

# **THOUGHTS ON OVERVIEW OF ENERGY SECTOR IN INDIA**

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## **INTRODUCTION**

Energy is derived from the Greek work '*energia*' and is referred to as a scalar physical quantity that is a property of objects and systems which is conserved by nature. Energy is often defined as the ability to work.

Energy is an important building block in human development, and, as such, acts as a key factor in determining the economic development of all countries.

The International Energy Agency (IEA) in its report 'World Energy Outlook 2024 states that total global energy demand rose by around 2% in 2023, with declines in advanced economies more than offset by large increases in emerging market and developing economies. A record high level of clean energy came online globally, including more than 560 gigawatts (GW) of new renewable power capacity. Around USD 2 trillion is expected to be invested in clean energy in 2024, almost double the amount invested in fossil fuels. However, two-thirds of the overall increase in energy demand in 2023 was met by fossil fuels and energy-related carbon dioxide (CO<sub>2</sub>) emissions reached a record high.

India's substantial and sustained economic growth is placing enormous demand on its energy resources. Energy requirement in our country is increasing at a very rapid rate. While efforts are being made to improve availability of various energy sources, there is still a continuing gap between demand and supply of energy. Thus energy conservation has also emerged as one of the major issues in recent years. Conservation and efficient utilization of energy resources play a vital role in narrowing the gap between demand and supply of energy. Improving energy efficiency is probably the most profitable thing that can be done in the short term.

## **FEW RECENT DEVELOPMENTS IN ENERGY SECTOR**

- Ministry of Power (MOP) notified the Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022 (REOA Rules) on 6 June 2022 in order to further accelerate India's ambitious renewable energy programmes, with the objective of ensuring access to affordable, reliable, sustainable and green energy for all. Further, State Electricity Regulatory Commissions have been directed to align their regulations with the REOA Rules in terms of the Electricity Act, 2003.
- Government has notified guidelines for the procurement and utilisation of battery energy storage systems (BESS) as part of generation, transmission and distribution assets, along with ancillary services.
- Development of Energy Storage System (ESS) Roadmap for India 2019-2032
- MOP notified the National Framework for Energy Storage System (ESS) in August 2023 with the key objective of ensuring a constant supply of renewable energy (Round-the-Clock Renewable Energy), reduction of emissions and lowering of costs by incentivising ESS deployment.
- Ministry of Power, vide its Order dated 22 July 2022, notified the Renewable Purchase Obligation (RPO) and Energy Storage Obligation trajectory until financial year 2029–30, whereby a long-term growth trajectory has been set out. The Order was issued in pursuance of paragraph 6.4(1) of the National Tariff Policy, 2016, which stipulates that MOP, in consultation with Ministry of New and Renewable Energy (MNRE), will prescribe such long-term trajectory.
- National Green Hydrogen Mission (NHM) was approved by the Union Cabinet on 4 January 2023 with an outlay of Rs 19,744 crore with the aim of making India a global hub of green hydrogen production, utilisation and export.
- The Green Hydrogen Standard notified on 19.8.2023

- In October 2023, R&D Roadmap for National Green Hydrogen Mission unveiled.
- The Ministry of Petroleum and Natural Gas (MOPNG) is undertaking several hydrogen initiatives and demonstration projects under the NHM, ultimately designed to achieve a greater use of hydrogen within India's energy sector.
- The Government of India has also introduced the Hydrogen Purchase Obligations under which certain industries, such as refining and fertiliser, will be required to use a certain proportion of green hydrogen out of their overall consumption of fossil fuel-based grey hydrogen.
- Carbon Credit Trading Scheme 2023 notified vide Notification No. S.O 2825(E) dated 28.6.23, The primary objective of the Carbon Credit Trading Scheme is to establish a robust platform for the trading of carbon credits. These credits represent quantified units of emissions reduction, removal, or avoidance, with each credit equivalent to one metric ton of carbon dioxide equivalent (tCO<sub>2</sub>e). Such credits may be traded within the country's industries and entities to control the emissions of greenhouse gases. The scheme intends to encourage obligated entities to minimize their carbon footprint by reducing emissions.
- Offshore Wind Energy Lease Rules 2023 notified on 19.12.23 to regulate the allocation of offshore wind sea blocks for developers.
- Revised Guidelines for Tariff-based Competitive Bidding Process for procurement of power from Grid connected for solar, wind and wind solar hybrid projects issued on 28.7.23, 26.7.23 and 21.8.23 respectively.
- Renewal Purchase Obligation (RPO) targets until March 2030 were notified under the Energy Conservation Act 2001
- Energy Conservation (Amendment) Act 2022 enacted. The notification issued on October 20, 2023 under the Energy Conservation Act mandates the minimum share of non-fossil energy consumption for designated consumers, effective from April 1, 2024.

- A number of Notifications by CERC viz. the CERC (Connectivity and General Network Access to the Inter-State Transmission System) Regulations, 2022; the CERC (Terms and Conditions for Renewable Energy Certificates for Renewable Energy Generation) Regulations, 2022; the CERC (Indian Electricity Grid Code) Regulations, 2023.

### **MEANING OF 'ENERGY'**

Under Section 2(h) of the Energy Conservation Act 2001, Energy means any form of energy derived from fossil fuels or non-fossil sources or renewable sources.

