. 9	**Complied with.** POWERGRID informed Project Completion Review mission that they have complied with all the statutory requirements and provisions of the listing agreement with the Securities and Exchange Board of India relating to corporate governance.
The Borrower shall ensure that all contracts financed by ADB in connection with the Project shall include provisions specifying the right of ADB to audit and examine the records and accounts of the Borrower, and all contractors, suppliers, consultants, and other service providers as they relate to the Project. The Borrower shall allow and assist ADB's representatives to carry out random spot checks on the work in progress and utilization of funds for the Project. The Borrower shall update its website regularly to include (a) bidding procedures, bidders and contract awards; (b) use of the funds disbursed under the Project; and (c) physical progress of the Project.	LA, Schedule 5, para. 10	**Complied with.** The Borrower has always allowed and assisted ADB's representatives to carry out reviews as per ADB requests during the review missions. The Borrower also updated its website regularly on tendering, contract awards, and physical progress of the project.

Project Specific Covenants	Reference	Status of Compliance
This Loan Agreement is subject to the continuing assurances of the Guarantor that:	LA, Schedule 5, para. 11	
a. the Borrower shall continue to function as the central transmission utility under the (Indian) Electricity Act 2003, as amended from time to time, provide transmission services, and facilitate private sector participation in power transmission as per its directives from time to time; and	LA, Schedule 5, para. 11 (a)	**Complied with.** Role of CTU was separated from POWERGRID responsibility due to compliance requirement under Electricity Act 2003. As requested by the POWERGRID letter of 7 September 2020 required changes in loan covenants amendments were affected vide Loan Amendment of 24 December 2020. Accordingly, the para was amended as follows: "the Borrower shall continue to provide transmission services".
b. it shall continue to support the autonomy of the Borrower with respect to its commercial, administrative, and operational activities.	LA, Schedule 5, para. 11 (b)	**Complied with.** There has been no change as far as Borrower autonomy is concerned with respect to its commercial, administrative, and operational activities.
Environment The Borrower shall ensure that the preparation, design, construction, implementation, operation and decommissioning of the Project and all Project facilities comply with (a) all applicable laws and regulations of the Guarantor and the relevant States relating to environment, health and safety; (b) the ESPP; (c) the Environmental Safeguards; and (d) all measures and requirements set forth in the IEE, the EMP, and any corrective or preventative actions set forth in the Safeguards Monitoring Report.	LA, Schedule 5, para. 12	**Complied with.** The Borrower ensured that each of the subprojects under the project, and all project facilities were assessed, designed, implemented, constructed, operated, maintained, and monitored in accordance with all applicable environmental laws and regulations of the Guarantor, relevant States, ADB's Safeguard Policy Statement (2009), ESPP, and IEE. For all subprojects, an IEE report was prepared by POWERGRID and cleared by ADB prior to commencement of works; and there were no major changes in the substation locations and transmission line alignments when compared with ADB-cleared IEE reports. POWERGRID'S ESMD supervised the implementation of environmental safeguards with experienced environmental staff supported by the contractors' safety officers.
The Borrower shall ensure that (a) the Project and/or Project facilities are not located within national parks, forests, and wildlife sanctuaries, unless prior environmental clearances are obtained from the relevant government agencies; (b) the monuments of cultural or historical importance are avoided; and (c) works do not commence without obtaining prior forest clearances, wherever applicable.	LA, Schedule 5, para. 13	**Complied with.** The Borrower ensured that (a) the Project and/or Project facilities were not located within national parks, wildlife sanctuaries, and forests unless prior clearances were obtained from the relevant government agencies, (b) monuments of cultural or historical importance were avoided; and (c) the works commenced only after obtaining relevant statutory approvals and permissions.

Project Specific Covenants	Reference	Status of Compliance
Land Acquisition and Involuntary Resettlement		
The Borrower shall ensure, or cause to be ensured, that all land and all rights-of-way required for the Project are made available to the works contractor in accordance with the schedule agreed under the related works contract and all land acquisition and resettlement activities are implemented in compliance with (a) all applicable laws and regulations of the Guarantor and the relevant States relating to land acquisition and involuntary resettlement; (b) ESPP; (c) the Involuntary Resettlement Safeguards; and (d) all measures and requirements set forth in the CPTD and the RP, and any corrective or preventative actions set forth in the Safeguards Monitoring Report.	LA, Schedule 5, para. 14	**Complied with.** The project acquired land for the substations and caused temporary impacts on crops for the transmission lines. The Borrower ensured that compensation for the land and temporary impacts were paid in accordance with the applicable laws, regulations and policies of the Guarantor, the relevant State rules, ADB's SPS (2009), ESPP, and RPs under the project. POWERGRID confirmed that the project was implemented in accordance with the RP and ESPP.
Without limiting the application of the Involuntary Resettlement Safeguards, the CPTD or the RP, the Borrower shall ensure that no physical or economic displacement takes place in connection with the Project until:	LA, Schedule 5, para. 15	**Complied with.**
a. compensation and other entitlements have been provided to affected people in accordance with the CPTD or the RP; and	LA, Schedule 5, para. 15 (a)	**Complied with.** Compensation for the land and temporary damages were paid in accordance with the applicable laws, regulations, and policies of the Guarantor, the relevant State rules, ADB's SPS, ESPP, and RP under the project. POWERGRID confirmed that the project was implemented in accordance with the RP and ESPP.
b. a comprehensive income and livelihood restoration program has been established in accordance with the RP.	LA, Schedule 5, para. 15 (b)	**Complied with.** The borrower ensured the implementation of social safeguards in accordance with the RP.
In the event irrigation supplies are disrupted and affected farmers experience losses, the Borrower shall ensure that a provision is made for independent valuation of the losses and timely compensation in respect thereof.	LA, Schedule 5, para. 16	**Complied with.** Losses were compensated to PAPs based on an independent valuation by the district administrations.
Human and Financial Resources to Implement Safeguards Requirements		
The Borrower shall make available necessary budgetary and human resources to fully implement the EMP, the CPTD and the RP.	LA, Schedule 5, para. 17	**Complied with.** The borrower provided the necessary resources to fully implement the EMP, the CPTD and the RP.
Safeguards-Related Provisions in Bidding Documents and Works Contracts		
The Borrower shall ensure that all bidding documents and contracts for works contain provisions that require contractors to:	LA, Schedule 5, para. 18	
a. comply with the measures relevant to the contractor set forth in the IEE, the EMP, the CPTD and the RP (to the extent they concern impacts on affected people during construction), and any corrective or preventative actions set forth in the Safeguards Monitoring Report;	LA, Schedule 5, para. 18 (a)	**Complied with.** The Borrower ensured inclusion of provisions in biding documents that require contractors to comply with measures relevant to the contractor set forth in the IEE and the RP, and any corrective or preventative actions in the Safeguards Monitoring Report.

