

# Management Discussion and Analysis



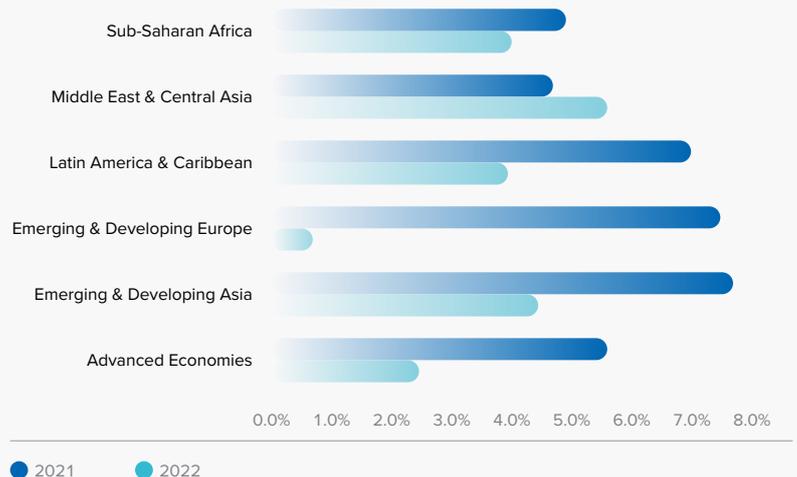
## Economic Overview

### Global

The global economy is gradually recovering from the blows of COVID-19 and Russia’s war in Ukraine. While the lowering food and energy prices, improved supply chain functioning and China’s economic reopening provided the necessary fillip to the economy, risks are firmly to the downside with increased inflation and uncertainty from the recent financial sector turmoil.

**Chart 1: Growth in economies in 2022 vs 2021**

A slow recovery, mainly weighed down by Russia’s invasion on Ukraine and inflation



The inflation which reached multi-decade high last year, appears to have peaked in many economies, notably in the United States, the Euro area, and Latin America. Further, the global monetary policy remained tight to push the inflation back towards its targets. As per IMF World Economic Outlook April 2023, the world economy grew 3.4% in 2022, led by Middle East and Asia which added most of the growth.

### Outlook

The global economic growth is expected to be moderate for next two years, growing at 2.8% in 2023 and 3.0% in 2024, as per the IMF World Economic Outlook. Advanced economies are expected to see an especially pronounced growth slowdown, from 2.7% in 2022 to 1.3% in 2023 and 1.4% in 2024. Developing economies of Asia are expected to drive most of global growth in both years, growing at 4.4% and 5.3% respectively, as they benefit from ongoing reopening dynamics and less intense inflationary pressures compared to other regions. Overall, global inflation will decrease, although more slowly than initially anticipated, from 8.7% in 2022 to 7.0% in 2023 and 4.9% in 2024.



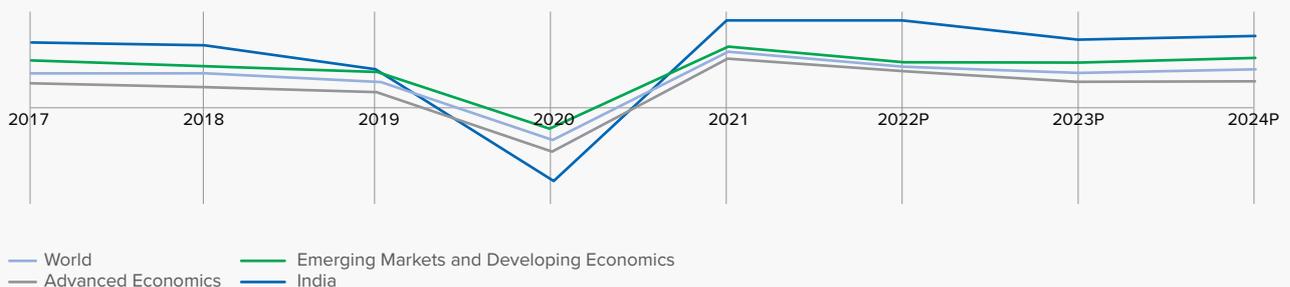
### India

The global economies slowed in 2022, however, India was one of the fastest growing economies in the world with 6.8% of growth. Growth was supported by robust domestic demand – strong investment activity augmented by the government’s capex push and buoyant private consumption, particularly among higher income earners. External demand was weak as central banks globally continued monetary tightening to tame inflation. The inflation for India remained above the Reserve Bank of India’s (RBI) target range of 2-6%.

