

INDIA

Towards a sustainable future

An overview of India's energy sector policies and initiatives
ensuring energy security and promoting environmental sustainability



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CONTENTS

India: The economic growth story	6
India's energy landscape	9
India's power sector	27
India's policy initiatives towards sustainability and energy transition	37
Climate initiatives and the way forward	47
Powering progress: Profiles and achievements of India's energy companies	58

India: The economic growth story

INDIA is one of the fastest-growing economies in the world and is poised to continue on this path. It aims to reach high middle-income status by 2047, the centenary of Indian independence. India is also committed to ensuring that its continued growth path is equipped to deal with the challenges of climate change and is in line with its goal of achieving net-zero emissions by 2070.

India's economy has gone from strength to strength in recent years, with the country's GDP nearly doubling in nominal terms in the past decade to become the fifth largest in the world. Over the same period, real GDP growth has averaged around 6%, one of the best rates in Asia.

India is not just one of the world's largest economies; it is one of the youngest too. Almost half of India's population today is under the age of 26. This is significant, as these generations are cited as having a unique digital bond to the internet, growing up during the 'Web 2.0' revolution since the mid-2000s.

India's middle class currently represents around 31% of the population, but that number is set to rise to over 38% by 2031 (and 60% by 2047). This growth should increase spending power and further boost India's economy.

A DIGITAL POPULATION

In 2023, smartphone penetration reached 71%, and it is expected to reach 96% by 2040

START-UP HUB

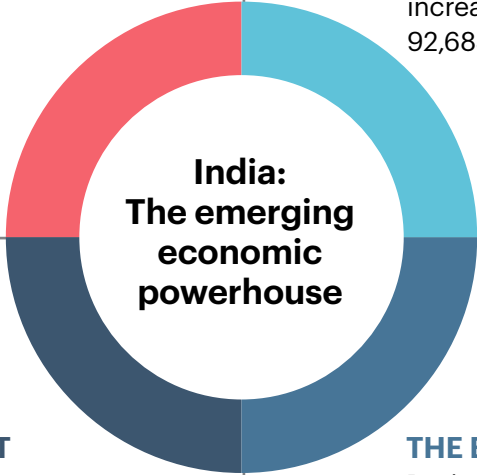
Startup ecosystem has exponential surge of 260% increase since 2016 with over 92,683 recognized startups.

INFRASTRUCTURE BOOST

Construction of national highways, from an average of 12 kilometres per day in 2014-15 to around 29 kilometres per day in 2021-22.

THE EMERGING MARKET

Business and Political Stability, Fast-growing Demographics, Friendly Investment Environment and Ease of Doing Business



**India:
The emerging
economic
powerhouse**

India's economy in numbers

- India's nominal gross domestic product (GDP) at current prices is estimated to be at Rs. 296.58 trillion (US\$ 3.56 trillion) as of January 2024.
- India presently has the third-largest unicorn base in the world. As of 2023, India is home to 111 unicorns with a total valuation of US\$

349.67 billion. Out of the total number of unicorns, 45 unicorns with a total valuation of US\$ 102.30 billion were born in 2021 and 22 unicorns with a total valuation of \$ 29.20 billion were born in 2022.

- India is expected to become the third-largest economy in the world with a GDP of \$5 trillion in the next three years and touch \$7 trillion by 2030.

Economic reforms

Placing India's economy on a rapid growth trajectory



01 India paving the way for economic growth

India 3rd largest economy in the world in Purchasing Power Parity terms

Highest-ever annual FDI inflow of \$84.8 billion in FY 2021-22

Highest-ever exports of \$770 billion worth of goods and services in FY23

Merchandise exports rise nearly 50% in 7 years!



Services exports ROSE 112% in 9+ years

India's services sector PMI hits near **13-YEAR HIGH OF 62** in April 2023



02 Building a better economy

India rapidly transforming into a 'Digital Economy'

RBI launched first pilot of **Digital Rupee** – Retail segment on 1 December 2022

India's digital payments highest in the world

UPI-based transactions grew **121%** in value between 2019 and 2022

03 Tax reforms

Seamless, painless, faceless transactions

Monthly GST collection hits all-time high **Rs. 1.87 LAKH CRORE** in April 2023

OVER RS. 1.4 LAKH CRORE of GST every month for 11 months of FY 2022-23

Tax-GDP RATIO at the highest level of **11.7%** in 2021-22

Number of individual tax returns increased **NEARLY TWO-FOLD** between 2013-14 and 2020-21

Indirect tax collection increased by **OVER 137%** from 2014-15 and 2021-22

Direct tax collection increased **121.18%** from FY 2013-14 to FY 2021-22

04

'Make in India, Make for the World'

New India a manufacturing powerhouse

PLI SCHEMES

Centre released Rs. 2,874 crore to PLI beneficiaries till March 2023

Employment generation of around 2.5 Lakh reported

FDI EQUITY INFLOW in manufacturing sector **INCREASED BY 76%** between 2020-21 and 2021-22

EMPLOYMENT AND INVESTMENT IN MANUFACTURING SECTOR

Employment increased from 57 million in 2017-18 to 62.4 million in 2019-20

Exports of ceramic products rose 6.21 times in April-January 2022-23 compared to the same period in 2013-14

India Semiconductor Mission set up at a cost of **RS. 76,000 CRORE**

05 MSMEs

Emergency Credit Line Guarantee Scheme (ECLGS) saves the sector

Rs. 3.73 lakh crore sanctioned under the scheme

12% of MSME loan accounts saved from becoming NPAs by extending credit

6 crore+ jobs created through MSME's between 2017 and 2023

06

Robust economic reforms

Ensures jobs and opportunities for Young India

Rate of Unemployment declined from **6% in 2017-18 to 4.1% in 2021-22**

Indian Railways employed over 3.5 lakh people between 2014 and 2022

PLI schemes to create 60 lakh additional jobs over next 5 years starting FY 22

8.6 Lakh jobs created directly by startups

40.17 lakh jobs created directly by Khadi and Village by industries alone since 2014-15

1.1 lakh man-days of jobs from highway construction in 2017-18, compared to only 45,600 during 2013-14

07

Expanding the stock market of India

Manifold increase in record resource mobilisation through IPOs between 2013-14 and 2021-22

Number of SMES launching IPOs doubled in FY 2023, raising three-fold amount of funds compared to FY 2022 (till November 2021)



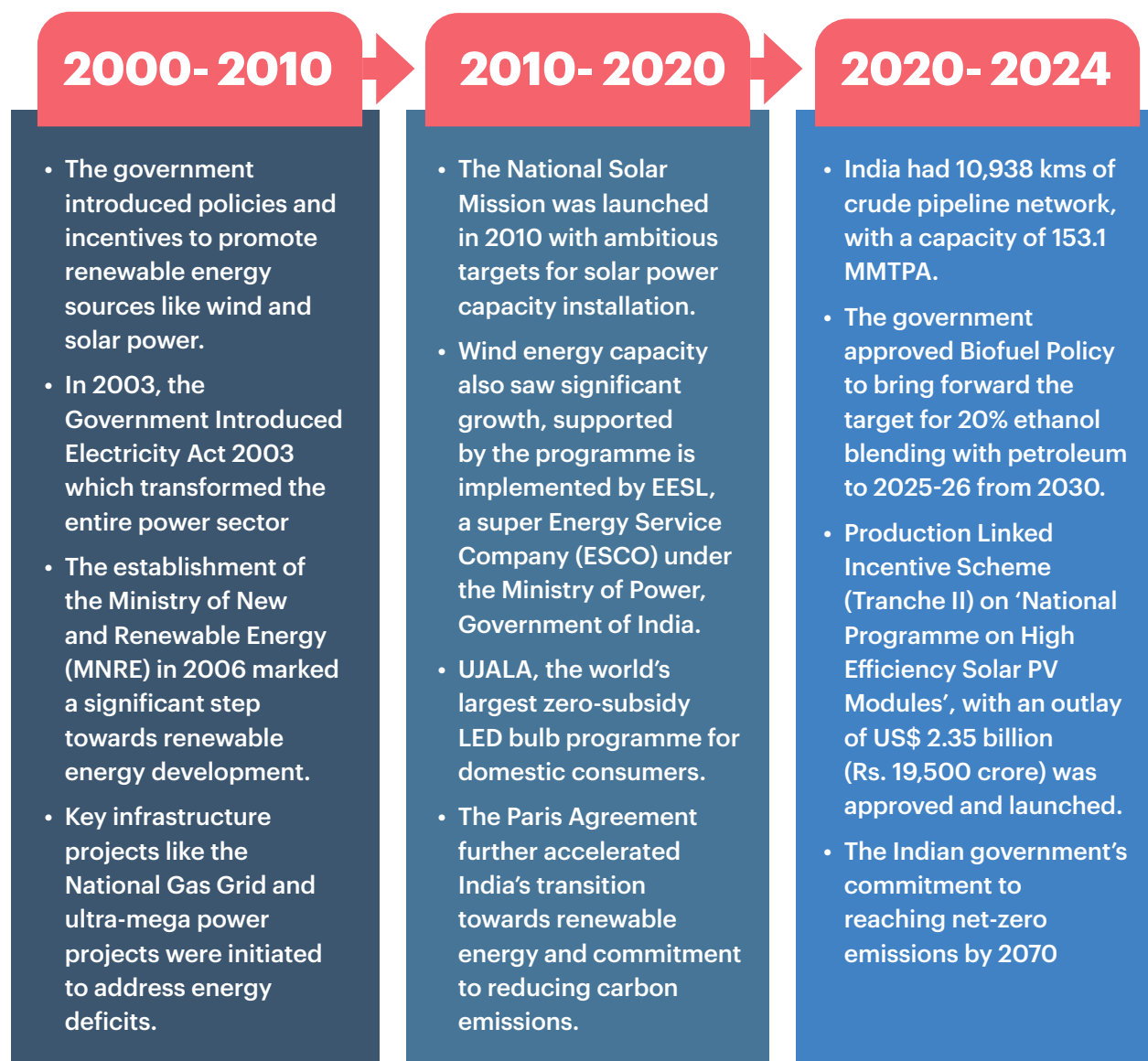
India's energy landscape

THE Indian energy sector demonstrates a promising future driven by significant advancements and initiatives. Renewable energy has emerged as a key player, with over 180 GW of installed capacity, showcasing India's commitment to sustainability and reducing carbon emissions. The government's focus on energy access has resulted in remarkable success, with over 100% of households having access to electricity, fostering socio-economic development and improving quality of life. Continued investments in natural gas infrastructure and policies promoting cleaner energy alternatives signal a shift towards a greener energy mix. Moreover, initiatives aimed at enhancing energy efficiency and promoting innovation underscore India's efforts to build a resilient and sustainable energy future.

As a party to the United Nations Framework Convention on Climate Change (UNFCCC) and its Paris Agreement, India submitted its first Nationally Determined Contribution (NDC) in the year 2015 comprising, inter-alia, of following two quantifiable targets:

- To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level; and
- To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030.

These two targets have been achieved well ahead of time. As of 31 October 2023, the cumulative electric power installed capacity from non-



fossil fuel-based energy resources is 186.46 GW, which is 43.81% of the total cumulative electric power installed capacity. As per the third

national communication submitted by India to the UNFCCC in December 2023, the emission intensity of its GDP has been reduced by 33

percent between 2005 and 2019.

In August 2022, India updated its NDC according to which target to reduce the emissions intensity of its GDP has been enhanced to 45 per cent by 2030 from the 2005 level, and the target on cumulative electric power installed capacity from non-fossil fuel-based energy resources has been enhanced to 50% by 2030.

India, a country renowned for its vast and diverse landscapes, is making remarkable strides in its journey towards a sustainable future.

- India, presently ranked as the fifth-largest economy globally, is poised to ascend to the position of the third-largest economy by 2027. India's energy demand will continue to grow at a rate of 2.7% until 2050, significantly outpacing the global average of 0.6%
- India is the 3rd largest producer of electricity worldwide with an installed capacity of 434 GW
- India stands 4th globally in Renewable Energy Installed Capacity
- India ranks 4th globally in solar energy with installed capacity of 75,576 MW

Journey of India's energy sector

The Indian energy sector has undergone significant transformations from 2000 to 2024, reflecting the country's economic growth, technological advancements, policy shifts, and environmental concerns.

Energy supply and consumption growth in the past decade

Fig 1: Total Primary Energy Supply (TPES) Per Capita (Mega Joule)

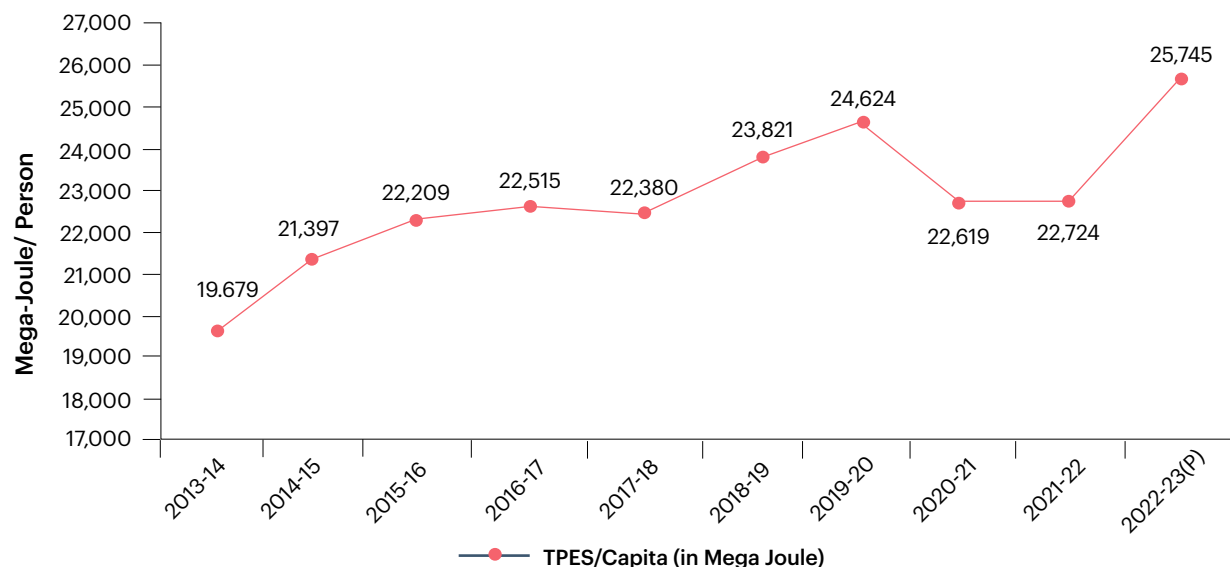
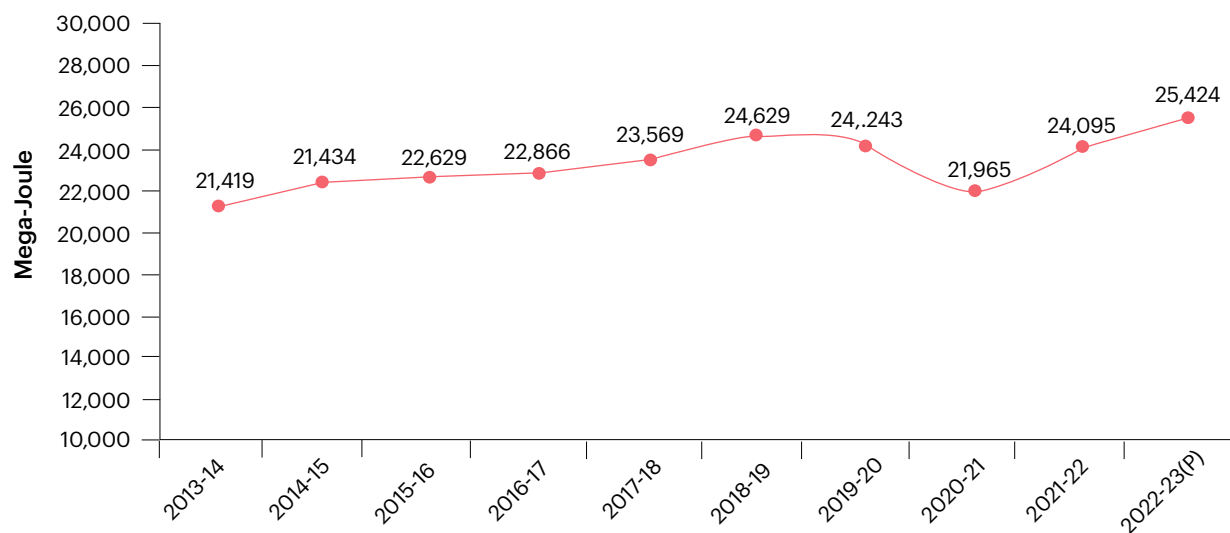


Fig 2: Per Capita Energy Consumption in India (Megajoule/Person) from 2013-14 to 2022-23(P)



India's coal sector

COAL is the most important and abundant fossil fuel in India. It accounts for 55% of the country's energy need. The country's industrial heritage was built upon indigenous coal.

India is the second largest consumer of coal and coal has hitherto played a crucial role in India's energy sector, accounting for 55% of the country's energy needs and over 75% of its electricity needs. In addition, coal is also a vital ingredient and energy source in production of many important material/products viz. Steel, Cement, Fertilizer, Paper etc. With significant availability of indigenous coal reserves and its affordability, coal is likely to continue as primary source of energy for a considerable period of time to meet the developmental needs of rising economy.

