



Chapter - 22 Energy

India is the **third-largest consumer** of energy in the world. According to the Ministry of Power, the country's peak demand reached a record high of **223 gigawatts (GW)** in June 2023.

India's energy sector is undergoing a dynamic transformation, balancing traditional needs with the growing importance of renewable energy sources.

Power Generation Capacity

- Increase from 248 GW in 2014 to 425 GW by September 2023.
- Contribution of 91,344 MW from conventional sources and 102,964 MW from renewable energy (RE) sources.
- Expected installed capacity: 777 GW by 2029-30 and 900 GW by 2031-32.
- Non-fossil based energy to contribute 485.15 GW (62.43%) by 2029-30 and 596.27 GW (66.22%) by 2031-32.
- India ranked **4th globally in renewable energy installed capacity**, 4th in wind power, and 5th in solar power.
 - Fastest growth rate in the renewable energy sector from 76.37 GW in March 2014 to 178.63 GW in September 2023.

Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

- The program aims to separate agricultural and non-agricultural feeders for better supply management in rural areas, strengthen rural infrastructure, implement metering, and absorb the rural electrification scheme.

Saubhagya - Pradhan Mantri Sahaj Bijli Har Ghar Yojana:

- To achieve universal household electrification in the country by March 2019, the government launched the Saubhagya scheme.
- The scope of the Scheme includes:
 - Providing electricity connections to all un-electrified households in rural areas.
 - APL households will get electricity connections on payment of ₹ 500 (which is payable in 10 installments in the electricity bill).
 - Providing Solar PhotoVoltaic (SPV) based standalone systems for un-electrified households located in remote and inaccessible villages/habitations.
 - Providing electricity connections to all remaining economically poor unelectrified households in urban areas.

The UDAY-Ujwal DISCOM Assurance Yojana

- It was launched in 2015 to provide a sustainable solution to the operational and financial inefficiencies faced by **DISCOMs** across the country.
- The scheme aims to achieve this through targeted interventions, including lowering interest costs, reducing the cost of power, increasing revenues, and improving operational efficiencies.
- The scheme is closely monitored by an inter-ministerial committee and a state-level committee to

ensure its effectiveness and implementation.

- This portal not only streamlines data collection but also provides basic analytics and progress reports on the performance of various states and DISCOMs, promoting transparency and accountability.

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

The PM KUSUM Scheme aims to provide energy security to consumers. This scheme provides funding support to **promote installation of solar energy installations** for provision of electricity to agriculture pump-sets.

Reforms in Transmission Sector

Power Sector Reforms:

- In 2003, significant reforms were introduced in the power sector to enhance efficiency and streamline processes.
- One of the key developments was the designation of Powergrid, a CPSE under the Ministry of Power, as the **Central Transmission Utility (CTU)**.
- This move paved the way for the emergence of private transmission developers, bringing more players into the Transmission Sector.

Transmission System Revamp:

- The transmission planning process underwent a major overhaul to align with Climate Change Adaptation goals and achieve a non-fossil energy capacity of 500 GW by 2030.
- The introduction of **Electricity (Transmission System Planning, Development and Recovery of Inter-State Transmission Charges) Rules in 2021** played a crucial role in revamping the transmission system.
- These rules facilitated easier access to the electricity transmission network across the country and simplified the standard bidding documents, fostering development in the transmission sector.

Simplified Bidding Processes:

- Standard bidding documents were streamlined and simplified, making it easier for stakeholders to participate in the development of the transmission infrastructure.
- This initiative aimed to attract more investments and promote competition in the sector.

Market and Dispatch Improvements:

- The introduction of the Real Time Market in 2020 provided an organized platform for energy trade closer to real-time, enhancing market efficiency.
- Additionally, Security Constrained Economic Dispatch was implemented to reduce the cost of power procured by distribution licensees, contributing to overall cost savings in the power sector.

Promotion of E-Mobility:

- The **Go Electric Campaign**, launched nationwide in 2021, aimed to educate the general public about the benefits of e-mobility.
- It also informed potential Electric Vehicle (EV) owners about incentives for EV adoption, generating curiosity and promoting sustainable transportation solutions.