### Outlook

The International Monetary Fund (IMF) has projected an optimistic outlook for India with a growth rate of 5.9% in 2023 and 6.3% in 2024. Despite the global slowdown, India’s economic growth rate is stronger than in many peer economies and reflects relatively robust domestic consumption and lesser dependence on global demand. The Government of India’s strong infrastructure push, improving labour market conditions and consumer confidence will drive growth. Inflation will likely moderate to 5% in 2023 assuming moderation in oil and food prices, and slow further to 4.5% in FY 2024 as inflationary pressures subside. However, geopolitical tensions and weather-related shocks are key risks to India’s economic outlook.

**Chart 2: GDP growth in India and major global economic groups**  
 Indian economy growth rate is stronger among the global peers



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### Brazil

Brazil had a fragile growth before the pandemic, as it was still recovering from the severe recession in 2015-16. While the government was on track to rebound the economy, the COVID-19 pandemic has halted growth and left Brazil with one of the highest global death tolls. A rapid vaccine rollout programme and implementation of the government measures to counteract the resulting economic crisis contributed to a return to relative normality. As of March 30, 2023, 85% of Brazilians had received at least one dose of the vaccine, and 77% had received two.

The economy grew stronger in 2021 with GDP expansion of 5%. However, inflation which reached 9.4% in 2022, along with high level of social spending, among other factors mitigated the recovery in 2022. Overall, GDP grew 2.9% last year, driven by household consumption, private investment, and export. The labour market recovery continued, as unemployment dropped to 7.9% by December 2022 – the lowest since 2015.

### Outlook

The economic growth is likely to be slow in Brazil due to its large public debt, higher social welfare spending and subdued global demand. Together, these factors are likely to depress private consumptions, export, and investments. IMF projects the economy to grow by 0.9% and 1.5% in 2023 and 2024 respectively.

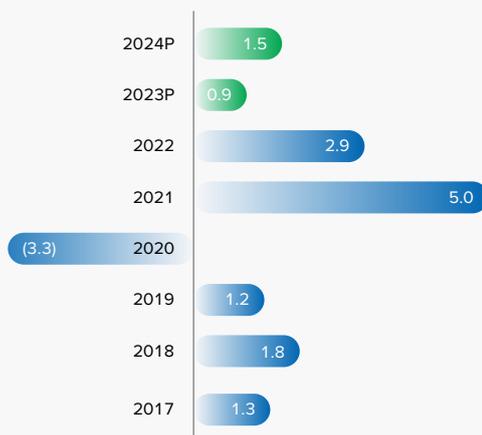
Looking forward Brazil political dynamics remain a key area to monitor in South America’s largest economy. The widening fiscal deficit and the heavy debt burden continued to be the most severe issues for Brazil and returning to a path of fiscal consolidation will be Brazil primary challenge.

The recent reforms in the infrastructure sector, together with the federal administration’s renewed interest in the climate agenda, provide sound opportunities for Brazil’s green recovery and for lifting millions of Brazilians out of poverty. However, Brazil has yet to develop an integrated long-term national strategy to achieve its climate goals.



**Chart 3: Historic GDP growth in Brazil and growth projections**

Growth is expected to be slow in 2023 and 2024



# Industry

## Global

The global policy support and increasing competitiveness of clean energy technologies continues to accelerate the energy transition.

In 2022, According to BNEF, global energy transition investment totalled US\$ 1.1 trillion up from 31% in 2021 and the first time the figures has been measured in trillions. Renewables energy remained the largest sector with US\$ 495 billion of investment (up 17% y-o-y). While the inflation and supply chain disruption have posed challenges, they do not appear to have put a meaningful dent in the speed of the transition.

The strongest engine of the global energy transition is electrification, expanding in all regions and almost all sectors. Electricity becomes the “new oil” in terms of its dominance of final consumptions by 2050. As per IEA, the share of electricity is expected to reach more than 50% by 2050 a significant rise from current 20% share. Hydrogen also takes off after 2030 and expected to account for 10% of total final consumption by 2050.



