सत्यमेव जयते
Government of India

ACCELERATING CITIZEN-CENTRIC ENERGY TRANSITION

THE INDIA STORY

Nodal Ministry

सत्यमेव जयते
Ministry of New and Renewable Energy
Government of India

About the front cover

The Delhi Metro is an iconic and integral part of the National Capital Region. With state-of-the-art trains and reliable services, it transports millions of citizens daily to their workplaces and connects them with their loved ones. It is powered in part by one of India's largest solar power parks, the 750 MW Rewa Solar Power Project in Madhya Project. It also uses rooftop solar installations to power stations and depots.

The Delhi Metro, a modern technological innovation, also works in perfect harmony with the power of the Sun, represented in the cover and throughout the e-book, by the timeless motif of the wheel of the chariot of the Sun God at the Temple of Konark in Odisha. This reiterates India's association with, and regard for, the power of nature has endured over millennia.

And at this confluence of the wisdom of the ancients and the ambition of New India, lies **The India Story**.

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Contributing Ministries

Ministry of New and Renewable Energy
Ministry of Power
Ministry of Petroleum and Natural Gas
Bureau of Energy Efficiency
Ministry of Environment, Forest and Climate Change
Ministry of Civil Aviation
Indian Railways
Smart Cities Mission
Department of Biotechnology
Department for Promotion of Industry and Internal Trade
Skill Council for Green Jobs
Department of heavy Industry
International Solar Alliance

Knowledge Partner

CEEW
THE COUNCIL

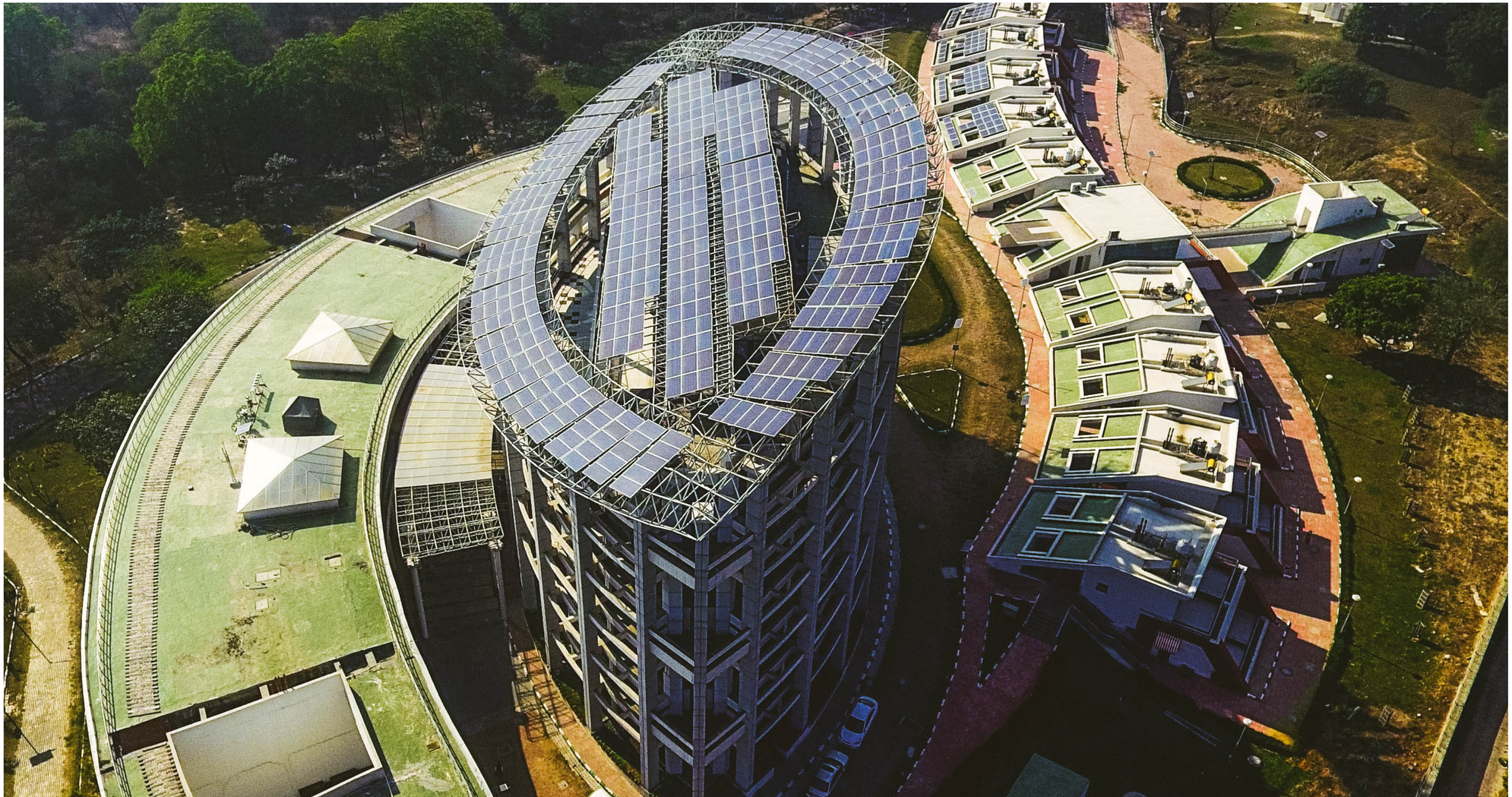

Image: Knut-Erik Helle/Flickr

FOREWORD

Shri Raj Kumar Singh

Hon'ble Minister of State (I/C) for Power and New and Renewable Energy, and Minister of State, Skill Development and Entrepreneurship, Government of India

The world has ten years to achieve Sustainable Development Goal (SDG) 7 to "ensure access to affordable, reliable, sustainable and modern energy for all." This will require conscious and cooperative global action. India steadfastly supports this vision by strong political commitment. Universalising energy access, promoting renewable energy (RE), and increasing energy efficiency. With the world's 4th highest RE capacity, India is the only G20 nation whose pace of energy transition is in consonance with the target of a sub 2°C rise in global temperature. Its energy transition actions are not only consonant with, but higher than its NDC commitment. India had committed that the share of non fossil fuel sources in its power generation will be 40 per cent by 2030. This is already at 38 per cent in 2021, and if capacity under construction is added, it is already at 54 per cent. We ensured universal energy access in record time by concerted action – connecting all villages and hamlets in 917 days, and 28 million homes in just 18 months.

As a Global Theme Champion for Energy Transition at the United Nations High-Level Dialogue on Energy 2021, India would like to thank the UN Secretary-General for initiating this global effort and accelerating action towards SDG7. We look forward to working with all stakeholders, including governments, multilateral organisations, the private sector, and civil society. The private sector will be especially instrumental in scaling up action for the energy transition and driving the SDG7 objectives. Only conscious, collective, and intersectoral efforts will enable the rapid changes we need to achieve our global targets by 2030.

India's energy goal has always been two-fold. First, to create an electrified economy where energy is consumed as electricity instead of traditional fossil fuel sources, and to make this electricity green.

India has emerged as a world leader in energy transition. Our success is a result of multi-level action. We have introduced several initiatives for rapid deployment of grid-connected, utility-scale RE plants, as well as citizen-centric schemes such as *PM-KUSUM* (*Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan Yojana*) for solarisation of agriculture and rooftop solar programmes for transforming energy consumers into energy producers. Our energy transition and RE development have facilitated universal energy access, particularly in remote areas where grid-connected electricity would have taken longer to reach. We have repeatedly shown support for international energy commitments through global initiatives and domestic action.

We hope the experiences and benefits we gain through our transition will help other countries too. While all nations can learn from our achievements, we must solve the critical challenge of access to finance for RE development in developing countries. This will require global collaboration, capacity-building through robust financial mechanisms and institutions, and strong political will.

We look forward to learning from our peers during the High-Level Energy Dialogue. Each of us should share our energy stories – both successes and setbacks. The challenges linked to SDG7 are huge, but I firmly believe that we can meet them and ensure clean energy for future generations. We must work collectively to truly make 2021 a year of energy action and transition – a role India is excited and prepared to take on. So, with hopes of learning and contributing, I present to you our energy narrative: ***Accelerating Citizen-Centric Energy Transition: The India Story.***

PREFACE

Indian civilisation has always nurtured a deep respect for the natural world. The grandeur of the Sun Temple in Konark, an architectural representation of the Sun god's chariot, bears testament to this. It also gives artistic expression to our longstanding awareness of the fundamental importance of solar energy for life on Earth. Inspired by such rich heritage and an unwavering belief that the world is one '*Vasudeiva Kutumbakam*', India proudly assumes its role as a **Global Theme Champion for 'Energy Transition' at the UN High-level Dialogue on Energy scheduled for September 2021.** We are now working with other Global Champions to help accelerate progress towards Sustainable Development Goal 7 which focuses on "access to affordable, reliable, sustainable and modern energy for all".

India's biggest asset as a global energy transition advocate and change agent is its own example. India is the only G20 nation whose actions are consonant with a sub 2°C rise in global temperatures. Its achievements in energy transition is way beyond its NDCs. Further, India is making brisk progress towards its ambitious goal to install 450 GW of renewable energy (RE) capacity by 2030. It has also emerged as one of the world's most attractive destinations for investments in RE.

Most important of all, India's energy transition is citizen-centric. It is powered by schemes that have provided electricity access and clean cooking fuel to millions of households (*SAUBHAGYA* and *PMUY*), enabled the installation of hundreds of thousands of solar agri-pumps (*PM-KUSUM*) and improved livelihoods through skill development (SCGJ). India is also taking steps to building sustainable cities through the *Smart City Mission* and accelerating electrical mobility through the FAME scheme. This will not only improve quality of life but also enable sustainable living.

Finally, India is not only accelerating its own energy transition but is also laying down a sustainable growth pathway for other emerging economies to emulate. It is behind pathbreaking initiatives such as the International Solar Alliance and Mission Innovation which are helping multiple countries transform their energy systems while meeting their climate and developmental commitments.

What follows in this e-book is the story of these visionary initiatives.

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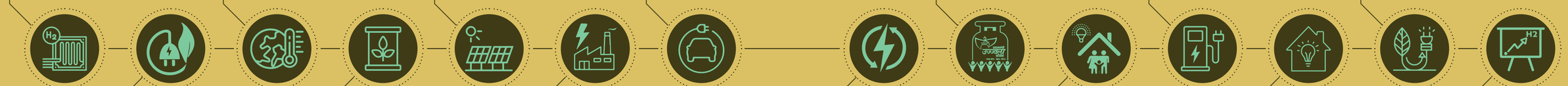
Image: iStock