Energy comes in different forms:

- heat (thermal),
- light (radiant),
- mechanical,
- electrical,
- chemical, and
- nuclear energy.

All forms of energy are stored in different ways, in the energy sources that we use every day. Energy sources are divided into two groups – Primary and Secondary sources of energy. The main difference between primary and secondary energy sources is that Primary energy resources are those found in nature whereas Secondary energy resources are those forms that must be produced by conversion/transformation of primary resources.

#### A. Primary Sources of Energy

1. Renewable Sources - (an energy source that can be replenished in a short period of time)

- Solar
- Wind
- Geothermal
- Biomass
- Hydro

2. Non Renewable Sources - (an energy source that we are using up and cannot recreate in a short period of time)

- Oil (Petroleum)
- Coal
- Natural Gas
- Nuclear Power

#### B. Secondary Sources of Energy

- Electricity
- Hydrogen

Renewable and nonrenewable energy sources can be used to produce secondary energy sources including electricity and hydrogen.

India's energy-mix comprises both non-renewable (coal, lignite, petroleum and natural gas) and renewable energy sources (wind, solar, small hydro, biomass, cogeneration bagasse etc.).

Information on reserves of non-renewable sources of energy like coal, lignite, petroleum, natural gas and the potential for generation of renewable energy sources is a pre-requisite for assessing the country's potential for meeting its future energy needs.

The major sources for commercial energy in India are coal, oil products, natural gas and electricity. Non-energy producing sectors derive energy from the resources available in primary form such as coal, crude oil, natural gas, hydro-power and nuclear power. Some of the energy resources are converted into other (final) energy products that are used for purposes other than energy generation.

Coal is also used as a final product or intermediate for power generation. Similarly, natural gas is also used directly or as an intermediate in power generation. Many petroleum products, are used as a final product by the non-energy producing sectors and also used for power generation.

This indicates that the same energy source can be used in various forms at various stages of consumption.

## **RENEWABLE SOURCES OF ENERGY**

In India, there is high potential for generation of renewable energy from various sources- wind, solar, biomass, small hydro and cogeneration bagasse. The total potential for renewable power generation in the country as on 31.03.2023 is estimated at 2,109,654 MW. This includes solar power potential of 7,48,990 MW (35.50%), wind power potential of 1,163,856 MW (55.17%) at 150m hub height, large hydro power of 133,410MW (6.32%), SHP (small-hydro power) potential of 21,134 MW (1%), Biomass power of 28,447 MW (1.35%) and 13,818 MW (0.66%) from bagasse-based cogeneration in sugar mills. The geographic distribution of the estimated potential of renewable power as on 31.03.2023 shows that Rajasthan has the highest share of about 20.3% (428322 MW). This is followed by Maharashtra with 11.79% (share 248665MW). Gujarat and Karnataka come next with a 10.45% and 9.75% share (220505 MW and 205648 MW respectively). These four (4) states are having more than 52% of the total potential of Renewable Power in India.

As on 31<sup>st</sup> March 2024, India's renewable energy power installed capacity was 190.57GW, constituting about 43% of its total installed capacity, with non-fossil fuels

sources contributing around 45%. During last 9 years, growth of renewable energy installed capacity, excluding large hydro power, has grown at 260%. As per renewable energy statistics published by International Renewable Energy Agency (IRENA), India ranks 4<sup>th</sup> globally in overall renewable energy installed capacity.

### **Renewable Sources of Energy:**

Renewable energy is derived from natural processes that are replenished constantly. In its various forms, it derives directly from the sun, or from heat generated deep within the earth. It also includes electricity and heat generated from solar, wind, ocean, hydropower, biomass, geothermal resources, and biofuels and hydrogen derived from renewable resources. Each of these sources has unique characteristics which influence how and where they are used.

1. Wind Power – It is the conversion of wind energy into a useful form, such as electricity using wind turbines. Most wind power is generated in the form of electricity. Large scale wind farms are connected to electrical grids. Individual turbines can provide electricity to isolated locations. Wind energy is plentiful, renewable, widely distributed, clean and reduces greenhouse gas emissions when it displaces fossil-fuel-derived electricity.

Like old fashioned windmills, today's wind machines use blades to collect the wind's kinetic energy. Windmills work because they slow down the speed of the wind. The wind flows over the airfoil shaped blades causing lift, like the effect on airplane wings, causing them to turn. The blades are connected to a drive shaft that turns an electric generator to produce electricity.

2. Water Power – Water Power or Hydropower or hydraulic power is the force or energy of moving water. It may be captured for some useful purpose. Prior to the widespread availability of commercial electric power, hydropower was used for irrigation, and operation of various machines, such as watermills, textile machines, and sawmill.

3. Solar energy is the utilization of the radiant energy from the Sun. Solar power is used interchangeably with solar energy but refers more specifically to the conversion of sunlight into electricity by photovoltaics and concentrating solar thermal devices, or by one of several experimental technologies such as thermoelectric converters, solar chimneys and solar ponds.

4. Biofuel can be broadly defined as solid, liquid, or gas fuel derived from recently dead biological material, most commonly plants. This distinguishes it from fossil fuel, which is derived from long dead biological material. Biofuel can be theoretically produced from any (biological) carbon source. The most common by far is photosynthetic plants that capture solar energy. Many different plants and plant-derived materials are used for biofuel manufacture.