India, heavily reliant on coal for power generation, has embarked on a sustainability journey by implementing various measures. Supercritical plants, boasting higher efficiency, have been introduced, leading to a significant reduction in carbon emissions. Biomass blending in coal-fired power plants has gained momentum, with an estimated

Fig 3: Production during last five years (MT)

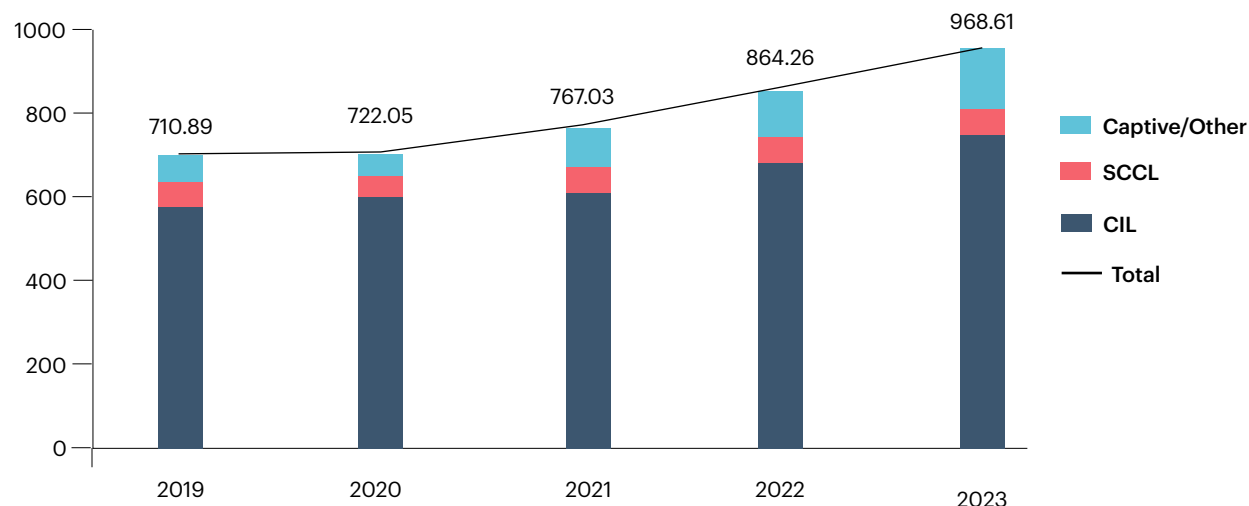
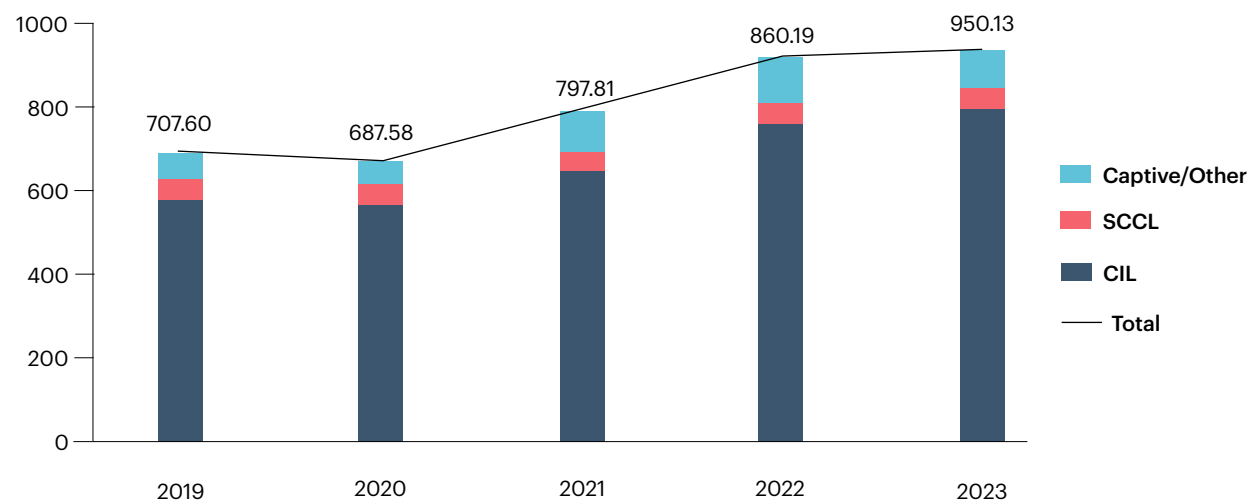


Fig 4: Dispatch during last five years (MT)



India, heavily reliant on coal for power generation, has embarked on a sustainability journey by implementing various measures. Supercritical plants, boasting higher efficiency, have been introduced, leading to a significant reduction in carbon emissions



5-10% biomass co-firing ratio being adopted in several facilities. Additionally, Carbon Capture, Utilization, and Storage (CCUS) technology have been deployed, with pilot projects capturing around 1 million tons of CO₂ annually. These concerted efforts underline India's commitment to balancing energy needs with environmental concerns, signaling a pivotal shift towards greener power generation.

Commercial primary energy consumption in India has grown by about 700% in the last four decades. The current per capita commercial primary energy consumption in India is about 350 kgoe/year which is well below that of developed countries. Driven by the rising population, expanding economy and a quest for improved quality of life, energy usage in India is expected to rise. Considering the limited reserve potentiality of petroleum & natural gas, eco-conservation restriction on hydel project and geo-political perception of nuclear power, coal will continue to occupy centre-stage of India's energy scenario.

Indian coal offers a unique ecofriendly fuel source to domestic energy market for the next century and beyond. Hard coal deposit spread over 27 major coalfields, are mainly confined to eastern and south central parts of the country.

Coal/lignite PSUs have not only enhanced their production level over the years to meet the

rising energy demand of the country but also shown their sensitivity and care towards native environment by adopting various mitigation measures including reclamation of mined out areas and extensive plantation in and around coal bearing areas.

India has rich deposits of coal in the world. Total estimated reserves of coal are 361.41 billion tonnes, an addition of 9.29 billion tonnes over the corresponding period of previous year. India's coal industry is the second largest in the world with production in its FY 2022 – 2023 of 893 million Tons, an annual increase of 14.8%, having achieved 8.7% growth in the previous year, with the country now accounting for over 10% of global production, ranking it second after China.

This growth is being driven by the Indian government's push to reduce dependency on imports and realise AtmaNirbhar Bharat, or 'self-reliant India'. Imports of coal are critical to India and have been steadily rising, accounting for 24% of consumption in 2022 compared with 12% in 2010. In order to achieve self-reliance, the Indian government is working towards increasing the domestic output to over 1 billion tonnes of coal in 2023 – 2024 and 1.5 billion tonnes by 2029 – 2030, with coal-fired power remaining a key element of its electricity portfolio.

Promoting renewables – Moving towards net zero carbon

In order minimize the carbon footprints of

mining and to progress towards the goal of net zero carbon emission, coal/lignite companies are keen on promoting renewables. Coal companies are going for both roof top solar and ground mounted solar projects. It has also been envisaged to develop solar parks in some of the reclaimed mining areas.

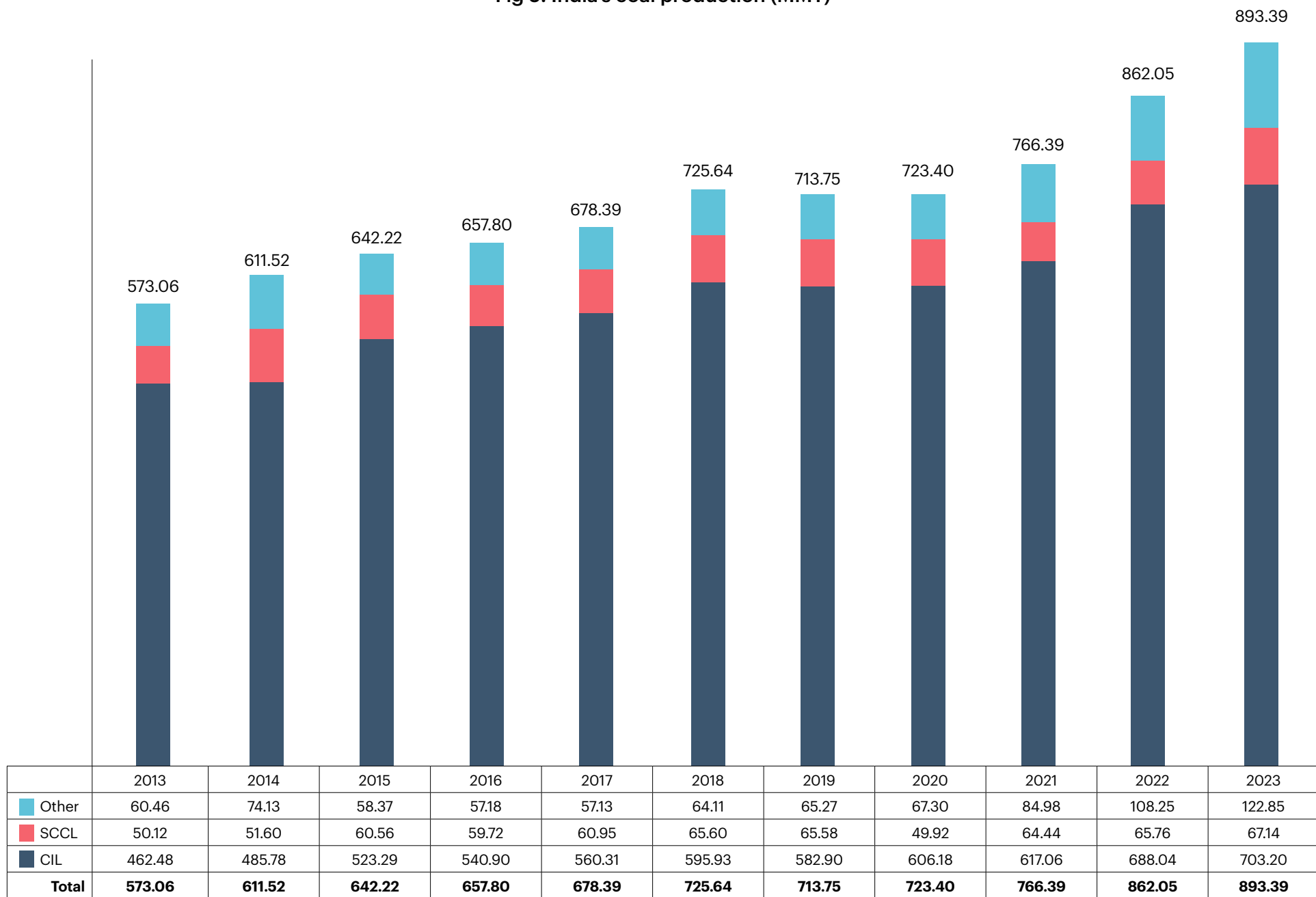
As on 26 May 2023, Coal/lignite PSUs have installed solar capacity of about 1656 MW and wind mills of 51 MW. Total Renewable energy is planned to install 5570 MW of renewable capacity by 2030.

Coal India Limited (CIL) is currently installed 11 MW as rooftop solar power. Coal India, a fossil fuel producer has aligned itself and is committed to becoming a Net Zero Energy Company and is in the process of implementing 3 GW solar power programme by 2025-26. Total 398.8 MW capacity will be developed in FY2024, 1443 MW in FY2025 and 1158 MW in FY2026.

Production side

- In 2022-23, coal production in India reached 893.188 MT and registered a growth of 14.77% over the last year. (See **Figure 5** on next page)
- Domestic coal production crosses one billion tonnes in 2023-2024. Coal production touched 664.37 million tonnes during FY 2023-24. With 8.39% growth, coal dispatch to power sector during this period also touched 577.11 million tonnes.

Fig 5: India's coal production (MMT)



Supply side

During the calendar year 2023, the country supplied about 918.62 MT of coal as compared to about 860.19 MT coal; the coal supply to the Power Sector was 764.57 MT as compared to 732.88 MT coal and the coal supply to Non-Regulated Sector (NRS) was 154.05 MT as compared to 127.31 MT during the same period of last year with a growth of about 6.79%, 4.32% and 21.00% respectively. (See **Figure 6**)

- India's coal imports increased sharply by around 18% y-o-y to over 237 million tonnes (mnt) in financial year 2022-2023 (FY23) from 202 mnt in FY22
- Out of the total coal demand of the country about 20- 25% of the demand is met from import. Import of coal mainly consists of coking coal and higher grade (GCV) coal as their domestic production is limited due to either scarce reserves or non-availability. The Net Import of coal steadily increased from 143.34 MTs in 2012- 13 to 247.51 MTs in 2019-20.

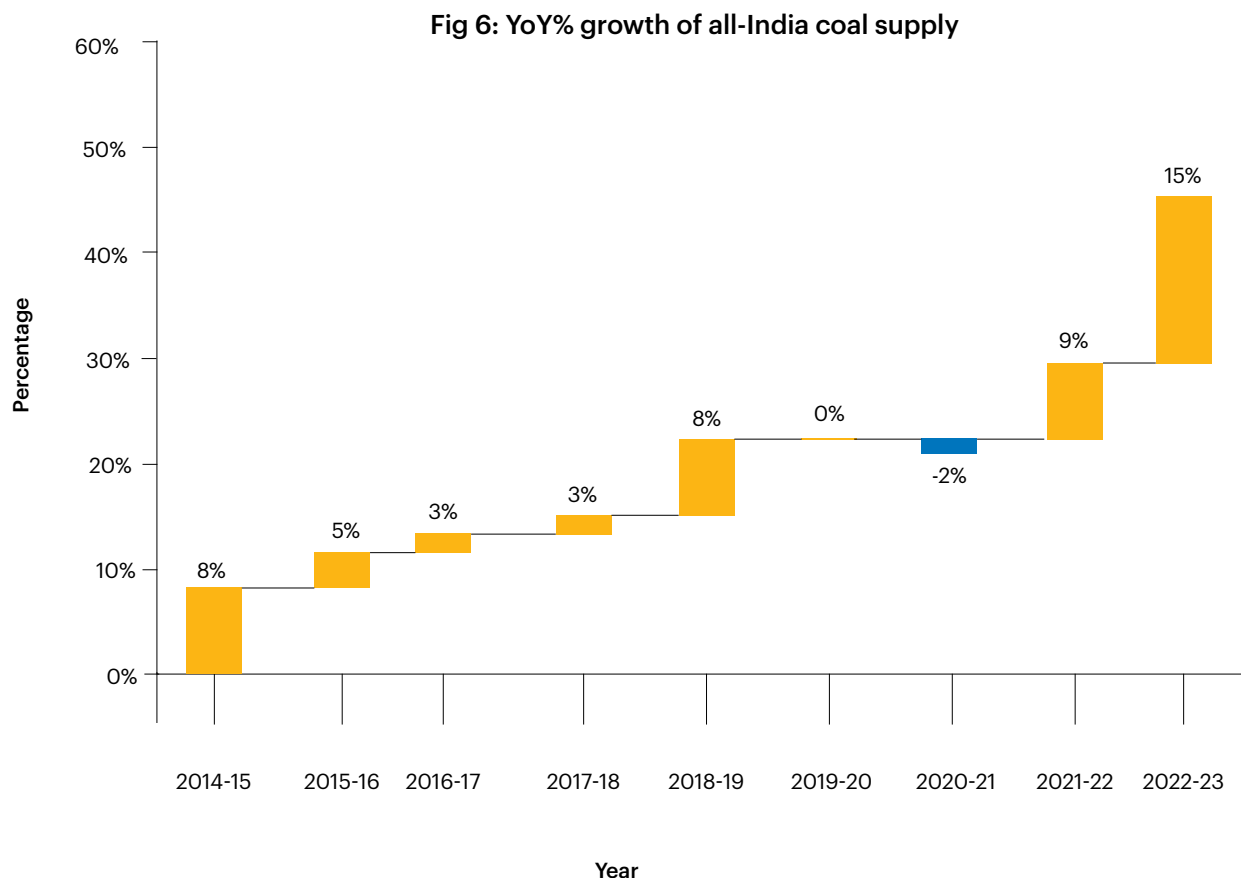
Policy and reforms

• Initiatives under PM Gati Shakti

The Ministry of Coal has undertaken 13 Railway Projects to develop multimodal connectivity and identified missing infrastructure gaps for each projects.

• Coal Linkage Policy implementation

A. Policy for Auction of Coal Linkages to Non-Regulated Sector: During the calendar year



of 2023 under the NRS e-auction, 24.23 MT was booked against the total offered quantity of 30.37 MT.

B. Scheme for Harnessing and Allocating Koyala (Coal) Transparently in India (SHAKTI) Policy:

- Five tranches of Linkage Auction have been

conducted by Coal India Limited from January to November 2023. Out of total offered quantity of 35.53 MT of coal, 27.99 MT of coal have been booked by successful bidders.

- Coal linkages granted to 11 central/state Gencos under for a capacity of 13420 MW from January to November 2023.

India's oil sector

INDIA is one of the fastest growing major economies in the world and the third largest consumer of petroleum products, after US and China. Although there is an increased focus on gas and renewables, demand for oil has always been on the rise, and is estimated to grow at least until 2040.

India will become the largest source of global oil demand growth between now and 2030. India's role in global oil markets is expected to expand substantially over the remainder of the decade, fuelled by strong growth in its economy, population and demographics.

India is on track to post an increase of almost 1.2 mb/d, accounting for more than one-third of the projected 3.2 mb/d global gains, to reach 6.6 mb/d by 2030. The massive industrial expansion means that diesel/gasoil is the single largest source of oil demand growth, accounting for almost half of the rise in the nation's demand and more than one-sixth of total global oil demand growth through to 2030.

Moreover, the Jet-kerosene demand is poised to grow strongly, at around 5.9% per year on average, but from a low base compared to other countries. Gasoline will grow by 0.7% on average, as the electrification of India's vehicle fleet avoids a more substantial rise. LPG rounds

out the growth picture, as petrochemical industry investments in production facilities boost feedstock demand.

The Indian government's world-leading progress in bringing clean cooking programmes to its rural populations have led to LPG imports surging nearly three-fold in the past decade and further initiatives will see demand growth continue through 2030.

Over the next seven years, 1 mb/d of new refinery distillation capacity will be added – more than any other country in the world outside of China. Several other large projects are currently under consideration that may lift capacity beyond the 6.8 mb/d capacity.

The combined use of new EVs and energy efficiency improvements will avoid 480 kb/d of extra oil demand in the 2023-2030 period. Biofuels are also expected to play a key role in India's decarbonisation of the transport sector. India's ethanol blending rate of around 12% is among the world's highest, and the country has advanced by five years its deadline for doubling nationwide ethanol blending in gasoline to 20% in Q4 2026.