Project Specific Covenants	Reference	Status of Compliance
b. make available a budget for all such environmental and social measures;	LA, Schedule 5, para. 18 (b)	**Complied with.** The borrower made available budget for all such environmental and social measures set forth in IEE, the EMP, and the RP.
c. provide the Borrower with a written notice of any unanticipated environmental, resettlement or indigenous peoples risks or impacts that arise during construction, implementation or operation of the Project that were not considered in the IEE, the EMP, the CPTD and the RP;	LA, Schedule 5, para. 18 (c)	**Complied with.** The Borrower confirmed that no unanticipated environmental, resettlement, or indigenous peoples risks or impacts arose during the construction, implementation or operation of the Project that were not considered in the IEE and the RP.
d. adequately record the condition of roads, agricultural land and other infrastructure prior to starting to transport materials and construction; and	LA, Schedule 5, para. 18 (d)	**Complied with.** The Borrower confirmed the compliance.
e. reinstate pathways, other local infrastructure, and agricultural land to at least their pre-project condition upon the completion of construction.	LA, Schedule 5, para. 18 (e)	**Complied with.** The Borrower confirmed the compliance.
Safeguards Monitoring and Reporting		
The Borrower shall do the following:	LA, Schedule 5, para. 19	
a. submit semiannual Safeguards Monitoring Reports to ADB and disclose relevant information from such reports to affected persons promptly upon submission	LA, Schedule 5, para. 19 (a)	**Complied with.** The Borrower provided semi-annual Safeguards Monitoring Reports to ADB and disclosed relevant information.
b. if any unanticipated environmental and/or social risks and impacts arise during construction, implementation or operation of the Project that were not considered in the IEE, the EMP, the CPTD and the RP, promptly inform ADB of the occurrence of such risks or impacts, with detailed description of the event and proposed corrective action plan;	LA, Schedule 5, para. 19 (b)	**Complied with.** The Borrower confirmed that no unanticipated environmental and/or social risks and impacts arose during the construction, implementation or operation of the Project that were not considered in the IEE, the EMP, the CPTD and the RP.
c. report any actual or potential breach of compliance with the measures and requirements set forth in the EMP, the CPTD and the RP promptly after becoming aware of the breach; and	LA, Schedule 5, para. 19 (c)	**Complied with.** The borrower confirmed that there was no breach of compliance with the measures and requirements of the EMP, the CPTD and RP.
d. in the event unexpected significant safeguard impacts are identified, promptly engage qualified and experienced external expert or agency under terms of reference intimated to ADB, to verify information produced through the Project monitoring process, and facilitate the carrying out of any verification activities by such external experts.	LA, Schedule 5, para. 19 (d)	**Complied with**. The Borrower confirmed that no unexpected significant safeguard impacts were identified during the project implementation and operation.
Execution of Works Contracts		
The Borrower shall ensure that subsequent to award of works contract, no works are commenced by the contractor unless the applicable provisions of the IEE, the EMP, the CPTD and the RP, as approved by ADB, have been complied with.	LA, Schedule 5, para. 20	**Complied with.** No civil works were started by the contractor unless the applicable provisions of the ADB-cleared RP and EMP were complied with.

Project Specific Covenants	Reference	Status of Compliance
In relation to the Project, the Borrower shall cause the contractors to undertake detailed survey of the affected persons during transmission line alignment finalization. The Borrower shall prepare CPTD which meets ADB's requirements, and update it based upon the detailed design information during the survey carried out by work contractors. The Borrower shall submit to ADB for approval the revised CPTD progressively during the implementation of the related works.	LA, Schedule 5, para. 21	**Complied with.** The Borrower carried out a detailed survey of the affected persons during transmission line alignment finalization under the Project.
Any changes to the location, land alignment, or environment impacts on account of detailed designs of the Project shall be subject to prior approval by ADB before commencement of works for transmission lines under the Project.	LA, Schedule 5, para. 22	**Complied with.** The Borrower confirmed that there were no major changes in the planned tower locations or line alignment on account of detailed designs of the related transmission project.
Indigenous Peoples In the event of any significant or related impacts on indigenous peoples, the Borrower shall prepare and implement an indigenous peoples plan in accordance with the applicable laws and regulations of the Guarantor and the relevant States, and the Indigenous Peoples Safeguards.	LA, Schedule 5, para. 23	**Complied with.** No significant or related impacts on indigenous peoples under any subproject were observed. In the event of non-significant impacts, the Borrower complied with the requirements set out in the related RP.
Prohibited List of Investments The Borrower shall ensure that no proceeds of the Loan are used to finance any activity included in the list of prohibited investment activities provided in Appendix 5 of the SPS.	LA, Schedule 5, para. 24	**Complied with.** The Borrower did not fund proceeds of the Loan to finance any activity included in the list of prohibited investment activities provided in Appendix 5 of ADB's SPS (2009).
Labor Standards The Borrower shall ensure that for procurement of Goods, Works, and Consulting Services, the contractors, subcontractors and consultants will comply with the applicable labor legislations of the Guarantor, and the relevant States, (e.g. safe working conditions, etc.), as well as with the core labor standards: (a) elimination of force or compulsory labor; (b) abolition of child labor; (c) elimination of discrimination in respect of employment; and (d) freedom of association.	LA, Schedule 5, para. 25	**Complied with.** The Borrower ensured that for procurement of Goods and Works, the contractors, and subcontractors complied with the applicable labor legislations of the Guarantor, and the relevant States as well as with the applicable Core Labor Standards agreed to by the Government of India.
Gender and Development The Borrower shall ensure that the principles of gender equity are followed during implementation of the Project, including (a) equal pay to men and women for work of equal value; and (b) enabling working conditions for women workers. The Borrower, in coordination with the appropriate agencies, shall ensure the effective implementation of measures aimed at increasing Project benefits and impacts on women in and around the Project area.	LA, Schedule 5, para. 26	**Complied with.** All principles of gender equity were adhered to during project implementation.
Particular Covenants a. The Borrower shall cause the Project to be carried out with due diligence and efficiency and in conformity with sound applicable technical, financial, business, and development practices.	LA Article IV, Section 4.01 (a)	**Complied with.** The Borrower ensured that the Project was carried out with due diligence and in conformation with sound technical, financial, engineering, environmental, business and power sector development practices.

Project Specific Covenants	Reference	Status of Compliance
b. In the carrying out of the Project and operation of the Project facilities, the Borrower shall perform, or cause to be performed, all obligations set forth in Schedule 5 to this Loan Agreement.	LA Article IV, Section 4.01 (b)	**Complied with.**
The Borrower shall make available, promptly as needed, the funds, facilities, services, and other resources, as required, in addition to the proceeds of the Loan, for the carrying out of the Project and for the operation and maintenance of the Project facilities.	LA Article IV, Section 4.02	**Complied with.** The Borrower has made available, promptly as needed, the funds, facilities, services, land, and other resources which was required, in addition to the proceeds of the loans, for the carrying out of the Project and for the operation and maintenance of the Project facilities.
a. Whenever applicable, in the carrying out of the Project, the Borrower shall cause competent and qualified consultants and contractors, acceptable to ADB to be employed to an extent and upon terms and conditions satisfactory to the Borrower and ADB.	LA Article IV, Section 4.03 (a)	**Complied with.** The Borrower engaged competent and qualified contractors which was acceptable to ADB. No consultant was recruited.
b. The Borrower shall cause the Project to be carried out in accordance with plans, design standards, specifications, work schedules and construction methods acceptable to the Borrower and ADB, as applicable. The Borrower shall furnish, or cause to be furnished, to ADB, promptly after their preparation, such plans, design standards, specifications and work schedules, and any material modifications subsequently made therein, in such detail as ADB shall reasonably request.	LA Article IV, Section 4.03 (b)	**Complied with.** The Borrower ensured that, the Project carried out in accordance with plans, design standards, specifications, work schedules and construction methods acceptable to ADB. The Borrower have provided such plans, design standards, specifications and work schedules to ADB as and when required.
The Borrower shall ensure that the activities of its departments and agencies with respect to the carrying out of the Project and operation of the Project facilities are conducted and coordinated in accordance with sound administrative policies and procedures.	LA Article IV, Section 4.04	**Complied with.**
a. The Borrower shall (i) have its accounts and financial statements (balance sheet, statement of income and expenses, cash flow and related statements) audited annually, in accordance with appropriate auditing standards consistently applied, by independent auditors whose qualifications, experience and terms of reference are acceptable to ADB; (ii) furnish to ADB, as soon as available but in any event not later than 6 months after the end of each related fiscal year, certified copies of such audited accounts and financial statements and the report of the auditors relating thereto (including the auditors' opinion on the use of the Loan proceeds and compliance with the financial covenants of this Loan Agreement), all in the English language; and (iii) furnish to ADB such further information concerning such accounts and financial statements, and the audit thereof, as ADB shall from time to time reasonably request.	LA, Article IV, Section 4.05 (a)	**Complied with.** The Borrower has submitted audited entity financial statement to ADB with in time frame of 6 months to end of each financial year.
b. The Borrower shall enable ADB, upon ADB's request, to discuss the Borrower's financial statements and its financial affairs from time to time with the auditors appointed by the Borrower pursuant to subsection (a) hereinabove, and shall	LA, Article IV, Section 4.05 (b)	**Complied with.**