ABBREVIATIONS

AAI	Airports Authority of India
AC	Air Conditioner
ADB	Asian Development Bank
ADITYA	*Atal Distribution System Improvement Yojana*
AFD	*Agence Française de Développement*
AHEC	Alternate Hydro Energy Centre
AMI	Advanced Metering Infrastructure
ARHC	Affordable Rental Housing Complex
AT&C	Aggregate Technical and Commercial
BEE	Bureau of Energy Efficiency
BPCL	Bharat Petroleum Corporation Limited
BPL	Below Poverty Line
CAGR	Compound Annual Growth Rate
CCUS	Carbon Capture, Utilization and Storage
CEEW	Council on Energy, Environment and Water
CEIIC	Clean Energy International Incubation Centre
CEM	Clean Energy Ministerial
CEM-IF	CEM-Investment and Finance Initiative
CEMILAC	Centre for Military Airworthiness and Certification
CGD	City Gas Distribution
CII	Confederation of Indian Industry
COP	Conference of Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CBG	Compressed Biogas
CNG	Compressed Natural Gas
ckm	Circuit Kilometre
C3E	Clean Energy Education and Empowerment Initiative
DBT	Direct Benefit Transfer
DPIIT	Department for Promotion of Industry and Internal Trade
DRE	Distributed Renewable Energy
E20	20 per cent ethanol-blended petrol
ECBC	Energy Conservation Building Code
EESL	Energy Efficiency Services Ltd.
ESCerts	Energy Saving Certificates
EUR	Euro
FAME	Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles
FAR	Floor Area Ratio
FDI	Foreign Direct Investment
FiT	Feed-In-Tariff
FTE	Full-Time Equivalent
FUA	Flexible Use of Airspace
FY	Financial Year
GBS	Gross Budgetary Support
GDP	Gross Domestic Product
GEC	Green Energy Corridor
GHG	Greenhouse Gas Emissions
GIFT	Green Initiative for Future Transport
GIP	Green Initiative for Power
GRIHA	Green Rating for Integrated Habitat Assessment
GST	Goods and Services Tax
GVA	Gross Value Added
GW	Gigawatt
GWP	Global Warming Potential
H-CNG	Hydrogen Compressed Natural Gas
HFC	Hydrofluorocarbon
HPCL	Hindustan Petroleum Corporation Limited
IC	Innovation Challenge
ICAO	International Civil Aviation Organization
ICAP	India Cooling Action Plan
IDDI	Industrial Deep Decarbonization Initiative
IEA	International Energy Agency
IGBC	India Green Building Council
IIT	Indian Institute of Technology
INR	Indian Rupees
InSTS	Intra State Transmission System
IOCL	Indian Oil Corporation Limited
IP	Intellectual Property
IR	Indian Railways
IREDA	Indian Renewable Energy Development Agency
ISA	International Solar Alliance
ISTAR C	International Solar Alliance Solar Technology and Application Resource Centre
JI-VAN	*Jaiv Indhan-Vatavaran Anukool Fasal Awashesh Nivaran*
KfW	*Kreditanstalt Fuer Wiederaufbau*
Kwh	Kilowatt-hour
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LiDAR	Light Detection and Ranging
LNG	Liquefied Natural Gas
LPG	Liquified Petroleum Gas
LTES	Long-Term Energy Scenarios
m	metre
MI	Mission Innovation
MII	Make in India
MMSCM	million metric standard cubic metre
MMTPA	million metric tonnes per annum
MNRE	Ministry of New and Renewable Energy
MoEFCC	Ministry of Environment, Forest, and Climate Change
MoHUA	Ministry of Housing and Urban Affairs
MoPNG	Ministry of Petroleum and Natural Gas
MRO	Maintenance, Repair & Overhaul
MSDE	Ministry of Skill Development and Entrepreneurship
MSME	Ministry of Micro, Small & Medium Enterprises
MT	Million Tonnes
MTCO2e	Million Tonnes of Carbon Dioxide equivalent
Mtoe	Million Tonnes of oil equivalent
MVA	Million Volt Ampere
MW	Megawatt
MW-eq	Megawatt-equivalent
MW-p	Megawatt-peak
NAPCC	National Action Plan on Climate Change
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organisation
NHEM	National Hydrogen Energy Mission
NISE	National Institute of Solar Energy
NIWE	National Institute of Wind Energy
NMEEE	National Mission for Enhanced Energy Efficiency
NMSH	National Mission on Sustainable Habitat
NSGM	National Smart Grid Mission
NSM	National Solar Mission
OEM	Original Equipment Manufacturer
OMC	Oil Marketing Companies
OSOWOG	One Sun, One World, One Grid
PAHAL	*Pratyaksh Hanstantrit Labh*
PAT	Perform, Achieve and Trade
PBN	Performance-based Navigation
PLI	Production-Linked Incentive
PMAY	*Pradhan Mantri Awas Yojana*
PM-KUSUM	*Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan Yojana*
PMKVY	*Pradhan Mantri Kaushal Vikas Yojana*
PMUY	*Pradhan Mantri Ujjwala Yojana*
PNG	Piped Natural Gas
PNGRB	Petroleum and Natural Gas Regulatory Board
PSU	Public Sector Undertaking
PV	Photovoltaic
R&D	Research and Development
RD&D	Research, Development and Demonstration
RE	Renewable Energy
REC	Rural Electrification Corporation
REMC	Renewable Energy Management Centre
RKM	Route Kilometre
RTS	Roof Top Solar
SAUBHAGYA	*Pradhan Mantri Sahaj Bijli Har Ghar Yojana*
SAF	Sustainable Aviation Fuel
SATAT	Sustainable Alternative Towards Affordable Transportation
SCGJ	Skill Council for Green Jobs
SCM	Smart City Mission
SDG	Sustainable Development Goals
SHP	Small Hydro Power
SLDC	State Load Dispatch Centre
SLNP	Street Lighting National Programme
SMNP	Smart Meter National Programme
SRMI	Solar Risk Mitigation Initiative
SSDP	*Suryamitra Skill Development Programme*
SPV	Solar Photo Voltaic
sq ft	square feet
sq km	square kilometre
STU	State Transmission Utility
T&D	Transmissions and Distribution
TBCB	Tariff Based Competitive Bidding
UDAN	*Ude Desh ka Aam Nagrik*
UDAY	*Ujwal Discom Assurance Yojana*
UJALA	*Unnat Jyoti by Affordable LEDs for All*
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States Dollar
xEV	Electric Vehicles
2W	Two-Wheeler
3W	Three-Wheeler

MILESTONES IN INDIA'S ENERGY TRANSITION



2005
National Hydrogen Energy Roadmap

2007
Energy Conservation Building Code (ECBC)

2008
National Action Plan on Climate Change (NAPCC)

Perform, Achieve, Trade (PAT) Scheme

2009
National Policy on Biofuels

India joins Clean Energy Ministerial (CEM)

2010
National Solar Mission, target 20 GW solar by 2022

2012
Perform, Achieve, Trade (PAT) Scheme Cycle I

2013
Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) I

India hosts CEM4

2015
Renewable energy capacity target enhanced to 175 GW by 2022

Flagship schemes and initiatives launched

- Ujwal Discom Assurance Yojana (UDAY)
- Unnat Jyoti by Affordable LEDs for All (UJALA)
- National Offshore Wind Energy Policy
- National Smart Grid Mission
- Pradhan Mantri Awas Yojana (PMAY)
- Smart City Mission
- Skill Council for Green Jobs
- International Solar Alliance (ISA)
- Mission Innovation
- Intra State Transmission System and Inter State Transmission System

2016
Pradhan Mantri Ujjwala Yojana (PMUY)

Major Green Energy Corridor (GEC) schemes identified

Perform, Achieve, Trade (PAT) Scheme Cycle II

2017
Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA)

Tariff-based competitive bidding (TBCB) for the wind sector

Suryamitra Skill Development Programme (SSDP)

Perform, Achieve, Trade (PAT) Scheme Cycle III

Pradhan Mantri Awas Yojana (PMAY) extended to rural areas

International Solar Alliance Framework ratified

2018
Sustainable Alternative for Affordable towards Transportation (SATAT) Scheme

Perform, Achieve, Trade (PAT) Scheme Cycle IV

UJJWALA achieves target of 50 million LPG connections, extended to 80 million connections

2019
India announces ambition to be a USD 5 trillion economy by 2025

India Cooling Action Plan (ICAP)

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

Atal Distribution System Improvement Yojana (ADITYA) replaces UDAY

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

ClimateSmart Cities Assessment Framework

Perform, Achieve, Trade (PAT) Scheme Cycle V

SAUBHAGYA achieves 100% electrification of households

UJJWALA achieves target of 80 million LPG connections

2020
Production-Linked Incentive (PLI) Scheme

Perform, Achieve, Trade (PAT) Scheme Cycle VI

10 GW installed bioenergy capacity target achieved

2021
National Hydrogen Energy Mission announced

Mission Innovation 2.0

CEM launches Industrial Deep Decarbonisation Initiative (IDDI)

ISTS evacuates 6 GW of inter-state RE-based power

SAUBHAGYA has provided electricity connections to 28 million households

UJALA has distributed over 367 million LEDs

UJJWALA targets 10 million additional LPG connections

COMMENCED **TARGET ACHIEVED**

Image: iStock

#ELECTRIFICATION

DeenDayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

Electrifying all villages and hamlets

THE PURPOSE

The *DeenDayal Upadhyaya Gram Jyoti Yojana (DDUGJY)* was launched in 2014 to achieve universal village electrification and provide continuous power supply to rural India. 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. *DDUGJY* is complemented by another flagship programme, *SAUBHAGYA*, under which 28 million households were provided free or subsidised electricity connections.

THE ROLLOUT

***DDUGJY* was implemented by the Ministry of Power through the Rural Electrification Corporation (nodal agency) and the power distribution companies.** The scheme entailed an investment of INR 43,033 core (USD 5.9 billion), which includes the central budgetary support of INR 33,453 crore (USD 4.6 billion). The scheme had three key components, including separation of agriculture and non-agriculture feeders; strengthening of sub-transmission & distribution infrastructure, micro grid or off-grid distribution networks; and completion of projects sanctioned under the erstwhile *Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)* scheme.

MILESTONES

Under the scheme, remaining villages in the country in forest areas, riverine areas, flood-affected and remote hilly areas as per the pledge of Hon'ble Prime Minister in his Independence Day speech August 2015. All remaining inhabited 18,374 villages were electrified by 28th April 2018—a Landmark Day, with electrification of Leisang village, in Senapati district of Manipur, and 100 per cent electrification of villages in the country achieved.

The physical progress under various components of DDUGJY Is as follows:

Commissioning of Sub-stations	**1,825 nos.**
Commissioning of Aug. Sub-stations	**2,123 nos.**
Commissioning of Distribution Transformer	**3,85,287 nos.**
Erection of 11KV Feeder Segregation	**1,28,402 Ckm**
Erection of Low-Tension Line	**2,85,048 Ckm**
Erection of 11 kV Line	**1,15,947 Ckm**
Erection of 33 kV Line	**22,400 Ckm**
Consumer Metering	**154,19,897 nos.**
Installation of Meters in Distribution Transformers	**2,37,231 nos.**
Installation of Meters in 11 KV Feeders	**13,813 nos.**

JOBS

***DDUGJY* implementation has created tens of thousands of new direct and indirect jobs** associated with grid-infrastructure expansion and augmentation, and those stimulated by the availability of reliable electricity in rural areas.

GROWTH

***DDUGJY* is expected to boost rural economy by stimulating and improving** productivity of electricity-powered farm and non-farm enterprises.

SUSTAINABILITY

Village electrification has played a significant role in curbing the use of polluting fuels like kerosene and diesel in rural areas. Rural electricity supply in India has also significantly improved to an average daily supply of 20 hours. The International Energy Agency has recognised India's efforts to electrify each village as one of the greatest success stories globally.

2030 AGENDA

The Government of India intends to prioritise efforts to provide reliable and quality power supply to all consumers, which in turn would enable realisation of multiple SGDs, particularly SDG 3 (good health and well-being), SDG 7 (affordable and clean energy), SDG 8 (decent work and economic growth), and SDG 13 (climate action).

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Ministry of Power. 2014. "DeenDayal Upadhyaya Gram Jyoti Yojana." December 3, 2014.

india.gov.in. "DeenDayal Upadhyaya Gram Jyoti Yojana." Accessed June 21, 2021.

garv.gov.in. "Villages Electrified." Access on June 21, 2021.

Rural Electrification Corporation. 2017. "Three Years of DDUGJY Scheme". May 19, 2017.

Image: iStock

Image: iStock

INR 16, 320 crore (USD 2.1 billion)

Total budgetary outlay for the project

100 million

Estimated number of man-days of work generated under this scheme

28+ million

Households that have been electrified under *SAUBHAGYA* as of 31 March 2021

#ELECTRIFICATION

Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA)

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

THE PURPOSE

The *SAUBHAGYA* scheme was launched in 2017 to provide universal electricity access to all homes by 31 March 2019, with three overarching objectives.

SAUBHAGYA and its complementary initiative, *Power for All*, envision an overhaul of the power sector value chain—covering generation, transmission, distribution, and energy efficiency—to close the access gap and eventually provide 24x7 power to all urban and rural households.

THE ROLLOUT

Total outlay of the project was INR 16,320 crore (USD 2.1 billion) while the Gross Budgetary Support (GBS) is INR 12,320 crore (USD 1.6 billion). Achievement: 28 million homes in 18 months.

JOBS

SAUBHAGYA is estimated to have generated around 100 million man-days of work.

GROWTH

The substitution of kerosene-based energy systems with electricity-based energy systems in rural areas has reduced dependency on fossil fuels, reducing imports and resulting in savings of associated foreign exchange. It will also help reduce the annual subsidy on petroleum-based products, besides contributing to decarbonisation.

Image: iStock

INR 21,510 crore (USD 2.93 billion)

Total estimated cost of the Inter State Transmission System and the Intra State Transmission System

11

Commissioned Renewable Energy Management Centres, with two more scheduled for 2021

24 GW

Renewables-based power evacuation target of the Intra State Transmission System by June 2022

#ELECTRIFICATION

One Nation One Grid

Expansion of grid - Inter-regional power transfer capacity increased to 10,000 MW. One nation, one electricity market, two exchanges for sale and purchase of power

THE PURPOSE

The GEC aims to synchronise large volumes of renewables-based electricity with conventional grid-based power stations. It is a critical national infrastructure project supporting India's target of installing 175 GW renewable energy (RE) capacity by 2022.

THE ROLLOUT

In 2015, the Ministry of New and Renewable Energy (MNRE) sanctioned the Intra State Transmission System to evacuate renewables-based power in eight renewables-rich states – Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Madhya Pradesh, Rajasthan, and Tamil Nadu. It is being implemented by the respective State Transmission Utilities (STUs). The Inter State Transmission System, approved by the Ministry of Power in 2015, is being implemented by the Power Grid Corporation of India Limited (PGCIL).

The estimated costs of the intra- and the inter-state systems are INR 10,141 crore (USD 1.38 billion) and INR 11,369 crore (USD 1.55 billion), respectively.

Forty per cent of the intra-state project's funding comes from the Union Government through the National Clean Energy Fund. A soft loan of EUR 500 million (USD 606 million) from KfW Germany accounts for another 40 per cent, with state equity making up the remainder.

The inter-state project is co-funded by PGCIL with 30 per cent equity, and the balance through a soft loan of EUR 500 million (USD 606 million) from KfW Germany and ~INR 2,800 crore (USD 382 million) from the Asian Development Bank (ADB).

MILESTONES

The intra-state GEC had targeted around 9,700 circuit kilometres (ckm) of transmission lines and substations of 22,600 million volt ampere (MVA) capacity by March 2020. As of May 2021, around 7,965 ckm of transmission lines have been constructed and 13,693 MVA of substations have been set up, with some projects facing delays due to the COVID-19 pandemic. The inter-state GEC was commissioned in March 2020 with 3,200 ckm of transmission lines and 17,000 MVA of substations.

Renewable Energy Management Centres (REMCs) equipped with advanced forecasting tools and smart dispatching solutions are integral to the GEC. REMCs monitor RE generation in real time and work in sync with State, Regional, and National Load Despatch Centres. Eleven REMCs have been commissioned, with two more scheduled for 2021.