The Indian oil sector is a crucial component of the country's energy landscape, encompassing

exploration, refining, marketing, and distribution activities. Here's an overview of the Indian oil sector, including key data points and trends up to 2023:

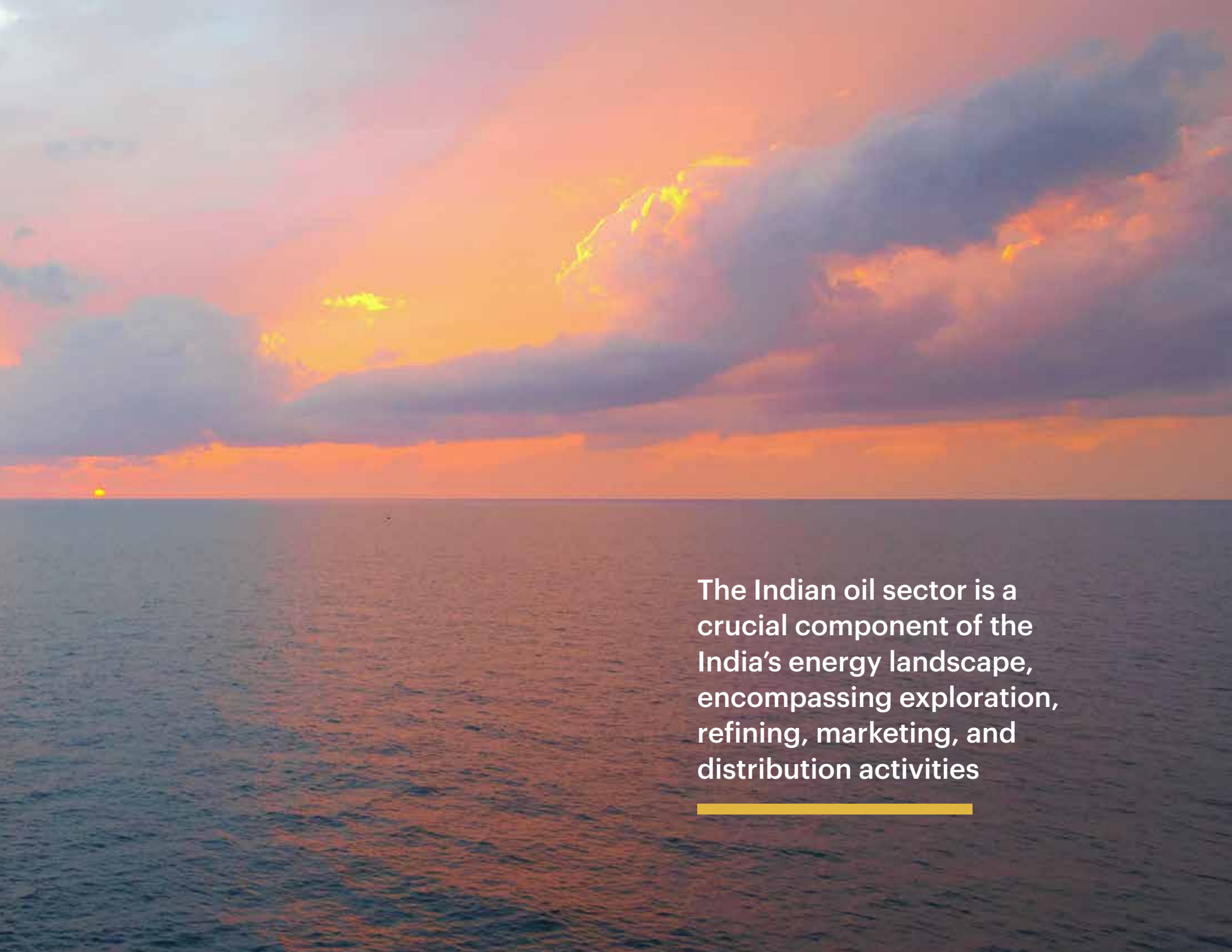
- As of April 2023, India's oil refining capacity stood at 253.91 MMT, making it the second-largest refiner in Asia. Private companies owned about 35% of the total refining capacity.
- India is expected to be one of the largest contributors to non-OECD petroleum consumption growth globally. India's consumption of petrol products stood at 222.3 MMT in FY23. High-Speed Diesel was the most consumed oil product in India and accounted for 38.6% of petroleum product consumption in FY23.
- The Indian oil sector is poised for further growth and evolution, driven by factors such as urbanization, industrialization, economic expansion, and evolving consumer preferences.

Production side

Oil production and reserves

- India's domestic oil production has been relatively stagnant over the years, accounting for a small fraction of its total oil consumption.
- As of 2023, India's proven oil reserves stood at approximately 600 million metric tons (MMT), primarily located in the western offshore regions of the country.



A wide-angle photograph of a sunset over the ocean. The sky is filled with large, dark clouds that are illuminated from below by the setting sun, creating a vibrant orange and yellow glow. The sun itself is a small, bright yellow circle on the horizon line. The ocean is a deep blue-grey color, with small waves visible. A small, dark boat is visible on the horizon to the left of the center.

The Indian oil sector is a
crucial component of the
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encompassing exploration,
refining, marketing, and
distribution activities

- Despite efforts to boost domestic production through exploration and enhanced oil recovery techniques, India continues to rely heavily on oil imports to meet its growing energy needs.

Refining capacity

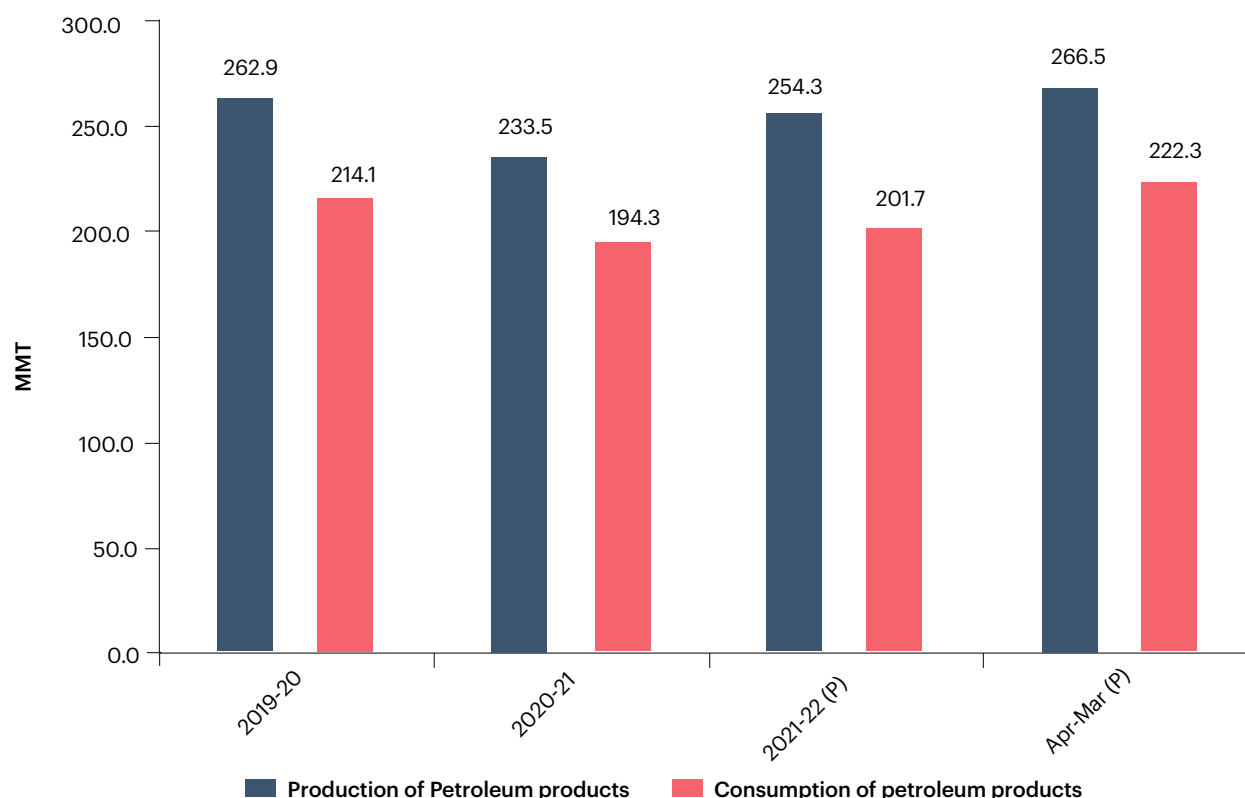
- India is home to several large oil refineries, with a combined refining capacity exceeding 250 million metric tons per annum (MMTPA) as of 2023.
- The refining sector has witnessed significant investments in capacity expansion, modernization, and efficiency improvement projects to meet both domestic demand and export requirements.
- Indian refineries have gradually upgraded their capabilities to process heavier and sourer crude oils, diversifying their crude oil sourcing strategies to optimize costs and enhance flexibility.

Consumption side

The overall consumption of Petroleum products in the country saw an increment of 5.2% to reach 192.7 MMT in Apr-Jan 2024 from 183.1 MMT during the same period of the previous year. The major product-wise breakdown of the same are as follows:

- The LPG consumption increased by 26% from 23.7 MMT during Apr-Jan 2023 to 24.4 MMT during Apr-Jan 2024. As on 01.03.2023, there are 314 Mn active LPG domestic connections by PSUs.
- The Motor Spirit consumption increased from

Fig 7: Production & Consumption of Petroleum Products (MMT)



29.1 MMT during Apr-Jan 2023 to reach to 30.9 MMT in Apr-Jan 2024.

- The HSD consumption increased from 71.1 MMT during Apr-Jan 2023 to 74.2 MMT during Apr-Jan 2024.

- In May 2022, the government approved changes in the Biofuel Policy to bring forward the target for 20% ethanol blending with petroleum to 2025-26 from 2030

Government initiatives

- On May 21, 2022, the Government announced a reduction in excise duty of Rs. 8 (US\$ 0.10) per litre on petrol and Rs. 6 (US\$ 0.077) per litre on diesel.

National Biofuel Policy 2018

The government introduced the National Biofuel Policy in 2018 to promote the blending of ethanol with petrol and biodiesel with diesel. This policy aims to reduce India's dependence on imported fossil fuels, promote sustainable



agriculture, and reduce greenhouse gas emissions. Under this policy, targets were set for ethanol and biodiesel blending in petrol and diesel, respectively.

- In July 2021, the Department for Promotion of Industry and Internal Trade (DPIIT) approved an order allowing 100% foreign direct investments (FDIs) under automatic route for oil and gas PSUs.
- The Government has allowed 100% Foreign Direct Investment (FDI) in upstream and

private sector refining projects.

Hydrocarbon Exploration and Licensing Policy (HELP)

Introduced in 2016, HELP replaced the New Exploration Licensing Policy (NELP) to simplify the process of awarding oil and gas exploration blocks. This policy aimed to attract investment, enhance domestic production, and reduce bureaucratic hurdles in the hydrocarbon sector.

Rapid economic growth is leading to greater outputs, which in turn is increasing the demand of oil for production and transportation. Crude oil consumption is expected to grow at a CAGR of 5.14% to 500 million tonnes by FY40 from 202.7 million tonnes in FY22. In terms of barrels, India's oil consumption is forecast to rise from 4.05 MBPD in FY22 to 7.2 MBPD in 2030 and 9.2 MBPD in 2050. Diesel demand in India is expected to double to 163 MT by 2029-30, with diesel and petrol covering 58% of India's oil demand by 2045. Demand is not likely to simmer down anytime soon, given strong economic growth and rising urbanisation.

International engagements

Global Biofuels Alliance (GBA): Global Biofuels Alliance (GBA) is a multi-stake holder alliance of Governments, International Organizations and Industries, an initiative by India as the G20 Chair, bringing together the biggest consumers and producers of biofuels to drive development and deployment of biofuels. The initiative aims to position biofuels as a key to energy transition and contribute to jobs and economic growth.

The Alliance intends to expedite the global uptake of biofuels through facilitating capacity-building exercises across the value chain, technical support for national programs and promoting policy lessons-sharing, technology advancements, intensifying utilization of sustainable biofuels through the participation of a wide spectrum of stakeholders.

India's gas sector

In recent years the demand for natural gas in India has increased significantly due to its higher availability, development of transmission and distribution infrastructure, the savings from the usage of natural gas in place of alternate fuels, the environment friendly characteristics of natural gas as a fuel and the overall favourable economics of supplying gas at reasonable prices to end consumers. Power and Fertilizer sector remain the two biggest contributors to natural gas demand in India and continue to account for more than 55% of gas consumption.

India, currently, has a network of about 13,000 km of natural gas transmission pipelines with a design capacity of around 337 MMSCMD. This pipeline network is expected to expand to around 28,000 Kms with a total design capacity of around 721 MMSCMD in next 5-6 years, putting in place most of the National Gas Grid that would connect all major demand and supply centre in India. This would ensure wider availability across all regions and also potentially help to achieve uniform economic and social progress.

- A total of 23,298 km of the natural gas pipeline is operational and about 10,009 km of the gas pipeline is under construction as of 2023.
- Target to increase the pipeline coverage by ~54% to 34,500 km by 2024-25 and to connect all the states with the trunk natural gas pipeline

Production and consumption						
	2019-20	2020-21	2021-22	2022-23(P)	Apr-Sep 2022	Apr-Sep 2023(P)
Gross Production	31184	28672	34024	34450	17184	17879
Net Production (net of flare and Loss)	30257	27784	33131	33664	16771	17504
LNG import	33887	33198	31028	26304	13680	15416
'Total Consumption including internal use (Net Production + LNG import)'	64144	60982	64159	59968	30451	32920
Total Consumption (in BCM)	64.1	61.0	64.2	60.0	30.5	32.9

network by 2027.

Government policies

1. Open Acreage Licensing Policy (OALP): OALP was introduced to attract investment in domestic oil and gas exploration by offering companies the freedom to choose their exploration blocks and submit bids throughout the year. This policy aims to increase domestic hydrocarbon production and reduce import dependency.

2. Hydrocarbon Exploration and Licensing Policy (HELP): HELP replaced the New Exploration Licensing Policy (NELP) to simplify the process of awarding exploration and production rights for oil and gas blocks. It offers more flexibility in contract terms, including revenue sharing and operational freedom for contractors, to encourage exploration and production activities.

3. Unified Tariff Regime (UTR): UTR was introduced to promote competition and transparency in the natural gas pipeline sector

by standardizing transportation tariffs and providing non-discriminatory access to pipeline infrastructure for gas suppliers. This policy aims to enhance the efficiency of gas transportation and distribution across the country.

4. Pradhan Mantri Urja Ganga Pipeline Project: This flagship project aims to develop a 2,655-kilometer-long natural gas pipeline network connecting eastern India to the national gas grid. It seeks to supply natural gas to various states, industries, and households in the eastern region, promoting cleaner energy usage and economic development.

5. City Gas Distribution (CGD) Network Expansion: The government has been actively promoting the expansion of CGD networks to provide piped natural gas (PNG) and compressed natural gas (CNG) to households, industries, and vehicles in urban areas. CGD bidding rounds are conducted to allocate licenses for the development of CGD networks in different geographical areas.

Biomass

B IOMASS is an important energy source in the rural area, contributing ~32% of the total final energy consumption. Total consumption is estimated to increase from 157 Mtoe in 2013 to 204 Mtoe in 2022. As of now, use of biomass other than cooking (e.g., biofuel) has been very limited. As of now, use of biomass other than cooking (e.g., biofuel) has been very limited. With the de-bottlenecking of supply chain, the future potential of biomass could be significant.

Biomass programme

The Ministry of New and Renewable Energy (MNRE) has been implementing the programme to promote Biomass Power and Bagasse Cogeneration in the country since the 1990s. The Biomass-based Cogeneration Programme (launched in May 2018) was under implementation with the main objective of promoting cogeneration for optimum use of the country's biomass resources through cogeneration technology in sugar mills and other industries (rice, paper mills, etc).

The programme which earlier focused on cogeneration will now support the manufacturing of pellets and briquettes for use in power generation. The scheme will support the implementation of the National Mission on Co-firing of Biomass in Thermal Power Plants.

According to PwC's assessment, the expected outcomes from the development of the bioenergy projects can help meet the Sustainable Development Goals (SDGs) below.

Fig 8: Expected outcomes

Energy security (SDG 7)	Affordable energy (SDG 7)	Youth empowerment (SDG 5)
Infrastructure (SDG 9)	Smart States (SDG 11)	Environment conservation (SDG 15)
Agricultural productivity (SDG 2)	Enterprise productivity (SDG 12)	Technology and innovation (SDG 9 and 12)
Poverty eradication (SDG 1 and 2)	Quality of Life (SDG 16)	Social equality (SDG 5 and 10)
Health (SDG 3)	Climate change mitigation (SDG 13)	Jobs (SDG 8)

Policy reforms	
Intervention	Details
National Policy on Biofuels	<ul style="list-style-type: none"> The Phase-I of the Bio Mass Programme has been approved with a budget outlay of Rs. 858 crore.
<ul style="list-style-type: none"> The Goal of the Policy is to enable availability of biofuels in the market thereby increasing its blending percentage. 	
PM Ji-Van Yojna	In March'2019, Government had notified the "Pradhan Mantri JI-VAN (Jaiv Indhan- Vatavaran Anukool fasal awashesh Nivaran) Yojana" for providing financial support to integrated bio-ethanol projects for setting up Second Generation (2G) ethanol projects in the country



This will enable a reduction in the practice of stubble burning particularly in the northern states of the country.

SAMARTH Mission

- Modified Revised Biomass Policy has been issued on 16.06.2023 indicating price benchmarking of biomass pellets and procurement process of pellets. Addendum to the Revised Policy issued on 03.05.2023 for inclusion of Bamboo and its by-products for manufacturing Biomass pellets.
- Total Biomass usage in the year 2023 has crossed 2.08 LMT (lakh metric tonnes).

Cumulative biomass usage till the year 2023 has crossed 3 LMT. In the year 2023, orders for 31.50 LMT Biomass pellets have been placed. Tendering of ~ 38 LMT of Biomass pellets is under different stages.