Biofuels are used globally and biofuel industries are expanding in Europe, Asia and the Americas. The most common use for biofuels is as liquid fuels for automotive transport. The use of renewable biofuels provides increased independence from petroleum and enhances energy security.

5. Geothermal energy is energy obtained by tapping the heat of the earth itself, usually from kilometers deep into the Earth's crust. It is expensive to build a power station but operating costs are low resulting in low energy costs for suitable sites. Ultimately, this energy derives from heat in the Earth's core.

6. Biomass refers to living and recently dead biological material that can be used as fuel or for industrial production. Most commonly, biomass refers to plant matter grown for use as biofuel, but it also includes plant or animal matter used for production of fibres, chemicals or heat. Biomass may also include biodegradable wastes that can be burnt as fuel. It excludes organic material which has been transformed by geological processes into substances such as coal or petroleum.



## **NON-RENEWABLE SOURCES OF ENERGY**

India has one of the largest proven coal reserves in the world. However, one of the objectives of India's energy mix has been to promote the production of energy through the use of renewable energy sources in accordance with climate, environment and macroeconomic considerations in order to reduce dependence on fossil fuels, ensure security of supply and reduce emissions of CO<sub>2</sub> and other greenhouse gases.

India has rich deposits of coal in the world. Total estimated reserves of coal as on 01-04-2022 were 361.41 billion tonnes, an addition of 9.29 billion tonnes over the corresponding period of previous year. The top three states with highest coal reserves in India are Odisha, Jharkhand, Chhattisgarh, which account for approximately 69% of the total coal reserves in the country. Out of the total reserves in the country, proven reserves i.e. those available for extraction in terms of i.e. economically viability, feasibility study and geologically exploration level, account for almost 52% of the total.

Total estimated of lignite as on 01-04-2022 were 46.20 billion tonnes, an addition of 0.19 billion tonnes over the corresponding period of previous year. The highest reserves of lignite are found in the state of Tamil Nadu. Out of the total Lignite reserves in the country, proven reserves account for almost only 16% of the total.

The estimated reserves of crude oil in India as on 01-04-2022 stood at 653.02 million tonnes against 591.92 million tonnes in the previous year. Geographical distribution of Crude Oil indicates that the maximum reserves are in the Western Offshore (33%) followed by Assam (23%).

The estimated reserves of Natural Gas as on 01-04-2022 was at 1149.46 Billion Cubic Meters. The maximum reserves of Natural Gas are in the Western Offshore (29.3%) followed by Eastern offshore (23.4%).

## **Non-Renewable Sources of Energy:**

Non-renewable energy is energy taken from resources that will eventually dwindle becoming too expensive or too environmentally damaging to retrieve. Non-renewable energy resource is a limited resource that will eventually deplete over time. Examples of non-renewable energy are coal, crude oil, natural gas (methane) etc.

1. Coal - Coal is formed from ancient plants' remains and extracted from underground mines or surface mining methods. It is widely used in electricity generation and industrial processes, making it a prominent non-renewable energy resource.

2. Petroleum products - Petroleum products are another essential component of non-renewable energy sources derived from crude oil. Crude oil is extracted from underground reservoirs and refined into various products, including gasoline, diesel, jet fuel, and heating oil.

3. Natural Gas - Natural gas is a gaseous fossil fuel composed mainly of methane. It is often found in association with oil deposits. Natural gas is a versatile energy source used for heating, cooking, electricity generation, and as a fuel for vehicles.

4. Nuclear power - Nuclear fuels are utilized in nuclear power plants, where energy is generated through nuclear fission. The most commonly used nuclear fuel is uranium, found in the Earth's crust in relatively low concentrations. Uranium undergoes fission reactions, releasing large amounts of energy.

## **LEGISLATIVE FRAMEWORK AND ADMINISTRATION OF ENERGY SECTOR**

The energy sector in India is governed by several ministries and regulators. Different Ministries of the Government are involved with different aspects of Energy Law. In addition to these ministries, there are also state-level bodies that regulate electricity

distribution companies. Each type of fuel and energy source has its own regulators. For example, the petroleum and natural gas sector has two regulators viz. the Directorate General of Hydrocarbons and the Petroleum and Natural Gas Regulatory Board. In addition, The Ministry of Statistics and Programme Implementation collates data available from various ministries and conducts surveys. On the energy efficiency front, the Bureau of Energy Efficiency is the sole statutory authority with the mandate to regulate energy efficiency on the consumption side.

1. The Ministry of Power - The Ministry of Power started functioning independently with effect from 2nd July, 1992. Earlier it was known as the Ministry of Energy sources. Electricity is a concurrent subject at Entry 38 in List III of the seventh Schedule of the Constitution of India. The Ministry of Power is primarily responsible for the development of electrical energy in the country and with perspective planning, policy formulation, processing of projects for investment decision, monitoring of the implementation of power projects, training and manpower development and the administration and enactment of legislation in regard to thermal, hydro power generation, transmission and distribution.
2. The Ministry of Petroleum & Natural Gas - is entrusted with the responsibility of exploration and production of oil and natural gas, their refining, distribution and marketing, import, export, and conservation of petroleum products and Liquefied Natural Gas.
3. The Ministry of New and Renewable Energy (MNRE) - is the nodal Ministry of the Government of India for all matters relating to new and renewable energy. The broad aim of the Ministry is to develop and deploy new and renewable energy for supplementing the energy requirements of the country.
4. The Ministry of Coal - The Ministry of Coal has the overall responsibility of determining policies and strategies in respect of exploration and development of coal and lignite reserves, sanctioning of important projects of high value and for deciding all related issues.