The Inter State Transmission System has achieved its target to evacuate 6 GW of inter-state renewables-based power. The Intra State Transmission System will evacuate its targeted 24 GW intra-state renewables-based power by June 2022.

JOBS

The GEC projects contribute to direct and indirect jobs in clean power generation and transmission.

GROWTH

The GEC is key to India's efforts to extend RE-based electrification countrywide across sectors and achieving the Nationally Determined Contribution of 40 per cent power from non-fossil fuel sources by 2030.

SUSTAINABILITY

The GEC is supporting the expansion of India's clean power sector by integrating RE projects with the national grid.

2030 AGENDA

In line with India's ambitious RE targets, the MNRE is expanding the intra-state transmission infrastructure. It has received proposals from seven states to add about 9,800 ckm of transmission lines and substations of ~25,000 MVA capacity for commissioning by 2025 to facilitate the evacuation of an additional 15 GW of RE power. The total estimated cost of these projects is INR 11,560 crore (USD 1.58 billion). The MNRE has proposed a scheme—the GEC Phase-II—to cater to these projects.

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Ministry of Power, Government of India. "Transmission Works under Green Energy Corridors-I." Accessed June 15, 2021.

Image: iStock

Image: iStock

250 million

Conventional meters to be replaced with prepaid smart meters in the next 3-5 years

INR 3 lakh crore (USD 40 billion)

Proposed outlay for a new reforms-based and results-linked distribution sector scheme

~98%

Expected improvement in billing efficiency, resulting in increased utility revenues

#ELECTRIFICATION

National Smart Grid Mission (NSGM) and Smart Metering initiative

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

THE PURPOSE

The Union Government set up the *National Smart Grid Mission (NSGM)* in 2015 as an institutional mechanism for accelerating smart grid deployment in India. The NSGM facilitates technology, policy, and training to promote smart grids at the distribution level. The focus of this Mission is to lower Aggregate Technical and Commercial (AT&C) losses and power purchase costs; manage peak loads; and improve the quality of grid visibility, asset management, renewable power integration, and services like net-metering.

Under this initiative, the Ministry of Power (MoP) aims to replace 250 million conventional meters with prepaid smart meters over the coming 3-5 years. The smart meter, which is the main component of the Advanced Metering Infrastructure (AMI), enables accurate energy audits, reduces utilities' commercial losses, enhances revenues, and allows consumers to track and adjust usage. The transparency and trust enabled by smart meters is an important tool for providing 24x7 quality power for all.

THE ROLLOUT

The NSGM comprises a multi-tier structure headed by the Minister for Power. For day-to-day operations, it has a Project Management Unit. Under the NSGM, utilities have been encouraged to develop state-specific roadmaps for the deployment of prepaid smart meters and other smart grid attributes like demand response. The progress is reviewed regularly to tackle shortcomings and accelerate deployments.

In 2015, the Union Government launched the *Ujwal Discom Assurance Yojana (UDAY)*. One of the priorities under this scheme was the installation of smart meters for all customers with a monthly consumption of over 500 units by December 2017, and for those with a consumption of 200-500 units per month by December 2019. UDAY's term ended in March 2020. **A new reforms-based and results-linked distribution sector scheme has now been proposed with an outlay of over INR 3 lakh crore (USD 40 billion).**

MILESTONES

As of June 2021, the Energy Efficiency Services Limited (EESL) has an order pipeline of 15 million smart meters. More than 2.45 million smart meters have been installed across India under various initiatives, with another 7.6 million in deployment.

Smart meters deployment has also led to a significant rise in consumer satisfaction due to supply reliability and lower billing discrepancy from the absence of human intervention.

Image: Milan Jacob/CEEW

GROWTH

The EESL has established itself as a leader in smart metering through its initiative to deploy the devices through the operation expenditure (Opex) model. Its dashboard shows that as of 2021, the installation of smart meters has led to an average increase of 20.5 per cent in discom revenues – INR 301 (USD 4.04) per month per meter. Further, AT&C losses have fallen by 11-36 per cent, while billing efficiency has increased by 21 per cent. **Overall, the deployment of smart meters is expected to improve billing efficiency to more than 98 per cent, resulting in increased utility revenues.**

SUSTAINABILITY

Smart meters help consumers manage their energy use by potentially reducing their bills with time-of-use tariff options. Additionally, power companies are able to control AT&C losses, leading to significant efficiency gains.

With guidance from the MoP, the NSGM has finalised a Model Standard Bidding Document (SBD) for the selection and appointment of Advanced Metering Infrastructure Service Providers (AMISPs) for smart prepaid metering on a Design-Build-Finance-Own-Operate-Transfer (DBFOOT) basis by state power utilities. States and utilities are being encouraged to adopt the Opex model to facilitate faster implementation and earlier benefits.

2030 AGENDA

The MoP has formulated a 20-year plan for integrated inter-regional, inter-state and intra-state transmission networks in India. This will be a crucial backbone for the vision on 24x7 power for all homes in the country.

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Image: Shalu Agrawal/CEEW

5th
India's global rank in terms of installed solar energy capacity

100 GW
India's solar energy installed capacity target by 2022

INR 1.99/Kwh
Solar power tariff per unit in December 2020, down from INR 6.47/Kwh in 2013-14

#RENEWABLEENERGY

The National Solar Mission (NSM)

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

THE PURPOSE

In 2015, India declared a target of 100 GW installed solar energy capacity by 2022, quintupling the *National Solar Mission*'s (NSM) earlier target to install 20 GW solar capacity by 2022. The 100 GW target includes 60 GW from utility-scale plants and 40 GW from rooftop systems. The aim is to harness India's abundant sunshine, averaging 300 sunny days a year, to build a clean energy system that supports its rapid economic growth and consequent rise in energy demand.

THE ROLLOUT

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. States are also being encouraged to have at least one Solar City, fully powered by solar energy.

MILESTONES

India is ranked 5th globally in installed solar capacity. The NSM's schemes and programmes have increased installed solar capacity from 36 MW in 2010–11 to 40 GW as of 31 March 2021.

JOBS

As of 2019, India's solar sector employed over 77,000 workers – up from 16,000 in fiscal 2016 – and is one of the fastest-growing employment generation sectors. The Council on Energy, Environment and Water (CEEW) and the NRDC estimate that the combined target of 100 GW solar and 60 GW wind capacity are likely to generate about 1.3 million direct jobs on a Full-Time Equivalent (FTE) basis, which amounts to a workforce of 330,000 people. Rooftop solar installations could create about 50,000 skilled and unskilled jobs per 4 GW, while small- and large-scale micro-grids of 20 GW can employ around 1,10,000 workers of various skill levels. The new target of 450 GW installed renewable capacity by 2030 will amplify this potential manifold.

As of March 2021, around 47,000 *Suryamitras* have been trained by the National Institute of Solar Energy (NISE).

GROWTH

The accelerated expansion of India's solar energy sector has been driven by a mix of conducive policy and regulatory frameworks, a global decline in prices of panels and other equipment, and competitive reverse bidding that saw tariffs plummet from INR 6.47/Kwh in 2013-14 to a record low of INR 1.99/Kwh in December 2020. As of March 2021, 44 solar parks have been sanctioned in 15 states with a cumulative capacity of over 28.3 GW. India has created a market for over 37 GW of domestic cells and modules over the next 2 to 3 years.

SUSTAINABILITY

India's current installed solar capacity reduces annual CO_2 emissions by 55.86 million tonnes.

2030 AGENDA

The NSM is a critical element of India's energy transition.

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Image: iStock

4th
India's global rank for installed wind capacity

41.5%
Contribution of wind energy in India's renewable energy basket

183,500
Potential wind sector jobs for 60 GW capacity target

#RENEWABLEENERGY

The Wind Energy Revolution

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

THE PURPOSE

India has the fourth highest installed wind capacity in the world with 39.4 GW (May 2021), and a target of 60 GW by 2022. Wind energy constitutes 41.5 per cent of India's renewable energy basket.

India is also a leading global wind turbine manufacturer for sizes ranging from 225 KW to 3.6 MW, with proven technologies to harness low and medium wind flows at hub heights up to 140 m and rotor sizes up to 145 m. India also exports turbines and components to Australia, Brazil, Asia, Europe, and the US.

THE ROLLOUT

India's wind sector received an early impetus in the 1990s from the government's accelerated depreciation and captive power adjustment benefits, which attracted private investors and led to a rapid increase in capacity. Till 2017, India added capacity through the feed-in-tariff (FiT) mechanism, with fixed prices for power procured from grid-connected projects. In 2017, tariff-based competitive bidding (TBCB) was introduced to promote competitiveness and transparency.

In 2015, the Union Government notified the *National Offshore Wind Energy Policy*. The first Light Detection and Ranging (LiDAR) equipment was commissioned in November 2017 for offshore wind resource assessment, including soil and sub-sea geophysical surveys of 365 sq km (required for a 1 GW project) in the Gulf of Khambhat, off the coast of Gujarat.

Single location solar-wind hybrid projects are being set up to optimise land use and manage the inherent intermittency of renewable power. India's first large scale solar-wind project, located at Kavithal in Karnataka, combines a 50 MW wind farm and a 28 MW solar PV plant.

MILESTONES

The first tariff-based competitive bidding (TBCB) auction in February 2017 led to a 16.8 per cent tariff reduction from FiT of INR 4.16/unit to INR 3.46/unit, before achieving a record low of INR 2.43/unit in December 2017. The turbine manufacturing industry also has strong potential, with 14 international manufacturers making 36 models with a capacity of over 9,500 MW per annum.

Image: Regen Power

JOBS

The wind sector is likely to generate 183,500 jobs against the targeted 60 GW capacity.

GROWTH

Achieving the 60 GW wind capacity target will require capital investment of about USD 120 billion and equity infusion of USD 40 billion. Financial incentives include customs duty exemptions on select components and the waiver of inter-state transmission charges and losses for projects commissioned by June 2023. Non-fiscal incentives include technical support, including resource assessment and site identification, by the National Institute of Wind Energy (NIWE).

SUSTAINABILITY

Wind energy generation is self-sufficient. It does not produce CO_2 emissions and does not consume water during operation. Wind farms can be set up reasonably quickly and the land can simultaneously be used for farming – a major benefit that supports rural employment and contributes to farmer incomes.

2030 AGENDA

The NIWE estimates India's gross wind power potential to be 695 GW at a hub height of 120 m, with about 97 per cent coming from Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, and Telangana. India is also set to tap into its 70 GW offshore wind potential. Small wind turbine systems could provide distributed renewable energy (DRE)-based power through mini- and micro-grids in low-wind rural areas and complex terrains.

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Image: ReGen Powertech

5th
India's global rank for hydropower production (large and small hydro)

4.79 GW
India's installed SHP capacity, with a target of 5 GW by 2022

21.3 GW
India's SHP potential from 7,133 sites

#RENEWABLEENERGY

Hydro Power

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

THE PURPOSE

India is the fifth largest hydropower producer in the world with an installed capacity of 46.2 GW as of February 2021. Hydropower contributes 12.2 per cent of India's total installed electricity capacity and is classified into large and small hydro power (SHP). SHP plants have capacities of 25 MW or less, and include mini (101 kW–2 MW) and micro (100 kW or less) plants. They are ideal for powering villages and remote areas.

In 2015, India set a target of 5 GW SHP capacity as part of its 175 GW renewable energy target. It has achieved 4.79 GW as of March 2021. In 2019, large hydropower was designated as renewable energy. The Ministry of Power manages large hydropower while the Ministry of New and Renewable Energy (MNRE) oversees SHP.

THE ROLLOUT

In July 2016, IIT Roorkee's Alternate Hydro Energy Centre (AHEC) estimated India's SHP potential to be 21.3 GW from 7,133 sites. About half of this potential is based in the hilly states of Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, and Uttarakhand.

The MNRE has taken several steps to develop SHP in a planned manner, with close engagement with states to review policies, monitor projects, and generate private sector investment for commercial projects through financial and non-financial incentives, including state government subsidies.

MILESTONES

While SHP capacity has risen in recent years, most of the estimated 21.3 GW potential remains untapped. As of 2020, the cost of installing a solar plant—about INR 4 crore/MW, compared to almost INR 12 crore/MW for SHP—and the relative ease and speed of solar mini-grid installation, have led to solar being the preferred clean energy alternative over SHP in viable areas.

JOBS

SHP plants do not directly employ many people, but providing electricity access to remote villages through SHP could power distributed renewable energy (DRE)-based livelihood appliances and small-scale industries, helping integrate these communities into the economic mainstream.

GROWTH

The Council on Energy, Environment and Water (CEEW) estimates a USD 50 billion market for DRE-powered livelihood generation appliances in India; a part of this could be driven by SHP-based electricity.

SUSTAINABILITY

Canal-based and run-of-the-river SHP plants use running water to drive turbines, with small barrages and no storage. SHP plants are clean and sustainable, and do not have the major issues associated with large hydropower projects, such as displacement of local populations or deforestation.

2030 AGENDA

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. The MNRE is encouraging State Nodal Agencies and local organisations (such as the Water Mills Associations, registered NGOs, and village energy cooperatives) to adopt new and efficient water mills for power generation, and to set up micro-hydel projects for remote village electrification.

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Image: iStock

Image: Indian Oil

10 GW
India's 2022 bioenergy capacity target, achieved in 2020

5,000
CBG plants to be installed by 2024 via the *SATAT* scheme

INR 100,000 crore (USD 13.8 billion)
Potential reduction in India's annual fuel import bill by using biofuels

#RENEWABLEENERGY

National Biofuels Policy and SATAT

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

THE PURPOSE

India has many incentives for developing avenues to convert biomass into energy as liquid fuels, gas, and electricity. Biomass-based fuels and energy can reduce fossil fuel imports, improve farmer incomes, generate varied employment opportunities, and feed circular economies of waste to energy.