- Revised Model Contract for Biomass procurement has been issued. Price Benchmarking of Biomass Pellets in NCR, WR & NR for co-firing in Thermal Power Plants has been notified.
- Bankable project report for pellet-briquette manufacturing has been issued in association with SBI. Exclusive loan schemes for Biomass pellet manufacturing have been launched by

SBI and other Government banks.

- Provisioning of necessary administrative approvals for Biomass Pellet Plant Installation through National Single Window System (NSWS) has been enabled through launch of NSWS Mission Website as an informative & interactive platform for all stakeholders, with further provision for pellet manufacturers to display the status of readily available pellets along with price. Procurement Provision on GeM portal for Biomass pellets has been made. Raw Biomass has been added as a commodity on e-NAM portal of Ministry of Agriculture and Farmers' Welfare.

India's nuclear sector

AMONG all the developing nations, India is the only one to have generated electricity using indigenously developed, demonstrated, and deployed nuclear reactors. Nuclear energy is the fifth-largest source of electricity for India. India also stands at seventh position in terms of the number of nuclear reactors, with over 23 nuclear reactors in 7 power plants across the country which produces 6780 MW of nuclear power. With an aim to increase its atomic power contribution from 3.2% to 5% by 2031, this surge in the nuclear energy contribution in India will help the country lead towards a more sustainable and economic future.

The Government has initiated steps to increase the nuclear power capacity from 7480 MW to 22480 MW by 2031-32

Planned nuclear power plants

Government initiatives

The government has taken several steps to increase the country's nuclear power plant output.

- Amending the Atomic Energy Act to allow public-sector companies to form joint ventures to build nuclear power plants.
- Resolution of issues relating to the Civil Liability for Nuclear Damage (CLND) Act and establishing an Indian Nuclear Insurance Pool (INIP).



Map not to scale



India's power sector

AS ONE OF THE fastest-growing economies in the world, India has set ambitious clean energy targets embracing sustainable alternatives to fulfil its energy requirements. The Panchamrit plan unveiled at COP26 calls for India to increase non-fossil energy capacity to 500 GW by 2030, meet 50 percent of its energy requirements from energy by 2030, and achieve the Net Zero emissions target by 2070. This call to action will transform India's power sector, accelerating the pace of reforms and the adoption of new technologies and systems.

The share of renewables in India's overall electricity generation mix has substantially increased in the last few years. Distributed Energy Resources (DERs) have emerged as significant drivers of local sustainability because of their proximity to load centres and play a pivotal role in achieving the Net Zero target while ensuring adequacy, reliability, and quality of supply even in remote areas. DERs can include rooftop Solar PV units, wind farms, combined heat and power plants, Battery Energy Storage Systems (BESS), small natural gas-fuelled generators, and Electric Vehicles (EVs). The Government of India has announced new policies and incentives to boost the installation of Solar PV units and increase the penetration of hybrid and electric vehicles.

The increasing installation of DERs in the distribution network, the emergence of prosumers, and the availability of granular,

The performance of India's power sector in the last decade (2014 to Jan 2024)

SUPPLY
Universal Electrification <ul style="list-style-type: none"> • All villages and willing households electrified. • 18374 villages and 2.86 Cr households electrified.
Supply Hours Jump <ul style="list-style-type: none"> • Marching towards 24/7 power supply. • Daily supply hours increased in rural areas from 12.5 hours to 20.6 hours. • Daily supply hours increased in urban areas from 22 hours to 23.8 hours.
Power shortages plummet <ul style="list-style-type: none"> • The country met nearly all its peak demand of 243 GW today. Only 96.5% met in 2013. • This happened even with power demand soaring by 80% compared to 130 GW in 2013.
GENERATION
Country's installed generation capacity increased by 179 GW from 249 GW to 428 GW
Thermal capacity increased by 43% (72 GW) from 168 GW to 240 GW
Hydro capacity increased by 6 GW from 41 GW to 47 GW
RE capacity more than doubled (105 GW) from 76 GW to 181 GW
TRANSMISSION
Inter-Regional Transmission capacity more than tripled from 36GW to 117GW
High Voltage Transmission line length (220 kV and above) increased by 65% (1.9 lakh ckm) from 2.9 lakh ckm to 4.8 lakh ckm
Transformation capacity (220 kV & above) increased from 531 GVA to 1225 GVA (131%).
DISTRIBUTION AND VIABILITY
Strengthened distribution network
Added/ upgraded <ul style="list-style-type: none"> • 8.35 lakh ckm lines • 6900 new/upgraded substations • 6.9 lakh distribution transformers
Aggregate Technical & Commercial losses reduced from 26% (2014-15) to 15%
The difference between Average Cost of Supply and Average Revenue Realised per unit of electricity sold by distribution companies in the country reduced by almost 75% from `0.78 per kWh to `0.45 per kWh.
The outstanding payments due to be paid to the power suppliers by distribution companies reduced from `1.4 lakh Cr to `0.47 lakh Cr between 2022 to 2023.

real-time data are driving reforms in the power sector worldwide. The traditional power grid is also transitioning to one that incorporates automation, information management, control

and communication technologies allowing two-way information and data flow from utility companies and consumers. India's Distribution Companies (DISCOMs) must adapt to this

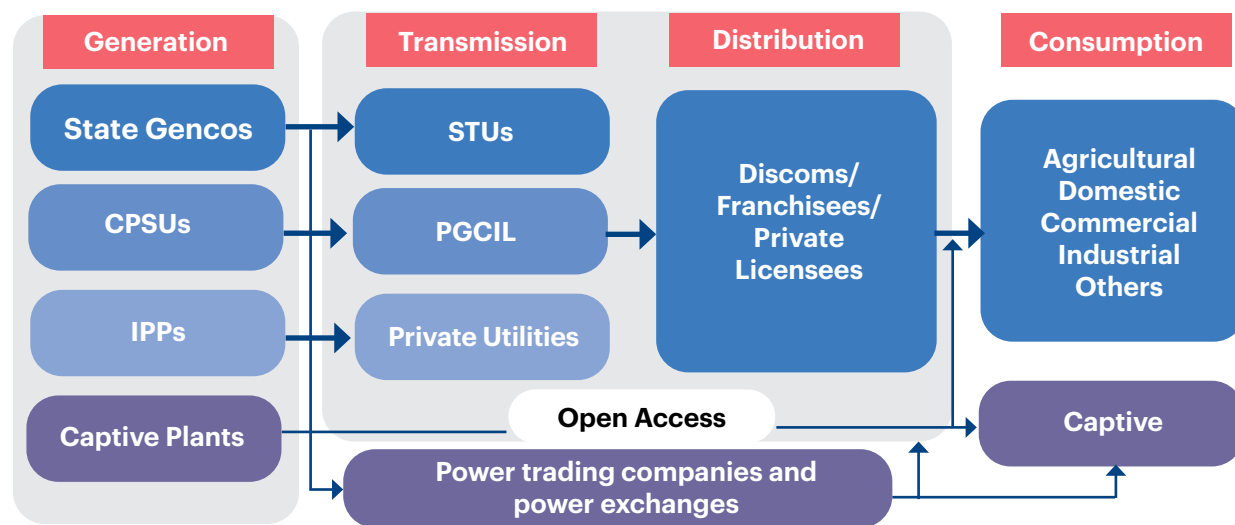
This achievement was made possible by the large-scale addition of generation, transmission and distribution capacities. This was also made possible by reforms which improved the viability of the power sector.

In 2013, integrating the Southern Region Grid faced challenges like market splitting with different regional electricity prices. This constrained 16% of electricity transactions.

But the government took decisive action, significantly strengthening the transmission system. We added over 65% more transmission lines, reaching a total length of 4.8 lakh ckm, and tripled inter-regional capacity to 117 GW.

Today, the country boasts the world's largest synchronous grid, overcoming initial hurdles and achieving "One Nation, One Grid, One Frequency."

This has reduced congestion, eliminated market splitting, and led to a unified market price. Now, power flows seamlessly from areas with surplus to those in need, reliably meeting consumer demands and supporting the growth of renewable energy.



A detailed transmission plan is paving the way for India's ambitious renewable energy (RE) goal of exceeding 500 GW capacity by 2030. This plan, covering nearly 537 GW, prioritizes key RE zones in Leh, Rajasthan, Gujarat, Karnataka and Andhra Pradesh.

Offshore wind farms in Gujarat and Tamil Nadu will also receive dedicated transmission infrastructure to evacuate 10 GW of clean energy. This ambitious project is already underway, with the planned transmission system being progressively implemented.

India's power sector has undergone a

remarkable transformation, aimed at providing reliable, affordable, and sustainable energy to its people. Over the last 9 years, significant strides have been made in enhancing power generation capacity, expanding access to electricity, promoting renewable energy, and implementing innovative policies. Here we explore the inspiring achievements and transformative initiatives that have propelled India's power sector to new heights.

The journey towards a greener future has gained global recognition. With the addition of over 175 GW of generation capacity in the past nine years, India has transitioned from a power deficit to a power surplus nation. The country's commitment to renewable energy sources has played a pivotal role in achieving this feat. The

The share of renewables in India's overall electricity generation mix has substantially increased in the last few years. Distributed Energy Resources (DERs) have emerged as significant drivers of local sustainability and play a pivotal role in achieving the Net Zero target

Photo courtesy: Solar Energy Corporation of India Limited (SECI)





remarkable growth of solar and wind energy capacity has cemented India’s position as a global leader in renewable energy adoption. Today, India stands 4th globally in Renewable Energy Installed Capacity, with 43% of its total installed electricity capacity coming from non-fossil energy sources.

India’s commitment to power generation and universal electrification has been a driving force behind its transformation. The Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA) initiative stands tall as a symbol of success, achieving universal household electrification, covering every village and district in the country. This ambitious program has provided electricity connections to 2.86 crore unelectrified households since September 25, 2017, both in rural and urban areas. The International Energy Agency (IEA) has called this the fastest expansion of access anywhere in the world in the history of power. The availability of power in both rural and urban areas has significantly increased, with rural areas experiencing a rise from about 12 hours per day in 2014 to 22.5 hours per day currently, and urban areas enjoying nearly 24 hours of power availability.

To improve the quality and reliability of power supply in rural areas, Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) was launched in 2014. The DDUGJY program achieved 100% village electrification on April 28, 2018, by

Overview of the Power Sector: World vs India				
	World (CY' 22)	India (FY'23)	%	Rank
Capacity	8,156 GW	416 GW	5.1 %	3rd
Thermal	4398 GW	237 GW	5.4 %	--
Non-Fossil	3758 GW	179 GW	5.3%	4th
Generation	28,518 BU	1622 BU	5.7 %	3rd
Per capita Consumption	3600 U	1255 U	35% of Global Avg.	
Cost of Electricity (\$KWh)	\$ 0.165 ₹ 12.4	\$ 0.07 ₹ 5.5	Half of world average	

Fig 9: Installed Capacity (GW) 2024

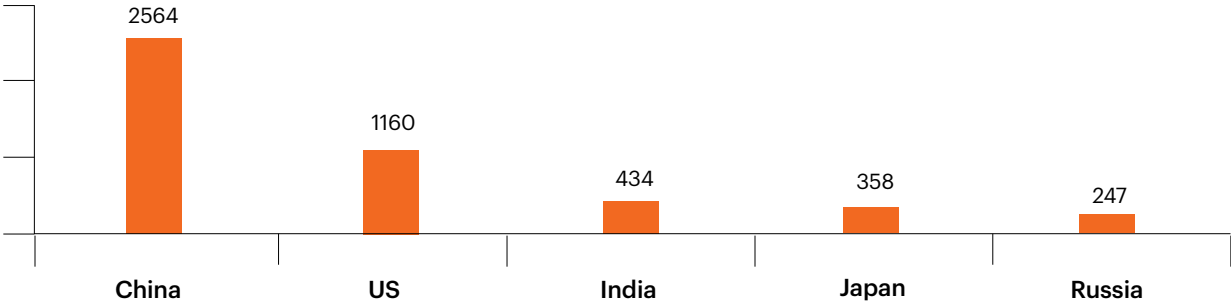
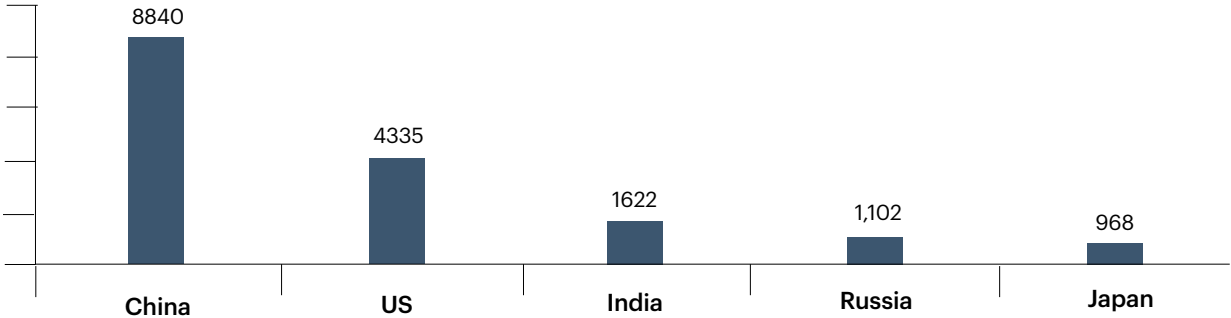


Fig 10: Electricity Generation (BUs) 2023



electrifying 18,374 un-electrified villages, strengthening the distribution network and ensuring electricity reaches every corner of rural India.

The government's efforts in promoting energy efficiency have also yielded remarkable results. Under the Unnat Jyoti by Affordable LEDs for All (UJALA) scheme, the procured price of LED bulbs decreased by almost 90% between 2014 and 2019, from Rs. 310 to Rs. 39.90. So far, over 36.86 crore LED bulbs have been distributed under this scheme. This initiative not only brought down electricity costs for households but also encouraged domestic manufacturing of LED bulbs, supporting the "Make in India" campaign. As a result, India has witnessed widespread adoption of energy-efficient lighting solutions, contributing to reduced energy consumption and a greener environment.

To enhance the efficiency of power distribution, the government has implemented initiatives like the Restructured Distribution Sector Scheme (RDSS). The RDSS has significantly reduced distribution losses of DISCOMs, from 21.5% in FY 2020-21 to 16.5% in FY 2021-22. These initiatives focus on reducing technical and commercial losses, improving metering and billing systems, and promoting energy efficiency.

India's power market

Prior to the Electricity Act 2003, the electricity

industry recognized generation, transmission, and supply as three principal activities, and the legal provisions were also woven around these concepts. With the enactment of the Electricity Act 2003, the transactions involving the purchase and sale of electricity have been recognized as a distinct, licensed activity. Recognition of trading as a separate activity is in sync with the overall framework of encouraging competition in all segments of the electricity industry. The Electricity Act 2003 laid down provisions for promoting competition in the Indian power market.

The introduction of non-discriminatory open access in the electricity sector provided further impetus for enhancing competition in the market. The responsibility of developing the market in electricity has been vested with the Regulatory Commissions. The open access regulations, inter-state trading regulations, power market regulations, etc., of the Central Commission have facilitated power trading in an organized manner.

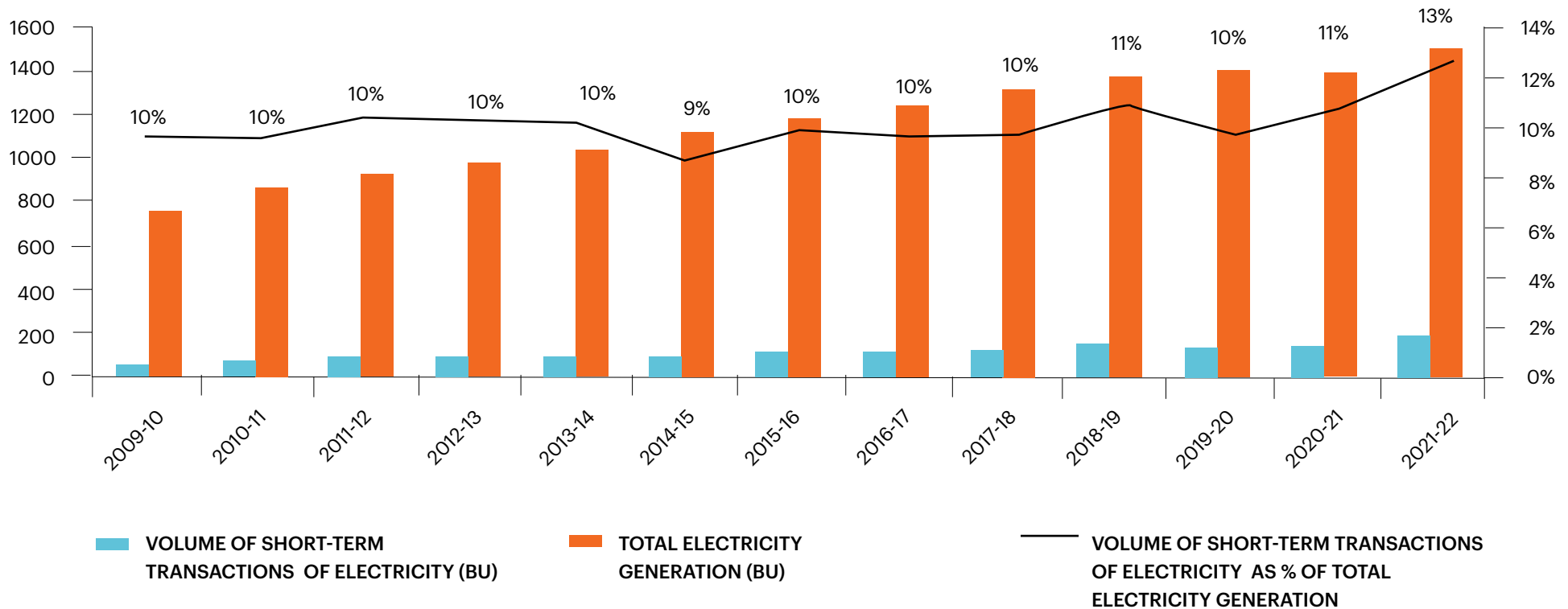
In exercise of the powers conferred under section 178 of the Electricity Act, 2003, the Commission had notified the CERC (Procedure, Terms and Conditions for grant of trading licence and other related matters) Regulations, 2009 in February 2009 and the CERC (Fixation of Trading Margin) Regulations, 2010 in January 2010. Over the past decade, the Indian power sector has undergone many developments,

including an increased volume of electricity traded on power exchanges, the Introduction of new types of energy procurement & sale contracts, cross-border trade of electricity, etc. Considering the developments, the Commission notified the CERC (Procedure, Terms and Conditions for grant of Trading Licence and other related matters) Regulations, 2020 in January 2020, repealing the earlier Regulations. The Regulations specify the terms and conditions for grant of trading licence and other related matters including but not limited to capital adequacy and liquidity requirements, obligations of the trading licensees, requirements for submission of Report on Short-term Power Market in India, 2022-23 information, penalties for contravention and non-compliance by the trading licensees and the trading margin that the trading licensees shall charge for various types of contracts.