5. The Department of Atomic Energy - The Department of Atomic Energy (DAE) came into being on August 3, 1954 under the direct charge of the Prime Minister through a Presidential Order. As per this order, all businesses of the Government of India, related to Atomic Energy and to the functions of the Central Government under the Atomic Energy Act, 1948 were directed to be transacted in the Department of Atomic Energy.

“Energy Laws” is a comprehensive term and would include the following:

- a. Laws governing Electricity
- b. Laws governing Energy Conservation
- c. Laws governing all forms of renewable energy
- d. Laws governing the Petroleum and Natural Gas sector including all fuels derived from petroleum sources
- e. Laws governing the Coal sector including all forms of coal
- f. Laws governing Nuclear Energy for electricity generation

A few of the important legislations falling in different heads under energy laws are:

- The Electricity Act 2003
- Electricity Regulatory Commissions Act, 1998
- Energy Conservation Act, 2001
- The Petroleum Act, 1934
- The Petroleum and Natural Gas Regulatory Board Act 2006
- The Oilfields (Regulation and Development) Act, 1948

- The Petroleum and Mineral Pipelines Act, 1962
- The Oil Industry Act, 1974
- Coal Mines (Conservation & Development) Act, 1974
- Coal Mines Provident Fund and Miscellaneous Provision Act, 1948
- The Coal Mines (Special Provisions) Act, 2015
- Mines & Minerals (Development & Regulation) Act, 1957
- The Atomic Energy Act 1962
- International and National Regulations of Nuclear Energy and legal regime for Civil Nuclear Liability

### **COAL AND COAL DERIVATIVES**

COAL is the most important and abundant fossil fuel in India. The total inventory of Geological Resources of Indian Coal as on 01.04.2023 and up to a depth of 1200m is 378.21 billion tonne. The resources have been found mainly in Odisha, Jharkhand, Chhattisgarh, West Bengal, Madhya Pradesh, Telangana and Maharashtra. Lignite reserves in the country are estimated at around 47.37 Billion Tonne (as on 01.04.2023). The major deposits are located in the State of Tamil Nadu, followed by Rajasthan, Gujarat, Union Territory of Puducherry, Jammu and Kashmir, Kerala, Odisha, and West Bengal.

Ministry of Coal has the overall responsibility of determining policies and strategies in respect of exploration and development of coal and lignite reserves, sanctioning of important projects of high value and for deciding all related issues. These key functions are exercised through its public sector undertakings namely Coal India Limited (CIL), NLC India Limited (NLCIL) and Singareni Collieries Company Limited (SCCL). Other offices under the ministry are Office of the Coal Controller's Organization (CCO) (a

subordinate office) and Coal Mines Provident Fund Organization (CMPFO) (an autonomous body).

Three Central Sector Schemes in Coal and Coal derivatives are -

- i. Exploration of Coal and Lignite,
- ii. Research & Development and
- iii. Conservation, Safety and Infrastructural Development in Coal Mines.

Few Policy Initiatives in coal sector include:

- Policy for Auction of Coal linkages to Non-Regulated sector
- Single window for e-auction of coal
- Amendment to the New Coal Distribution Policy 2007, in order to allow the coal produced from Closed/Abandoned/Discontinued Mines to be sold through a transparent and objective manner
- Policy guidelines for use of land acquired under the Coal Bearing Areas (Acquisition and Development) Act 1957 in April 2022
- Amendment in Mineral Concession Rules 1960 vide Notification dated 7.9.2022 with a view to decriminalize its provisions
- Guidelines for Mines closure for mines closed before 2009

## **PETROLEUM AND NATURAL GAS**

The Ministry of Petroleum & Natural Gas is the nodal ministry responsible for activities relating to exploration and production of oil and natural gas (including import of Liquefied Natural Gas (LNG)), refining, distribution & marketing, import, export and conservation of petroleum products. Various Public Sector Undertakings and other organizations are under the administrative control of the Ministry of Petroleum & Natural Gas.

The Government has set a target to raise the share of natural gas in energy mix to 15% by 2030. During the year 2021-22, the crude oil production was 29.69 MMT and natural gas production was 34.02 Billion Cubic Meters. India is the fourth largest refiner in the world and second largest refiner in Asia after China and has emerged as a refining hub with refining capacity exceeding demand.