India's 2015 commitment of 10 GW bioenergy capacity by 2022—part of its broader goal to install 175 GW renewable energy capacity—was achieved in 2020, mainly from bagasse-based and captive co-generation, under the aegis of the Ministry of New and Renewable Energy (MNRE).

The *National Policy on Biofuels* 2018 also improves upon the 2009 edition in terms of policy, range of technologies, and progressive market mechanisms; and encourages the use of domestic feedstock to produce biofuels. India has targeted 20 per cent ethanol blending in petrol (E20) by 2025, and 5 per cent biodiesel blending by 2030.

The *Sustainable Alternative Towards Affordable Transportation (SATAT)* scheme was launched in 2018 by the Ministry of Petroleum and Natural Gas (MoPNG) to promote compressed biogas (CBG) as a green transport fuel. *SATAT* aims to set up 5,000 CBG plants by 2024 at an investment of about INR 175,000 crore (USD 24.15 billion) to produce 15 million metric tonnes per annum (MMTPA) of CBG. The scheme offers assured price offtake by public sector Oil Marketing Companies (OMCs) for ten years.

THE ROLLOUT

The MNRE, MoPNG, and state governments have multi-pronged approaches to roll out various bioenergy programmes. The MNRE provides financial support for CBG projects, while the INR 1,969.5 crore (USD 280 million) *Pradhan Mantri JI-VAN (Jaiv Indhan-Vatavaran Anukool Fasal Awashesh Nivaran) Yojana* provides financial support to bioethanol projects using lignocellulosic biomass. In January 2020, sugar mills were allowed cheaper loans to invest in ethanol-blending factories.

MILESTONES

As of June 2021, ethanol blending has reached ~8.5 per cent, up from 1.5 per cent in 2014. India is on track to achieve 10 per cent blending by 2022. Ethanol purchases have increased from ~380 million litres in 2013-14 to 3.2 billion litres per year. As of May 2021, 1,900 CBG plants are in development. The installed power capacity and fuel generation from urban, industrial, and agricultural waste was 168.64 MW (grid-connected) and 204.73 MW-eq (off-grid) in January 2021.

Image: iStock

JOBS

The CBG and biofuels value chains are expected to create 75,000 direct job opportunities and millions of indirect jobs in the farm, post-farm, micro, small and medium enterprises (MSME), and commercial sectors by 2024.

GROWTH

Biofuels could reduce India's annual fuel import bill by INR 100,000 crore (USD 13.8 billion). CBG is included in Priority Sector Lending and nationalised banks such as the State Bank of India, Bank of Baroda and Canara Bank have loan products for CBG projects. Multilateral Financial Institutions are encouraged to support the sector.

SUSTAINABILITY

Converting agri-residue into bioenergy reduces stubble burning. Each year, 275 million tonnes of agricultural, industrial and municipal solid waste could be used to produce CBG and ethanol with co-benefits for air quality. Fermented Organic Manure, a co-product of CBG, could drive an ecosystem for organic farming and sustainable agriculture.

2030 AGENDA

The *National Policy on Biofuels* is an element of the Union Government's five-point strategy to curb India's oil and gas imports. Advanced biofuels produced using non-food, organic, industrial, and municipal solid waste offer new feedstock avenues.

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Image: PRESPL

Illustrative image: iStock

Upto 100%

MNRE's financial support for mission-mode hydrogen research, design, and development (RD&D) projects of academic institutions

50

Hydrogen-CNG (H-CNG) hybrid buses plying in New Delhi as a public transportation pilot

#RENEWABLEENERGY

National Hydrogen Energy Mission (NHEM)

Exploring the commercial viability of a versatile clean fuel

THE PURPOSE

India has jump-started the development of its hydrogen ecosystem by announcing the *National Hydrogen Energy Mission* (NHEM) in the Union Budget 2021. The aim is to make India a global manufacturing hub for hydrogen and fuel cell technologies across the value chain.

Hydrogen can serve as a transport fuel, an input to refineries, and as a source of heat and power for a wide range of sectors such as chemicals, iron and steel, fertilisers, and petroleum. This versatility, combined with a low-carbon footprint, makes hydrogen a strategic choice for India's energy mix. It can be stored and transported in pressurised and liquefied form, and can be used for power-to-gas, power-to-power, power-to-mobility, and vehicle-to-grid applications.

THE ROLLOUT

India's foray into hydrogen technologies began in 2005 with the *National Hydrogen Energy Roadmap*. The Ministry of New and Renewable Energy (MNRE) supports mission-mode hydrogen research, design, and development (RD&D) projects with up to 100 per cent funding for academic institutions and up to 50 per cent for industry. Several technologies have been developed and demonstrated under these projects. Downstream, the Ministry of Petroleum and Natural Gas (MoPNG) is set to augment India's hydrogen supply chain infrastructure and business models.

MILESTONES

The NHEM is expected to propose a short-term (4-year) specific strategy, and principles for a long-term (10 years and beyond) roadmap, in 2021-22.

Illustrative image: iStock

JOBS

Hydrogen is an emerging sector and is expected to be a major contributor to the green jobs sector once operations reach commercial viability.

GROWTH

The NHEM aims to enable cost-competitive green hydrogen production, storage, distribution, and application technologies; develop large-scale, globally competitive manufacturing expertise; and set regulations for safety, performance and quality standards.

SUSTAINABILITY

Hydrogen as an energy carrier will help integrate renewable energy in transportation and in energy-intensive, hard-to-abate sectors such as fertilisers, chemicals, petrochemicals, and iron and steel.

2030 AGENDA

Hydrogen would align well with the government's efforts to promote compressed biogas (CBG) under the *SATAT* scheme, and with the expansion of the gas-based economy, which envisages a 15 per cent share of natural gas in the energy mix by 2030.

Pilot projects of green hydrogen (produced using renewable energy) and grey hydrogen (derived from natural gas) are underway, along with test runs of 50 hydrogen-CNG (H-CNG) hybrid buses in New Delhi, and a planned extension of domestic cooking applications.

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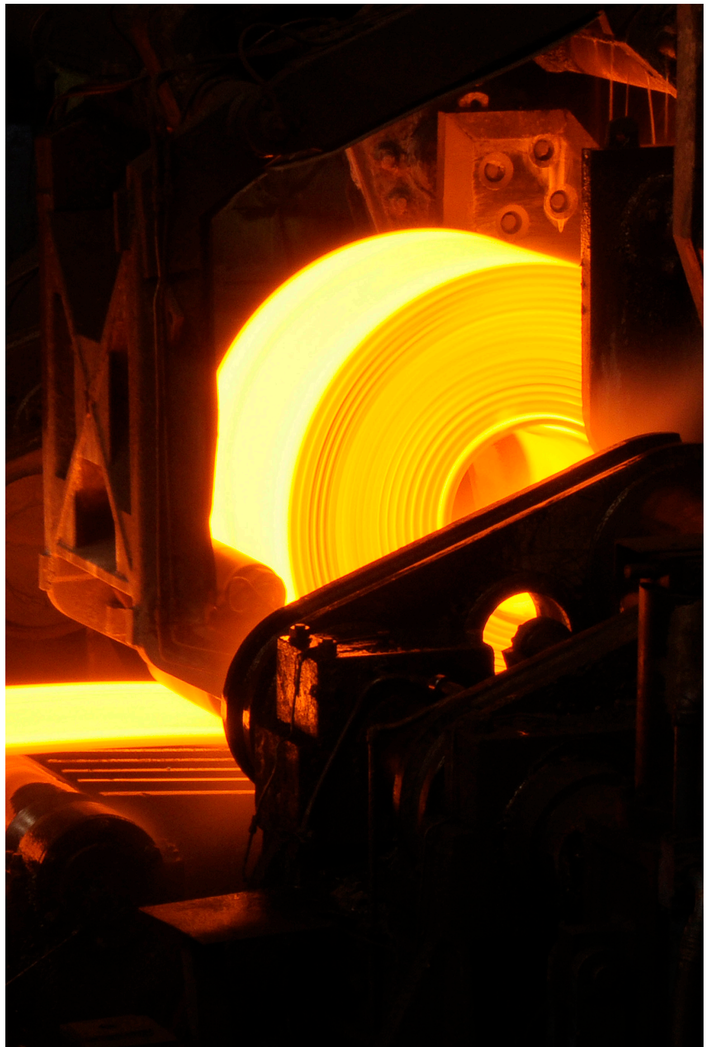

Image: iStock

Image: Vikram Solar

INR 197,000 crore (USD 27 billion)

Union Budget 2021 outlay for PLI schemes over the next five years

INR 17,200 crore (USD 2.36 billion)

Investment in projects and materials for additional 10,000 MW of integrated solar PV manufacturing plants

30,000 & 120,000

Expected direct and indirect job creation in the solar module sector

#RENEWABLEENERGY

Production-Linked Incentive (PLI) Scheme

Integrating India into the global clean energy value chains

THE PURPOSE

The Union Cabinet approved the *Production-Linked Incentive (PLI) Scheme* in November 2020 for ten key sectors, ranging from high-efficiency solar PV modules to white goods such as air conditioners and LED, speciality steel, and pharmaceuticals. The scheme will provide funding over five years to improve India's manufacturing capabilities, attract investment in core competency areas and cutting-edge technologies, drive efficiencies and economies of scale, promote competitive exports, and make India an integral part of the global clean energy value chain.

THE ROLLOUT

The Union Budget 2021 includes an outlay of INR 197,000 crore (USD 26.99 billion) for the *PLI scheme*, spread over five years. The consequent minimum production is expected to exceed INR 36.5 trillion (USD 500 billion).

The *PLI scheme* for high-efficiency solar modules is being implemented by the MNRE via the Indian Renewable Energy Development Agency (IREDA), and the allocation of INR 4,500 crore (USD 0.62 billion) aims to drive gigawatt-scale production. Beneficiaries will be selected by a transparent bidding process, and will receive a maximum incentive for 2 GW annual production capacity or half the planned output of their facility – whichever is lower. PLI funds will be paid as per actual production and sales of modules. They will also depend on local value addition.

MILESTONES

The PLI scheme is in the process of being rolled out countrywide.

Illustrative image: iStock

JOBS

About 30,000 direct and 120,000 indirect jobs are expected to be created in the solar modules sector.

GROWTH

The PLI scheme will incentivise domestic and global players to build large scale capacity in India. Expected outcomes include an additional 10,000 MW of integrated solar PV manufacturing capacity; direct investment of about INR 17,200 crore (USD 2.36 billion) in projects and in materials such as solar glass, back-sheets, and junction boxes; and annual import substitution of INR 17,500 crore (USD 2.39 billion).

SUSTAINABILITY

The PLI scheme feeds into India's plans to install 450 GW renewable energy capacity by 2030.

2030 AGENDA

India's solar capacity addition depends largely on imported solar PV cells and modules. This poses strategic risks in supply chain resilience and security. Given India's commitment to generate 40 per cent of its electricity from non-fossil fuel sources by 2030, the PLI scheme, in conjunction with other measures, will help reduce import dependence in this strategic sector.

It would also improve India's clean energy ecosystem with the advent of new types of industries, entry of small and medium enterprises and ancillary units, investments in R&D, process improvements to achieve higher module efficiencies, and sourcing of materials from the domestic market.

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Image: iStock

Image: iStock

INR 19,081 crore (USD 2.63 billion)

Cost savings per year through *UJALA* as of May 2021

47, 701 million kWh

Annual energy savings through UJALA as of May 2021

38.6 MTco2e

India's annual emission reduction through UJALA

#ENERGYEFFICIENCY

Unnat Jyoti by Affordable LEDs for All (UJALA)

Bringing affordable, energy-efficient lighting and appliances to citizens

THE PURPOSE

***UJALA* is the world's largest domestic lighting programme.** The *UJALA* scheme and the accompanying LED *Street Lighting National Programme* (SLNP) were launched in 2015 to address India's high cost of electrification and high emissions from inefficient lighting. The government's objectives were to promote efficient lighting; enhance awareness of efficient, cost-saving equipment; and preserve the environment. The SLNP aimed to replace 13.4 million conventional streetlights with energy-efficient LED lights across India by March 2020.

Both *UJALA* and SLNP are implemented by Energy Efficiency Services Ltd (EESL), a joint venture company of PSUs under the Ministry of Power.

THE ROLLOUT

***UJALA* was implemented as a phase-wise distribution of affordable LED bulbs and energy-efficient appliances.** Under the scheme, every grid-connected consumer with a metered connection is eligible to receive LED bulbs at around 40 per cent of the market price.

MILESTONES

The domestic LED market has grown significantly. The industry has sold over 1.15 billion LEDs, far exceeding *UJALA's* target of 700 million LED units. The number of LED streetlights doubled from 4.9 million in March 2018 to 10 million in October 2019. Over 7.2 million LED tube lights and 2.3 million energy-efficient fans have been distributed at affordable prices under the *UJALA* scheme.

Image: Emotivelens

GROWTH

As of May 2021, as many as 367.3 million LEDs have been distributed across India through *UJALA*, resulting in annual energy savings of 47, 701 million kWh and consequent cost savings of INR 19,081 crore (USD 2.63 billion). As of February 2021, 11.4 million LED streetlights have been installed across India under the SLNP, leading to estimated energy savings of around 8,100 million kWh per year and consequent annual cost savings of INR 4,860 crore (USD 0.66 billion) in municipalities' electricity bills.