# US\$ 1.1 trillion

Global energy transition investment in 2022

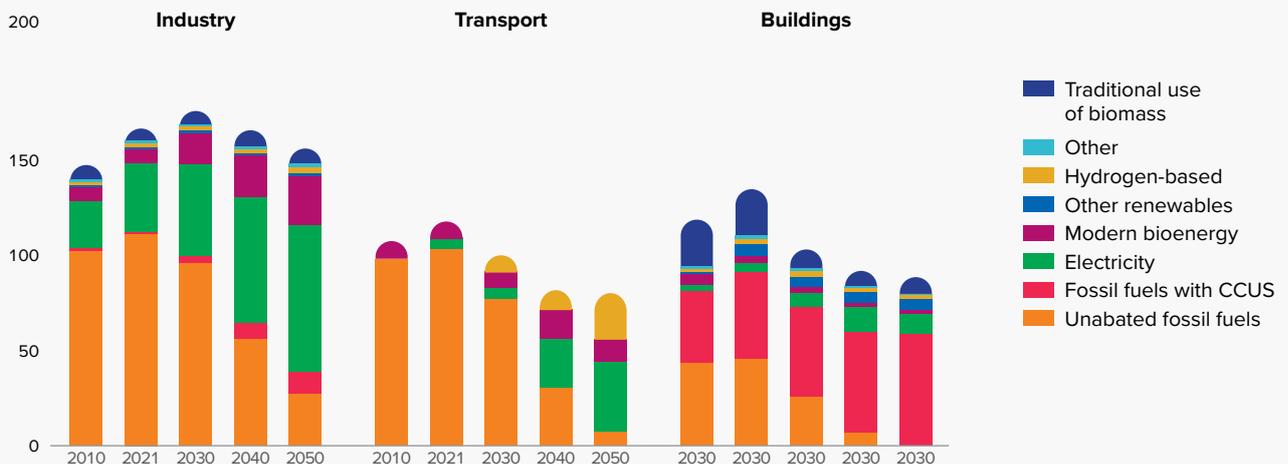
# US\$ 495 billion

Global investment in Renewable Energy in 2022

# ~31%

Year on year increase in energy transition investment

**Chart 4: Final energy consumption by sector in the IEA Net Zero Scenario (2010-2050) – (Exajoule)**  
 Dominated by electricity, with provides 50% of total final consumption by 2050



Note: Other renewables include solar thermal and geothermal used directly in end-use sectors.

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**Chart 5: Annual capacity addition for coal (GW)**

There is an evident decline in annual coal capacity additions over the past decade



**Chart 6: Annual capacity addition for renewables (GW)**

Annual installed capacity for renewables has consistently grown over the past decade



The growth in renewable electricity generation has been consistent and fast enough to outpace the contribution of fossil fuels for power in the long-term. While the recent energy crisis (due to Russia’s invasion of Ukraine) pushes up the higher utilisation of coal-fired assets, however these political and market responses are a short-term blip and will not prevent thermal coal’s decline in the medium to long term.

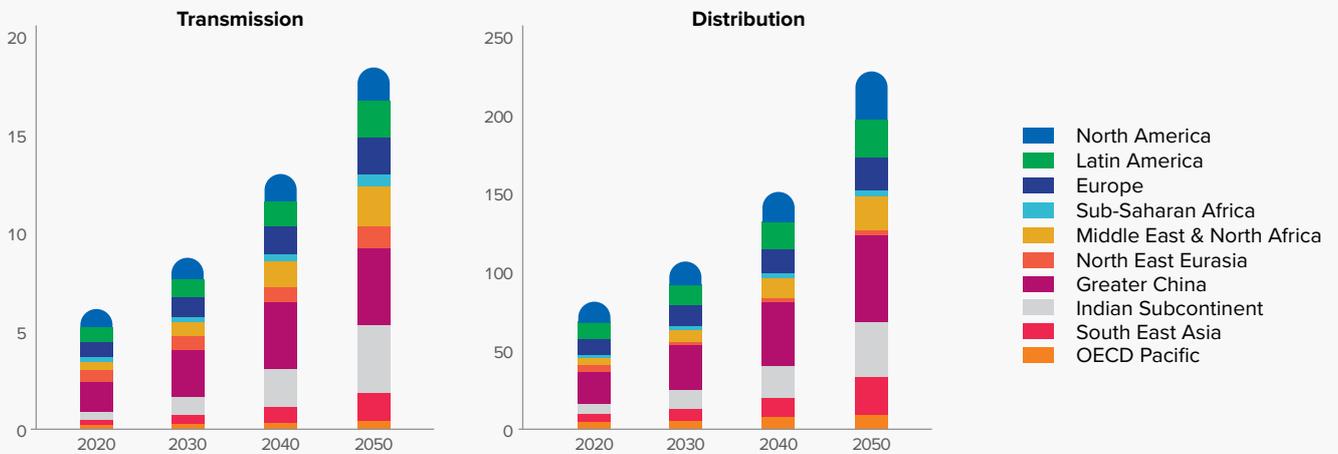
Between 2012 and 2016, the average new coal fired power plant capacity added per annum was close to 87 GW, which declined to ~60 GW in the 2017-21 period. In 2022, only 45 GW of such new capacity was added. By contrast, on average 138 GW renewable capacity was added between 2012-16 which increased to an annual average of over 212 GW between 2017 and 2021. In 2022, the renewable energy additions were 295 GW higher than the previous year, which shows the resilience of renewable energy amidst the lingering energy crisis. As per IEA World Energy Outlook, investments in clean energy is projected to triple by 2030 from the current level in its Net Zero scenario.