Few Policy Initiatives in Petroleum and Natural Gas sector include:

- Hydrocarbon Exploration Licensing Policy 2016. Open Acreage Licensing Policy (OALP); Modalities for operationalization of Hydrocarbon Exploration & Licensing Policy (HELP) 2017; Reforms in Hydrocarbon Exploration and Licensing Policy for enhancing domestic exploration and production of oil and gas 2019
- Policy for Extension of Production Sharing Contracts 2016 and 2017
- Policy for Relaxations, Extensions and Clarifications under Production Sharing Contract (PSC) regime for early monetization of hydrocarbon discoveries, 2014
- Setting up of National Data Repository 2017
- Discovered Small Field Policy 2015
- 2D Seismic Survey.
- Natural Gas Grid and City Gas Distribution.
- Refineries and Auto Fuel Vision and Policy.
- Implementation of BS-IV & BS-VI.
- Pradhan Mantri Ujjwala Yojana and PAHAL.
- Gram Swaraj Abhiyan and Extended Gram Swaraj Abhiyaan.

- Direct Benefit Transfer Kerosene.
- National Policy on Biofuels 2018.
- Compressed Bio Gas Plants.
- Neighborhood First Policy.
- Natural Gas Marketing reforms 2020
- Deregulation of sale of domestically produced crude oil 2022

### **ATOMIC ENERGY**

The Atomic Energy Commission was first setup in August 1948 in the Department of Scientific Research, which was created a few months earlier in June 1948. The Department of Atomic Energy (DAE) was setup on August 3, 1954 under the direct charge of the Prime Minister through a Presidential Order. Subsequently, in accordance with a Government Resolution dated March 1, 1958, the Atomic Energy Commission (AEC) was established in the Department of Atomic Energy.

The Atomic Energy Commission is responsible for formulating the policy of the Department of Atomic Energy. DAE encompasses all the areas related to power and non-power applications of atomic energy. The Department has the mandate of development of nuclear power technology which includes exploration, identification and processing of uranium resources and atomic minerals, fabrication of nuclear fuel, production of heavy water, construction and operation of nuclear power plants, nuclear fuel reprocessing and waste management. DAE is also responsible for research and development

The Atomic Energy Commission (AEC), reporting directly to the Prime Minister, is the apex body of the Government of India for atomic energy. AEC has executive and financial powers and has powers of the Government of India within the limits of approved budget provision. AEC provides direction on policies related to atomic energy. The members of AEC include, among others, some eminent scientists & technocrats,



secretaries of different ministries and senior-most officials from the office of the Prime Minister. Development and implementation of AEC directions in nuclear power, related nuclear fuel cycle activities and research & development activities is carried out by various units of Department of Atomic Energy (DAE).

Atomic Energy Regulatory Board (AERB) is the national regulatory body having powers to frame safety policies, lay down safety standards & requirements and powers to monitor & enforce safety provisions in nuclear and radiation installations and practices. AERB reports to the Atomic Energy Commission.

Nuclear power has a very important role to play in India's future energy. Nuclear power is economically competitive and therefore can provide large base load generation, while contributing significantly to de carbonization of the power sector, being devoid of greenhouse gas emissions, with life cycle emissions comparable with hydro and wind power. India has signed Civil nuclear cooperation agreements with many countries, including, USA, Russia, France, UK, South Korea, Namibia, Canada and others.

## **NEW AND RENEWABLE ENERGY**

The role of new and renewable energy has been assuming increasing significance in recent times with the growing concern for the country's energy security.

In 1982, a separate Department of Non-Conventional Energy Sources (DNES) was created in the Ministry of Energy to look after all the aspects relating to New and Renewable Energy. The Department was upgraded into a separate Ministry of Non-Conventional Energy Sources (MNES) in 1992 and was re-christened as Ministry of New and Renewable Energy (MNRE), in October 2006.

The Ministry of New and Renewable Energy (MNRE) is the nodal Ministry of the Government of India at the federal level for all matters relating to new and renewable energy. The Ministry has been facilitating the implementation of broad spectrum programmes including harnessing renewable power, renewable energy to rural areas for lighting, cooking and motive power, use of renewable energy in urban, industrial and

commercial applications and development of alternate fuels and applications. In addition, it supports research, design and development of new and renewable energy technologies, products and services.

In India, the renewable energy sources contributed 20.75% of the total energy generation during 2023-24. India currently ranks 4<sup>th</sup> globally in terms of total renewable energy installed capacity and is steadily advancing towards its goal of 500GW of non-fossil fuel-based installed capacity by 2030.

Few Policy Initiatives in new and renewable energy sector include:

- National Solar Mission (NSM) was launched on 11th January, 2010.
- National Green Hydrogen Mission, approved by the Union Cabinet on 04.01.2023
- Annual Bidding Trajectory
- New solar power scheme for particularly vulnerable tribal groups (PVTG) habitations and villages
- Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhayan (PM-KUSUM) for decentralised solar aiming to energise the agricultural pumps through Solar power
- Prime Minister (PM)- Surya Ghar Muft Bijli Yojana launched on 13.2.2024
- Central Public Sector Undertaking (CPSU) Scheme for Grid-Connected Solar Photovoltaic (PV) Power Projects
- Development of Solar Parks and Ultra Mega Solar Power Projects
- Performance Linked Initiatives (PLI) Scheme: ‘National Programme on High-Efficiency Solar PV Modules’
- Green Energy Corridor Scheme for construction of intra-state and inter-state transmission lines for power evacuation and grid interaction etc. for development of Solar Power sector.

- Renewable Energy Research and Technology Development (RE-RTD) Programme
- Key policy initiatives and schemes to tap the potential of other renewable Energy sources like Wind power, Bio Power and Small Hydro Power.