Project Specific Covenants	Reference	Status of Compliance
authorize and require any representative of such auditors to participate in any such discussions requested by ADB, provided that any such discussion shall be conducted only in the presence of an authorized officer of the Borrower unless the Borrower shall otherwise agree.		
The Borrower shall enable ADB's representatives to inspect the Project, the Goods and Works, and any relevant records and documents.	LA, Article IV, Section 4.06	**Complied with.** The Borrower allowed ADB's representatives inspect the Project, the goods and works financed out of the proceeds of the Loan, and any relevant records and documents during its review missions.
a. The Borrower shall, promptly as required, take all action within its powers to maintain its corporate existence, to carry on its operations and to acquire, maintain and renew all rights, properties, powers, privileges and franchises which are necessary in the carrying out of the Project or in the conduct of its business.	LA, Article IV, Section 4.07 (a)	**Complied with.**
b. The Borrower shall at all times conduct its business in accordance with sound technical, financial, business and development practices, and under the supervision of competent and experienced management and personnel.	LA, Article IV, Section 4.07 (b)	**Complied with.**
c. The Borrower shall at all times operate and maintain its plants, equipment and other property, and from time to time, promptly as needed, make all necessary repairs and renewals thereof, all in accordance with sound applicable technical, financial, business, development, operational and maintenance practices.	LA, Article IV, Section 4.07 (c)	**Complied with.**
Except as ADB may otherwise agree, the Borrower shall not sell, lease or otherwise dispose of any of its assets which shall be required for the efficient carrying on of its operations or the disposal of which may prejudice the ability of the Borrower to perform satisfactorily any of its obligations under this Loan Agreement.	LA, Article IV, Section 4.08	**Complied with.** POWERGRID has confirmed that it did not sell, lease or otherwise dispose of any of its assets. However, POWERGRID transferred its 74% of its equity shareholding in 5 nos. subsidiaries/ SPVs to PGInvIT with prior approval of ADB vide letter of 27.05.2020.
No provision under this Loan Agreement shall operate to mitigate or prejudice any requirement on either party under the Nonsovereign Loan Agreement.	LA, Article IV, Section 4.09	**Complied with.** No provisions under this Loan Agreement were operated to mitigate or prejudice any requirement on either party under the Nonsovereign Loan Agreement.
Suspension; Acceleration of Maturity The following are specified as additional events for suspension of the right of the Borrower to make withdrawals from the Loan Account for the purposes of Section 9.01(l) of the Loan Regulations:	LA Article V, Section 5.01	
a. any change shall have been made in the memorandum and articles of association of the Borrower, which may in the reasonable opinion of ADB, materially and adversely affect the financial condition, operations, or ability of the Borrower to perform any of its obligations under this Loan Agreement; or	LA Article V, Section 5.01 (a)	**Complied with.** POWERGRID confirmed that no changes were made in the memorandum and articles of association of the Borrower, materially and adversely affect the financial condition, operations, or ability of the Borrower to perform any of its obligations under this Loan Agreement

Project Specific Covenants	Reference	Status of Compliance
b. a subsidiary or any other entity shall have been created, acquired, or taken over by the Borrower, if such creation, acquisition or taking over, in the reasonable opinion of ADB, may materially and adversely affect the conduct of its business or its financial condition or the efficiency of its management and personnel or the carrying out of the Project.	LA Article V, Section 5.01 (b)	**Complied with.** POWERGRID has created subsidiaries CTUIL and POWERGRID Teleservices Limited with prior approval of ADB.
The following is specified as an additional event for acceleration of maturity for the purposes of Section 9.07(a)(iv) of the Loan Regulations: any of the events specified in Section 5.01 of this Loan Agreement shall have occurred.	LA Article V, Section 5.02	**Complied with.**
Effectiveness The following are specified as additional conditions to the effectiveness of this Loan Agreement for the purposes of Section 10.01(f) of the Loan Regulations:	LA Article VI, Section 6.01	
a. all conditions precedent to disbursement of the Non-sovereign Loan under the Non-sovereign Loan Agreement shall have been met in accordance with its terms;	LA Article VI, Section 6.01 (a)	**Complied with.** POWERGRID has met all conditions precedent to disbursement of nonsovereign Loan.
b. creation by the Borrower in favor of ADB of a pari-passu interest in the liens created on its assets as security for debt in order to equally and ratably secure the payment of ADB loans under No. 2415 dated 28 March 2008 and No. 2510 dated 27 March 2009; and	LA Article VI, Section 6.01 (b)	**Complied with.**
c. receipt by ADB of a legal opinion, satisfactory to ADB, of an independent counsel acceptable to ADB, confirming that security documents pursuant to subsection (b) hereinabove, are legally valid and binding on the Borrower, and create valid pari-passu liens in favor of ADB.	LA Article VI, Section 6.01 (c)	**Complied with.** POWERGRID has submitted a legal opinion satisfactory to ADB prior to loan was made effective on 22 October 2012.
A date 90 days after the date of this Loan Agreement is specified for the effectiveness of this Loan Agreement for the purposes of Section 10.04 of the Loan Regulations.	LA Article VI, Section 6.02	**Complied with**. Loan agreement was signed on 30 March 2012 and Loan effectiveness was from 22 October 2012. The delay was primarily on account of time taken to meet conditions precedent to disbursement of the nonsovereign loan.
Guarantee Agreement		
Without limitation or restriction upon any of the other covenants on its part in this Guarantee Agreement contained, the Guarantor hereby unconditionally guarantees, as primary obligor and not as surety merely, the due and punctual payment of the principal of, and the interest and other charges on, the Loan, the premium, if any, on the prepayment of the Loan, and the punctual performance of all the covenants and agreements of the Borrower, all as set forth in the Loan Agreement. 2	GA. Article II, Section 2.01	**Complied with.**
The Guarantor shall not take any action, or permit any of its political subdivisions or agencies or any agency of any such political subdivisions to take any action, which would prevent or interfere with the	GA. Article II, Section 2.02	**Complied with.** The Guarantor has not taken any action or permit other agencies to interfere with the successful carrying out of the Project.