Privatisation Initiatives

- Under the Atma Nirbhar Bharat Abhiyaan, announcements were made regarding the **privatisation of Power Departments/Utilities**.
- This initiative aimed to bring dynamism to power generation and distribution, fostering efficiency and innovation in the sector.

Addressing Payment Issues:

- The Electricity (Late Payment Surcharge and Related Matters) Rules, 2022 were introduced to address cash flow issues in the power sector.
- These rules obligated DISCOMS to clear legacy dues in a time-bound manner and established a payment security mechanism.
- Non-compliance could result in progressive withdrawal of open access and power regulations.

Optimum Electricity Generation Mix:

- The Central Electricity Authority (CEA) issued a report on **Optimum Electricity Generation Mix** for 2030, targeting a capacity of 500 GW from non-fossil resources.
- This initiative reflects the government's commitment to sustainable energy development and climate change mitigation.
- **Energy Conservation Measures:**
 - Amendments to the Energy Conservation Act, 2001 were made to specify minimum consumption of non-fossil resources by designated consumers.
 - Additionally, various energy conservation measures such as **promoting LED adoption, street lighting programs**, and efficient cooking initiatives were implemented to enhance energy efficiency and reduce environmental impact.

National Mission on Use of Biomass in Thermal Power Plants (SAMARTH)

- To address stubble burning, reduce carbon footprint in Thermal Power Plants (TPPs), and support farmer income, the Ministry of Power (MoP) has initiated the National Mission on Use of Biomass in Thermal Power Plants, also known as SAMARTH.
- This mission requires all TPPs in India to use **5% to 10% biomass for power generation**.
- The policy on Biomass Utilization for Power Generation through Co-firing in Coal-based Power Plants, issued in 2021 and modified in 2023, mandates this biomass utilization.
 - As of September 2023, approximately 2.26 lakh MT of biomass has been co-fired in thermal power plants, indicating the initiative's positive impact.

Petroleum and Natural Gas Sector

- The Ministry of Petroleum and Natural Gas focuses on **oil and natural gas exploration**, production, refining, distribution, marketing, import, export, and conservation of petroleum products.
- With India's rapid economic growth, Oil and gas collectively account for around 35% of India's energy consumption.

Pradhan Mantri Ujjwala Yojana (PMUY)

- The Pradhan Mantri Ujjwala Yojana was launched by the government to provide deposit-free LPG connections to **8 crore women from Below Poverty Line (BPL)** households, primarily in rural areas.
- The goal was to offer clean cooking fuel to improve health by reducing health hazards associated with traditional cooking fuels.
- Eligible families are identified through various categories such as Socio-Economic Caste Census lists, beneficiaries of **Pradhan Mantri Awas Yojana (PMAY-Gramin)**, Antyodaya Anna Yojana, SC/ST households, most backward classes, forest dwellers, tea/ex-tea garden tribes, and residents of islands/river islands.

Ujjwala 2.0

- Ujjwala 2.0, launched in 2021, aimed to provide an additional **one crore LPG connections to adult women** from poor households under PMUY.
- The eligibility criteria remained the same, with additional features like online application facilities on the pmuy.gov.in portal and acceptance of self-declaration from migrants for family composition and address proof.

PAHAL (Pratyaksha Hastaantarit Laabh)

- PAHAL is a **Direct Benefit Transfer scheme** introduced by the government to streamline subsidy delivery to LPG consumers.
- It rationalises subsidies by reducing leakages and directly transferring applicable subsidies into beneficiaries' bank accounts.
- PAHAL holds the **Guinness World Record** as the largest Direct Benefit Transfer scheme.

Refining Capacity and Export/Import

- India's refinery industry has become a major global player, ranking fourth globally and second in Asia after China.
- The country's refining capacity exceeds demand, reaching 248.9 MMTPA. This growth positions India as a refinery hub with a significant refining capacity.

Sahaj: Online Payment and 'e-SV' Issuance

- Sahaj is a digital initiative introduced by oil marketing companies under the Digital India initiative. It allows customers to apply for an LPG connection online, make online payments, and receive an '**e-SV**' (**electronic subscription voucher**).
- This facility is now available nationwide, making the process of obtaining an LPG connection more convenient and accessible.