## **ELECTRICITY**

Electricity is a concurrent subject at Entry 38 in List III of the seventh Schedule of the Constitution of India. The Ministry of Power is the nodal central ministry responsible for development of power sector in India.

The main items of work dealt with by the Ministry of Power inter alia include, all matters relating to hydro-electric power (except small/mini/micro hydel projects of and below 25 MW capacity) and thermal power and transmission & distribution system network; administration of the Electricity Act, 2003, the Energy Conservation Act, 2001, the Damodar Valley Corporation Act, 1948 and Bhakra Beas Management Board as provided in the Punjab - Reorganisation Act, 1966; all matters relating to Central Electricity Authority, Central Electricity Board and Central Electricity Regulatory Commission; all matters concerning energy conservation etc.

### **The Electricity Act 2003**

Electricity Act 2003 has been enacted and came into force from 10.06.2003. The Act has been enacted to consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of electricity industry, promoting competition therein, protecting interest of consumers and supply of electricity to all areas, rationalization of electricity tariff, ensuring transparent policies regarding subsidies, promotion of efficient and environmentally benign policies, constitution of Central Electricity Authority, Regulatory

Commissions and establishment of Appellate Tribunal and for matters connected therewith or incidental thereto.

The Act provides for National Electricity Policy, Rural Electrification, Open access in transmission, phased open access in distribution, mandatory SERCs, license free generation and distribution, power trading, mandatory metering and stringent penalties for theft of electricity. It is a comprehensive legislation replacing Electricity Act 1910, Electricity Supply Act 1948 and Electricity Regulatory Commission Act 1998. The Electricity Act, 2003 has been amended on two occasions by the Electricity (Amendment) Act, 2003 and the Electricity (Amendment) Act, 2007. The aim is to push the sector onto a trajectory of sound commercial growth and to enable the States and the Centre to move in harmony and coordination.

### **Central Electricity Authority (CEA)**

CEA is an "Attached Office" of the Ministry of Power. In all technical and economic matters, Ministry of Power is assisted by the Central Electricity Authority (CEA). While the Authority (CEA) is a Statutory Body constituted under the erstwhile Electricity (Supply) Act, 1948, hereinafter replaced by the Electricity Act, 2003, where similar provisions exist, the office of the CEA is an "Attached Office" of the Ministry of Power. The CEA is responsible for the technical coordination and supervision of programmes and is also entrusted with a number of statutory functions. The functions and duties of the Authority are delineated under section 73 of the Electricity Act 2003. Besides, CEA has to discharge various other functions as well under Section 3 (National Electricity Policy & Plan), Section 8 (Hydro Electric Generation), Section 34 (Grid Standards), Section 53 (Provision relating to Safety and Electric Supply), Section 55 (Use of Meters) and Section 177 (Making of Regulations) of the Electricity Act, 2003.

### **Central Electricity Regulatory Commission (CERC)**

CERC is a statutory body functioning under section 76 of the Electricity Act 2003 (CERC was initially constituted under the Electricity Regulatory Commissions Act, 1998 on 24th July, 1998). The Commission intends to promote competition, efficiency and economy in bulk power markets, improve the quality of supply, promote investments and advise government on the removal of institutional barriers to bridge the demand supply gap and thus foster the interests of consumers. The main functions of the CERC are to regulate the tariff of generating companies owned or controlled by the Central Government, to regulate the tariff of generating companies other than those owned or controlled by the Central Government, if such generating companies enter into or otherwise have a composite scheme for generation and sale of electricity in more than one State, to regulate the inter-State transmission of energy including tariff of the transmission utilities, to grant licences for inter-State transmission and trading and to advise the Central Government in formulation of National Electricity Policy and Tariff Policy.

### **Appellate Tribunal for Electricity**

The Appellate Tribunal for Electricity (APTEL) has been set up in exercise of powers conferred under section 110 of the Electricity Act 2003 w.e.f.7th April, 2004 notified vide S.O. 478 (E) and falls under the Ministry of Power, Government of India. APTEL shall ordinarily sit at Delhi. The Appellate Tribunal commenced functioning and hearing of appeals, petitions etc. from 21st July'2005 as per notification issued by the Ministry of Power on 19/7/2005.

The Tribunal has jurisdiction to hear appeals against the orders of the Adjudicating Officer under the Electricity Act, 2003 (except under section 127) or the appropriate Commission under the Act. Besides regular appellate power, APTEL has a superintending role over regulators in terms of Section 121 of the Electricity Act, 2003 to issue orders, instructions or directions as it may deem fit, to any State or Central Electricity Regulatory Commission for performance of its statutory functions under the Electricity Act, 2003. APTEL is headed by a Chairperson who is a retired Judge of Hon'ble Supreme Court or a retired Chief Justice of a High Court. In addition to the

Chairperson, APTEL has one Judicial Member, two Technical Members Electricity and one Technical Member P&NG.

Besides Electricity matters, The Tribunal has also been conferred jurisdiction under the Petroleum and Natural Gas Regulatory Board Act, 2006 to hear appeals against the orders/decisions of the Petroleum and Natural Gas Regulatory Board set up under the Act.