Project Specific Covenants	Reference	Status of Compliance
successful carrying out of the Project or the successful operation of the Project facilities, or the performance by the Borrower of its obligations under the Loan Agreement.		
The Guarantor shall from time to time take such action as may be necessary or appropriate on its part to ensure prompt performance by the Borrower of its obligations under the Loan Agreement.	GA. Article II, Section 2.03 (a)	**Complied with.** The Guarantor has performed all the required functions.
The Guarantor shall perform all the obligations set forth in the Loan Agreement to the extent that they are applicable to the Guarantor.	GA. Article II, Section 2.03 (b)	**Complied with.** The Guarantor has performed all the required functions.
It is the mutual intention of the Guarantor and ADB that no other external debt shall have any priority over the Loan by way of a lien on the assets of the Guarantor. To that end, the Guarantor undertakes (i) that, except as ADB may otherwise agree, if any lien shall be created on any assets of the Guarantor as security for any external debt, such lien will ipso facto equally and ratably secure the payment of the principal of, and interest and other charges on, the Loan; and (ii) that the Guarantor, in creating or permitting the creation of any such lien, will make express provision to that effect.	GA. Article II, Section 2.04 (a)	**Complied with.** The Guarantor has not had any external debt by way of lien on the assets.
The provisions of subsection (a) hereinabove shall not apply to (i) any lien created on property, at the time of purchase thereof, solely as security for payment of the purchase price of such property; or (ii) any lien arising in the ordinary course of banking transactions and securing a debt maturing not more than one year after its date.	GA. Article II, Section 2.04 (b)	
The term “assets of the Guarantor” as used in subsection (a) hereinabove includes assets of any political subdivision or any agency of the Guarantor and assets of any agency of any such political subdivision, including the Reserve Bank of India and any other institution performing the functions of a central bank for the Guarantor.	GA. Article II, Section 2.04 (c)	

ADB = Asian Development Bank, CPTD = compensation plan for temporary damages, CTU = central transmission utility, CTUIL = Central Transmission Utility of India Limited, EMP = environmental management plan, ESPP = environmental and social policy and procedures, ESMD = environmental and social management department, FY = financial year, GA = Guarantee Agreement, GAPP = generally accepted accounting principles, IEE = initial environmental examination, LA = loan agreement, PAM = project administration manual, PAP = project affected person, PGInvIT = POWERGRID Infrastructure Investment Trust, RP = resettlement plan, SPS = safeguard policy statement, SPV = special purpose vehicle

Sources: Asian Development Bank and POWERGRID.

ECONOMIC REEVALUATION

I. Introduction

1. In assessing the efficiency of ADB financing and the project, the economic reevaluation analysis of the project was carried out in accordance with Asian Development Bank (ADB) guidelines. At approval and completion, the economic internal rate of return (EIRR) was undertaken, including sensitivity analyses.

II. Economic Reevaluation of the Project

2. The economic reevaluation measured the costs and benefits in 2022 constant prices. The EIRR was calculated by comparing with-and without-project scenarios. All financial prices were converted into economic prices by applying the corresponding conversion factors. At completion, interventions resulted in economic benefits from two subprojects: (i) establishment of HVDC Interregional transmission system between northern (Haryana) and western regions (Chhattisgarh)—Original Scope; and (ii) interregional system strengthening scheme for the Western and Northern Regional Grids (Part-B—Additional scope approved in February 2015).

3. **Economic Costs.** The economic costs were derived from the financial costs by deducting taxes and duties and price contingencies or inflationary effects. Financial costs included: (i) capital costs for generation; (ii) ADB-funded transmission costs; and (iii) distribution capital costs. All costs and benefits were valued using the domestic price numeraire. These financial costs were categorized into foreign exchange and local currency costs. Traded inputs (15% of capital costs) were valued at their border price equivalent value and were converted to domestic equivalents using an estimated standard exchange rate factor (SERF) of 1.04,[1] which was calculated using a simple trade weighted approach. Non-traded inputs were valued at domestic prices. Labor cost was assumed to be 10% of the local currency costs, and unskilled labor costs were assumed to be 35% of the labor costs. It was assumed that there are no significant distortions in the wage rates for skilled labor. In the case of unskilled labor, underemployment exists in the economy, and the shadow wage rate factor (SWR) of 0.75 was used for this reevaluation.[2] Operation and maintenance (O&M) costs are based on actual costs of the constructed facilities as provided by POWERGRID. Operation and maintenance (O&M) costs were estimated based on data provided by POWERGRID based on government O&M norms. The specific conversion factor for O&M costs was estimated to be approximately 1.0 and therefore no shadow pricing of O&M costs was undertaken. Table A12.1 presents the financial and economic costs.

[1] SERF was estimated based on trade statistics 2019 and ADB. 2004. *Economics and Research Department (ERD) Technical Note Series No. 11: Shadow Exchange Rates for Project Economic Analysis: Toward Improving Practice at the Asian Development Bank.* Manila.
https://wits.worldbank.org/CountryProfile/en/Country/IND/Year/2012/TradeFlow/Export/Partner/all/Product/Total

[2] Shadow wage rate (SWR) is based on recent completion reports: (i) 2019. *Completion Report. India: Gujarat Solar Power Transmission Project*. Manila (SWF=0.75), and (ii) 2020. *Completion Report. India: Rural Connectivity Investment Program (Tranche 1) (SWR: 0.74).*

Table A12.1: Financial and Economic Costs-Combined
(₹ million)

Fiscal Year	Financial Cost	Financial Cost (w/o taxes / w/o IDC)	15% Tradable	85% NonTradable	SERF @ 1.04	Unskilled Labor (0.75 SWRF)	Economic Cost
2011/12	438	430	65	366	67	1	431
2012/13	11,873	11,582	1,737	9,844	1,807	31	11,620
2013/14	19,735	18,561	2,784	15,776	2,895	52	18,620
2014/15	44,081	41,574	6,236	35,338	6,486	116	41,708
2015/16	31,781	28,545	4,282	24,263	4,453	83	28,633
2016/17	43,252	38,399	5,760	32,639	5,990	114	38,516
2017/18	43,329	39,217	5,882	33,334	6,118	114	39,338
2018/19	17,857	16,458	2,469	13,989	2,567	47	16,510
2019/20	5,589	4,770	716	4,055	744	15	4,784
2020/21	3,241	3,090	464	2,627	482	9	3,100
2021/22	1,693	1,603	240	1,363	250	4	1,608
Total	**222,869**	**204,229**	**30,634**	**173,595**	**31,860**	**585**	**204,869**

Numbers may not add up due to rounding.
IDC = interest during construction, SERF = standard exchange rate factor, SWRF = shadow wage rate factor.
Source: Asian Development Bank estimates.

4. **Economic Benefits.** The economic analysis was carried out on the basis of economic benefits of power consumption to the final consumers represented by their willingness to pay (WTP). The methodology was primarily based on ADB's ERD Technical Note No. 3 "Measuring Willingness to Pay for Electricity".[3] Demand functions relating energy price to energy demand were estimated for each of the main consumer types (domestic, industrial, agriculture, and commercial).[4] Incremental outputs were valued using consumers' estimated WTP for incremental consumption. Consumer surplus plus revenue equals to gross economic benefit (or WTP).[5] Incremental benefits due to increased consumption were valued at WTP. Incremental benefits were calculated based on energy flows, net of transmission and distribution losses of 20.66%,[6] times the WTP calculated for the selected project areas. WTP was calculated based on demand function for domestic (household) and firm (industry and commercial), average tariffs, and consumption by consumer type in the project areas. The weighted average retail tariff for the various consumer types of the five project areas was calculated at ₹6.64/kwh, and WTP was estimated at ₹8.72/kwh. WTP for better quality and reliable services exists and is evident, which has likewise been considered.[7]

5. Non-incremental benefits were calculated based on: (i) resource cost savings expected to occur when captive generation that would have been required to meet demand in the without project scenario is replaced with energy flows from the five IPP generation from the Chhattisgarh