Further, to accelerate the electrification, more grid connections will be needed. Investment in world grid would reach levels of US\$ 500 billion/year in 2030s and growing up to US\$ 1 trillion/year by 2050s from the 2022 levels of ~US\$ 274 billion/year, according to DNV Energy Transition report. The growth in the grid investments would be driven by accelerating integration of renewables, grid modernisation to improve resilience and reliability and digital transformation.



**Chart 7: World Transmission and Distribution Power line length by region**  
 Transmission and Distribution lines will almost triple by 2050

Units: million circuit-km



Source: DNV Energy Transition Outlook 2022 report.

As per the DNV Energy Transition Report, it is forecasted that world transmission lines will increase from ~6 million ckm in 2020 to almost 18.5 million ckm by 2050. Distribution lines will almost triple from 2020 to 2050, reaching about 230 million ckm globally, from 80 million ckm. The Indian Subcontinent and Greater China would have the larger share of the T&D line expansion.

## Management Discussion and Analysis

### India

#### Overview

Power sector is a critical component of infrastructure and crucial for economic growth and welfare of a country. The Indian power industry has been focused on providing universal access to affordable power in a sustainable way. In recent years, India has made significant efforts to evolve the industry and turn the country from one with a power shortage to one with a surplus including creating a single national grid and achieving a universal household electrification. India's power sector is most diversified in

the world with higher dependency on conventional sources, however the country is moving towards clean energy – in line with the global energy transition and decarbonisation efforts. Hon. Prime Minister's announcement at COP 26 summit has set a framework towards the same. Further, India holds the presidency of G20 in 2023 and might leverage its role to make some bold announcements affecting energy transition.



Raise non-fossil fuel capacity to 500 GW



Meet 50% requirement from RE by 2030



Reduce carbon emission by 1 Bn tonnes by 2030



Reduce 45% carbon intensity by 2030



Achieve Net Zero by 2070

The electricity demand in India is experiencing a strong growth, as per the IEA World Energy Outlook Report 2022, India is expected to witness largest increase in energy demand of any country. In FY 2023, electricity demand grew by 9.5%, driven by a combination of continued economic recovery after the COVID-19 slowdown and peak summer temperatures.

To achieve the growing power and energy demand in sustainable manner, India is taking actions for deployment of renewable energy capacity and related infrastructure. The Government of India came up with Green Hydrogen Policy in Feb 2022 and National Green Hydrogen Mission in January 2023, which would add up to the Renewables power demand from industries producing Green Hydrogen and Green Ammonia using power from renewable Energy (RE) resources. The government also established a plan under its report titled 'Transmission System for Integration of over 500 MW RE Capacity by 2030' for the integration of the additional capacity within the transmission grid that includes grid expansions and additional storage capacity. For the expansion of large-scale grid-connected solar and wind projects, the waiver of inter-state transmission system charges for solar and wind projects has been extended for projects scheduled for installation until 30 June 2025, and a phased waiver has been proposed up to 2030. The Green Energy Corridor scheme has also been implemented to expand the existing infrastructure and cater to the transmission requirements of new renewable energy installations.



Further, India’s power transmission infrastructure needs to be future-ready to handle the increasing electricity demand and data traffic. The government’s thrust on Digital India resulting in a strong growth in data consumption. The power transmission infrastructure is being leveraged as a carrier to transmit the data using the OPGW fibres on them. With advantages like greater bandwidth and faster data transfer rates, OPGW is particularly important for India which has emerged as the world’s largest and fastest-growing market for digital technologies and services.