To serve the growing volumes of electricity trade and increasing penetration of renewable energy in the grid, the Commission has also introduced new market segments on the Power Exchanges, namely the Real Time Market (RTM) and the Green Term Ahead Market (GTAM), in the year 2020-21.

RTM has commenced on the power exchanges from 1 June 2020 to enable better portfolio management by the utilities with efficient power procurement planning, scheduling, and imbalance handling. The market provides

Fig 11: Volume of Short-term Transactions of Electricity



buyers and sellers with an organized platform for trading electricity closer to real-time. Providing a new avenue for renewable energy generators to sell power and for obligated entities to fulfil their RPOs, the GTAM was introduced on the Power exchanges on 1 August 2020. It is a market-based mechanism

wherein RE surplus and RE deficit States can trade RE power and balance their RPO targets. This would incentivize RE resource-rich States to develop RE capacity beyond their obligation and help to develop of RE capacity in India. The contracts in GTAM are similar to contracts in TAM.

With a view to provide avenues to existing and prospective Renewable Energy generators for sale of RE through the Power Exchange and to provide more options to the Obligated Entities to fulfil their RPOs, the Commission granted approval for introduction of Green Day Ahead Contract (GDAC) in Day Ahead Market (DAM)

on the power exchanges in 2021-22.

In G-DAM, the contracts enable buyers and sellers to trade RE power on a day-ahead basis. The sellers are provided the option to transfer their uncleared bids to DAM with the flexibility to specify different prices for uncleared bids in G-DAM. These contracts were introduced on IEX from 27 October 2021 and on PXIL from 20 December 2021. The Commission also granted approval for the introduction of hydropower contracts in the Green Term Ahead Market on IEX on 24 February 2022. These contracts would Report on the Short-term Power Market in India, 2022-23, and provide an additional avenue for existing and prospective hydropower generators to sell power.

The obligated entities could procure hydropower through these contracts and thus meet their HPO requirements. These hydro GTAM contracts have been approved on similar lines to existing contracts under GTAM. In 2022-23, the Commission approved the introduction of longer duration contracts, which were earlier restricted up to 11 days, in the Term-Ahead Market and Green Term-Ahead Market. The introduction of these contracts was made possible because of the outcome of the Hon'ble Supreme Court of India's Order dated 6 October 2021, which favourably disposed of the jurisdictional matter between CERC and SEBI in terms of the agreement reached between the two that the CERC will regulate all the physical

Government policy initiatives	
Revamped Distribution Sector Scheme (RDSS)	RDSS has an outlay of ~ Rs. 3.04 lakh Cr. over 5 years i.e., FY 2021-22 to FY 2025-26 <ul style="list-style-type: none"> Reduction of AT&C losses to pan-India levels of 12-15% by FY 2024-25. Reduction of ACS-ARR gap to zero by FY 2024-25. Improvement in the quality, reliability, and affordability of power supply
National Smart Grid Mission (NSGM)	NSGM is designated to lead the assessments for Smart Distribution cities, under the guidance of Ministry of Power, with the technical assistance of USAID's South Asia Regional Energy Partnership (SAREP)
Unnat Jyoti by Affordable LEDs for ALL (UJALA)	<ul style="list-style-type: none"> On 5th January 2015 launched Unnat Jyoti by Affordable LED for All (UJALA) programme. Under UJALA scheme, LED bulbs, LED Tube lights and Energy efficient fans are being sold to the domestic consumers for replacement of conventional and inefficient variants. Over 36.86 crore LED bulbs, 72.18 lakh LED Tube lights and 23.59 lakh Energy efficient fans (including over 55,000 BLDC fans) have been distributed by EESL.
Street Lighting National Program (SLNP)	<ul style="list-style-type: none"> On 5th January 2015 launched Street Lighting National Programme (SLNP) to replace conventional streetlights with smart and energy efficient LED streetlights across India. EESL has installed over 1.30 crore LED Street Lights in ULBs and Gram Panchayats across India.
Subsidy Accounting and Framework for Financial Sustainability in Power Sector	Amendment in the Electricity Rules, 2005 notified on 26.07.2023, the Government has put in place additional measures to improve financial health of Discoms with streamlining the process of accounting, reporting, billing and payment of subsidy by States to the Distribution Companies.
Amendments in Electricity (Promoting Renewable Energy through Green Energy open Access) Rules, 2022	<ul style="list-style-type: none"> Green Open Access Rules, 2022 have been notified on 6th June 2022. The Rules reduces the Open Access limit from 1 MW to 100 kW, which pave the way for small consumers also to purchase RE and there is no limit for Captive Consumers.
Production Linked Incentives	Provide subsidies towards the creation of new manufacturing capacity of solar PV modules and modern batteries.
Carbon Market	Passed a law in 2022 that sets the stage for the creation of the Indian Carbon Market, a carbon credit trading scheme.

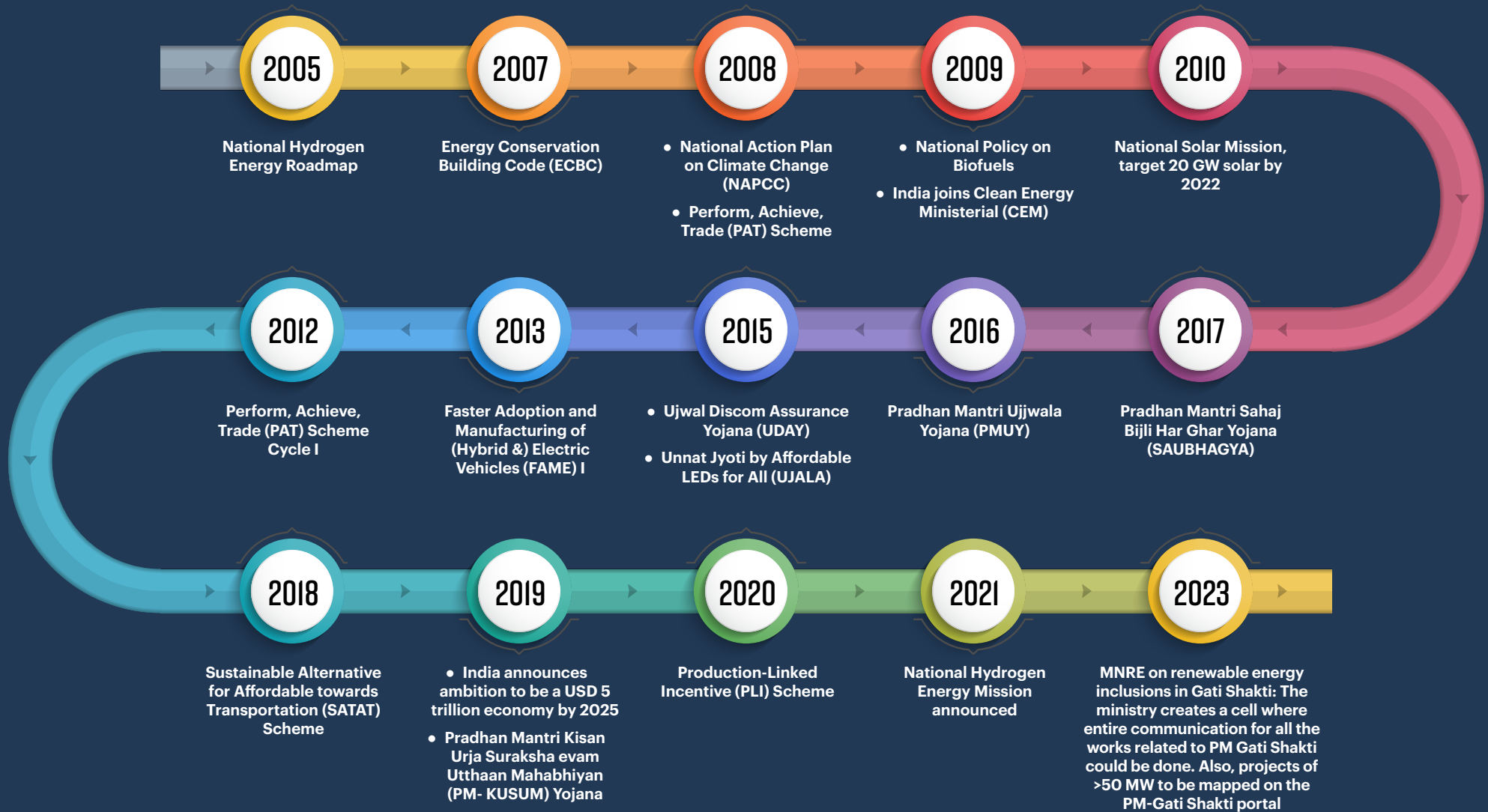
delivery contracts, whereas the SEBI will regulate the financial contracts. These contracts are allowed as non-transferable specific delivery-

based forward contracts (NTSD contracts) at power exchanges under both conventional and renewable energy segments.



India's policy initiatives towards sustainability and energy transition

INDIA'S JOURNEY IN ENERGY TRANSITION



Key Government schemes to accelerate energy transition

Electrification

Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

Electrifying all villages and hamlets

- The focus included electrifying 18,542 un-electrified villages, intensive electrification of electrified villages, and provision of free electricity connections to 4 million poor households by May 2018.

Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA)

Empowering rural and urban households through access to reliable and affordable electricity.

- India has achieved universal electricity access by connecting ~28 million households in 18 months under Saubhagya. This was the largest expansion of access anywhere in the world in such a time frame.
- 37 crore LED bulbs were distributed in the country under the Ujala scheme. As a result, about 48 BU of electricity have been saved. Our poor and middle-class are saving 20,000 crore rupees annually in electricity bills. Also, about 40 million tonnes of carbon emissions have been reduced annually. We also replaced the traditional street lights with

125 crore smart LED bulbs. Our local bodies, municipalities, municipal corporations, and panchayats saved 6,000 crore rupees annually in electricity bills by replacing street lights with LED bulbs. This has also saved electricity and about five million tonnes of carbon emissions have also been reduced.

National Smart Grid Mission (NSGM) and Smart Meter National Programme (SMNP)

Modernising India's power sector into a secure, adaptive, sustainable, and digitally enabled ecosystem

- Smart Meter National Programme aims to replace 25 crore conventional meters with smart meters in India.

National Solar Mission (NSM)

The 100 GW solar ambition at the heart of one of the world's largest renewable energy expansion programmes

- Major initiatives to promote the development and deployment of solar energy include the Solar Park Scheme to build solar parks and ultra-mega solar power projects with a target capacity of 40 GW by 2022; the Roof Top Solar (RTS) Programme to accelerate the deployment of rooftop systems; the

Production Linked Incentive (PLI) scheme to catalyse domestic manufacturing capacity for high efficiency solar cells and modules; 100 per cent Foreign Direct Investment through the automatic route; the Suryamitra (friend of the Sun) Skill Development Program to skill solar maintenance and service technicians; and the PM-KUSUM scheme to solarise agricultural pumps.

The Wind Energy Revolution

Leveraging India's wind energy sector to boost clean energy manufacturing and the rural economy.

- The Ministry has formulated a committee to finalize a roadmap for offshore wind development in the country, including upcoming offshore projects.

Hydro Power

Harnessing the power of water to integrate remote communities into the economic mainstream

- Overall, India aims to install 70 GW of hydropower generation capacity (large and small hydro) by 2030 to increase the share of clean power in the national electricity mix and to balance the rapidly growing grid

integration of renewable energy.

National Biofuels Policy and SATAT

Building value chains to reduce fuel imports, increase clean energy, manage waste, and create jobs

- This policy will also encourage the application of advance technologies for generation of biofuels. Feedstock Availability & its Development, Blending & Bio-refinery Programm, Ethanol Blended Petrol Programme, Second Generation (2G) Ethanol, Biodiesel Blending Programme, Other Biofuels (Drop-in-fuels, Bio-CNG, BioHydrogen, Bio-methanol, DME, etc. India has set a target of 20 per cent ethanol-blending with petrol by 2023-24.

National Hydrogen Energy Mission (NHEM)

Exploring the commercial viability of a versatile clean fuel

- Hon'ble Prime Minister launched the National Hydrogen Mission on India's 75th Independence Day (i.e. 15th August, 2021). The Mission aims to aid the government in meeting its climate targets and making India a green hydrogen hub. This will help in meeting the target of production of 5 million tonnes of Green hydrogen by 2030 and the related development of renewable energy capacity

Production-Linked Incentive (PLI) Scheme

Integrating India into the global clean energy value chains

- Government has enhanced the funding under

the production linked incentive (PLI) scheme for the domestic solar cells and module manufacturing to Rs 24,000 crore from the existing Rs 4,500 crore to make India an exporting nation. Government approved the Production Linked Incentive (PLI) Scheme 'National Programme on Advanced Chemistry Cell (ACC) Battery

- Storage' for achieving manufacturing capacity of Fifty (50) Giga Watt Hour (GWh) of ACC for enhancing India's Manufacturing Capabilities with a budgetary outlay of Rs. 18,100 crore.

Policy for utilization of biomass for power generation

- The policy specifies the mandate for biomass pellets from agro residue for blending in coal fired stations (5% -10% for different categories and over time.)

Energy Efficiency

Unnat Jyoti by Affordable LEDs for All (UJALA)

Bringing affordable, energy-efficient lighting and appliances to citizens

- Under UJALA scheme, LED bulbs, LED tube lights and energy-efficient fans are being provided to domestic consumers for replacement of conventional and inefficient variant.
- Till date, over 36.70 crore LED bulbs, 72.09 lakh LED Tube lights and 23.41 lakh Energy efficient fans distributed by EESL across India. This has resulted in estimated energy savings of 47.98 billion kWh per year with avoided

peak demand of 9,747 MW, GHG emission reduction of 39 million t CO₂ per year and estimated annual monetary savings of INR 19,156 crore in consumer electricity bills

Standards and labelling

Transforming markets towards energy efficient products

- Starting with 10 appliances/ equipment in 2009, the programme now encompasses 28 appliances and equipments. Over 15,000 models have been awarded comparative 'Star labels' under the programme. Under UJALA, nearly 367 million LED bulbs and 7.2 million LED tube-lights have also been distributed.

Clean Cooking

Pradhan Mantri Ujjwala Yojana (PMUY)

Delivering LPG to households for Swacch Indhan, Behtar Jeevan – Clean Fuel, Better Life

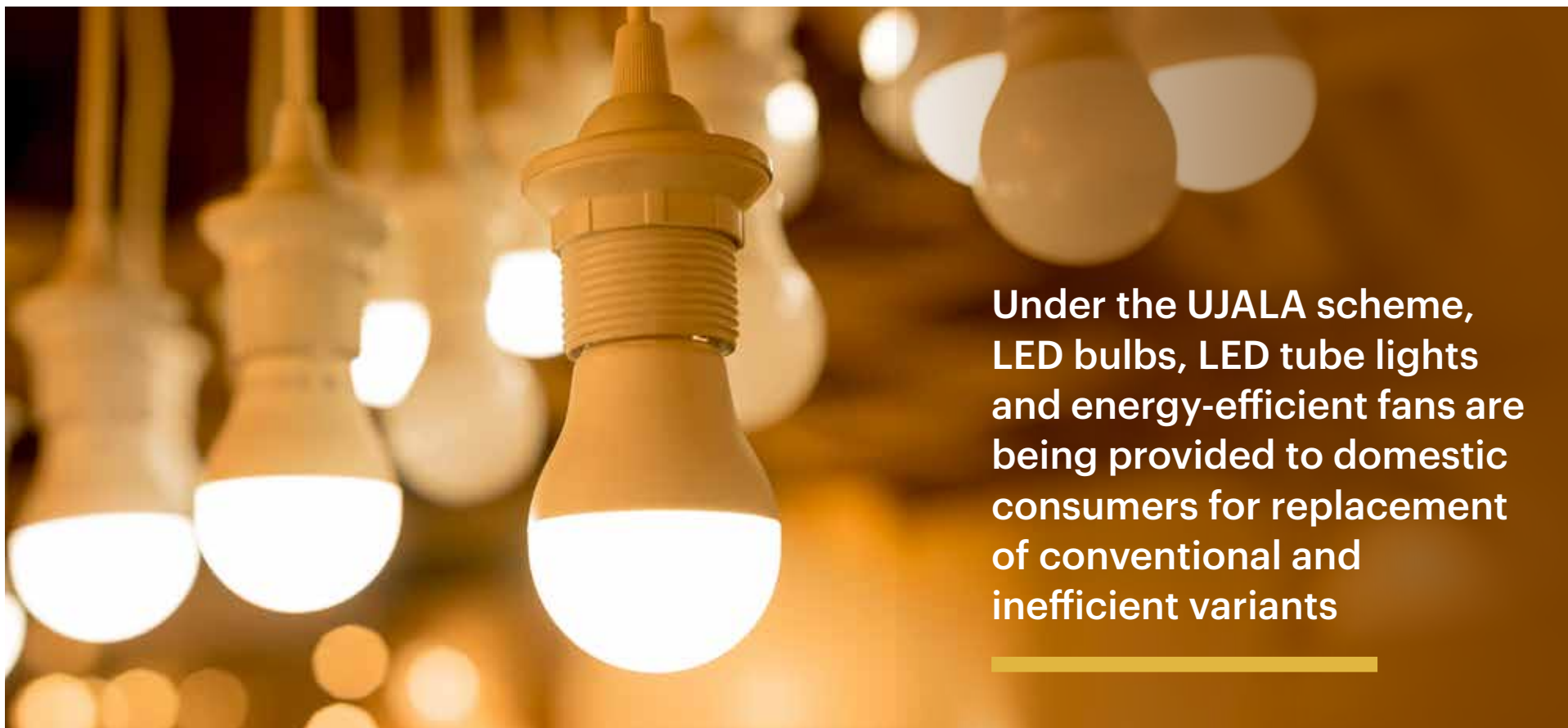
- The initial target under the scheme to release 8 Crore LPG Connections to the deprived households by March 2020 has been achieved. Under the Union Budget for FY 21-22, provision for release of additional 1 Crore LPG connections under the PMUY scheme has been made.