Direct Benefit Transfer of Kerosene

- To mitigate the impact of rising international oil prices on the common man, the government adjusted the retail selling prices of Public Distribution System (PDS) Kerosene.
- Since March 1, 2020, the retail selling price of PDS Kerosene has been maintained at a **NIL under-recovery level nationwide**, ensuring affordability for consumers.

Atma Nirbhar in the Energy Sector

- Under the Atmanirbhar Bharat Abhiyaan, the **Lakshya Bharat Portal** was launched in 2021.
- This portal serves as a central information pool accessible to the Government of India, Oil and Gas Public Sector Undertakings (OGPSUs), and manufacturers/traders. OGPSUs upload procurement details, including demand, on the portal, facilitating localization efforts and interactions with entrepreneurs through webinars.

Pricing of Petroleum Products

- The Administered Pricing Mechanism (APM) for petroleum products, introduced in 1976, was **abolished in 2002** following the deregulation of the oil sector in India.
- Pricing for all petroleum products, except PDS kerosene and domestic LPG, is now market-determined.

Customer Centric Initiatives in LPG

Public sector oil marketing companies, under the Ministry of Petroleum and Natural Gas, have implemented customer-centric initiatives leveraging emerging trends in information technology. These initiatives include:

- **LPG Connection Portability:** Customers dissatisfied with their existing distributor can shift to a new one easily using the website or mobile application. This option enhances customer convenience and choice.
- **LPG Refill Portability:** Customers can switch their distributor for a particular refill booking without any additional cost. This feature provides flexibility and ease of service for LPG consumers.
- **Secondary LPG Connections:** This option allows individuals who have moved away from their native place to get a secondary LPG connection linked to their parent connection. A combined cap of 12 refills per year applies to both the primary and secondary connections.
- **Online Booking of LPG Connection:** Customers can now apply for an LPG connection and book refills online through various platforms such as web portals, UMANG, and Whatsapp.
 - Multiple payment options are available, including credit cards, debit cards, net banking, UPI, etc.

Pradhan Mantri Urja Ganga

- The Pradhan Mantri Urja Ganga, also known as the **Jagdishpur-Haldia/Bokaro-Dhamra Gas Pipeline (JHBDPL) project**, is a 2655 km long gas pipeline project aimed at developing the national gas grid in Eastern India.
- It will pass through 50 districts across Uttar Pradesh, Bihar, Jharkhand, Odisha, and West Bengal, supporting the development of the energy sector and addressing environmental concerns.

City Gas Distribution Network

- The City Gas Distribution (CGD) network comprises interconnected pipelines for supplying gas to domestic, industrial, and commercial premises, as well as CNG stations.
- It includes four segments: **Compressed Natural Gas (CNG) for automobiles, Piped Natural Gas (PNG) for households**, commercial, and industrial use.
 - PNGRB is responsible for authorizing entities to develop CGD networks in specific geographical areas.

Energy Diplomacy

- India, as the world's third-largest energy consumer, faces challenges in meeting its energy needs, particularly due to its heavy reliance on oil imports.
- India's energy diplomacy has focused on maintaining a stable supply of crude oil and LPG, especially amidst turmoil in the Middle-East region.
- Strategic partnerships with countries like **Saudi Arabia and UAE** have been elevated beyond buyer-seller relationships to ensure energy security.

Ethanol Blending

- Ethanol, a key biofuel, offers a promising opportunity to reduce India's dependence on imported oil.
- India initiated ethanol blending in petrol on a pilot basis in 2001 and aims to achieve 20% ethanol blending by 2025, as per the **National Policy on Biofuels-2018**.
- Ethanol, produced through fermentation or petrochemical processes, has various applications, including as a fuel additive, antiseptic, disinfectant, chemical solvent, and in organic compound synthesis.
- The **second-generation Ethanol Plant in Haryana** showcases India's efforts in waste-to-wealth initiatives by utilizing rice straw to produce ethanol and reduce carbon emissions.

Ethanol Blending Programme

- The government's ethanol blending programme aligns with energy security, climate change, and rural economy enhancement goals.
- An indicative target of **20% ethanol blending in petrol by 2030** was set, later advanced to 2025, with efforts resulting in achieving a 10% blending rate ahead of schedule.
- The "**Roadmap for Ethanol Blending in India 2020-25**" provides a detailed strategy for achieving the blending target, showcasing successful coordination among Public Sector Oil Marketing Companies (OMCs).