### Generation

India is persistent in its commitment towards non-fossil fuel energy sources. India’s installed renewables capacity touched ~125 GW of mark in FY 2023, which is over 30% of the country’s total installed generation capacity of 417 GW during FY 2023. Despite the headwinds from the macroeconomic factors, high commodity prices and supply chain crunch, investors’ confidence in the country’s renewables sector remains strong. Funds raised from all sources by India’s clean energy activities reached ~US\$ 20 billion in 2022 (Jan – Dec), investment for building new renewable power projects took the lion share with US\$ 11.4 billion. M&A activity remained high with foreign investors continue to take an interest in the India renewable sector and domestic power producers pursuing aggressive acquisitions strategies (assets as well as companies).

On the flip side, the retirement of coal plants has lagged over the years with ~14 GW capacity initially scheduled for closure over the 2017-2022 period still in operation and used for balancing purposes. Further, the recent amendment at the policy level advising utilities to not retire coal-fired power plants till 2030 due to a surge in electricity demand, might impact the rate of growth in new renewables addition in the short term.

However, India is already a global leader in construction of wind and solar power, its auction and tender programmes are among the world’s most successful and have helped it build subsidy-free renewable energy capacity with some of the lowest costs. The global trend of declining installation of fossil fuel-based capacity is visible in India as well. Further, India’s rising population and surging power demand present a rich opportunity for clean energy deployment and it is projected that country’s renewable-based installed capacity would contribute about 50% of total installed generation capacity by FY 2028.

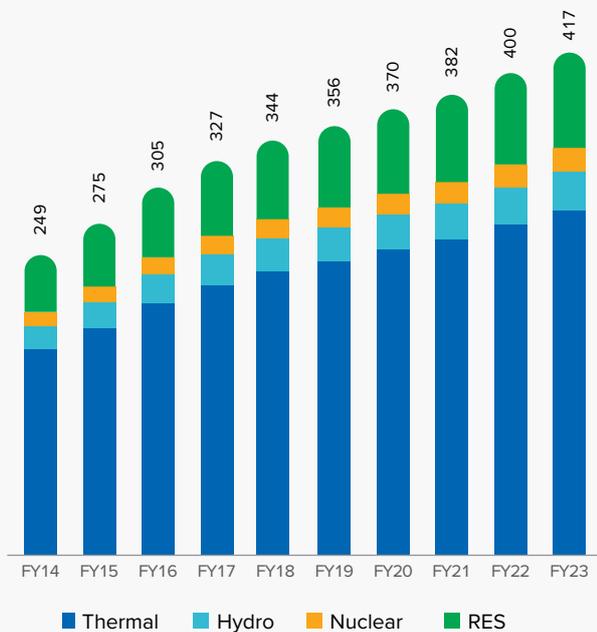
### Transmission

Transmission system plays a vital link between the generation and distribution of power. The unevenly distributed energy sources and the rapid growth of renewable power necessitates the robust development of transmission system for seamless transfer of power from surplus to deficit regions.

Unlike conventional thermal capacity, which requires 4-6 years for commissioning, renewables require ~2 years to develop. Consequently, pace of transmission build-out will require expediting to keep pace with the growing renewable mix. In line with this, In December 2022, the government launched a plan for building a transmission system for evacuating 500 Gigawatts (GW) of non-fossil-based energy by 2030. The transmission schemes have been planned considering energy storage to meet the requirement of round-the-clock (RTC) power. It has been estimated that 50,890 ckt. km and 433,575 MVA is the additional requirement of transmission lines and substation capacity respectively, planned under the ISTS for integrating additional wind and solar capacity by 2030. The plan provides transmission service providers with investment opportunities of about ₹ 2.44 lakh crore.

**Chart 8: Absolute annual capacity addition by source in previous decade**

Annual addition of renewable capacity outpacing other energy sources



Source : Annual reports of Ministry of Power, India

**14,625**

Ckms transmission line added in FY23

**75,902**

MVA of transformation capacity added in FY23

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In FY 2023, India added 14,625 ckm of transmission lines. Private sector entities put up an impressive performance in FY 2023, due to ISTS schemes under the TBCB route. Private sector added 3,883 ckm of transmission lines during the year, which is the highest annual achievement in recent years.