Sustainable Agriculture

Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan Yojana (PM-KUSUM)

Solarising irrigation, preserving groundwater, and enhancing farmer incomes

PM-KUSUM is aimed at ensuring energy security



Under the UJALA scheme, LED bulbs, LED tube lights and energy-efficient fans are being provided to domestic consumers for replacement of conventional and inefficient variants

for farmers in India, along with honouring India's commitment to increase the share of installed capacity of electric power from non-fossil-fuel sources to 40% by 2030 as part of Intended Nationally Determined Contributions (NDCs). The PM KUSUM Scheme was launched in 2019 with 3 components

- Setting up of 10,000 MW of Decentralized Grid Connected Renewable Energy Power Plants on barren land

- Installation of 17.50 Lakh stand-alone solar agriculture pumps
- Solarisation of 10 Lakh Grid Connected Agriculture Pumps

Distribution Sector Reforms

Revamped Distribution Sector Scheme (RDSS)

The Government of India has approved the Revamped Distribution Sector Scheme (RDSS) to help DISCOMs improve their operational

efficiencies and financial sustainability by providing result-linked financial assistance to DISCOMs to strengthen supply infrastructure based on meeting pre-qualifying criteria and achieving basic minimum benchmarks. The scheme has an outlay of Rs 3,03,758 Crore over 5 years i.e. FY 2021-22 to FY 2025-26. The outlay includes an estimated Government Budgetary Support (GBS) of Rs 97,631 Crore. The scheme aims to meet the objectives





**The Faster Adoption and
Manufacturing of Electric
Vehicles in India Phase II
(FAME India II) Scheme
was launched with an
outlay of Rs 10,000 crore
to incentivize demand for
electric vehicles**

- Reduction of AT&C losses to pan-India levels of 12-15% by 2024-25.
- Reduction of ACS-ARR gap to zero by 2024-25.
- Improvement in the quality, reliability and affordability of power supply to consumers through a financially sustainable and operationally efficient distribution sector.

Sustainable Transport

Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME)

Driving India's vision for reliable, affordable, and efficient electric mobility

- The Faster Adoption and Manufacturing of Electric Vehicles in India Phase II (FAME India II) Scheme has been launched with an outlay of Rs 10,000 crore to incentivize demand for Electric Vehicles (EVs) by providing upfront subsidies and creating EV charging infrastructure

Indian Railways: Going Green

Fuelled by environmental conservation, racing towards net zero carbon emissions by 2030

- Indian Railways is on a mission to become the world's first 'Net-Zero Railway' by 2030, with 100 per cent electrification powered by clean energy and 100 per cent of its buildings and stations illuminated by LED lighting.

Sustainable Aviation

Integrating cleaner fuels, energy efficiency and ecosystem preservation with aircraft and



airport operations

- The Airports Authority of India (AAI) is optimising routes through technical interventions and Performance-based Navigation (PBN). Also, with the Indian Air Force, AAI is improving airspace utilisation through the Flexible Use of Airspace (FUA).
- The AAI aims to reduce direct GHG emissions by 75 per cent by 2030 over the base year (2015) benchmark value through a 5 per cent per passenger per year reduction.

Climate Smart Cities:

Smart City Mission (SCM)

Developing sustainable and resilient urban habitats via 'smart solutions'

- In June 2015, the Government launched the pathbreaking Smart Cities Mission to promote cities offering core infrastructure, a clean and sustainable environment, and a decent quality of life to their citizens through 'smart solutions.' One hundred cities were selected through a two-stage competition.
- The Union Government allocated INR 48,000 crore (USD 6.6 billion) over five years, averaging INR 100 crore (USD 13.7 million) per city per year. An equal amount was to be provided by the state or Urban Local Body, with the rest to be raised through Public Private Partnerships (PPPs) and other novel funding mechanisms within the aggregate mission size of INR 205,000 crore (USD 28 billion)

The Green Buildings Market

Constructing resource efficient, sustainable and resilient buildings

- The Bureau of Energy Efficiency (BEE) introduced the Energy Conservation Building Code (ECBC) in 2007 and updated it in 2017 with enhanced performance standards. Eighteen states and Union Territories have made the ECBC mandatory
- The BEE has targeted a 50 per cent reduction in energy consumption by 2030 via the ECBC for commercial buildings in states

Cooling Action

India Cooling Action Plan (ICAP)

Incentivizing the air conditioner industry to

build a sustainable cooling value chain

- In March 2019, India became one of the first countries to launch a comprehensive cooling action plan—the India Cooling Action Plan (ICAP)—to address sustainable cooling requirements in residential and commercial buildings, cold chains, refrigeration, transport, and industry.
- The Kigali Amendment to the Montreal Protocol was enacted in 2019 to reduce hydrofluorocarbons (HFCs) by 80 – 85 per cent globally by 2045. India falls in Group 2, comprising countries with developing economies. These nations will start phasing down HFCs by 2032 and reduce their consumption to 15 per cent of 2024 – 2026 (baseline) levels by 2047.

Energy Storage

Comprehensive Policy framework to promote energy storage in power sector

- The formulation of Comprehensive Policy framework to promote energy storage in power sector is in process.

Skilling

Skill Council for Green Jobs (SCGJ)

Building a skilled and specialized workforce to deliver India's sustainable development goals

- 99,000 Candidates trained by the Skill Council on Green Jobs in solar and other renewable energy domains
- 88% of trainees of the Suryamitra Skill

Development Program reported enhanced employability and better job opportunities post-training

- 1.3 million Direct Full-Time Equivalent (FTE) jobs to be created through India's renewable targets

Global Initiatives

International Solar Alliance (ISA)

Harnessing the power of the sun for sustainable human development

- The International Solar Alliance (ISA), a global treaty-based, multilateral organisation, is a crucial advocate and change agent for solar power. It was launched on 30 November 2015 by the Hon'ble Prime Minister of India and the then-President of France, François Hollande, on the sidelines of the UNFCCC Conference of Parties (COP) 21 in Paris.
- The Paris Declaration defines the ISA as an alliance dedicated to the promotion of solar energy among its member countries. It is headquartered in Gurugram in Haryana, India.
- The ISA's major objectives include facilitating the deployment of 1,000 GW of solar capacity and mobilising USD 1 trillion investment in the solar energy sector by 2030.

Clean Energy Ministerial (CEM)

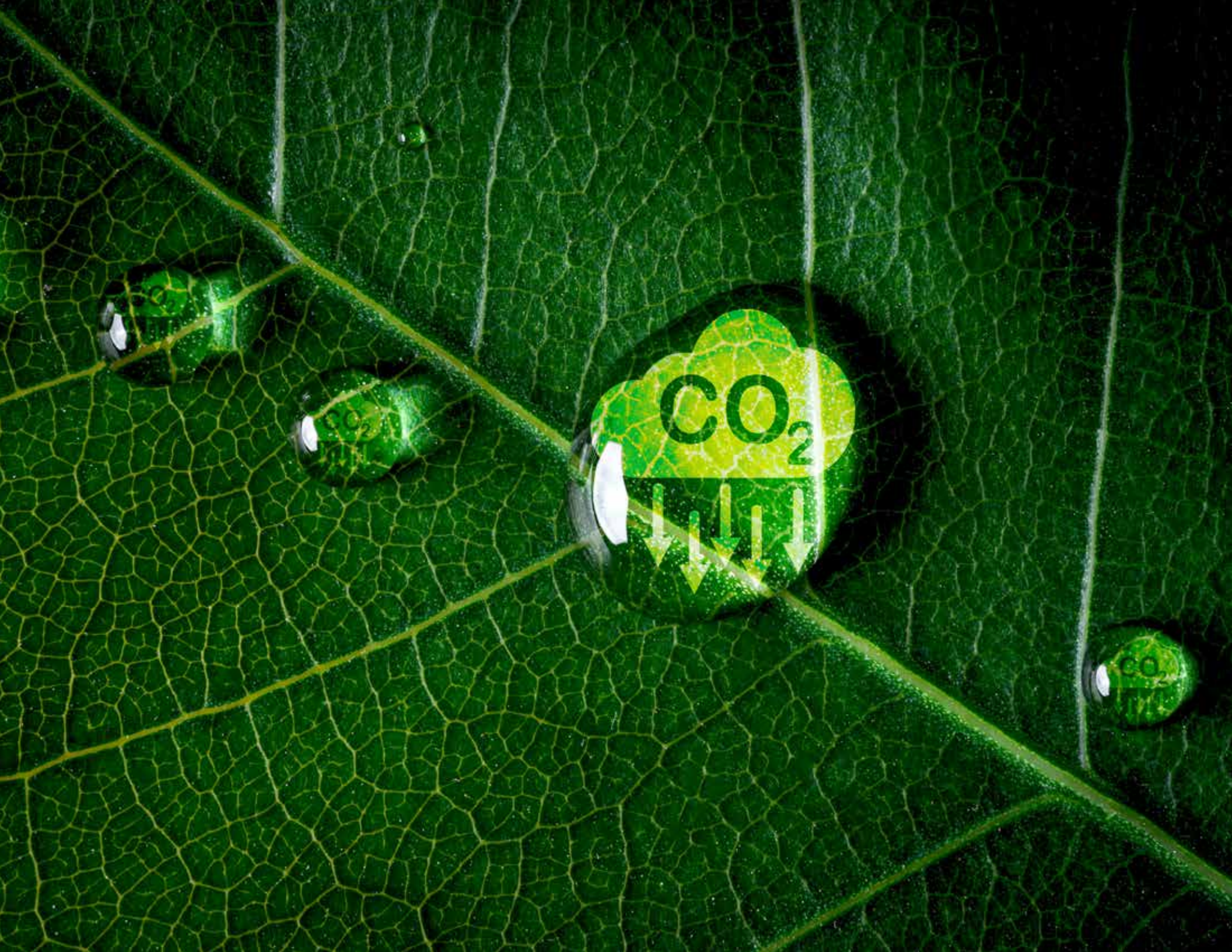
Fostering international cooperation for a technology-driven transition to a global clean energy economy

- The Clean Energy Ministerial (CEM) is a high-level global forum meant to promote policies and programmes that advance clean energy technology, share lessons learned and best practices, and encourage the transition to a global clean energy economy.
- India has been a founding member of the CEM since 2009. India hosted the 4th edition of the ministerial meeting in New Delhi and is also scheduled to host the 14th meeting (CEM14) in 2023.

Mission Innovation (MI)

Investing in innovation in breakthrough clean energy technologies to deliver impact at scale

- Mission Innovation (MI) was launched in November 2015 at the UNFCCC Conference of Parties (COP) 21 in Paris by India, France, and the United States as an action-oriented global forum of 22 countries and the European Commission.
- As a founding member of MI, India is actively engaged in eight Innovation Challenges (IC), and has co-led three ICs: Smart Grid, Off-Grid Access to Electricity, and Sustainable Biofuels. India leads the MI CleanTech Exchange, a network of incubators set up to promote the start-up ecosystem, and co-leads two Collaborate initiatives: Innovation for International Sustainable Aviation Fuel and the Innovation Community on Affordable Heating and Cooling of Buildings.



Climate change initiatives and the way forward

India's Intended Nationally Determined Contribution

During the 26th session of the Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC) in November 2021, India expressed its commitment to intensify climate action. India presented five crucial elements, termed as “Panchamrit,” as part of its climate strategy. The update to India's Nationally Determined Contributions (NDC) at COP26 signifies an enhancement of climate targets and a significant step toward achieving India's long-term objective of reaching net-zero emissions by 2070.

According to the revised NDC:

- India is dedicated to reducing the Emissions Intensity of its Gross Domestic Product (GDP) by 45 percent by 2030, compared to the 2005 level.
- The country aims to achieve approximately 50 percent of cumulative electric power installed capacity from non-fossil fuel-based energy sources by 2030.

A key aspect of the updated NDC is the promotion of a sustainable lifestyle rooted in traditions and values of conservation and moderation. This is encapsulated in the mass movement for ‘LIFE’ – ‘Lifestyle for Environment,’ identified as a crucial element in the fight against climate change. The updated NDC also outlines the overarching framework for India's transition to

cleaner energy for the period between 2021 and 2030.

National Action Plan on Climate Change (NAPCC)

India has been leading the way in taking proactive measures and embracing shared responsibilities for the well-being of both humanity and the planet. India is committed to the pursuit of low-carbon development strategies and is actively implementing them in line with its national circumstances. The nation actively seeks opportunities to transition towards low-carbon development pathways while prioritizing essential aspects such as household energy access, energy security, and the overall development of various economic sectors. On the home front,

the National Action Plan on Climate Change (NAPCC) was introduced in 2008, offering the nation a roadmap to confront climate change challenges and bolster its environmental sustainability. This strategic initiative outlines a comprehensive approach to adapt to climate change, emphasizing the need for ecological resilience and sustainable practices.

The initiation of the National Action Plan on Climate Change (NAPCC) exemplifies India's acknowledgment of potential co-benefits between climate action and development goals.

The National Action Plan on Climate Change (NAPCC) was introduced by the Government of India on 30 June 2008. This plan delineates eight National Missions dedicated to addressing

National Mission for Enhanced Energy Efficiency	Promote the market for energy efficiency through fostering innovative policies and market instruments
National Mission on Sustainable Habitat	Ensure that cities are made sustainable through improvements in energy efficiency in buildings, management of solid waste and shifting to modes of public transportation
National Water Mission	Conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management
National Mission for Sustaining the Himalayan Ecosystem	Addressing issues regarding Himalayan glaciers and their hydrological importance; protection and conservation of biodiversity; protection and conservation of wildlife; traditional knowledge societies and their livelihood; and planning for sustaining the Himalayan Ecosystem
National Mission for Green India	Protecting, restoring, and enhancing India's (diminishing) forest cover and responding to the issue of climate change through a combination of adaptation and mitigation activities
National Mission for Sustainable Agriculture	Promoting sustainable agriculture through adaptation measures which focus on ten key areas which are essential to Indian agriculture
National Mission on Strategic Knowledge for Climate Change	Build a dynamic and vibrant knowledge system that informs and supports national policy and action for responding effectively to climate change challenges, while not compromising on the nation's growth goals

climate change. These missions are:

Principles of NAPCC

- Safeguarding the well-being of the underprivileged through an all-encompassing and enduring development approach attuned to climate change.
- Accomplishing national growth and poverty alleviation goals while upholding ecological sustainability.
- Implementing efficient and economical strategies for managing demand on the consumption side.
- Widespread and swift adoption of fitting technologies for both adaptation to and mitigation of climate change.
- Introducing novel market, regulatory, and voluntary mechanisms to promote sustainable development.
- Ensuring effective implementation through distinctive connections with civil society, local government units (LGUs), and public-private partnerships.

State Action Plan on Climate Change (SAPCC)

In 2009, the Indian government instructed state governments to formulate their own policies, plans, and actions for climate change mitigation and adaptation. These initiatives were expected to align with both state priorities and the goals outlined in the National Action Plan on Climate Change (NAPCC). Before implementing activities

outlined in these plans, states are required to obtain prior approval from the Ministry of Environment, Forest and Climate Change (MoEFCC). The objective is to create institutional capacities and implement sectoral activities to address Climate change. Plans include current and future State of climate change scenarios and likely impact of climate change. Plans are focussed on adaptation in sectors such as water, agriculture, tourism, forestry, transport, habitat, energy, etc, with mitigation as co-benefit. As of October 2014, 30 states, including Union Territories, have completed their draft plans. The State Action Plan on Climate Change (SAPCC) is the most significant policy exemplifying India's decentralized approach to climate change mitigation.

International Commitments and Agreements

International Solar Alliance

The International Solar Alliance serves as a collaborative platform for sun-rich nations situated wholly or partially between the Tropics of Cancer and Capricorn, with the shared goal of significantly increasing the utilization of solar energy. The initiative was jointly launched by India and France during the CoP21 Climate Conference in Paris in December 2015. An interim secretariat for the International Solar Alliance (ISA) in Gurgaon was initiated through the laying of its foundation stone, marking a collaborative effort between India and France in the preceding year.

The Indian government has committed to providing both land and financial support amounting to \$30 million to establish a secretariat for the Alliance. This support is pledged for a duration of five years, demonstrating a sustained commitment to the objectives of the International Solar Alliance.

Objectives

- Encourage the adoption of solar technologies and investments in the solar sector to uplift income levels for impoverished communities and contribute to global environmental well-being.
- Create projects and programs aimed at promoting the use of solar applications.
- Innovate financial mechanisms to minimize the cost of capital associated with solar initiatives.
- Currently, 121 countries have become signatories to the agreement.
- Establish a shared knowledge e-Portal to foster information exchange.
- Facilitate capacity building initiatives to encourage the adoption and integration of solar technologies, as well as research and development activities, among member countries.

Advantages for India

Proactive Leadership on Climate Change

- ISA launch demonstrates India's proactive and forward-looking approach to climate change.

- Signals a commitment to transitioning to a less carbon-intensive growth trajectory.

Voice of Authority in Clean Energy

- Establishes India as a prominent voice in the developing world regarding clean energy.
- Positions India as a leader in advocating for renewable energy solutions.

Achieving Solar Energy Targets

- Facilitates progress towards India's ambitious goal of generating 175 GW of solar energy by 2022.

Cost Reduction in Solar Technology

- Expected to contribute to a decrease in the price of solar technology.
- Accelerates overall development in the country by making solar solutions more accessible.

Foreign Policy Tool

- Signals the intent to use ISA as a foreign policy tool.
- Aims to solidify India's leadership position among developing countries, countering challenges from nations like China in past decades.