[3] P. Choynowski. 2002. *Measuring Willingness to Pay for Electricity. ERD Technical Note No. 3.* Manila: ADB.
[4] Consumption pattern for domestic, commercial, industrial, agricultural, and other sectors account for 24%, 9%, 42%, 18%, and 7%, respectively based on actual consumption in financial year 2018–19. Source: Central Statistics Office. *Energy Statistics 2019.* Delhi
[5] WTP average estimates for domestic, commercial, industrial, and agriculture was ₹8.86/kWh in the project areas in the Northern Region (Delhi, Punjab, Haryana, Rajasthan and Uttar Pradesh. Beyond the basic level of electricity services (basic lighting), WTP is a factor of income (*in*)elasticity and therefore of affordability or the ability to pay.
[6] 2018/2019, CEA. Economic Survey 2020-21 flags high T&D losses in power sector, Energy News, ET EnergyWorld (indiatimes.com) in 2018/19
[7] Initiative for Sustainable Energy Policy (ISEP). R. Kennedy et. al. 2019. *Quality of Service Predicts Willingness to Pay for Household Electricity Connections in Rural India.* United States. Based on 2014–2015 ACCESS survey from 714 villages, WTP for electricity was estimated using quality measures (daily total hours available, hours available at night, and index that considers outages). Results indicated that, for better quality and power reliability, consumers are willing to pay higher tariffs.

region in the with-project scenario; and (ii) global environmental benefits attributed to a reduction in carbon emissions due to the use of HVDC technology. Given the likelihood that energy shortages in the service areas of the project led to self-generation by businesses and the use of alternate energy sources by households,[8] it is assumed that part of the additional energy provided by the project is non-incremental (resource cost savings). As conservatively assumed, it is estimated that 5% of demand would be met from alternative sources at completion, but only for domestic and industrial consumers.[9] Non-incremental benefits were calculated based on resource cost savings attributed to the use of alternative sources for domestic as well as industrial users.[10]

6. Non-incremental benefits from energy savings were likewise calculated for the project. Based on the power flows through the HVDC line as of March 2022, POWERGRID estimates that the project has contributed to cumulative emission offsets equivalent to 2.77 million metric tons (t) of CO_2 from commissioning in FY2015/2016 until the end of projection period (FY2047/2048). HVDC is a least-cost and low-carbon investment option. It is expected that the accrual of benefits will accelerate to around 60% capacity utilization and contribute to further reducing CO_2 emissions in India. The benefit due to reduction in CO_2 emissions is valued at social cost of carbon.[11] Similarly, opting for ±800 kV HVDC technology over conventional AC technology for the interregional transmission link has led to ROW requirements being reduced from 276 m to 69 m (equivalent to a savings more than 29,134 hectares) for the transmission line corridor, according to POWERGRID; this significantly minimized associated negative environmental and social impacts. Furthermore, adopting a GIS-based switchyard at the Kurukshetra substation saved about 40 acres of land compared to an AIS-based switchyard. Table A12.2 summarizes estimated economic benefit quantities and unit values for the project from the commissioning of the facilities. As a basis for comparison, end-use electricity tariffs per kWh in the project areas range from ₹2.06 (agriculture) to ₹11.89 (commercial).[12]

Table A12.2: Economic Benefits, FY2015/16 to FY2021/22

Economic Benefits	Units	FY 2015/16	FY 2016/17	FY 2017/18	FY 2018/19	FY 2019/20	FY 2020/21	FY 2021/22
Quantity								
Incremental output (Original Scope and Additional Financing February 2015	Million kWh	**115**	**458**	**11,223**	**16,454**	**18,552**	**23,683**	**24,209**
Original Scope	Million kWh	115	458	11,146	9,820	9,549	13,775	13,807
Additional Financing February 2015	Million kWh	0	0	76	6,634	9,003	9,908	10,403
Energy Savings-Original Scope	Million kWh		3.44	83.60	73.75	71.62	103.31	103.55
Unit Value								
Average willingness to pay	Rs/kWh	8.72	8.72	8.72	8.72	8.72	8.72	8.72

[8] Electricity supplied from the project will be used to meet any unserved demand for electricity in the northern region. When there is no unserved demand in this region, electricity supplied from the project will be used to displace more expensive sources of generation, primarily diesel captive plants from industry as well as domestic users of kerosene.

[9] ADB. 2011. *Periodic Financing Request Report, Multitranche Financing Facility India: National Power Grid Development Investment Program Tranche 3.* Manila.

[10] Demand would be met from alternative sources for domestic consumers (kerosene lamps for lighting) and industrial consumers. Marginal costs of diesel are based on an estimated cost of diesel of Rs100.53 per gallon, 10.6 kilowatt-hour (kWh) per gallon, and non-fuel operating and maintenance costs of Rs0.6 per kWh. This gives a total variable cost of approximately Rs10.1 per kWh. The variable cost of output from kerosene lamps was estimated at Rs215.7 cost per gallon divided by 39.5 kwh per gallon of kerosene), giving a total variable cost of approximately Rs5.46 per kWh. The variable cost per kwh is applied to non-incremental energy flows assumed at 5% of total energy flows, assuming 50:50 ratio for domestic and industrial consumers.

[11] ADB. 2019. *Greenhouse Gas Emissions Accounting for ADB Energy Project Economic Analysis. (page 7).* Manila.

[12] Central Electricity Authority. 2019–2020. *Annual Report.* Delhi.

Economic Benefits	Units	FY 2015/16	FY 2016/17	FY 2017/18	FY 2018/19	FY 2019/20	FY 2020/21	FY 2021/22
Total Net Energy Flows[a]		**91**	**363**	**8,904**	**13,055**	**14,719**	**18,790**	**19,208**
Original Scope	Million kWh	91	363	8,843	7,791	7,576	10,929	10,954
Additional Financing February 2015	Million kWh	–	–	60	5,264	7,143	7,861	8,254

kWh = kilowatt hours.
[a] Net of transmission and distribution (T&D) Losses (as of 2022), or net energy flows of 79.34%.
Source: Asian Development Bank staff estimates.

7. **Economic Internal Rate of Return.** The EIRR compares the annual streams of economic capital and operating costs against benefits based on WTP. All economic costs and benefits are expressed in 2022 constant prices. Investments took place in the period FY2011/2012 to FY2021/2022, and benefits realized from FY2015/2016. The cost-benefit calculations show that the investments remain economically viable at completion and have delivered significant economic benefits. The EIRR for the project is estimated to be 16.25%, well above the hurdle rate of 12.0%, and an economic net present value of ₹206,291 million, indicating the project's economic viability. Economic cost and benefit flows for the investment is in Table A12.3.

Table A12.3: Economic Internal Rate of Return-Combined Project

(₹ million)

	Economic Cost					Economic Benefits		
	Capital Cost							
Year	Generation	Transmission Cost	Subtransmission and Distribution	O&M	Total Cost	Incremental	Non-Incremental	Net Inflows
2011/2012	863	431	431	0	1,726			(1,726)
2012/2013	23,240	11,620	11,620	–	46,479			(46,479)
2013/2014	37,240	18,620	18,620	–	74,480			(74,480)
2014/2015	83,416	41,708	41,708	–	166,832			(166,832)
2015/2016	57,266	28,633	28,633	6,487	121,018	792	147	(120,078)
2016/2017	77,032	38,516	38,516	6,557	160,622	3,168	2,283	(155,171)
2017/2018	78,676	39,338	39,338	8,948	166,301	77,608	4,599	(84,094)
2018/2019	33,019	16,510	16,510	10,505	76,544	113,788	5,615	42,860
2019/2020	9,569	4,784	4,784	11,235	30,373	128,296	6,916	104,839
2020/2021	6,201	3,100	3,100	13,670	26,072	163,774	7,620	145,321
2021/2022	3,217	1,608	1,608	13,425	19,859	167,418	7,729	155,288
2022/2023				10,737	10,737	172,785	7,842	169,890
2023/2024				8,959	8,959	178,455	7,957	177,453
2024/2025				8,504	8,504	184,443	8,076	184,015
2025/2026				8,424	8,424	190,768	8,199	190,543
2026/2027				8,403	8,403	197,449	8,322	197,368
2027/2028				8,403	8,403	204,505	8,430	204,531
2028/2029				8,403	8,403	204,505	8,539	204,641
2029/2030				8,403	8,403	204,505	8,651	204,753
2030/2031				8,403	8,403	204,505	8,765	204,866
2031/2032				8,403	8,403	204,505	8,881	204,982
2032/2033				8,403	8,403	204,505	8,999	205,101
2033/2034				8,403	8,403	204,505	9,123	205,225
2034/2035				8,403	8,403	204,505	9,250	205,352
2035/2036				8,403	8,403	204,505	9,380	205,481
2036/2037				8,403	8,403	204,505	9,511	205,613
2037/2038				8,403	8,403	204,505	9,646	205,748
2038/2039				8,403	8,403	204,505	9,783	205,885
2039/2040				8,403	8,403	204,505	9,923	206,025
2040/2041				8,403	8,403	204,505	10,066	206,168
2041/2042				8,403	8,403	204,505	10,212	206,313
2042/2043				8,403	8,403	204,505	10,360	206,462
2043/2044				8,403	8,403	204,505	10,512	206,613
2044/2045				8,403	8,403	204,505	10,666	206,768