### **ENERGY CONSERVATION**

Energy conservation facilitates the replacement of non-renewable resources with renewable energy. It is often the most economical solution to energy shortages, and is a more environmentally benign alternative to increased energy production. It is the quickest, cheapest and most practical method of overcoming energy shortage. Energy conservation has emerged as one of the major issues in recent years.

The institutional framework in place for pursuing the agenda of Energy Efficiency includes the Energy Conservation Act 2001 (EC Act) and the Bureau of Energy Efficiency (BEE) which is the nodal central statutory body to assist the Government in implementing the provisions of the EC Act. As a regulatory and policy advisory body, the Bureau helps in developing policies and strategies that emphasize self-regulation and market principles to achieve the primary objective of reducing the energy intensity of the Indian Economy. The EC Act also empowers the State Government to facilitate and enforce the efficient use of energy through their respective State Designated Agencies in consultation with BEE. It also empowers the Central Government to specify energy performance standards.

### **The Energy Conservation Act 2001**

Considering the vast potential of energy savings and benefits of energy efficiency, the Government of India enacted the Energy Conservation Act, 2001. The Act provides for the legal framework, institutional arrangement and a regulatory mechanism at the Central and State level to embark upon energy efficiency drive in the country.

The Energy Conservation Act, 2001 is an Act to provide for efficient use of energy and its conservation and for matters connected therewith or incidental thereto. The Act is divided into 10 chapters, comprising of 62 sections and one Schedule. The Schedule to the Act contains the List of Energy Intensive Industries and other establishments specified as designated consumers.

The Energy Conservation Act, 2001, was amended with the Energy Conservation (Amendment) Act, 2022 recently. The amended Act received the President's assent on December 19, 2022, and by way of a notification issued by the Ministry of Power, dated December 26, 2022, the amended Act along with all its provisions came into force on January 1, 2023. The amended Act has brought about some significant changes that inter alia include:

- I. Carbon credit trading: The Amendment Act empowers the Central Government to specify a carbon credit trading scheme.
- II. Obligation to use non-fossil sources of energy: The Amendment Act empowers the Central Government to specify minimum share of consumption of non-fossil sources by designated consumers as energy or feedstock. Different share of consumption may be specified for different types of non-fossil sources for different designated consumers.
- III. Energy conservation code for buildings: The Amendment Act substitutes the definition of 'energy conservation building codes' with 'energy conservation and sustainable building code' to mean the code which provides norms and standards for energy efficiency and conservation, use of renewable energy and other green building requirements for a building.
- IV. Standards for vehicles and vessels: Prior to the Amendment Act, the energy consumption standards could be specified for equipment and appliances,

which consumed, generated, transmitted, or supplied energy. The amended Act expands the scope of Section 14 (Power of Central Government to enforce efficient use of energy and its conservation) to include 'vehicles' (as defined under Section 2 (28) of the Motor Vehicles Act, 1988) and vessels (includes ships and boats).

V. The amended Act brings in new penalties and aggravates existing penalties for violations of certain provisions of the Act.

### **Bureau of Energy Efficiency (BEE)**

The Bureau of Energy Efficiency (BEE) is a statutory Body under the Ministry of Power, Government of India established under the provisions of the Energy Conservation Act, 2001. Under the provisions of the Act, Bureau of Energy Efficiency has been established with effect from 1<sup>st</sup> March, 2002.

The Mission of BEE is to develop policy and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act (EC Act), 2001 with the primary objective of reducing energy intensity of the Indian economy. The Bureau would be responsible for spearheading the improvement of energy efficiency of the economy through various regulatory and promotional instruments. The BEE has published specifications of several electrical equipments and appliances on energy efficiency.

The major regulatory functions of BEE include:

- Develop minimum energy performance standards for equipment and appliances under Standards and Labelling
- Develop minimum energy performance standards for Commercial Buildings
- Develop Energy Consumption Norms for Designated Consumers
- Certify energy managers and energy auditors.
  - Accreditation of energy auditors.



- Manner and periodicity of mandatory energy audits.

Bureau of Energy Efficiency (BEE), has initiated a number of energy efficiency initiatives in the areas of household lighting, commercial buildings, standards and labelling of appliances, demand side management in agriculture/municipalities, SME's and large industries including the initiation of the process for development of energy consumption norms for industrial sub sectors, capacity building of State Designated Agencies (SDA's) etc.

Few important Initiatives of the BEE include:

- Perform Achieve and Trade (PAT) Scheme aimed at improving energy efficiency in large energy intensive industries.  
PAT Scheme under the National Mission for Enhanced Energy Efficiency was launched in 2012, as a market-based compliance mechanism to accelerate improvements in energy efficiency in energy intensive industries. Under the PAT Scheme, the energy savings achieved by notified industries is converted into a tradable instrument called Energy Saving Certificates (ESCs). The ESCs, after issuance by the Bureau of Energy Efficiency, are traded at Power Exchanges.
- For improving energy efficiency in small and medium enterprises sector, BEE has developed 'Energy Efficiency Enterprise (E3) Certifications Programme for Brick Manufacturing sector'
- Providing financial assistance to the State Designated Agencies (SDAs) to coordinate, regulate and enforce efficient use of energy and its conservation. Providing contribution to State Energy Conservation Fund (SECF)
- Standards and Labeling(S&L) program first launched in 2006, to provide the consumer an informed choice about energy efficient appliances and equipment. Voluntary star labelling program for Ultra-High Definition Televisions (UHD TV) and Air Compressor was launched in January 2021
- Updated Energy Conservation Building Codes (ECBC) developed