Strategic Petroleum Reserves

- India has set up Strategic Petroleum Reserves at three locations with a capacity of 5.33 MMT, capable of meeting approximately 9.5 days of national demand.

Key Organizations:

- **Hindustan Petroleum Corporation Limited (HPCL)**: A major PSU with 'Maharatna' status, holding equity in Mangalore Refinery and Petrochemicals Limited and operating refineries in Mumbai and Visakhapatnam.
- **Gas Authority of India Limited (GAIL)**: Started as a gas transmission company, it now operates

across the natural gas value chain with a focus on LNG import infrastructure and city gas distribution.

- **Indian Oil Corporation Limited (IOCL):** India's flagship national oil company involved in the entire hydrocarbon value chain, including refining, marketing, exploration, and renewable energy.
- **Bharat Petroleum Corporation Limited (BPCL):** Engaged in refining and marketing petroleum products with a robust distribution network.
- **Oil and Natural Gas Corporation Limited (ONGC):** Engaged in exploration and production of crude oil, natural gas, and value-added products.
- **ONGC Videsh Limited (OVL):** Focuses on international exploration and production in various countries.
- **Bharat Petro Resources Limited (BPRL):** A subsidiary of BPCL involved in upstream activities in India and overseas.
- **Oil India Limited (OIL):** Engaged in exploration, production, and transportation of crude oil and natural gas, with operations in several states and countries.

Renewable Energy Capacity

- As of July 2023, India has installed a total of **177.73 GW of Renewable Energy capacity**, including 70.10 GW from solar power, 46.85 GW from large hydro, 43.77 GW from wind power, 10.81 GW from bio-power, and 4.96 GW from small hydro power.
- India ranks fourth globally in Renewable Energy Installed Capacity, including large hydro.
 - It ranks **fourth in wind power capacity** and fifth in solar power capacity globally.

Ongoing Renewable Energy Schemes

- **Production Linked Incentive Scheme** for High-Efficiency Solar PV Modules: Aimed at achieving GW-scale manufacturing capacity in High-Efficiency Solar PV modules.
- **National Green Hydrogen Mission:** Approved in 2023 with an initial outlay of ₹19,744 crore, focusing on making India a leader in Green Hydrogen production.
- **PM-KUSUM Scheme:** Provides for the installation of standalone solar pumps, solarization of grid-connected pumps, and setting up solar power plants.
- **Solar Parks Scheme:** Facilitates large-scale grid-connected solar power projects with a target capacity of 40 GW.
- **Rooftop Solar Programme Phase-II:** Aims at accelerating the deployment of solar rooftop systems with a target of 40 GW installed capacity.
- **Wind Power:** India's wind power initiatives continue to evolve, contributing significantly to the renewable energy landscape.

National Solar Mission (NSM)

- Initiated in January 2010 under the **National Action Plan on Climate Change (NAPCC)**.
- Aims to position India as a global leader in solar energy through rapid diffusion of solar technology.
- Promotes solar water heaters and rooftop systems via regulatory interventions and subsidies.
- Encourages research and development through approved projects and establishment of centres of excellence.

Solar Cities Programme

- Aims for a minimum 10% reduction in conventional energy demand in five years.
- Assists municipal bodies in creating master plans for energy efficiency and renewable energy integration.

Coal in India

- The **Geological Survey of India** estimates 344.02 billion tonnes of coal reserves mainly in states like Jharkhand, Odisha, etc.
- Lignite reserves are estimated at around 46.02 billion tonnes mainly in **Tamil Nadu**, Rajasthan,

etc.

- Coal production reached 729.10 MT in 2019-20, showing slight growth compared to the previous year.
- Major coal PSUs include **Coal India Limited (CIL), Neyveli Lignite Corporation Limited (NLC), and Singareni Collieries Company Limited (SCCL)**.
 - CIL is the largest coal-producing company globally and manages coal operations under the Ministry of Coal.
 - NLC, a Navratna company, operates in Tamil Nadu with ISO-certified mines.
 - SCCL, the oldest government-owned coal mining company, focuses on coal mining and diversifies into power generation and other sectors.

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