The Indian power transmission segment has grown significantly over the years and is now set for another phase of accelerated growth with the industry expecting the government to invite bids for power transmission projects worth ₹ 1.50 lakh crore in the next 18 months. As per the recent the CTU's ISTS Rolling Plan 2027-28. Cumulatively, 41,255 ckm of transmission lines and transformation capacity of 3,84,925 MVA at estimated cost of ₹ 2,23,954 crores is expected to be added in the grid by 2027-28.

Since the projects are typically awarded through the competitive bidding process, the level of competition among players is intense. In addition, the new technologies, such as HVDC transmission lines, smart grids and digitalisation is driving the competition in the market, as companies compete to offer the latest and most advanced solutions.

Off late, private sector has been steadily expanding its share in the overall grid length. The private sector growth in the transmission network has been outpacing the growth in the centre and state transmission. Further, the government's interest to monetise transmission assets of the state government-owned transmission undertakings and central public sector undertakings would infuse the private capital in the sector.

**Chart 9: Annual addition to transmission infrastructure-line length and transformation capacity**

India has consistently added ~15,000 ckm annually since FY13



Source: Central Electricity Authority (CEA)

**Table 1: Sector-wise growth in transmission build-out in India over the years**

Transmission ckm at the end of		Central	State	Private	Total
6th plan	ckm	3,472	48,562	-	52,034
	%	7%	93%		
7th plan	ckm	17,626	61,827	-	79,453
	%	22%	78%		
8th plan	ckm	31,199	86,177	-	1,17,376
	%	27%	73%		
9th plan	ckm	42,017	1,10,252	-	1,52,269
	%	28%	72%		
10th plan	ckm	64,295	1,31,828	-	1,96,123
	%	33%	67%		
11th plan	ckm	91,950	1,57,116	8,415	2,57,481
	%	36%	61%	<b>3%</b>	
12th plan	ckm	1,41,033	2,02,197	24,621	3,67,851
	%	38%	55%	<b>7%</b>	
2017-22 (up to March 22)	ckm	1,75,164	2,46,709	34,843	4,56,716
	%	38%	54%	<b>8%</b>	

## Distribution

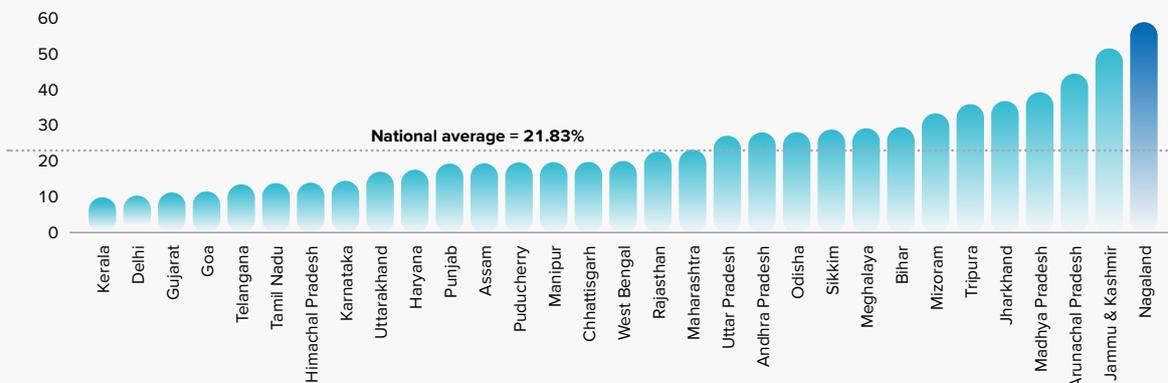
Distribution is the interface between utilities and consumer and the most important link in the entire power sector value chain. However, the sector continues to make major losses because of expensive long-term power purchase agreements, poor infrastructure, and inefficient operations, among others.

The average AT&C losses for distribution companies in FY 2020 and FY 2021 was hovering around 20%-22%. Ministry of Power instituted number of measures to improve the performance of utilities as a result the AT&C losses of DISCOMs have declined significantly. The preliminary analysis of data for FY 2022 indicates that AT&C losses have declined to ~17% in FY 2022 from ~22% in FY 2021. AT&C losses reflects DISCOMs efficiency in recovering the cost of supplying electricity and their abilities to pay to the GENCOs.