SUSTAINABILITY

India has avoided peak demand of 9,545 MW and reduced emissions by 38.6 $MTCO_2e$ per year through *UJALA*. It has avoided peak demand of 1,350 MW and reduced estimated GHG emissions by 5.50 $MTCO_2e$ per year under the SNLP.

The EESL has started an innovative *GRAM UJALA Programme* through its wholly owned subsidiary Convergence Energy Services Limited (CESL). Under this scheme, it is distributing LED bulbs at an affordable price of INR 10 (0.13 USD) per bulb in rural areas.

2030 AGENDA

India's strong emphasis on the deployment of affordable, energy-efficient appliances has caused a paradigm shift in energy access, the energy transition, and savings for the public. **The EESL intends to invest around INR 80 billion (USD 1.074 billion) by 2024 to cover rural India and retrofit/install over 30 million LED streetlights.**

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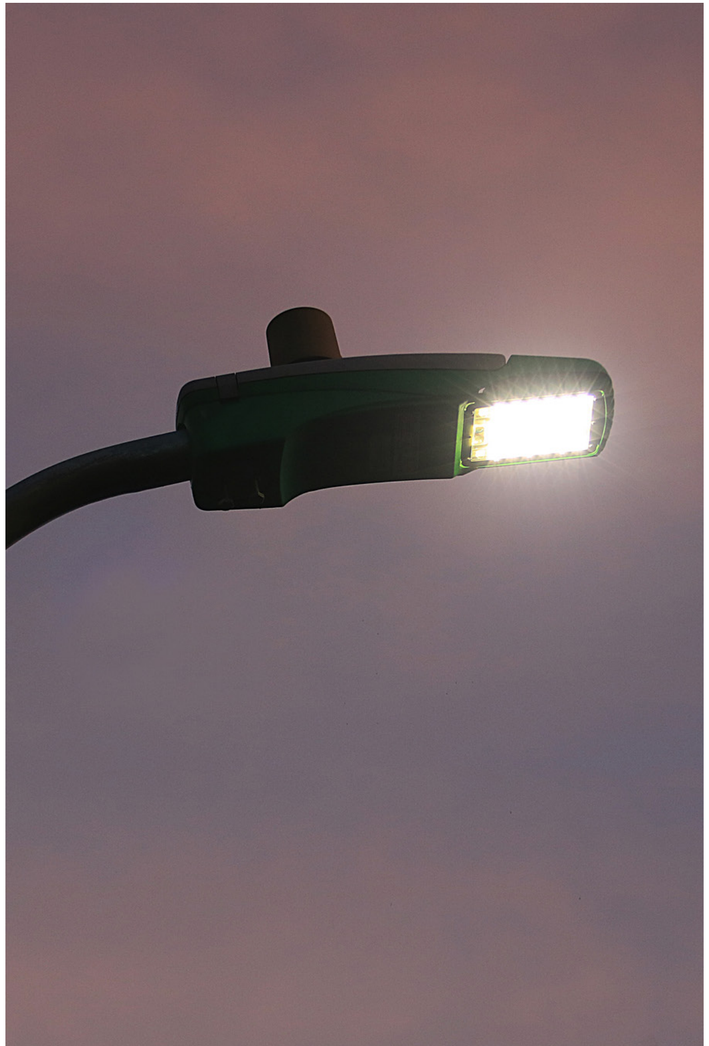

Image: iStock

Image: Emotivelens

#ENERGYEFFICIENCY

Standards and Labelling (SnL)

Transforming markets towards energy efficient products

THE PURPOSE

The *Standards & Labelling (SnL)* programme, launched in 2006, aims to inform consumers about the energy and cost savings potential of adopting energy-efficient products available in the market. The programme targets display of energy performance labels (or 'Star labels') on select appliances and equipment, and lays down minimum energy performance standards.

Complementing the SnL programme, the Government of India launched the *Unnat Jyoti by Affordable LED for All (UJALA)* scheme in 2015 to bring down the market price of LED lighting fixtures and promote its nationwide adoption.

THE ROLLOUT

The Bureau of Energy Efficiency (BEE), established in 2002 under the Ministry of Power, is the implementing agency for this programme. **BEE routinely upgrades energy performance standards of appliances/ equipment falling within the purview of the programme. This nudges the market towards higher energy efficiency.**

MILESTONES

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.

JOBS

The programme has spurred investments in the manufacturing of energy-efficient products and appliances. This, in turn, has created high value jobs.

GROWTH

During the financial year 2020-21, the use of energy efficient equipment led to savings of 56 billion kWh, worth over INR 30,000 crore (USD 4.1 billion).

SUSTAINABILITY

Use of energy efficient appliances/ equipment under the programme has helped save about 46 million tonnes of CO2 every year.

2030 AGENDA

The *SnL* programme is set to bring more appliances such as ceiling fans, desert coolers, and induction cookstoves into its purview. The programme has been a strong enabler of SDG-7 (clean and affordable energy), SDG 11 (Sustainable cities and communities), SDG 12 (Sustainable consumption and production), and SDG 7 (climate action).

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Image: Shalu Agrawal/CEEW

Image: iStock

80 million

BPL households provided with LPG connections under revised *PMUY* targets in September 2019

289.5 million

Total LPG consumers in India as of April 2021, representing national LPG coverage of 99.8%

INR 5,000 crore (USD 695 million)

Government savings in LPG subsides since the launch of the *Give it Up* campaign

#CLEANCOOKING

Pradhan Mantri Ujjwala Yojana (PMUY)

Delivering LPG to households for *Swacch Indhan, Behtar Jeevan* (Clean Fuel, Better Life)

THE PURPOSE

The *Pradhan Mantri Ujjwala Yojana* (PMUY) was launched in 2016 as an ambitious, centrally funded welfare scheme to provide below poverty line (BPL) households with clean cooking energy. Within this scheme, the Union Government provides eligible households financial assistance to meet the upfront cost of liquified petroleum gas (LPG) connections. The aim is to reduce respiratory disorders caused by indoor air pollution from biomass-based cooking, lessen drudgery, and bring qualitative improvements in living standards.

The Union Government's *Give It Up* campaign supported the *PMUY*, and led to more than 10 million upper and middle-income households voluntarily giving up cooking gas subsidies for the benefit of poor households. Another scheme, *Pratyaksh Hanstantrit Labh* (PAHAL), uses the Direct Benefit Transfer (DBT) mechanism to transfer gas subsidies directly to consumers' accounts, plugging leaks in the LPG subsidy delivery system.

THE ROLLOUT

***PMUY* is implemented by the Ministry of Petroleum and Natural Gas (MoPNG) through its Oil Marketing Companies (OMCs) IOCL, BPCL and HPCL, and their distributor network.** States and Union Territories were consulted to identify eligible families. The government spends INR 1,600 (USD 22) per connection, which is distributed to the women of the households. Most PMUY beneficiaries also availed an optional interest-free loan facility to buy a hotplate and one LPG refill.

MILESTONES

***PMUY's* initial target to provide 50 million connections was achieved in 2018, in a record time of 28 months. The revised target of 80 million households [with budgetary allocation increasing from INR 8,000 crore (USD 1.07 billion) to INR 12,800 crore (USD 1.72 billion)], was achieved by September 2019. In 2021, the Union Government decided to provide 10 million more *PMUY* connections.**

***PMUY* can be credited as the single largest contributor to the rise in national LPG coverage from 62 per cent in April 2016 to 99.8 per cent (with a total of 289.5 million LPG consumers) in April 2021.**

JOBS

PMUY implementation has created thousands of new direct and indirect jobs through more than 7,300 new LPG distribution centres, manufacturing of cylinders, hotplates and hosepipes, and other allied activities.

GROWTH

***PMUY* is expected to generate business opportunities worth at least INR 10,000 crore (USD 1.37 billion)**. It has boosted the *Make in India* campaign for the domestic manufacturing of cylinders, gas stoves, regulators, and hoses. **Further, the government has saved more than INR 5,000 crore (USD 695 million) in LPG subsidies since the launch of the *Give It Up* campaign**. These funds have been used to provide *PMUY* connections and LPG subsidies to poor households.

SUSTAINABILITY

Nearly 99.5 per cent of *PMUY* consumers returned for a second refill, while over 75 per cent took three or more refills in FY 2020-21. **The World Health Organisation has recognised *PMUY* as a decisive intervention to address indoor air pollution**.

2030 AGENDA

The Government of India will focus on sustaining the adoption of clean cooking energy, especially among BPL households. Targetted efforts will be made to support behavioural change, strengthen supply chains, and adopt innovative ways to increase refills. *PMUY* is an enabler of SDG 3 (good health and well-being) and SDG 7 (affordable and clean energy).

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Image: iStock

Image: iStock

25,750 MW

Solar capacity to be installed via *PM-KUSUM* scheme by 2022

631,000

Potential employment opportunity in jobs-years for skilled and unskilled workers through *PM-KUSUM* scheme

1.4 billion

Litres of diesel being saved per annum by using solar-powered irrigation pumps

#SUSTAINABLEAGRICULTURE

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

Solarising irrigation, preserving groundwater, and enhancing farmer incomes

THE PURPOSE

The *PM-KUSUM* scheme, launched in 2019, has three key objectives – to install 10,000 MW decentralised, grid-connected renewable power plants on barren land through individual farmers, panchayats, and cooperative groups; to add 1.75 million solar agricultural (agri) pumps to replace diesel pumps and irrigation systems in off-grid areas; and to solarise 1 million grid-connected agri-pumps for irrigation and sell the excess power to utilities, thereby enhancing farmer incomes. **The scheme aims to add 25,750 MW solar capacity by 2022.**

THE ROLLOUT

The Union Budget 2020-21 expanded *PM-KUSUM's* scope to provide financial aid to solarise an additional 1.5 million grid-connected agri-pumps and help 2 million farmers install standalone solar pumps. With the expansion, the scheme aims to add 30,813 MW solar capacity by 2022. In December 2020, a new variant of feeder level solarisation was included in *PM-KUSUM* to supply solar power to feeders providing electricity to pumps.

MILESTONES

The PM-KUSUM scheme is helping expand renewables-based power for agricultural use in rural India. This not only ensures reliable daytime power but also promotes clean energy security for the agri-sector.

Image: iStock

JOBS

Besides self-employment for the millions of farmers, *PM-KUSUM* is expected to create an employment opportunity equivalent to 631,000 job-years for skilled and unskilled workers.

GROWTH

Over 41,000 solar agri-pumps have been installed as of 31 May 2021. To support domestic value chains, the scheme mandates the use of indigenously manufactured solar cells and modules for the standalone and grid-connected pumps. Over time, the scheme will help lower the electricity subsidy burden of state governments and utilities.

SUSTAINABILITY

De-dieselising agri-pumps is already saving 1.4 billion litres of diesel annually, plus associated savings in foreign exchange for the import of crude. It has also reduced emissions by 32 MTCO$_2$ per year.

2030 AGENDA

The *PM-KUSUM* scheme will contribute to the achievement of India's Nationally Determined Contributions (NDCs) of a 40 per cent non-fossil-fuel share in power generation and a 33-35 per cent reduction in emissions intensity by 2030. It supports the UN Sustainable Development Goal 7 by providing affordable energy access to India's agricultural sector, which employs around 48 per cent of India's population.

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Image: iStock

Image: iStock

1073

PAT scheme Designated Consumers (DCs) across 13 sectors upto March 2020

INR 1 billion (~USD 13.8 million)

Energy Saving Certificates traded in PAT I

26 Mtoe and 70 MTCO2e

Projected energy savings and emissions reduction through PAT cycles by 2023

#INDUSTRIALDECARBONISATION

Perform, Achieve and Trade (PAT)

Enhancing energy efficiency and curtailing emissions of hard-to-abate industrial sectors

THE PURPOSE

The PAT scheme is a multi-cycle flagship programme of the Bureau of Energy Efficiency (BEE). The programme was launched in 2008 by the Government of India under the *National Mission for Enhanced Energy Efficiency* (NMEEE). PAT is a market-based compliance mechanism aimed at accelerating energy efficiency improvements in energy-intensive industries. The energy savings by notified industries are converted into tradable instruments called Energy Saving Certificates (ESCerts) issued by the Ministry of Power and traded at power exchanges.

THE ROLLOUT

The PAT scheme operates in cycles of 3 years. The first cycle, PAT I, ran from 2012-13 to 2014-15. PAT II ran from 2016 to 2018, PAT III from 2017 to 2019 and PAT IV from 2018 to 2020. PAT V is underway from 2019-20 to 2021, and the upcoming cycle, PAT VI is set from 2020 to 2023.

MILESTONES

The BEE has rolled out six PAT cycles till March 2020, covering 1,073 Designated Consumers (DCs) across 13 energy-intensive sectors.

JOBS

PAT I engaged 5000+ engineers and operators and 13,718 energy operators and auditors. These may not have necessarily created new jobs. PAT II engaged 12,000 engineers and operators and 17,000 energy operators and auditors.

GROWTH

PAT I targeted 478 plants across eight sectors (aluminium, cement, iron and steel, fertilisers, chlor-alkali, paper and pulp, textiles, and thermal power plants) and saved 8.67 million tonnes of oil equivalent (Mtoe) energy, exceeding the target by about 30 per cent, and reducing 31 MTCO2e emissions. **Nearly 1.2 million ESCerts worth around INR 1 billion (~USD 13.8 million) were traded**.