	Economic Cost					Economic Benefits		
	Capital Cost							
Year	Generation	Transmission Cost	Subtransmission and Distribution	O&M	Total Cost	Incremental	Non-Incremental	Net Inflows
2045/2046				8,403	8,403	204,505	10,824	206,926
2046/2047				8,403	8,403	204,505	10,985	207,086
2047/2048				8,403	8,403	204,505	11,149	207,250
							EIRR =	**16.25%**
							ENPV (₹ million) **=**	**206,291**

EIRR = economic internal rate of return, ENPV = economic net present value, O&M = operation and maintenance.
Source: Asian Development Bank estimates.

8. **Sensitivity Analysis.** The economic analysis confirms that the proposed investment is economically viable. Sensitivity analysis considered the following variables: (i) a 20% decrease in benefits from incremental flows; and (ii) 20% increase in O&M costs of generation, transmission and distribution. The analysis yields an EIRR of 13.43% based on decreased benefits, 16.05% based on increased O&M costs, and 13.22% under a combined scenario, compared to 16.25% base case (Table A12.4).

Table A12.4: Sensitivity Analysis

	Change Variable	**EIRR** (%)	**ENPV** (₹ million)
1	Benefits decrease by 20%	13.43	65,293
2	O&M increase by 20%	16.05	196,805
3	Combined scenarios	13.22	55,807
	Base EIRR =	**16.27%**	**206,291**
	Base ENPV @ 12% (₹ million)	**206,291**	

EIRR = economic internal rate of return, ENPV = economic net present value, O&M = operation and maintenance.
Source: Asian Development Bank estimates.

FINANCIAL REEVALUATION

A. Introduction

1. The financial reevaluation of the project investments was carried out in accordance with the Financial Analysis and Evaluation of Asian Development Bank[1]. The capital investment of the project was based on completion costs. The investment costs include civil works, equipment, land development, environment, and social mitigation expenses, as well as taxes and duties. Incremental operating and maintenance (O&M) costs was provided by POWERGRID based on actual costs incurred. Financial viability was examined by comparing incremental costs and benefits.

2. The financial internal rate of return (FIRR) has been estimated over a 30-year period, and no salvage value was assumed at the end of the useful life of the project assets. Useful life of a transmission asset is usually 35 years. RRP estimates are based on 20-year projections and a written down value remaining at the end of 20 years. Since we have used 30-year projections, written down value at the end of 30 years is likely to be insignificant and has been ignored on conservative basis.

B. Evaluation of the Project

a. Capital Costs

3. ADB's loans have partly financed two projects (6000 MW HVDC terminals and transmission line between Champa and Kurukshetra – referred to as the "Original Scope" and Interregional System Strengthening Scheme for Western Region and Northern Region added with the change of scope memo in 2015 – referred to as the "Additional Scope"). Further the Original Scope also includes the terminal upgrades from 3000 MW to 6000 MW capacity financed by the World Bank and other lenders, since it forms the part of the same asset and complete isolation of revenues and costs is not feasible.

4. Further loan savings of $90 million from the two subprojects was used to finance a third ADB approved project – Establishment of 800 kV, 6000 MW HVDC system between the Western (Raigarh) and Southern (Pugalur) Regions and Establishment of 320 kV 2000 MW voltage source converter (VSC) based HVDC system between Pugalur and North Trichur (Kerala). The present evaluation of financial returns is based on the capital costs and revenues of the Original Scope and the Additional Scope since the third project will be evaluated via a separate Project Completion Report (PCR). For the evaluation of returns, actual financial costs indexed to FY2022 prices and exchange rates are used. For the two subprojects, the combined indexed capital cost is presented in Table A13.1.

[1] ADB. 2019. *Financial Analysis and Evaluation: Technical Guidance Note*. Manila.

Table A13.1: Inflation and Exchange Rate Indexed Capital Costs – Combined Subprojects

Year	$ million	Price Index	US $ Price Indexed	Exchange Rate	Rs (in Terms of US$ Index Price	INR million	Price Index	INR Price Indexed	Total
2011/2012	–	79.5	–	76.2	–	186	42.5	438	438
2012/2013	61.46	83.2	73.85	76.2	5,627.58	3,273	52.4	6,246	11,873
2013/2014	50.47	85.8	58.81	76.2	4,481.37	9,427	61.8	15,254	19,735
2014/2015	192.45	88.1	218.45	76.2	16,646.26	18,600	67.8	27,434	44,081
2015/2016	159.28	89.5	177.91	76.2	13,556.91	13,249	72.7	18,224	31,781
2016/2017	171.90	91.0	188.90	76.2	14,394.06	22,278	77.2	28,858	43,252
2017/2018	203.71	92.4	220.47	76.2	16,799.74	21,436	80.8	26,529	43,329
2018/2019	131.83	93.9	140.40	76.2	10,698.41	6,028	84.2	7,159	17,857
2019/2020	3.46	95.4	3.62	76.2	276.21	4,728	89.0	5,313	5,589
2020/2021	–	97.7	–	76.2	–	3,086	95.2	3,241	3,241
2021/2022	–	100.0	–	76.2	–	1,693	100.0	1,693	1,693
Total	**974.56**		**1,082.42**		**82,480.53**	**103,983**		**140,388**	**222,869**

FY = fiscal year, INR = Indian Rupee.
Source: Asian Development Bank estimates.

5. For the financial reevaluation, project capital costs at completion includes taxes and duties and interest during construction (IDC).[2] Total annual expenditure against the project was taken from the actual loan disbursements and actual expenditure incurred by POWERGRID as counterpart contributions. Cost of debt is adjusted for tax using the effective tax rate of 17.47% as informed by POWERGRID. Table A13.2 shows the estimation of weighted average cost of capital (WACC) based on actual debt and equity inflows into the Original Scope and the Additional Scope, their respective costs, reduced by the currency specific inflation factor and weighted by their respective shares in the overall financing. The real weighted average cost of capital is 1.58% as shown below.

Table A13.2: Weighted Average Capital Costs of the Original Scope and Additional Scope

($ million)

Source of Funding	Original Scope	Additional Scope	Total	Weight	Nominal Tax Adjusted Cost	Nominal Rate[b] (%)	Tax Rate (%)	Real Tax Adjusted Cost
ADB – LN2787	312.2	78.9	**391.1**[a]	15.1%	1.65%	2.0	17.47	-0.07%
ADB – LN2788	209.2	40.8	**250.0**	9.7%	1.65%	2.0	17.47	-0.07%
Other - FCY Lenders	333.5	-	**333.5**	12.9%	1.42%	1.72	17.47	-0.30%
Other INR Lenders	454.8	369.0	**823.8**	31.9%	6.32%	7.66	17.47	1.67%
Power Grid Equity	575.1	208.9	**784.0**	30.4%	8.38%	8.38	0.00	3.63%
Total	**1,885.8**	**697.6**	**2,582.4**		**WACC**			**1.58%**

FCY = foreign currency, INR = Indian Rupee, WACC = weighted average cost of capital.