The Hon'ble Prime Minister of India took the lead in establishing both Mission Innovation (MI) and the International Solar Alliance during the COP21 in 2015, a significant contribution that earned him the esteemed 'Champions of Earth Award 2018' from

the United Nations. Mission Innovation (MI) stands as a collaborative effort involving 23 countries and the European Commission, acting on behalf of the European Union. Its primary objective is to expedite the global shift towards clean energy, aligning with the goals of the Paris Agreement and the pathways leading to net-zero emissions. India proudly holds the position of a founding member within the Mission Innovation initiative.

G20 New Delhi summit, 2023

Strategic Diplomacy by the Hon'ble Prime Minister of India

- The Hon'ble Prime Minister views the G20 Summit as a diplomatic milestone for India.
- G20 Presidency seen as a platform to amplify Global South's concerns.
- Significant for the Hon'ble Prime Minister's personal political standing ahead of general elections next year.

Leaders' Declaration on Ukraine

- India, leveraging its economic significance, secured unanimous support for a Leaders' Declaration on the Ukraine conflict without specifying any aggressor.
- The Hon'ble PM advocated for global institution reform, including the UN Security Council, aligning with changing world dynamics.

Historic G20 New Delhi Declaration

- All 83 paragraphs unanimously approved, achieving 100 percent consensus.
- No footnotes or Chair's Summary, marking a

historic moment.

Finance Track Agreements

- Multiple agreements embedded in the declaration related to the Finance Track.
- Emphasis on strengthening multilateral development banks, regulating cryptocurrencies, and deploying digital public infrastructure for financial inclusion.
- Concrete strategy outlined by Finance Minister.

Climate Change Commitments

- Urgency stressed to mobilize significant funds for developing countries to achieve net-zero emissions.
- Commitment to triple global renewable energy capacity and peak emissions before 2025.
- No consensus on the phase-out of fossil fuels, casting a shadow over upcoming climate discussions.

African Union Full Membership

- African Union granted full membership, expanding representation beyond South Africa.
- India seeks support from Africa for its aspirations, including a permanent seat on the UN Security Council.
- Invited Nigeria, Egypt, and Mauritius as 'Guest Countries.'

Global Leadership Participation

- Diverse global leaders attended, including



German Chancellor, French President, British Prime Minister, Turkish President, Canadian Prime Minister, Italian Prime Minister, South Korean President, and Brazilian President.

- Absence of Chinese President Xi Jinping and Russian President Vladimir Putin; China represented by Premier Li Qiang, and Russia by Foreign Minister Sergey Lavrov.

India – Middle East – Europe Economic Corridor (IMEC)

- MoU signed among India, U.S., Saudi Arabia, EU, UAE, France, Germany, and Italy for IMEC.
- Aims to establish a transportation network promoting economic development between Asia, Arabian Gulf, and Europe.
- Positioned as an alternative to China's Belt and Road Initiative (BRI).

Climate Action and Global Initiatives

- No consensus on fossil fuel phase-out, but commitment to tripling renewable energy capacity.
- Launch of the Global Biofuel Alliance (GBA) to promote sustainable biofuels.
- Emphasis on sustainable finance, addressing plastic pollution, preserving the ocean-based economy, and pursuing Sustainable Development Goals (SDGs).

These outcomes underscore India's diplomatic success, strategic positioning on global issues, and initiatives for economic integration, climate action, and sustainable development on the international stage.

The Hon'ble Prime Minister of India's UNFCCC Speech

- The Hon'ble Prime Minister of India conveyed India's stance at the UNFCCC meet.
- Emphasized the importance of protecting rights and ensuring equal participation for global well-being.

Emission Targets Achieved

- India achieved its emission intensity-related target 11 years ago.
- On track to fulfil its Nationally Determined Contribution (NDC) under the Paris Pact.

Renewable Energy Commitments

- The Hon'ble Prime Minister of India reaffirmed India's commitment to renewable energy.

Coal's Role in Economy

- Foreign Secretary Vinay Mohan Kwatra asserted the essential role of coal in India's energy mix.
- Emphasized that coal will remain a crucial part of the country's economy.

Development Priorities Over Climate Pressure

- India signals that it won't compromise its development priorities under climate pressure.
- Affirms it won't raise climate ambitions at the expense of development.
- Contentious Issue of Coal Elimination:
 - The use of coal is expected to be a contentious issue at the Dubai COP.

- Two years ago, at Glasgow, India, China, and others influenced the COP26 declaration to "phase down" coal instead of "phase out."

Renewable Energy Growth in India

- The share of renewables in India's energy mix has been increasing for at least five years.
- Coal Dominance in Energy Needs
- Coal provides over 70% of India's energy needs.
- Despite growth in renewables, coal remains a major contributor to the energy mix.

Challenges in Transition

- India faces challenges in transitioning from coal due to its significant role in the economy.
- Unlike some Western countries, alternatives like natural gas are not readily available.

Nuanced Approach to Fossil Fuels

- India advocates a nuanced approach to phasing out all fossil fuels, not just coal.
- Stresses the need for considering the country's unique energy landscape and development priorities.

Other International Climate Initiatives by India

1. Coalition for Disaster Resilient Infrastructure
2. Leadit – Leadership Group for Industry Transition
3. One Sun, One World, One Grid
4. IRIS- Infrastructure for Resilient Island States
5. Global Biofuel Alliance

India and Triangular Cooperation for Climate Change

India has collaborated with various nations like Switzerland, Norway, and Canada on specific triangular projects. Over time, India has entered more extended formalized triangular arrangements, often emphasizing climate and energy, with donor countries and multilateral organizations.

Government campaigns promoting awareness in India on climate change

Several government campaigns in India aimed at promoting awareness on climate change have been initiated.

Mission LiFE

During the 2021 UN Climate Change Conference (UNFCCC COP26), the Hon'ble Prime Minister of India introduced Mission LiFE, aiming to prioritize individual behaviours in the global climate action discourse.

Core objectives of LiFE

- Replace the current 'use-and-dispose' economic model characterized by thoughtless and harmful consumption.
- Establish a circular economy based on intentional and considerate utilization.

The Mission helps to:

- Encourage individuals to incorporate simple

Partner	Partnership	Projects carried out	Status
US	Triangular Development Partnership (TriDeP)	Climate-smart agriculture, disaster risk management, renewable energy, and grid integration in Africa and Asia	The first amendment was signed in 2014; the second amendment was signed in 2021 and extended up to 2026
UK	Statement of intent on partnership for cooperation in third countries	Clean energy and modern energy access in Africa	Signed in 2015, Valid up to 2020; subsumed under India-UK Global Innovation Partnership 2022-2036
Japan	Asia-Africa Growth Corridor (AAGC)	None so far	Initiated in 2010; AAGC declared in 2016
Germany	Joint declaration of intent on partnership for triangular cooperation	None so far	Signed in 2022; Valid up to 2025
France	Indo-Pacific Triangular Cooperation Fund	None so far	Announced in 2023
UN	India-UN Development Partnership Fund	Renewable energy and agriculture	Established in 2017

The table provides details on some pivotal long-term agreements announced and the resulting climate and energy projects. Nevertheless, the outcomes of these partnerships have been uneven in their success.

actions into daily routines.

- Aim for global adoption of these actions to address climate change significantly.

LiFE intends to harness the influence of social networks to shape societal norms related to climate consciousness. The mission envisions establishing a worldwide community of individuals, referred to as 'Pro-Planet People' (P3), who share a commitment to embracing and advocating for eco-friendly lifestyles. Through

the P3 community, LiFE aims to cultivate an environment that sustains and promotes environmentally conscious behaviours, fostering a self-sustaining

Approach of LiFE Campaign

Focus on Individual Behaviours

Transform life into a mass movement (Jan Andolan) by directing attention toward the behaviours and attitudes of individuals and communities.

Co-create Globally

Collaborate on a global scale by sourcing practical and scalable ideas from the world's leading minds through top universities, think tanks, and international organizations.

Leverage Local Cultures

Utilize climate-friendly social norms, beliefs, and daily household practices from diverse cultures worldwide to steer and enhance the campaign.

FAME India Scheme (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles)

FAME, or Faster Adoption and Manufacturing of Hybrid & Electric Vehicles, is a subsidy scheme initiated by the Government of India on April 1, 2019. Initially planned for a three-year duration, it was later extended for an additional two years, concluding on March 31, 2024.

The FAME Scheme Phase II has a total outlay of Rs 10,000 crore, aimed at providing incentives to buyers, including end users and consumers of electric vehicles. These incentives are designed to facilitate broader adoption by reducing the purchase price of electric vehicles.

The scheme exclusively focuses on public and commercial transport, covering electric three-wheelers (e-3W), electric four-wheelers (e-4W), and electric buses.

While the incentive benefits are extended to privately owned registered electric two-

wheelers (e-2W), the primary goal is to encourage the adoption of electric vehicles in the specified segments.

Climate Change Mitigation Actions and Programmes

Energy Efficiency

1. Pradhan Mantri Ujjwala Yojana
2. Perform, Achieve and Trade
3. Unnat Jyoti by Affordable LEDs for All
4. Street Lighting National Programme

Transportation

1. Green Highways Policy
2. The Faster Adoption and Manufacturing of Electric Vehicles (FAME)
3. Ethanol Blended Petrol Programme
4. Sustainable Alternative Towards Affordable Transportation (SATAT)
5. Use of Hydrogen as a fuel

Forests and Ecosystems

1. Green India Mission
2. Nagar Van Yojana
3. MISHTI
4. Amrit Dharohar

Agriculture

1. National Innovations in Climate Resilient Agriculture (NICRA)
2. Pradhan Mantri Fasal Bima Yojana

Livelihoods

1. National Rural Livelihood Mission
2. Mahatma Gandhi National Rural Employment

Guarantee Act (MGNREGA)

Coasts and Fisheries

1. Pradhan Mantri Matsya Sampada Yojana
2. National Coastal Mission

Habitats & Disaster Management

1. National Disaster Management Policy 2009 & DM Act 2005 & NDMP-2019
2. National Mission for Sustaining the Himalayan Ecosystem (NMSHE)

Climate Finance and Investments

India's ambitious sustainability goals require substantial climate finance by 2050, with an estimated US\$10.1 trillion needed to achieve net-zero by 2070. Recognizing that public investment alone is insufficient, the urgency of scaling climate solutions in India necessitates financing that attracts private sector investment.

Climate finance must increase by 590 percent by 2030 to meet international climate objectives. Blended finance instruments, such as concessional loans, guarantees, subordinated debt, and performance-based incentives, coupled with advisory and technical assistance, can de-risk projects that the private sector might otherwise consider too risky.

Green Climate Fund (GCF)

The Green Climate Fund (GCF) operates as a key entity under the financial mechanism of





the United Nations Framework Convention on Climate Change (UNFCCC). The decision to establish the GCF was made during COP 16 in Cancun in December 2010, and it became operational during COP 17 in Durban in 2011.

Aim

- To facilitate a shift towards low-emission and

climate-resilient development pathways.

Provides support to developing countries for:

- Mitigating or reducing greenhouse gas emissions.
- Adapting to the impacts of climate change.
- Specific focus on the needs of countries most vulnerable to these effects.

The financial assistance from the GCF is expected to cover the full and incremental costs of activities related to adaptation, mitigation (including REDD-plus), technology development and transfer (including carbon capture and storage), capacity-building, and the preparation of national reports by developing countries.

The National Bank for Agriculture and Rural Development (NABARD) achieved accreditation as a Direct Access Entity (DAE) to the GCF during 2015. NABARD is currently in the process of engaging with the GCF for the signing of an Amended and Restated Accreditation Master Agreement (A&R AMA). Upon signing the A&R AMA, NABARD will be eligible to submit proposals for large-sized projects (exceeding USD 250 million) under the Standard Proposal Approval Process (PAP) and access various other funding windows, including the Simplified Approval Process (SAP), Private Sector Facility (PSF), REDD+, among others.

Projects sanctioned under GCF

1. Ground water recharge and Solar Micro Irrigation to ensure food security and enhance resilience in vulnerable tribal areas of Odisha (34.357 million USD)
2. Line of Credit for Solar rooftop segment for Commercial, Industrial and Residential Housing sectors- Pan India (100.00 million USD)

Other Dedicated Domestic Finance

- National Adaptation Fund for Climate Change (NAFCC)

- Climate Change Action Programme (CCAP)
- National Clean Energy Fund (NCEF)

The way forward

1. Diversification towards Renewable Energy:

Continued emphasis on expanding renewable energy capacity, particularly solar and wind power, to diversify the energy mix and reduce dependence on fossil fuels. This involves scaling up investments in renewable energy infrastructure, promoting research and development in clean energy technologies, and enhancing grid integration capabilities.

2. Energy Efficiency and Demand-Side Management:

Implementing comprehensive energy efficiency measures and demand-side management initiatives to optimize energy consumption across sectors. This includes promoting energy-efficient practices, deploying smart grid technologies, and incentivizing energy conservation through policies and regulations.

3. Strengthening Energy Infrastructure:

Investing in the development and modernization of energy infrastructure, including power generation, transmission, and distribution

networks, to enhance reliability, resilience, and efficiency. This involves upgrading aging infrastructure, expanding transmission capacity, and integrating decentralized energy resources.

4. Promoting Sustainable Mobility:

Encouraging the adoption of electric vehicles (EVs) and alternative fuels to reduce emissions from the transportation sector. This includes incentivizing EV adoption through subsidies, charging infrastructure deployment, and promoting public transportation and non-motorized modes of transport.

5. Policy and Regulatory Reforms:

Implementing supportive policies and regulatory frameworks to facilitate private sector participation, foster investment, and ensure market competitiveness. This involves streamlining approval processes, enhancing transparency, and providing clarity on long-term policy objectives to attract domestic and foreign investments in the energy sector.

6. Climate Change Mitigation:

Integrating climate change mitigation and adaptation strategies into energy planning and policymaking to align with international commitments and address environmental challenges. This includes setting ambitious emission reduction targets, promoting

carbon pricing mechanisms, and implementing climate-resilient infrastructure projects.

7. Energy Access and Inclusion:

Ensuring universal access to affordable, reliable, and modern energy services, particularly in rural and underserved areas, to support socio-economic development and poverty alleviation. This involves deploying decentralized energy solutions, promoting off-grid and mini-grid electrification, and empowering communities through energy access programs.

8. Collaboration and Partnerships:

Fostering collaboration and partnerships among stakeholders, including government agencies, industry players, academia, and civil society, to drive innovation, knowledge sharing, and capacity building in the energy sector. This involves engaging in international cooperation initiatives and leveraging global best practices to address common challenges and seize emerging opportunities.

Powering progress: Profiles and achievements of India's energy companies

REC: Energizing India's growth story

REC Limited has played a pivotal role in shaping India's power sector landscape. Established in 1969 with a focus on electrifying rural India, REC has evolved into a leading NBFC to finance the entire power sector value chain, including generation, transmission, distribution, and renewable energy segments. As India's power sector is standing at the threshold of a significant transition committed to increase the green energy contribution and achieve the ambitious target of net zero emissions by 2070, REC is a key player in this journey.

Illuminating India: REC's primary mission since its inception has been to bridge the gap and electrify whole India. Through financial assistance for power projects in underserved areas, REC has significantly contributed to India's electrification drive. Our financing has helped build transmission and distribution lines, substations, and renewable energy projects, bringing light to millions of homes across the country. Every fourth bulb illuminated in the country is financed by REC. In last 10 years, REC has disbursed USD 87.8 billion (INR 7.32 lac crore) to the power & infra sectors.

Financing Power Growth: REC has emerged as a critical financial institution for the entire power sector. We provide loans for various power projects, including generation (thermal, hydro, renewable), transmission, and distribution including backward and forward linkages in Coal Blocks, Pollution Control measures to improve emission efficiency like FGD installation, Super Critical Thermal Plants etc. The loan book of REC has maintained its growth trajectory and increased to USD 59.64 billion (₹ 4.97 lakh crore) as on 31st December 2023 against 49.3 billion USD (Rs 4.11

lakh Cr) as on 31st December 2022, representing a healthy growth of 21%. Our 90% lending is in state sectors and 10% lending in private sector. The company is witnessing healthy traction in the new projects and the same is evident from the healthy growth in sanctions. The sanction during the 9M period FY 24 achieved 39.12 billion USD (INR 3.26 lakh crore) against 23.04 billion USD (INR 1.92 lakh Cr) achieved during 9M FY 23 period, representing a growth of 69%. The sanctions book shall translate into the loan book in the next couple of years. In line with the Installed Capacity projections of the country to grow from 416 GW in FY 2023 to 777 GW by FY 2030, REC's total Loan Book is targeted to grow from current level of USD 59.64 billion (INR 4.97 lakh Cr) to 120 billion USD (INR 10 lakh crore) by FY 2030.

REC's achievements over the years

- 2017 – First Indian PSU to issue USD Green Bonds on London Stock Exchange
- 2018 – Achieved 100% village electrification under DDUGJY as Nodal Agency
- 2019 – Achieved 100% Household Electrification under SAUBHAGYA as Nodal Agency
- 2021 – Appointed as Nodal Agency for RDSS
- 2022 – Raised Largest-ever Syndicated Term Loan by an Indian NBFC with USD 1,175 Million Term Loan
- 2022 – Conferred Maharatna Status by the Govt. of India
- 2022 – With Government's permission forayed into Infrastructure and Lo-



150 MW Solar project of Avaada Group in Karnataka

gistics sector financing.

- 2023 - Issued Green Bonds of USD 750 million & listed on GIFT IFSC Stock Exchanges
- 2023 - Secured place in MSCI Global Standard Index
- 2023 - Becomes the largest NBFC on standalone basis with a loan book of 4.97 lakh Cr
- 2023 - Lowest net NPA in the Industry at 0.82%
- 2024 – With market sentiment on the rise and investors showing stronger

interest, ascended from Mid Cap to Large-Cap basket in the AMFI's latest list published (Jan'24).

- 2024 – Issued first ever Yen denominated Green bonds by Indian PSU of JPY 61.1 Billion, which marked the largest ever Euro-Yen issuance and also non-sovereign Yen-denominated issuance ever by a South & South-East Asian issuer.
- 2024 – Appointed as Project Implementing Agency for PM Surya Ghar Muft Bijlee Yojana.