PAT II added railways, refineries, and power distribution companies to the eight PAT I sectors. **It led to energy savings of almost 12.28 Mtoe (~1.46 per cent of India's total energy consumption) and reduced emissions by around 2.5 per cent, saving INR 31,455 crore (USD 4.34 billion)**.

PAT III targeted 1.06 Mtoe energy consumption reduction from 116 DCs in six sectors: thermal power plants, cement, aluminium, pulp and paper, iron and steel, and textiles; initial assessments indicate energy savings of around 1.428 Mtoe. PAT IV has targeted 0.6998 Mtoe energy savings from 109 DCs in eight sectors, with petrochemicals and buildings being the additions.

SUSTAINABILITY

The industrial emissions reduction via the PAT scheme is a critical element of India achieving its Nationally Determined Contribution (NDC) of reducing emissions intensity by 33-35 percent over 2005 levels by 2030.

2030 AGENDA

The PAT cycles are projected to deliver ~26 Mtoe energy savings and reduce about 70 MTCO2e emissions by March 2023. They are a major mechanism to decarbonise hard-to-abate industrial sectors.

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Image: iStock

105 million

Estimated litres of fuel saved under FAME I and II as of May 2021

102 million

Projected EVs—commercial and private cars, buses, and two/three-wheelers—in India by 2030

3.5 million

Employment potential across India's EV ecosystem, covering EV production and infrastructure, batteries, sales, and services

#SUSTAINABLETRANSPORT

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

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

THE PURPOSE

The FAME schemes I (2015) and II (2019) aim to accelerate the electrification of vehicles and promote eco-friendly transportation. FAME I was launched in 2015 under the National Electric Mobility Mission Plan 2020 to drive the adoption of reliable, affordable, and efficient electric and hybrid vehicles (xEV).

FAME II succeeded FAME I in 2019, focusing on electric public and shared mobility, deploying charging stations, and incentivising purchases of electric and hybrid buses, passenger cars and two-/three-wheelers. FAME is implemented by the Union Government's Ministry of Heavy Industries and Public Enterprises.

THE ROLLOUT

FAME uses the Demand Incentive Disbursement Mechanism framework for various categories of vehicles and chargers. FAME I had an outlay of INR 895 crore (USD 125 million), including upfront incentives for EVs, and purchases of chargers.

FAME II has a budget of INR 10,000 crore (USD 1.4 billion) for a three-year period from April 2019. It aims to subsidise 7,090 e-buses, 55,000 e-cars, 1 million e-two-wheelers and 500,000 e-three-wheelers. An additional INR 1,000 crore (USD 0.14 billion) has been earmarked for the public and private sector to install charging stations.

MILESTONES

As of May 2021, incentives have been given for 355,000 e-vehicles, and 6,690 buses and 3,397 charging stations have been sanctioned under FAME.

JOBS

India is creating a specialised, skilled workforce to support its electric mobility mission, with the aim to create 3.5 million jobs in design and testing, battery manufacturing and management, sales and services, and EV infrastructure.

GROWTH

A 2019 report by NITI Aayog and the Rocky Mountain Institute envisions EV penetration of 70 per cent for commercial cars, 30 per cent for private cars, 40 per cent for buses, and 80 per cent for two-wheelers and three-wheelers by 2030. The CEEW Centre for Energy Finance (CEEW-CEF) estimates this to translate into 102 million EVs by 2030, needing 2.9 million public chargers.

CEEW-CEF projects EV sales to offer an investment opportunity of INR 13,46,300 crore (USD 192.2 billion) across vehicle production, charging infrastructure, and battery manufacturing, and a USD 206 billion market opportunity from end-consumers that can drive India's post-COVID economic recovery by generating jobs and financial gains across its value chains in existing industries and emerging sectors.

SUSTAINABILITY

As of May 2021, FAME I and II are estimated to have saved about 105 million litres of fuel and reduced about 250 million kg of CO_2. FAME II also encourages the integration of renewable energy sources with charging infrastructure.

2030 AGENDA

E-mobility is one of India's key strategies to decarbonise the transport sector and reduce urban pollution. FAME II encourages manufacturers to invest in developing EVs and related components, such as batteries and electric motors. The Union Government has asked states to frame their EV policies and provide fiscal and non-fiscal incentives to manufacturers and buyers.

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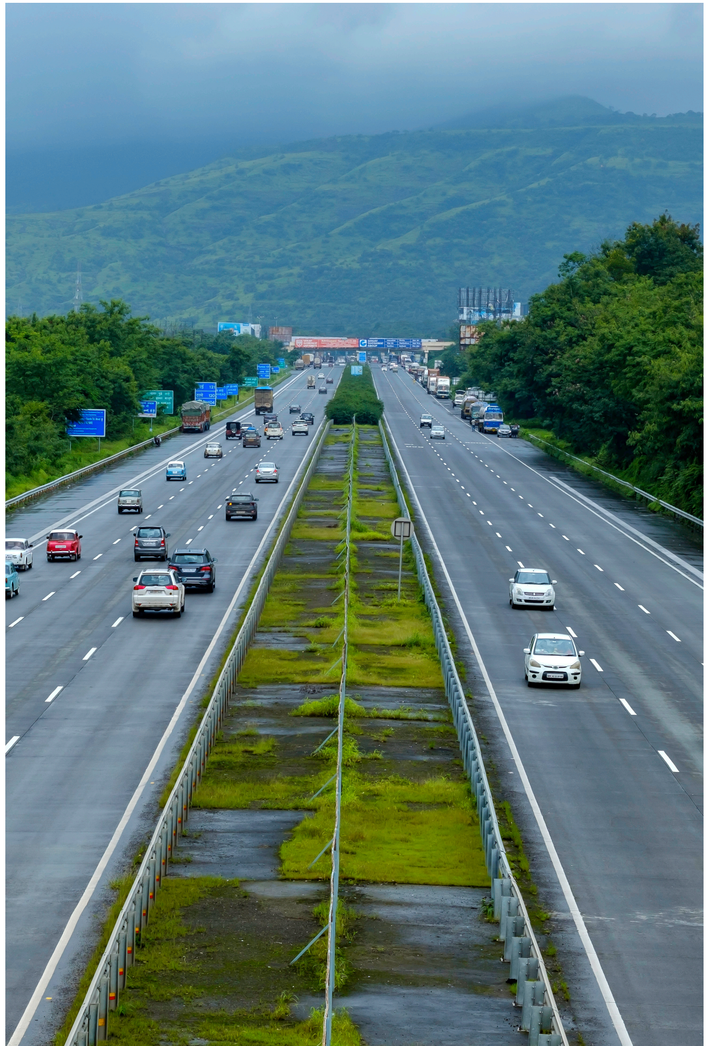

Image: iStock

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22.15 million

Daily passengers transported by Indian Railways from 7,325 stations in FY2019-20

~10x

Increase in the pace of electrification of the Indian Railways since 2014

INR 14,500 crore (USD 2.27 billion)

Projected annual savings from reduced diesel consumption due to electrification

#SUSTAINABLETRANSPORT

Indian Railways: Going Green

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

THE PURPOSE

The Indian Railways (IR) is among the world's largest rail networks, with 67,956 route kilometres, 13,169 passenger trains and 8,479 freight trains. It transported 22.15 million travellers and 3.32 million tonnes (MT) of freight daily from 7,325 stations in FY 2019-20. The Ministry of Railways has taken several major initiatives to achieve cost-effectiveness in daily operations and net zero carbon emissions by 2030. These include route electrification, green certifications for stations and installations, switching to renewable energy, and improving the energy efficiency of locomotives and operations.

THE ROLLOUT

As of May 2021, IR has electrified 45,881 route kilometres (RKM), equivalent to 71 per cent of the total 64,689 RKM of broad-gauge routes. By December 2023, it is set to become the first large rail network in the world to achieve 100 per cent electrification. Over 1,000 stations and 450 service buildings have rooftop solar plants. All stations, offices and residences have 100 per cent LED lighting. Thirty-nine workshops, seven production units, eight loco-sheds and one store depot are 'GreenCo'-certified.

MILESTONES

The Indian Railways' pace of electrification has increased by almost ten times since 2014.

JOBS

IR is one of India's largest employers and had over 1.25 million employees in 2020. Its efforts to modernise and expand the traction and non-traction operations in a sustainable manner holds immense potential to upskill existing employees and attract a new skilled and progressive workforce.

GROWTH

Electrification has reduced diesel consumption with potential annual savings of INR 14,500 crore (USD 2.27 billion).

SUSTAINABILITY

Railways are the most environment-friendly form of public transport, and transporting goods by rail freight also helps end-users reduce their carbon footprint. The installation of 258,906 bio-toilets has helped the IR prevent about 274,000 litres of human waste from falling onto the tracks daily. This has made coaches safer, saved maintenance costs, reduced daily water use by 5.4 million litres, removed foul odours, and restored the dignity of cleaning crews. **Automatic Coach Washing Plants at major depots are reducing water use by 96 per cent, saving 1.28 crore kilolitres annually.**

The 'Head-On-Generation' (HOG) technology to eliminate power cars will lead to fuel cost savings of INR 2,300 crore (USD 315 million) and reduce annual carbon footprint by 3,188,929 tonnes.

2030 AGENDA

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. It intends to use a portion of its vacant land, spread over 51,000 hectares, to install 20 GW of solar plants.

Through the *National Rail Plan 2030*, IR intends to increase freight share from 27 to 45 per cent, introduce double-stack container trains, finish building the entire 2,843 km of Dedicated Freight Corridors by June 2022, and integrate the rail network with other transport modes to develop a multi-modal transportation network that accelerates India's journey towards a low-carbon future.

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280 million

Domestic passengers handled by the Indian aviation sector annually (pre-COVID)

INR 15,000 crore (USD 2.05 billion)

India's annual civil Maintenance, Repair & Overhaul (MRO) expenditure

100%

Energy demand of Delhi and Bengaluru international airports met from renewables

#SUSTAINABLETRANSPORT

Sustainable Aviation

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

THE PURPOSE

India had the world's third-largest domestic aviation market before the COVID-19 restrictions came into force; it handled about 280 million passengers annually and was poised to become the third-largest global market by 2024. Less than 10 per cent of Indians travel by air, which presents the aviation sector with a massive opportunity to grow and propel socioeconomic growth. During this expansion, it is imperative to integrate cleaner fuels, energy efficiency, and ecosystem preservation with aircraft and airport operations to limit air, water, soil and noise pollution.

THE ROLLOUT

India has introduced many policy and technology-led initiatives to limit aviation emissions. 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). Since 2014, regular audits have been undertaken at airports to monitor and promote energy conservation.

MILESTONES

In August 2018, the private carrier SpiceJet used a 25 per cent biofuel-based blend of Sustainable Aviation Fuel (SAF) on a domestic flight. In January 2019, India's Centre for Military Airworthiness and Certification (CEMILAC) piloted SAF use across the Indian Air Force's AN-32 fleet.

JOBS/GROWTH

India's aviation sector grew at an annual rate of ~15 per cent between 2013–14 and 2018–19 (pre-COVID). The *Ude Desh ka Aam Nagrik (UDAN)* scheme, launched in 2016, envisages 100 new airports to improve air connectivity in remote areas. Over 6 million people have already flown within the *UDAN* scheme.

India's annual civil Maintenance, Repair & Overhaul (MRO) expenditure is around INR 15,000 crore (USD 2.05 billion). With several new policy initiatives, the MRO industry is expected to grow steadily.

SUSTAINABILITY

The AAI has implemented 64 Required Navigation Performance (RNP) approach procedures with global navigation satellite systems to enhance all-weather access to airports and reduce diversions, thus reducing avoidable fuel burn. Establishing 32 conditional routes and the FUA has cut annual CO_2 emissions by about 200,000 metric tonnes.

The Delhi and Bengaluru International airports meet 100 per cent energy demand from renewables. Mumbai International Airport has tripled its onsite renewable energy generation from 1,622 MWh in FY 2016-17 to 5,350 MWh in FY 2019-20. Total solar capacity at 51 AAI airports is about 45 MWp, with 16 MWp being installed. AAI aims to increase the solar capacity of its airports to 80 MWp by end-2022. **Cochin International Airport is India's first fully solar-powered airport. Installing solar at AAI airports has reduced CO2 emissions by 57,600 MT per annum**.

India follows the *Airport Council International's Airport Carbon Accreditation Programme* (ACI-ACAP) for carbon emissions. In 2016, Delhi Airport became the first in Asia-Pacific to achieve a *Level 3+, Neutrality* accreditation, and in 2020, secured the highest, *Level 4+, Transition*. Bengaluru, Mumbai, and Hyderabad airports have *Level 3+ accreditation*. Kolkata, Bhubaneswar, Trivandrum and Varanasi airports achieved Level 2 accreditation in December 2019.

In 2008, the Hyderabad airport became the first in Asia, and the second globally, to receive a LEED Silver green building rating. Subsequently, Delhi, Mumbai and Bengaluru airports have been rated *Gold* by LEED. Jammu, Chandigarh, and Tirupati airports have a 4-star *GRIHA* (Green Rating for Integrated Habitat Assessment) rating. In 2018, The Varanasi Airport was awarded the *National Energy Conservation Award* by the Ministry of Power.

The AAI is replacing conventional lighting with LED at 85 airports within the *UJALA* scheme; work is complete at 81, and in progress in the remaining four.