[a] Remaining portion of the loan ($90 million) was used to part finance Green Energy Corridor and Grid Strengthening Project approved by ADB which will be evaluated within a separate PCR.

[b] Nominal rates are based on the following: ADB loan based on actual interest incurred under the loan; domestic loans are provided by POWERGRID based on average their borrowing rates for the project; and equity nominal rate is based on cost of equity of POWERGRID (the cost of equity has been assumed at a relatively risk-free rate, i.e., 10 years bond rate plus 1% risk premium).
Source: Asian Development Bank estimates.

[2] IDC was considered because it was capitalized in the total project cost. As per regulatory norms, tariffs are based on full cost recovery of the capital investment, including capitalized IDC (as per POWERGRID).

b. Operation and Maintenance Cost

6. The O&M cost for the transmission project are actual pass-through costs which has been calculated based on the tariff regulations issued by CERC – year wise actual O&M costs for the subprojects are provided by POWERGRID. Since the projects are operational, projected O&M costs are kept in line with the latest year actual O&M costs. The O&M cost has been price indexed as per norms, tabulated in Table A13.3.

Table A13.3: Operation and Maintenance Cost

Fiscal Year	Actual Cost (₹ million)	Price Indexed Cost [a] (₹ million)
2015/2016	30	42
2016/2017	101	131
2017/2018	438	541
2018/2019	852	1,012
2019/2020	895	1,006
2020/2021	1,158	1,217
2021/2022	1,168	1,168
2032/2033	1,187	1,187
2042/2043	1,187	1,187
2047/2048	1,187	1,187

Source: Power Grid Corporation of India Limited.

c. Revenue Generation

7. The revenues for POWERGRID are mainly derived from transmission charges, which are based on the CERC norms for the tariff determination of transmission systems, considering 99.5% of transmission system availability and a 15.5% return on equity (ROE). The revenue begun with commencement of the subprojects starting from FY2016 and FY2018 for the Original Scope and Additional Scope, respectively. Projections for 30 years are based on the actual revenues and costs of FY2021 when the project is fully operational and stable. Annual actual revenues have been provided by POWERGRID and the projected revenues are kept the same as FY2021 actual revenues adjusted for FY2022 prices.

Table A13.4: Project Revenue

Fiscal Year	Actual (₹ million)	Price Indexed (₹ million)
2015/2016	422	580
2016/2017	1,517	1,965
2017/2018	9,686	11,988
2018/2019	16,747	19,889
2019/2020	17,788	19,987
2020/2021	19,537	20,523
2021/2022	19,715	19,715
2032/2033	19,832	19,832
2042/2043	19,832	19,832
2047/2048	19,832	19,832

Source: Power Grid Corporation of India Limited.

d. Financial Internal Rate of Return

8. Since both subprojects form part of a larger transmission scheme, revenues and capital costs from original scope project and additional scope are combined to arrive at the consolidated project return. Nominal returns are converted to real values based on weighted average inflation factor of Indian Rupee and US dollar denominated costs. Consolidated real FIRR of 6.92%

exceeds the real WACC of 1.58% and financial net present value of ₹205,609 million) are shown in Table A13.5 below.

Table A13.5: Consolidated Project FIRR

(₹ million)

Fiscal Year	Capital Cost (INR million)	O&M (INR million)	Revenue (INR million)	Net Cash Flow (INR million)
2011/2012	438	–	–	(438)
2012/2013	11,874	–	–	(11,874)
2013/2014	19,736	–	–	(19,736)
2014/2015	44,080	–	–	(44,080)
2015/2016	31,785	42	580	(31,247)
2016/2017	43,252	131	1,965	(41,417)
2017/2018	43,329	541	11,988	(31,883)
2018/2019	17,857	1,012	19,889	1,020
2019/2020	5,589	1,006	19,987	13,392
2020/2021	3,241	1,217	20,523	16,064
2021/2022	1,693	1,168	19,715	16,854
2022/2023	–	1,177	19,819	18,642
2023/2024	–	1,187	19,832	18,645
2024/2025	–	1,187	19,832	18,645
2025/2026	–	1,187	19,832	18,645
2026/2027	–	1,187	19,832	18,645
2027/2028	–	1,187	19,832	18,645
2028/2029	–	1,187	19,832	18,645
2029/2030	–	1,187	19,832	18,645
2030/2031	–	1,187	19,832	18,645
2031/2032	–	1,187	19,832	18,645
2032/2033	–	1,187	19,832	18,645
2033/2034	–	1,187	19,832	18,645
2034/2035	–	1,187	19,832	18,645
2035/2036	–	1,187	19,832	18,645
2036/2037	–	1,187	19,832	18,645
2037/2038	–	1,187	19,832	18,645
2038/2039	–	1,187	19,832	18,645
2039/2040	–	1,187	19,832	18,645
2040/2041	–	1,187	19,832	18,645
2041/2042	–	1,187	19,832	18,645
2042/2043	–	1,187	19,832	18,645
2043/2044	–	1,187	19,832	18,645
2044/2045	–	1,187	19,832	18,645
2045/2046	–	1,187	19,832	18,645
2046/2047	–	1,187	19,832	18,645
2047/2048	–	1,187	19,832	18,645
			FIRR Combined	**6.92%**
			FNPV Combined	**205,609**

FY = fiscal year, FIRR = financial internal rate of return, O&M = operations and maintenance, NCF = net cash flow.
Source: Asian Development Bank estimates.

POWERGRID HISTORICAL FINANCIAL PERFORMANCE

A. Introduction

1. The Power Grid Corporation of India Ltd (POWERGRID) operates in a regulated sector with return on equity (ROE) fixed by the Central Electricity Regulatory Commission (CERC). It derives income from the transmission of electricity and its primary source of revenue is transmission tariffs, which are set by CERC on a cost-plus basis with a minimum availability requirement. As a result of regulatory oversight, POWERGRID has been consistently profitable since its start of commercial operation. Domestic rating agencies ICRA, CRISIL, and CARE all rated POWERGRID's long-term debt instruments/bank borrowings as AAA (Stable), and POWERGRID's commercial papers as A+, A1+ and A1+ respectively. Foreign rating agencies Moody's, S&P and Fitch rated POWERGRID's long term debts as Baa3 Outlook: Stable, BBB Outlook: Stable, and BBB Outlook: Stable, respectively.

B. Historical Financial Performance

2. A summary of historical financial performance is shown in Table A14.1. The most recent financial results have been analyzed and some of the reasons for its performance and year-on-year changes are indicated. Information presented therein have been gathered from financial statements prepared by POWERGRID in accordance with sound accounting policies and practices which conform to generally accepted accounting principles in India and have been audited by its statutory auditors in accordance with Indian auditing standards.

Table A14.1: Summary of Historical Financial Performance

(₹ billion)

Items	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Total Income	265.77	307.66	356.18	383.18	405.27
Income Growth (%)	24.70	15.76	15.77	7.58	5.76
PBTRDA	95.00	102.70	114.89	126.47	146.26
Profit after Tax	75.70	82.53	99.22	107.07	119.61
Equity and Reserves	498.07	544.15	590.17	644.40	695.79
Long-term Debt	1,109.63	1,224.20	1,310.40	1,354.21	1,290.80
Total Assets	2,025.48	2,238.95	2,464.30	2,555.50	2,543.32
Profit after Tax/Total Income (%)	28.48	26.83	27.86	27.94	29.51
Profit after Tax to Net Worth %	15.20	15.17	16.81	16.62	17.19
Debt-Equity Ratio	70:30	71:29	71:29	69:31	67:33

Data from Power Grid Corporation of India Ltd. (POWERGRID) Audited Financial Statements.