The recent Electricity (Amendment) Bill, 2022 is a step towards bringing significant changes in power distribution sector. The bill pushes the private investments in the sector, which will allow competition in the distribution segment. The Government of India has also approved the distribution Revamped Distribution Sector Scheme (RDSS) to help DISCOMs improve their operational efficiencies and financial sustainability. The objective of the scheme is to reduce AT&C losses to the pan India levels of 12%-15% by 2024-25 and to completely negate ACS-ARR gap by 2024-25.

**Chart 10: State-wise AT&C losses in India in FY21**

Average losses in Indian DISCOMs remain high, however measures are being implemented to improve the performance



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### Power Exchanges

A power exchange is a power trading platform. It is a system that enables power purchases through bids to buy and sales through offers to sell. Currently, there are three power exchanges in India, Indian Energy Exchange (IEX), Power Exchange of India Limited (PXIL) and recently added Hindustan Power Exchange Ltd (HPX) which facilitate platform for physical delivery of electricity and discover optimised price for electricity.

At present, the India’s power exchange constitutes ~8% of the total annual electricity consumption, which is expected to increase significantly in the coming year. Further, the high targets set by the government for renewables capacity addition would amplify the growth in spot market.

Globally, power exchanges have played a key role in reducing cost of renewable energy integration and managing the intermittencies of renewables by efficiently integrating them with conventional power and matching demand and supply.

For FY 2023, IEX traded 96.8 BU, a degrowth of 5% y-o-y basis. The decline in the electricity volume was on the back of power supply related constraints, which led to the price increasing by 35% on y-o-y basis. While high temperatures and increased demand are expected in the coming months, supply side liquidity should improve due to the various conducive policy and regulatory initiatives announced by the government to increase coal and gas-based generation, thereby reducing the recent surge in prices on the exchanges.

**Chart 11: Electricity volume traded at IEX (BU)**

Power traded through the energy exchange has grown significantly in the previous years



## Brazil

### Overview

Brazil is the largest electricity market in Latin America and has the seventh largest electricity generation capacity in the world. Despite the recovery from COVID-19 pandemic, Brazil electricity demand in 2022 increased slightly by 0.3% y-o-y, however it is expected to rise by ~2% per year in 2023-2025 period. Electricity generation from hydropower rebounded in 2022 with a y-o-y increase of ~17% after the country’s most severe drought in 90 years.

Brazil power sector remains highly reliant on hydro which accounts for more than 60% of total installed capacity. The country is now seeking to diversify its electricity production by expanding solar, wind, biomass, natural gas, and nuclear energy. Recently, wind has supplanted natural gas as the second largest source of power with ~12% and utility-scale solar accounts for only 3%. The National Energy Plan targets 45% of renewable capacity by 2050. According to BNEF, new clean energy investment in Brazil reached US\$ 14.8 billion last year, an increase of 18% y-o-y.

The country is also laying the groundwork for offshore wind along with the R&D efforts in new clean technologies areas, such as green hydrogen. A total of ~170 GW of offshore wind farm projects are already under review in Brazil.

**Chart 12: Brazil new clean energy investment (US\$ Bn)**

Clean energy investment remains strong, defying economic headwinds



### Transmission

The shift in the energy mix requires a strong growth in power transmission network. As per the Decennial Energy Expansion Plan 2021-2031, the transmission system is expected to increase from 175,200 km of lines to 208,900 km and from 421,900 MVA to 539,000 MVA in transformation capacity by 2031. The report forecasts total investment of BRL 101 billion (US\$ 20 billion) in the transmission expansion plan by 2031, including BRL 51.8 (US\$ 10 billion) of projects already granted. Further, it highlights the challenges of country’s ageing electrical system and a need to replace them. By 2031, BRL56 billion (US\$ 11 billion) has been forecasted to be needed in assets at the end of their regulatory useful life.

Recently, Minister of Mines and Energy has presented Electricity Transmission Grants Plan (POTEE) to invest BRL 56 billion (US\$ 11 billion) for the construction of power transmission, predominantly to integrate renewables energy, in the northeast region.

The government intends to open three auctions this year, starting with one for BRL 16 billion (US\$ 3 billion) in the first half of the year for the construction of 6,184 km of transmission lines and modernisation of several existing

substations, followed by another for BRL 20 billion (US\$ 4 billion) by the end of the year for the construction and maintenance of 4,471 km of transmission line and two substations. The remaining BRL 20 billion (US\$ 4 billion) will be scheduled for 2024. The plan is expected to enable 30 GW of renewables installations and unlock ~BRL 120 billion (US\$ 24 billion) in private investment. The auctions scheduled in 2023 are among the largest in terms of the value and is in line with the energy transition ambitions of Brazil.