The AAI is providing water-efficient fixtures, sewage treatment plants (STPs), and rainwater harvesting systems at airports. Mumbai Airport has a 1.5 MT organic waste convertor that yields organic compost. The Delhi Airport has installed an STP of 16.6 million litres per day capacity. **By 2021, the Bengaluru Airport will achieve zero landfill through recycling, recovery and reuse. It also aims to become water-positive i.e., to produce more water than it consumes**.

2030 AGENDA

India is the fastest-growing domestic aviation market in the world and is expected to cater to 10 MT of freight traffic and 700 million passengers (domestic and international) by 2027. Indian carriers are projected to increase their fleet size to 1,200 aircraft by 2024. This growth must follow the tenets of streamlined transportation, green infrastructure, energy efficiency, and waste management. 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.

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400 million

India's urban population

INR 205,000 crore (USD 28 billion)

Funds allocated for the *Smart Cities Mission*

126

Cities participating in the *ClimateSMART Cities Assessment Framework* (CSCAF) 2.0

#CLIMATESMARTCITIES

Smart City Mission (SCM)

Developing sustainable and resilient urban habitats via 'smart solutions'

THE PURPOSE

India's population of 1.3 billion includes about 400 million urban residents. It is projected to have 1.6 billion people, including 800 million urban dwellers, by 2050. By 2030, at least seven megacities will likely have populations exceeding 10 million. **Two-thirds of the middle class will reside in urban areas, which will contribute close to 75 per cent of India's tax resources and 75 per cent of its overall GDP.**

This rapid urbanisation offers many advantages in terms of growth and prosperity, but is also perpetuating hazards such as environmental degradation, health concerns, and socioeconomic inequalities. Deteriorating air quality, for example, is a major challenge for city administrators, with 102 Indian cities — including 43 Smart Cities — facing poor to severe air quality. Nearly 60 per cent of India's rapidly increasing carbon emissions have urban origins, emanating from transport, industry, buildings, food, and waste.

The Ministry of Housing and Urban Affairs (MoHUA) has many programmes aligned with the Sustainable Development Goals (SDGs) to help make cities future-ready, and improve urban citizens' quality of life. These programmes focus on areas like water, wastewater and solid waste management, mobility, employment and livelihoods, affordable housing, and Smart City development.

THE ROLLOUT

The Union Government launched eight missions under the *National Action Plan on Climate Change* (NAPCC) in 2008, including the *National Mission on Sustainable Habitat* (NMSH), which envisaged cities building their readiness to tackle climate risks and pursue inclusive, equitable and sustainable development.

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).

In February 2019, the MoHUA launched the *ClimateSMART Cities Assessment Framework* (CSCAF) to mainstream climate action in cities. It was initially designed for 100 Smart Cities, but eventually rolled out in all cities with populations exceeding 500,000. The CSCAF is a first-of-its-kind public assessment framework with climate relevant parameters and serves as a tool for cities to assess their current situations and helps them adopt and implement green, sustainable, and resilient urban development practices. The framework has 28 indicators in five categories: Energy and Green Buildings; Urban Planning, Green Cover and Biodiversity; Mobility and Air Quality; Water Management; and Waste Management.

JOBS

The CSCAF has immense potential to create urban jobs, especially in the emerging areas of clean energy and sustainability, via the city improvement programmes. It is also leading to capacity building of city officials. For example, the city nodal officers were provided strategic support to help manage the COVID-19 pandemic. More than 1,000 city representatives were trained through 56 virtual city training workshops and theme-specific mentoring sessions.

GROWTH

As of June 2021, total allocated investments for the *Smart City Mission* stood at ~INR 205,018 crore (USD 28.3 billion), with 5,837 projects tendered. Work orders have been issued for 5,150 projects worth ~INR 150,000 crore (USD 20.5 billion) and 2,595 projects have been completed.

SUSTAINABILITY

As of June 2021, 101 smart water and 57 smart solar projects have been deployed in the cities, with another 185 smart water and 38 smart solar projects in the pipeline. The *Smart Cities Mission* has a strong focus on non-motorised transport and aims to improve walkability, cycling infrastructure and public transport. Sustainability, liveability and economic-ability are the three core principles of the mission.

MILESTONES

Phase I of the CSCAF set a baseline for 96 participating cities and informed them about their climate readiness over a six-month process in 2019. Twenty-seven national, state and city government departments, 300 officials, and other stakeholders provided inputs for 120 online data sets. Success stories, best practices, and advisories were made available on SmartNet for collaborative access. Phase II (CSCAF 2.0) was launched in September 2021 with several enhancements, to engage with 126 cities. The results of CSCAF 2.0 are being finalised.

2030 AGENDA

The *Smart Cities Mission* will help India achieve multiple SDGs.

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4

India's global ranking among the largest markets for green buildings

USD 300 billion

Estimated market potential for green building products and technologies by 2025

9 million

Potential skilled renewable energy and construction jobs created through green buildings by 2030

#CLIMATESMARTCITIES

The Green Buildings Market

Constructing resource-efficient, sustainable, and resilient buildings

THE PURPOSE

India is the fourth largest global market for green buildings and has an ambitious goal of having a 10 billion sq ft green building footprint by 2022. Of this, around 1.5 billion sq ft comes under India Green Building Council (IGBC) Green Homes. Nearly 1.4 million houses (totalling about 0.58 billion sq. m), have a 'green building' tag, but this constitutes only 5 per cent of all residential properties, underscoring the opportunities in this area.

India has over 1,400 LEED-certified (Leadership in Energy and Environmental Design) buildings, including schools, hospitals, offices, and residences. Maharashtra has the most LEED green buildings, followed by Karnataka, Haryana, Tamil Nadu, and Uttar Pradesh.

The *Green Rating for Integrated Habitat Assessment* (GRIHA) is an Indian rating system meant to promote and certify green buildings. As of June 2021, it has 2,109 projects covering 52.5 million sq. m. The Government has mandated all central government and PSU buildings to get at least 3-star ratings under GRIHA.

THE ROLLOUT

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. In 2018, the BEE introduced the *Eco Niwas Samhita* – a code for energy-efficient homes and a rating programme for homes. These and other progressive initiatives are shaping the future of green building infrastructure in India.

JOBS

Green buildings could create 9 million skilled jobs in the renewable and construction sectors by 2030.

GROWTH

The IGBC estimates a market potential of around INR 22.2 lakh crore (USD 300 billion) by 2025 for green building products and technologies. Several state governments are offering additional Floor Area Ratio (FAR) ranging from 5 to 15 per cent for IGBC silver, gold and platinum-rated projects.

SUSTAINABILITY

Energy use by buildings accounts for over 40 per cent of India's total consumption and is increasing by 8 per cent annually. If conventional, inefficient building practices persist, buildings would account for over 70 per cent of emissions by 2050. The BEE has targeted a 50 per cent reduction in energy consumption by 2030 via the ECBC for commercial buildings in states. The construction cost of green buildings is nominally higher than that of regular ones and easy to recoup through resource savings, such as 30-40 per cent less water and energy consumption.

2030 AGENDA

The International Finance Corporation estimates that about 70 per cent of the buildings that will exist in India in 2030 are yet to be built. Strategies to make them green buildings will help increase natural resource efficiency, decrease carbon emissions, address density challenges, and promote health and wellness.

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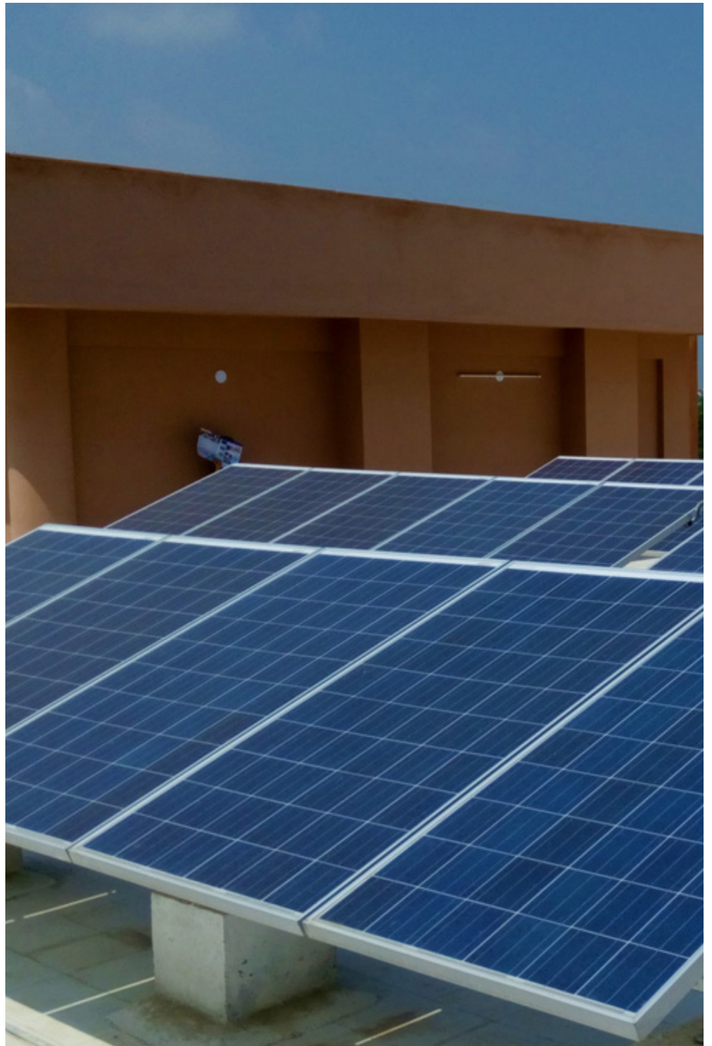

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71%

Proportion of India's population covered by the 9th and 10th CGD bidding rounds, covering 53 per cent of its geographical area

78,64,529

India's domestic, commercial industrial PNG connections as of 31 March 2021

USD 60 billion

India's pledged investment to create gas infrastructure (including pipelines, LNG terminals, and CGD networks) till 2024

#CITYGASDISTRIBUTION

India's CNG and PNG network

Increasing the adoption of the 'green' fossil fuel for vehicles, households, and industries

THE PURPOSE

India's city gas distribution (CGD) network contributes to around 19 per cent of India's total natural gas consumption. It supplies compressed natural gas (CNG) to public and private vehicles through retail outlets and delivers piped natural gas (PNG) to domestic consumers. It also supplies natural gas to industrial and commercial consumers.

Natural gas is quickly gaining adoption. It is cleaner than conventional fuels such as coal, petrol, diesel, and LPG; and is also more economical. An additional benefit is safety. Natural gas is lighter than air, dissipates rapidly in case of leakage, and does not ignite spontaneously.

THE ROLLOUT

The Petroleum and Natural Gas Regulatory Board (PNGRB) has been periodically bidding out CGD rounds since its inception in 2007. The 9th and 10th bidding rounds extended coverage to 71 per cent of India's population and 53 per cent of its geographical area. The Government of India has announced coverage for 100 more districts under the CGD network in the next three years. The 11th bidding round is expected to expand the network further, taking the total to over 500 districts.

MILESTONES

As of 31 March 2021, India had 7,820,387 domestic, 32,339 commercial, and 11,803 industrial PNG connections, as well as 3,101 CNG stations.

Image: iStock

JOBS

The Council on Energy, Environment and Water (CEEW) estimates that the CGD network could create 50,000 direct and indirect jobs by 2025.

GROWTH

India's gas demand will be driven by core industries such as fertilisers, power, and steel, as well as the pan-India CGD network. India's CGD market is expected to grow at a compound annual growth rate (CAGR) of 10 per cent from an estimated 9,223 million metric standard cubic metre (MMSCM) in FY 2020-21. **The PNGRB estimates that PNG consumption will grow from 5 to 26 per cent of households by 2030.**

India plans to spend USD 60 billion on creating gas infrastructure till 2024 (including pipelines, liquefied natural gas (LNG) terminals, and CGD networks) and add around 16,000 km of new gas pipelines in the next 4-6 years.

SUSTAINABILITY

Natural gas emits around 50 per cent less CO2 than coal and 30 per cent less CO2 than oil per unit of energy delivered. It is versatile and can be blended with other clean fuels such as compressed biogas (CBG) and hydrogen (H-CNG). **CEEW estimates that switching from LPG to PNG in a shorter five-year timeframe could reduce household emissions by 1,363 MTCO2-eq over the next ten years.**

2030 AGENDA

India aims to increase the share of natural gas in its energy mix from 6.3 per cent in 2021 to 15 per cent by 2030 to create a cleaner and more affordable energy basket. This will be an important contribution to keeping emissions 33 – 35 per cent below 2005 levels.

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Image: iStock

Image: iStock

5.6 billion

The IEA's estimated global stock of ACs in buildings by 2050, up from 1.6 billion in 2030

11x

India's estimated demand growth for space cooling in the next 20 years

400,000

Direct and indirect jobs that could be created through the Production-Linked Incentive (PLI) scheme for white goods – ACs and LED lights

#COOLINGACTION

India Cooling Action Plan (ICAP)

Incentivising the air conditioner industry to build a sustainable cooling value chain

THE PURPOSE

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 Ministry of Environment, Forest, and Climate Change (MoEFCC) oversees ICAP, which seeks to reduce cooling demand across sectors by 20 - 25 per cent, refrigerant demand by 25 - 30 per cent, and cooling energy requirements by 25 - 40 per cent by 2038.

Action areas include enhancing the energy efficiency of air conditioners (ACs), moving to non-Ozone Depleting Substance (ODS) and low-Global Warming Potential (GWP) refrigerants, and promoting domestic AC manufacturing capacity to build a globally competitive supply chain in India and reduce import dependence.