3. In FY2021, POWERGRID generated total income of ₹405.3 billion (US$5.45 billion equivalent). From this amount, ₹364.57 billion (US$4.9 billion equivalent) was realized from transmission revenue representing 90.0% of total income, while the remainder was attributed to the combined businesses from telecom service, international and domestic consulting work, interest on bonds, and lease income. After deducting operating expenses and income taxes, net income registered an all-time high of ₹119.6 billion (US$1.61 billion equivalent), which enabled the Company to pay ₹0.682 billion in dividends during the year as total income grew at a compounded average of 24.5% over the past four fiscal years. For the five fiscal years, POWERGRID generated between 27% to 29% net operating income, indicating the firm's strong financial health as a regulated business. Despite such financial soundness, POWERGRID's profitability growth has been constrained by the fast pace of capital expenditures, requiring increased borrowings and is inherently limited to a fixed rate of return. ROE for the past five fiscal

years has been steadily rising from 13.0% in FY2015 to 16.8% in FY2019 due to the expansion program of the sector.

4. POWERGRID has maintained a debt-equity ratio of about 70:30 and 71:29 during the last five years. POWERGRID's leverage is likely to gradually increase to keep pace with heavy capital expansion. It is expected, therefore, that no significant improvement in the leverage ratios are expected in the medium term. As its revenue is received almost entirely in local currency, POWERGRID may have to rely on the domestic market for loans and bonds for project financing. However, due to its financial health, the company has been granted long-term foreign debt by the Asian Development Bank (ADB) and the World Bank (WB). Funding from these sources has reduced annual interest expense and improved liquidity as payment terms have been obtained long-term, i.e., up to 20 years. Approximately 71% of its outstanding long-term debt is local currency bonds and term loans, and the remaining 29% is foreign currency loans, sourced mostly from multilateral lenders. This composition of debt has provided some flexibility in terms of debt servicing.

5. Historically, CERC has provided reasonable tariffs by incorporating all cost elements and a reasonable ROE to promote stable performance of the transmission sector and ensure climate of sustainable investment and growth. Under the tariff policy, all foreign exchange variations are a cost pass-through in the tariff, and as such POWERGRID's exposure to foreign exchange and interest fluctuation risks are minimal. Tables A14.2 and A14.3 present the summary Audited Financial Statements, 2015–2019 of POWERGRID.

Table A14.2: Audited Profit and Loss Statements

(₹ billion)

Items	2017	2018	2019	2020	2021
Income					
Revenue from transmission operations	257.1	297.6	341.2	361.9	376.7
Others	8.7	10.0	15.0	21.3	28.6
Total Income	**265.8**	**307.7**	**356.2**	**383.2**	**405.3**
Expenses					
Employee benefits expense	13.8	16.0	17.8	19.6	21.1
Finance costs	63.0	75.9	90.9	98.1	85.0
Depreciation and amortization expenses	76.6	90.9	102.0	110.7	117.1
Others	17.3	22.2	30.5	28.2	25.0
Total Expenses	**170.8**	**205.0**	**241.3**	**256.7**	**248.2**
Profit before Tax and Regulatory Deferral Account Balances	**95.0**	**102.7**	**114.9**	**126.5**	**146.3**
Tax Expense					
Current	19.9	21.7	24.9	22.3	25.3
Deferred	26.8	31.4	(34.7)	12.9	5.6
Profit after Tax and before Regulatory Deferral Account Balances	**48.3**	49.6	124.7	91.3	115.4
Net Movement in Regulatory Deferral Account Balances-Income (Expenses) (net of tax)	26.9	32.8	(25.3)	16.8	4.0
Profit for the Period	**75.2**	**82.4**	**99.4**	**108.1**	**119.4**
Items that will not be reclassified to p or l (net of tax)	0.5	0.1	(0.2)	(0.1)	0.3
Total Comprehensive Income for the Period	**75.7**	**82.5**	**99.2**	**107.1**	**119.6**

Source: Power Grid Corporation of India Ltd. (POWERGRID) Audited Financial Statements.

Table A14.3: Audited Balance Sheets

(₹ billion)

Items	2017	2018	2019	2020	2021
ASSETS					
Current Assets					
Cash	32.3	15.2	36.4	48.1	44.3
Inventories	9.1	10.4	12.3	14.0	13.6
Others	69.1	97.5	130.0	122.0	180.1
Total Current Assets	110.5	123.0	178.7	184.1	238.0
Non-Current Assets					
Property, Plant, and Equipment	1,342.5	1,522.4	1,622.7	1,683.4	1,753.9
Capital work-in progress	358.1	302.6	333.6	301.8	179.0
Others	134.6	177.9	248.9	285.0	266.3
Total Non-Current Assets	1,835.2	2,002.9	2,205.2	2,270.29	2,199.2
Regulatory Deferral Account Balances	1.08	113.04	80.8	101.2	106.1
TOTAL ASSETS	**1,946.8**	**2,239.0**	**2,464.7**	**2,555.5**	**2,543.3**
LIABILITIES AND EQUITY					
Current Liabilities					
Borrowings	15.0	10.0	43.0	30.0	18.0
Trade payables	4.1	2.4	3.6	2.3	1.9
Others	228.5	256.6	274.5	258.6	276.0
Total Current Liabilities	247.6	269.0	321.1	290.9	295.8
Non-Current Liabilities					
Borrowings	1,109.6	1,224.2	1,310.4	1,354.2	1,290.8
Others	42.7	151.9	148.5		
Total Non-Current Liabilities	1,152.3	1,376.1	1,458.8	1,511.0	1,454.2
Total Liabilities	1,399.9	1,645.1	1,780.0	1,809.1	1,750.0
Deferred Revenue	48.8	49.7	94.6	109.2	97.5
Equity					
Share Capital	52.3	52.3	52.3	52.3	52.3
Other Equity	445.8	491.8	537.9	592.1	643.5
Total Equity	498.1	544.1	590.2	644.4	695.8
TOTAL LIABILITIES AND EQUITY	**1,946.8**	**2,239.0**	**2,464.7**	**2,555.5**	**2,543.3**

Source: Power Grid Corporation of India Ltd. (POWERGRID) Audited Financial Statements.

CONTRIBUTION TO STRATEGY 2030 OPERATIONAL PRIORITIES

OP No.	Corporate Results Framework Indicators (Outputs and Outcome)	Expected Value	Achieved Value	Expected and Implemented Method	Assessment
1.3.1	Infrastructure Assets Established or Improved (number)	2	2	Works and equipment	**Achieved.** Constructed 2 HVDC terminal stations in Champa and Kurukshetra.
		1,773.0	1,683.3		1,288.1 km ±800 kV HVDC transmission lines constructed, 353.4 km of 765 kV and 41.8 km of 400 kV transmission lines installed.
3.1	Total annual greenhouse gas emissions reduction (tCO2e/year)	5.60 MT	2.77 MT		**Achieved.** Transmission losses reduced by 0.75% i.e., 3.25% – 2.5% due to HVDC technology.
3.1.3.	Low carbon infrastructure assets established or improved (number)	1,365.0	1,288.1		**Achieved.** 1,288.1 km ±800 kV HVDC transmission lines constructed between western (Champa, Chhattisgarh) and northern region (Kurukshetra, Haryana)

HVDC = high-voltage direct current, km= kilometer; kV = kilovolt, MT = million metric ton, OP = operational priorities.
Sources: Asian Development Bank and POWERGRID.