NHPC Limited

India's power sector is one of the most diversified sectors in the world. Hydropower, as a renewable energy source, plays a crucial role in our mission to mitigate the effects of climate change and reduce carbon footprints.

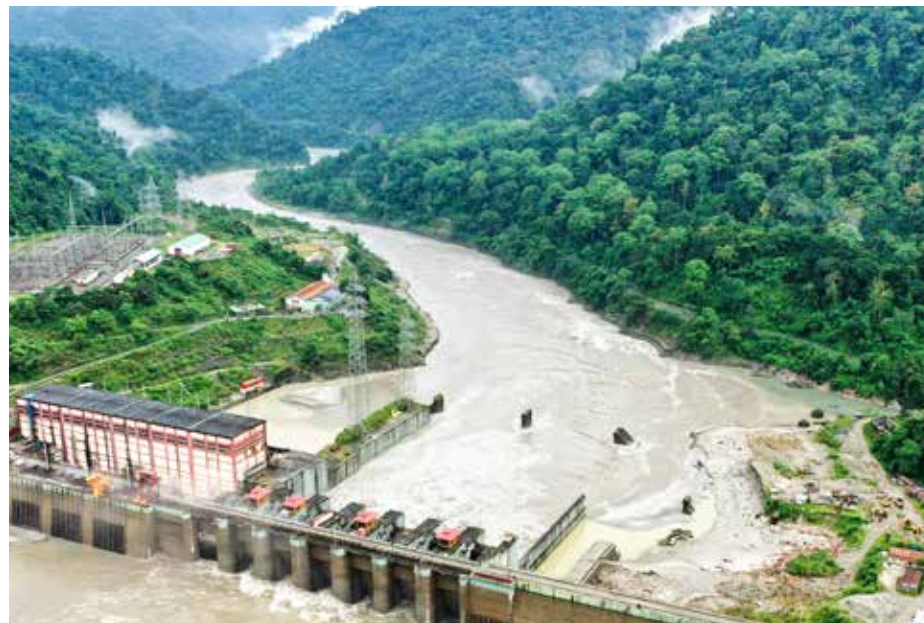
NHPC has been the flag bearer of hydropower development in the Country, contributing 7097.5 MW to the energy portfolio and another 10449.70 MW is under construction.

NHPC is a multi-disciplinary organization and has acquired sufficient expertise and state-of-the-art technology for investigation, planning, designing and executing large and small size hydro power projects. It has the strength of highly qualified and experienced professionals in design & engineering, geo-technical engineering, construction planning and construction management for building hydroelectric projects. The technical and engineering proficiency and experience of NHPC places it in a leading position in the field of hydro power development in India and neighbouring countries

NHPC is moving ahead for development of 2,880 MW Dibang Multipurpose Project in Arunachal Pradesh, which will be the largest hydropower project in the Country. In addition, 2000 MW Subansiri Upper HEP and 1800 MW Kamala HEP have been allotted to NHPC by Government of Arunachal Pradesh.

NHPC is also committed for the commissioning of two mega Projects i.e. 2000 MW Subansiri Lower HEP and 800 MW Parbati-II HEP in the present Financial Year, which will give a quantum jump to NHPC's portfolio. NHPC is having a strong visibility of future growth with 16 Projects of 10449.70 MW under construction on ownership/subsidiary/JV basis.

In order to expand international footprints NHPC has signed MoUs for three projects in Nepal i.e. West Seti (750 MW), SR-6 (450 MW) and Phukot Karnali (480 MW) HE Projects.



160 MW Teesta Low Dam IV Power Station (West Bengal) - Dam

NHPC is also venturing into development of Pumped Storage Hydro Projects of approx. capacity 10700 MW and Solar Power Projects of approx. capacity 1735 MW in different parts of the Country as well as exploring new technologies such as Green Hydrogen generation and Floating Solar projects.

Green Hydrogen Technology is expected to be the future of energy and is gaining traction across the globe. Recognizing the role, green hydrogen technology will play in future, NHPC has already initiated action for undertaking development of three Pilot Green Hydrogen Projects in Leh & Kargil Districts of UT of Ladakh and Chamba District of Himachal Pradesh. These pilot projects will create roadmap for future development of green hydrogen and subsequent reduction of the carbon emission in transportation/ heating sector.

Solar Energy Corporation Of India Limited (SECI)

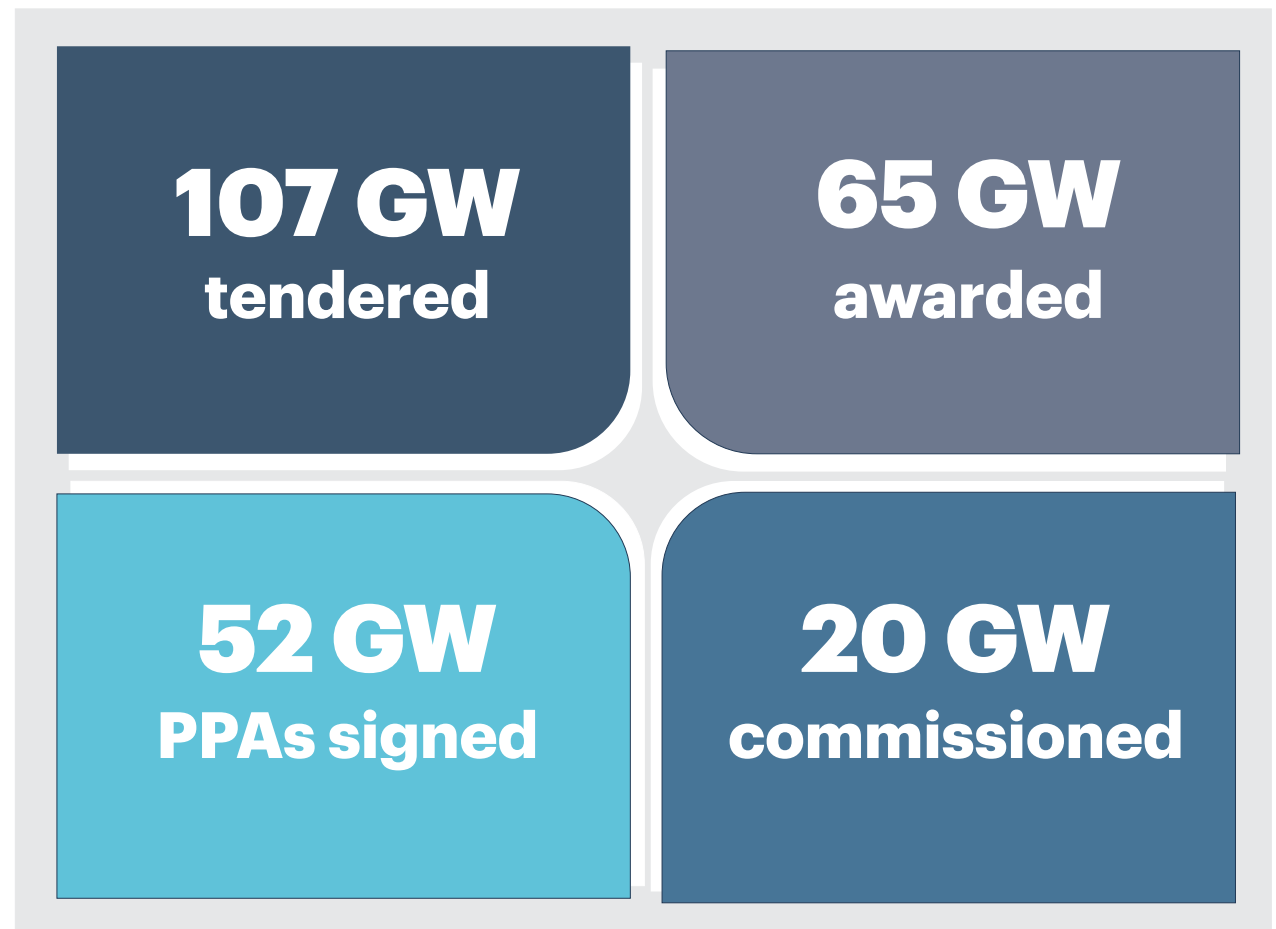
Background and Introduction

1. India, as one of the signatories to the 2015 Paris Agreement, has made a commitment to reduce emission intensity of the economy and to increase generation capacity from clean energy sources. Towards this objective, the Government of India is spearheading one of the world's largest renewable Energy (RE) programmes, targeting 500 GW of installed electricity capacity from non-fossil sources by 2030 and a net-zero economy by 2070.

2. Solar Energy Corporation of India Limited (SECI), a Public Sector Undertaking was incorporated under the aegis of Ministry of New & Renewable Energy (MNRE), Government of India, in 2011, to implement the Government's ambitious targets under the National Solar Mission (NSM) and subsequently, the targets set as part of India's commitment to Paris Agreement.

Achievements of SECI

1. As part of this role SECI has tendered an overall capacity of 107 GW, out of which over 65 GW capacity has been awarded and PPAs have been signed for over 52 GW capacity (as on 31st March, 2024). Over 20 GW capacity has already been commissioned under SECI, and remaining capacity is likely to be commissioned by 2027-28. SECI is currently India's largest RE power aggregator, in terms of volumes of power traded annually.



2. SECI has successfully awarded one of the world's largest Battery Energy Storage Systems tenders (500 MW/1000 MWh) to be set up at a single location, on standalone basis. The organization has brought the concepts of

"Round-the-Clock Supply", "Assured Peak Power Supply", "Firm and Dispatchable Supply" from 100% RE power, as part of its integrated approach towards bringing Energy Storage in the mainstream of India's Energy scenario, as



Rewa Solar Park

we aim towards a renewable-dominated energy supply portfolio by 2030.

3. As part of India's commitment towards energy independence and insulating the economy from global supply chain shocks, SECI has also successfully implemented a "Production-Linked Incentive" scheme for award of over 39 GW of domestic solar PV module manufacturing, through a Government support of USD 1.6 Billion, providing a much-needed reduction in import dependence over the next 3-4 years.

4. SECI has been instrumental in discovery of

some of the lowest tariffs in the world, in the RE sector, through its competitive bidding process. With India being a price sensitive nation, success of this concept predominantly depends on the cost of such transition in lifestyle, as envisaged. In this aspect, India has historically been on the lower side of the global electricity tariff spectrum. While the global electricity average tariff is 14 cents/unit, India's average electricity tariff is just half of this, i.e. 7 cents/unit, and China's tariff is 8 cents/unit. These two emerging economies, poised to dominate impact on the climate change efforts, are in an advantageous position of catalyzing rapid eco-

nomie growth and energy-intensive lifestyle transition, with little effect on end consumers. To add to the perspective, India's tariff is 1/4th of average tariff of Europe and 1/3rd of that of USA. This is one of the primary driving factors, in our efforts to become the global manufacturing hub as envisioned by the Hon'ble Prime Minister

5. SECI's innovative procurement model of auctioning RE capacity, which was kept continued even during the pandemic, was praised by the then Secretary General of the United Nations in 2020.

Powergrid – Leading Energy Transition For A Sustainable Future

'Redesigning Energy for People and Planet'

Global Transmission Leader

Power Grid Corporation of India Limited (POWERGRID), is World's leading transmission utility cum global consultant, having a net worth of USD 10.50 Bn and Gross Fixed Asset of USD 33 Bn with transmission network of 1,77,699 circuit km lines, 5,27,446 MVA power transformation capacity & 278 strategically located HV/EHV & HVDC substations. POWERGRID is a crowning jewel amongst Government of India owned enterprises.

Global Energy Connect

POWERGRID has established cross border

linkages in South Asia with Nepal, Bangladesh, Myanmar & Bhutan and is transforming global energy landscape with a pivotal role in futuristic initiatives such as 'One Sun, One World, One Grid'.

Meeting Challenges is a Way of Life

The transmission lines of POWERGRID crisscross some of the most diverse locales and climes in the world - snow laden mountains, barren deserts, deep forests and mighty rivers with an impressive 99.86% availability throughout the country.

Charting New Pathways

POWERGRID has made a mark beyond Power

Transmission, diversifying in the areas of Telecom, Distribution, Grid Automation and Communication, Capacity Building, Smart Grid, and Energy Efficiency. It is foraying into Solar Power generation and other new age businesses such as Battery Energy Storage Systems & Green Hydrogen.

Marquee Snapshot

In sync with its mantra of 'Transmitting Power, Transforming Lives,' POWERGRID has built and is operating one of the most complex and sophisticated transmission networks in the world bringing smiles across the globe by leveraging cutting-edge technologies



contributing to energy transition. Some marquee projects:

- World's longest multi-terminal HVDC 6000 MW - Agra Biswanath Chariali HVDC system
- 1765 km long HVDC Raigarh-Pugalur-Thrissur (RPT) – 1st VSC based HVDC in India
- Srinagar-Leh Transmission System – World's highest altitude S/S and second coldest inhabited place in the world
- World's Highest voltage System – 1200 kV Transmission at Bina

Innovating for Brighter Tomorrow

POWERGRID invests in research and development, focusing on energy-efficient technologies and automation. Following the principle of constant upgradation and tech advancements in project planning, construction & asset management/operation. Some indigenously developed solutions:

- Development of Asset Management Dashboard UDAAN (Unique Digital Analysis of Assets and Network)
- Integration of AI/ ML based defect identification in POWERGRID-Digital Application for Routine Patrolling and Assessment of Network (PG-DARPAN) for Data driven decision process
- POWERGRID Asset Life Management System (PALMS V2.0)
- Computer based Relay Setting Management
- Development of Substation Inspection Robot
- Aerial Patrolling using drones and helicopters



Human Assets and Knowledge Grid

POWERGRID's Human Assets consists of 8500+ dedicated professionals who have demonstrated consistent excellence in all spheres. From project management to operational excellence, capacity building to pathbreaking innovations, POWERGRID's HR practices have enabled a happy workplace and has been consistently rated as one of the best places for women to work.

POWERGRID Academy of Leadership (PAL) is the capacity building platform, that caters to power sector professionals globally. POWERGRID conducts over 1200 training programs in 280 assisted modules grossing over 50,000 man-days of trainings per annum.

Establishment of virtual Smart Grid Knowledge Centre (SGKC) & POWERGRID Advanced Research and Technology Centre (PARTeC) has enabled power sector knowledge sharing.

Marching Towards Sustainable Future

Towards India's ambitious target of achieving RE capacity of 500 GW by 2030, POWERGRID is facilitating large scale grid integration of renewables through implementation of schemes like Green Energy Corridors, dedicated transmission systems for solar parks/zones and Renewable Energy Management Centers.

POWERGRID is also implementing several initiatives such as development of digital substations, replacing conventional insulating oils with environment friendly natural ester oil etc.

POWERGRID is committed to achieving net zero by 2047, water positive by 2030, and zero waste to landfill by 2030.

Accolades

POWERGRID has earned laurels worldwide, including –

- Platts Global Energy Award
- International CSR Excellence
- Brandon Hall HCM Excellence Award 2023
- ATD Global Best Award
- Global Gold Award at The Green Org Green World Awards 2023
- SHRM India Excellence in Learning & Development etc.

NTPC: Powering India's Growth with Clean Energy Solutions

VISION: To be the world's leading power company, energizing India's growth

75,958 MW of installed capacity

25% share in India's total power generation

422 BU generation in FY 24

34.38 MMT of coal production in FY 24

130 GW of aimed installed capacity by 2032



Transition towards green energy

- 1st energy company to declare its energy compact goals as part of the UN High-level Dialogue on Energy (HLDE)
- Roadmap to 60 GW capacity through Renewable Energy sources constituting nearly 50% of its overall power generation capacity by 2032
- India's 1st Green Hydrogen - PNG Blending Project commissioned at NTPC Kawas, Surat
- India's 1st Hydrogen Mobility Project for public transport started trial run at Leh
- 1.1 Lakh Crore worth of Green Hydrogen Hub to be set up at Pudimadaka, Visakhapatnam

Sustainability

- NTPC has become a pioneer among its peers by developing Sustainability Strategy i.e. The Brighter Plan 2032.
- 38 million trees/sapling planted since inception
- 45.77 Lakh KL of rainwater harvested in 2022-23
- 1,55,000 Metric Tonnes of biomass pellets fired in 14 power stations
- 3100 TPD Waste to Charcoal Projects
- 82.45% ash utilization in FY 2022-23
- ESG Score improved by 2 levels in CDP Water Security Rating

ONGC: Dedicated to addressing climate change on a global scale



ONGC Energy Centre for Research on Green Hydrogen. The Centre has developed a cost-effective technology in collaboration with the Institute of Chemical Technology, Mumbai, and obtained three international patents for this process across seven countries: India, Canada, China, Japan, Korea, the UK, and the USA

Maharatna ONGC is India's largest crude oil and natural gas company, contributing over 70 per cent to domestic production. It is progressively expanding its footprint as an integrated Energy

company, with interests in upstream, midstream and downstream segments of the hydrocarbon value chain, renewables, LNG, power generation, petrochemicals and value-added products.

Ranked 4th in India and 158th globally in the Fortune Global 500 List 2023, ONGC is among the top Indian companies in terms of market capitalisation, net worth and social spending. It has a



ONGC's solar farm at Tatipaka in Andhra Pradesh. ONGC has a target of generating 10GW renewable energy by 2030

strong credit rating, both in domestic and international markets.

Committed to the best Environmental, Social, and Governance (ESG) principles, ONGC has launched several initiatives to mitigate the environmental impact of its operations. ONGC has a structured global outreach through collabora-

tions in Carbon Capture, Utilization, and Storage (CCUS), emphasising its dedication to addressing climate change on a global scale.

ONGC has lined up investments of US\$1 trillion in Green Initiatives by 2030 to expand its renewable capacity. The company's goals include achieving zero flaring and zero methane emis-

sions by 2030, with Scope I and Scope II Net Zero targets for 2038.

ONGC's wholly-owned subsidiary ONGC Videsh Limited has 32 oil and gas projects in 15 countries. Maharatna HPCL and Miniratna MRPL are also subsidiaries of ONGC, giving the ONGC group over 10 per cent of the Indian refining capacity.

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