THE ROLLOUT

India's building AC penetration is currently lower than 10 per cent, but demand for space cooling is expected to grow by 11 times in the next 20 years. The IEA predicted in 2018 that the global stock of ACs in buildings would increase from 1.6 billion in 2030 to 5.6 billion by 2050. By mid-century, most of the energy demand growth for space cooling will be driven by emerging economies, with about half coming from India, China and Indonesia.

JOBS

The Union Government introduced a *Production-Linked Incentive* (PLI) scheme for white goods—ACs and LED lights—in April 2021, which is expected to create 400,000 new direct and indirect jobs. The Council on Energy, Environment and Water (CEEW) estimates that jobs in the AC servicing sector alone will increase ten-fold between 2017 and 2037. The ICAP aims to train 100,000 service technicians by 2023 through the Ministry of Skill Development and Entrepreneurship (MSDE), the *Skill India* mission, and the *Pradhan Mantri Kaushal Vikas Yojana* (PMKVY). **The first two phases have upskilled and certified about 40,000 service technicians**.

GROWTH

Maharashtra, Gujarat, Tamil Nadu, Punjab, and Haryana are India's major manufacturing hubs for AC components, systems, and refrigerants. The *PLI scheme* has a budgetary outlay of INR 6,238 crore (USD 854.5 million) and aims to attract additional investment of INR 7,920 crore (USD 1.08 billion), deliver incremental production worth INR 168,000 crore (USD 23 billion), and lead to exports worth INR 64,400 crore (USD 8.8 billion) for the AC and LED industries.

The ICAP would also help provide thermal comfort for all and reduce occupational heat stress for millions of citizens, especially the economically weaker sections of society who are compelled to live and work in extremely hot and humid conditions for most of the year. It would also contribute to doubling farmers' income by expanding cold chain infrastructure and consequently, less wastage of produce; and lead to innovation in the cooling sector through R&D in cooling technologies.

SUSTAINABILITY

Cooling is being rapidly accepted as a developmental need, and is key to the health, wellbeing, and productivity of people in hot climates. Further, refrigerant-based cooling is extremely energy intensive and, according to the IEA, it is responsible for 10 per cent of the global CO_2 emissions. The multi-pronged ICAP is a robust roadmap for India to make cooling an integral part of its sustainable development agenda.

2030 AGENDA

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.

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Image: Emotivelens

Image: Vikram Solar

99,000

Candidates trained by the Skill Council on Green Jobs in solar and other renewable energy domains

88%

Proportion 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 that could be created through India's targets of 100 GW solar and 60 GW wind capacity by 2022

#SKILLING

Skill Council for Green Jobs (SCGJ)

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

THE PURPOSE

The Skill Council for Green Jobs (SCGJ) was set up in October 2015 through a joint initiative of the National Skill Development Corporation (NSDC), the Ministry of New and Renewable Energy (MNRE), and the Confederation of Indian Industry (CII). It aims to identify the skilling needs of manufacturers and service providers in the green business sector, and to implement nationwide, industry-led collaborative skill- and entrepreneur development programmes.

A complementary initiative is the *Suryamitra Skill Development Program* (SSDP), instituted in 2017 and run by the National Institute of Solar Energy (NISE) within the MNRE's skill development initiative. The SSDP helps young people develop job-oriented skills in solar power installation, operation, and maintenance in India and abroad.

THE ROLLOUT

The SCGJ covers three workstreams: renewable energy; environment, forests and climate change; and sustainable development. Focus areas include solar PV and solar thermal, wind, small hydro, bioenergy, storage, clean cookstoves, water, waste and e-waste management, carbon sinks, and green construction and transportation.

JOBS

Since inception, the SCGJ has incorporated 97 training partners and 218 registered training centres across India. It has trained over 99,000 candidates in solar and other renewable energy domains.

According to an impact assessment carried out by the SCGJ on the *Suryamitra* trainings, over 88 per cent of the trainees reported enhanced employability and better job opportunities, while 80 per cent reported increased incomes and improved livelihoods post-training.

GROWTH

The accelerated growth of solar and wind energy in India has resulted in a 1 million-strong skilled workforce across the sector. The Council on Energy, Environment and Water (CEEW) and NRDC estimate that the targets of 100 GW solar and 60 GW wind capacity by 2022 could generate about 1.3 million direct jobs on a Full-Time Equivalent (FTE) basis, which amounts to a workforce of 330,000 people. Rooftop solar installations could create about 50,000 skilled and unskilled jobs per 4 GW, while small- and large-scale micro-grids of 20 GW can employ around 110,000 workers of various skill levels. The new target of 450 GW installed renewable capacity by 2030 will amplify this potential manifold.

SUSTAINABILITY

The SCGJ is directly contributing to the expansion of India's clean energy ecosystem by helping create a skilled and competitive workforce.

2030 AGENDA

India needs a skilled workforce to support its energy transition and sustainable development goals. The increasing competitiveness of the Indian industry, supported by conducive policy design and implementation, is leading to job creation in existing and new areas. Green jobs enable the transition to a low-carbon economy and can help India make the most of its high demographic dividend.

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Image: Abhishek Jain/CEEW

Image: iStock

95

Countries have signed the ISA's Framework Agreement as of June 2021, with 77 having also deposited instruments of ratification

USD 1.4 billion

Pledge by the Exim Bank of India to fund solar projects in ISA member countries

USD 1,000 billion

Envisioned investment in the global solar energy sector by 2030, one of the ISA's major goals

#GLOBALINITIATIVES

International Solar Alliance (ISA)

Harnessing the infinite power of the sun for sustainable human development

THE PURPOSE

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 Prime Minister of India, Narendra Modi, 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.

THE ROLLOUT

The ISA has rapidly gained global acceptance and was ratified on 6 December 2017. The ISA's major programmes include scaling solar applications for agricultural use; promoting affordable finance at scale; scaling solar mini-grids, rooftops, and solar-supported e-mobility and storage; and the solar cooling initiative. It is also helping develop large-scale solar park projects in clusters/groups of member countries. It regularly undertakes Country Missions to study on-ground challenges and opportunities, and to build consensus for its programmes.

MILESTONES

As of June 2021, the ISA Framework Agreement has been signed by 95 countries, of which 77 countries have also deposited instruments of ratification.

JOBS

The ISA has facilitated the training of over 1,000 candidates from member countries in technologies such as solar mini-grids and rooftops.

The ISA Solar Technology and Application Resource Centre (ISTAR C) is helping build capacity in member countries through training to create a skilled global workforce for large scale deployment of solar applications and research, development, innovation, standardisation, and testing, and to drive a solar-powered green economic recovery.

The *ISA Solar Fellowship Program* offers M.Tech fellowships in *Renewable Energy Technologies and Management* for mid-career professionals from member countries. Two batches have been completed in collaboration with IIT Delhi, India, with 40 fellowships awarded.

GROWTH

The ISA has many global partnerships to finance the expansion of solar energy in its member countries. Major programmes include the World Bank and the Agence Française de Développement's (AFD) Solar Risk Mitigation Initiative (SRMI) to support bankable solar programmes in developing countries by leveraging private sector investments; the World Bank's USD 337 million Risk Mitigation Fund for 23 member countries in Africa; and the Export Import Bank of India and AFD's pledges to fund solar projects worth USD 1.4 billion and EUR 700 million, respectively.

The ISA is preparing a roadmap to help member countries mobilise USD 1 trillion in solar investments by 2030, especially in Least Developed Countries (LDCs) and Small Island Developed States (SIDS). It is also setting up a multi-donor trust fund and a blended finance risk mitigation facility to enhance support for its programmes and fund solar enterprises in member countries.

SUSTAINABILITY

The ISA is bringing together countries with rich solar potential to aggregate demand and create economies of scale, thereby reducing the prices of solar applications, facilitating the deployment of existing solar technologies at scale, and promoting collaborative solar R&D and capacity.

2030 AGENDA

The ISA promotes solar power through global advocacy and by extending programmatic support for innovative solar projects. It is facilitating cross-border renewable energy transfer projects as part of the *One Sun One World One Grid* (OSOWOG) vision, on the premise that '*The Sun Never Sets*,' and is shining over some geographical location on Earth at any given point in time. **The OSOWOG is a transnational electricity grid supplying solar power to 140 countries and helping solar-deficient countries adopt clean energy.** The ISA is conducting a study in partnership with the Ministry of New and Renewable Energy, India and the World Bank to provide a techno-economic feasibility analysis for the project, identify pilot countries, and recommend institutional design to realise the OSOWOG vision.

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Image: Abhishek Jain/CEEW

Image: iStock

81%

Share of global clean energy investment accounted for by CEM's 28 Member Countries and the European Commission

83%

Share of global greenhouse gas emissions from CEM's 28 Member Countries and the European Commission

#GLOBALINITIATIVES

Clean Energy Ministerial (CEM)

Fostering international cooperation and fast-tracking deployment of clean energy solutions to transition to a global clean energy economy

THE PURPOSE

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. In addition to attending an annual ministerial meeting, CEM members lead or participate in different workstreams—both long-term initiatives and shorter-term campaigns—across the spectrum of clean energy issues. These workstreams are based on areas of common interest for participating governments and other stakeholders.

The CEM Framework that defines the initiative's governance structure and outlines its mission statement, objectives, membership, and guiding principles was reaffirmed at the 12th CEM in 2021.

The CEM's 28 Member Countries and the European Commission account for around 81 per cent of global clean energy investments, 83 per cent of global greenhouse gas emissions and fund most of the public research and development in clean energy technologies.

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.

THE ROLLOUT

India co-leads several CEM work streams, including the 21st Century Power Partnership (21CPP), the International Smart Grid Action Network (ISGAN), the Super-Efficient Equipment and Appliance Deployment Initiative (SEAD), the Biofuture Platform Initiative (BfPI), and the Power System Flexibility Campaign (PSF).

In June 2021, India and the UK launched a new workstream, the Industrial Deep Decarbonisation Initiative (IDDI), at CEM12 with coordination support from the United Nations Industrial Development Organisation (UNIDO). The IDDI aims to promote industrial energy efficiency, infuse green technologies, and stimulate demand for low-carbon industrial material in energy-intensive sectors such as iron and steel, cement, and petrochemicals.

MILESTONES

India's active and sustained involvement in the CEM—the only major global ministerial-level forum dedicated exclusively to clean energy—has helped establish its credentials as a global thought leader and champion of the technology-driven energy transition, more so as a representative of developing and emerging economies.

India is also a member of CEM workstreams such as the Electric Vehicles Initiative (EVI); the Clean Energy Solutions Centre; the Clean Energy Education and Empowerment Initiative (C3E); the Hydrogen Initiative; the Carbon Capture, Utilisation and Storage initiative (CCUS); the Investment and Finance Initiative (CEM-IF); and Long-Term Energy Scenarios (LTES). India is represented at the CEM by the Minister of Power and New and Renewable Energy.

2030 AGENDA

The CEM's low-cost but high-impact technical work has mobilised international coordination between clean energy market leaders, improved policy and technology deployment, and engaged private sector players, including industry and non-governmental organisations. This collaborative and multi-stakeholder approach is key to helping CEM members achieve their respective SDGs by 2030.

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Image: Wase Khalid/CEEW

Image: Wase Khalid/CEEW

22

Countries are members of Mission Innovation along with the European Commission

90%

Share of global public investment in clean energy innovation contributed by MI members

USD 25 million

Investment by India into 70+ RD&D projects across various MI Innovation Challenges

#GLOBALINITIATIVES

Mission Innovation (MI)

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

THE PURPOSE

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. It was instituted to catalyse action and investment in research, development, and demonstration (RD&D) to make clean energy affordable and accessible for all through domestic innovation and international cooperation. MI's members contribute over 90 per cent of global public investment in clean energy innovation.

THE ROLLOUT

Building on a successful first phase, Mission Innovation 2.0 was launched in June 2021 to channel the collective ambition of its members into clean energy innovation aimed at accelerating progress towards the Paris Agreement goals.

MI 2.0's National Innovation Pathways will enable its members to illustrate energy transition scenarios and identify innovation needs until at least 2030; define plans to meet these innovation needs; measure innovation outcomes and ecosystem development; identify preferred methods of collaboration; and build on existing climate and clean energy plans.

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. Also, India is a core coalition member of the Green Powered Future Mission and the Clean Hydrogen Mission and is a core group member of the Zero-Emissions Shipping Mission**. India is represented at MI by the Ministry of Science and Technology.

MILESTONES

MI has helped India drive public and private innovation by drawing investments to clean energy technologies; promote private sector and start-up engagement via the Clean Energy International Incubation Centre (CEIIC); and build collaborative capacity between Indian and foreign institutions and industries. These efforts are enabling technology translation from fundamental research to applied R&D across disciplines, sectors, and technologies to deliver impact at scale.

Since the inception of MI, India (through the Department of Biotechnology and the Department of Science and Technology) has invested over USD 25 million in over 70 RD&D projects across ICs in areas such as smart grids, off-grid access, efficiencies in cooling and heating, sustainable biofuels, innovative waste-to-energy, carbon capture, clean energy materials, and hydrogen and fuel cells.

Image: iStock

2030 AGENDA

MI has a vital role in enhancing global cooperation on RD&D between governments, investors, businesses, and academia. Developing and scaling up innovations that provide access to cost-competitive clean energy solutions across economic sectors will help its members achieve their Paris Agreement commitments and 2030 SDGs.

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Image: Image: Wase Khalid/CEEW

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