**19%**

Growth in transmission line length expected up to 2031

**25%**

Growth in transformation capacity expected up to 2031

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Enablers for Investment in Transmission



**Diversifying End Uses of Electricity**

The push for green energy does not singularly entail the shift to clean power generation for electricity. It is being further augmented by electrification of transportation. As per DV Energy Transition report 2022, 78% of all vehicles worldwide will be electric (EVs) by 2050, which is bound to create a further fillip for investment in power grids to make them more resilient. In addition to EVs, electrification of cooking, heating, heavy machinery, and equipment will further augment this demand. As this enhances pressure on the grid network of densely populated cities, upgrade and uprate of existing grid infrastructure would be necessary to save on space.



**Increasing Impetus on Digital Economy**

With the enhanced push for digitalisation and exceptional growth of data consumption-driven by ongoing 4G to 5G adoption and new use cases in diverse industry verticals there is an innate need of data connectivity across the country. As per the MBIIT report released by Nokia, data traffic in India grew 3.2x in last five years. This creates a case for creation of a dense optical fibre network. For a country like India, where the population density is high and RoW issues severe, transmission assets can be uniquely leveraged to transmit data using OPGW fibres on them.



**Reforms for Intra-state Transmission in India**

The government's push for rural electrification and the consumer switch from sources such as diesel generators and other alternate sources will create an additional case for investment in intra-state transmission lines. Additionally, grid upgrades are necessary to combat high transmission losses to ensure efficient energy delivery. As per the CEAS estimates, RE capacity of 7 GW to be integrated to the intra-state transmission system under Green Energy Corridor - I (GEC-I) scheme, RE capacity of 19 GW to be integrated to the intra-state transmission system under Green Energy Corridor - II (GEC-II) scheme by 2030 in India.



**Grid Upgrades of Ageing Infrastructure**

Until recently, much of the focus has been on power generation. However, with ageing transmission and distribution systems, now it is time for utilities and the government to enhance efforts on modernising the grid. Ageing transmission infrastructure is a major risk factor for utilities as it is not designed to take up the increasing demand and the erratic nature of supply that gets absorbed in the system because of connecting intermittent sources of supply such as wind and solar. As per BNEF, of the US\$ 13.4 trillion envisaged in grid investment up to 2050, 31% or US\$ 4.1 trillion is sustain capital to replace ageing assets.



## Increasing Scope for Private Participation in Transmission

Private participation in transmission segment still lags the generation segment. In many countries, transmission lines have remained largely public. However, as these countries embark on energy transition journey, they require large investments that will make PPP critical to facilitate private investment. As a result, several nations are proposing PPP in transmission, opening more markets for private players. The recent Inflation Reduction Act (IRA) and Infrastructure Investment and Jobs Act (IIJA) in the US allocated US\$ 29 billion of funding to initiatives related to power grid which is expected to draw in private investment in the sector.



## Cross-border Interconnection

The growing impetus on regional energy collaboration among nations is a driving factor for transmission system expansion through cross-border interconnections. Power can be supplied from nations witnessing lower power load at a given time to nations that are power deficient as the demand peaks during the day. Cross-country transmission lines need to be built to support the cross-country electricity trade. Currently, India is making efforts on setting up an intercontinental grid, in line with India's 'One Sun, One Word, One Grid' initiative.



## The Push for Atmanirbhar Bharat and the Pull from Increasing Demand

India is currently experiencing significant economic growth and population expansion which has led to increasing demand for energy. As the per capita income of the country increases, the depth of access to electronic equipment to follow, thereby diversifying the centres of extensive power consumption. Additionally, the industrialisation expected to result from the government's push promote indigenous manufacturing and production will further propel growth. Investment in greenfield and brownfield transmission projects will become imperative to support this demand.



## Growing Momentum of Renewables and Decarbonisation

The global momentum towards renewables and decarbonisation has strengthened more than ever. Most of the countries have already announced their plans to transform their energy mix, for instance the UK and the US target to become Net Zero by 2050. India chases an ambitious target to install 500 GW of cumulative non-fossil fuel capacity. However, the pace and path of energy transition depends on electricity grid. There is an urgent need to develop a robust grid to integrate the renewable energy. As per BNEF, at least US\$ 13.4 trillion needs to be invested in electricity grids by 2050 to support a global economic transition scenario.