- Promotion of Electric Vehicles and creation of charging infrastructure. Charging infrastructure for Electric Vehicles – Guidelines and Standards issued in 2018 and thereafter revised.
- State-wise Actions on Annual Targets and Headways in Energy Efficiency portal launched in 2021
- National Mission for Enhanced Energy Efficiency
- Municipal Demand Side Management (MuDSM) Scheme
- Agricultural Demand Side Management (AgDSM) Scheme
- National Program on Energy Efficiency and Technology Upgradation of MSMEs
- Capacity building of power distribution companies (DISCOMs)

### **The Energy Conservation Building Codes (ECBC)**

The BEE launched the Energy Conservation Building Code (ECBC) on 27<sup>th</sup> May 2007 in New Delhi. The Energy Conservation Act, 2001 provides the framework for publishing Energy Conservation Building Code (ECBC). These Building energy codes have been adopted as a regulatory measure for ushering energy efficiency in the building sector.

#### A. Commercial Building sector

Updated version of Energy Conservation Building code was launched in 2017, as the step towards promoting energy efficiency in the commercial building sector. The Energy Conservation Building Code (ECBC) sets minimum energy performance standards for new commercial buildings having a connected load of 100 kW or more, or contract demand of 120 kVA or more. While the Central Government has powers under the EC Act to publish ECBC, the State Governments have the flexibility to modify the code to suit local or regional needs and notify them.

As on March, 2024, 25 States and Union Territories have notified ECBC for implementation in their respective states. Further, among the above 25 states and UTs, 13

States have incorporated ECBC in Municipal Bye-laws. About 476 Urban Local Bodies (ULBs) have been covered under these states for compliance.

Star Rating of Commercial Buildings - Launched by Ministry of Power in India in 2009, the programme is based on the energy usage in the building over its area expressed in Energy Performance Index (EPI) in kWh/sqm/year. In this program, buildings are rated on 1-5 scale, with 5 star labelled buildings being most efficient. Presently, four typologies of the buildings are covered in the scope viz. Office buildings, BPO, Hospitals, and shopping malls. The buildings having connected load 100kW and above are considered for BEE star rating scheme. Recently, BEE has revised the EPI band for Star Rating for Office Buildings and BPOs. The revision of the scheme is effective from January 2022. As on March, 2024 more than 346 buildings have been rated under various categories.

Shunya Labelling programme for Net Zero Energy Buildings (NZEB) and Net Positive Energy Buildings (NPEB) is launched in 2021. The programme is named as “Shunya” Labelling Programme. The Shunya programme aims to identify and commemorate the building owners of NZEB and NPEB by providing a label.

#### B. Residential Building sector

Eco Niwas Samhita (ENS) which was a voluntary norm targeting the residential sector was launched in 2018. After EC Act amendment in Dec 2022, the code is applicable to all residential buildings having a connected load of 100 Kw or more, or contract demand of 120 kVA or more. While the Central Government has powers under the EC Act to publish ENS, now the State Governments have the power to notify it and make it mandatory.

#### **Designated Consumers (DCs)**

Under Section 2(g) of the Energy Conservation Act, 2001 “designated consumer” means any consumer specified under clause (e) of section 14 of the Act.

Section 14(e) says - The Central Government may, by notification, in consultation with the Bureau, specify, having regard to the intensity or quantity of energy consumed and the amount of investment required for switching over to energy efficient equipments and capacity or industry to invest in it and availability of the energy efficient machinery and equipment required by the industry, any user or class of users of energy as a designated consumer for the purposes of this Act.

The Schedule to the Energy Conservation Act provides a list of the Designated Consumers. Designated consumers include: (i) industries such as mining, steel, cement, textile, chemicals, and petrochemicals, (ii) transport sector, including Railways, and (iii) commercial buildings, as specified in the schedule. These DCs have to:

1. Appoint/Designate Energy Managers
2. Get Energy Audit conducted by Accredited Energy Auditors
3. Implement Techno-Economic Viable Recommendations
4. Comply with norms of specific energy consumption fixed
5. Submit Report on Steps Taken

### **Standards and Labeling Programme for Appliances**

An energy labeling programme for appliances was launched in 2006, and comparative starbased labeling was introduced for fluorescent tubelights, air conditioners, and distribution transformers. The labels provide information about the energy consumption of an appliance, and thus enable consumers to make informed decisions.

The Figure below shows labels for refrigerators and Fluorescent Lamps.



The Standards and Labeling (S&L) Program is one of the major thrust areas of BEE. This Program was launched with the key objective of providing consumers an informed choice about the energy and cost saving potential of the labelled appliances/equipment being sold commercially. This program entails laying down minimum energy performance norms for appliances / equipment, rating the energy performance on a scale of 1 to 5, 5 star being the most energy efficient one. As on December 2023, 35 appliances are covered under the ambit of Standards and Labeling program. Out of which, 16 appliances are under mandatory regime and remaining 19 appliances are under voluntary regime. New S&L program for Solar Photovoltaic, Packaged Boiler, Commercial Beverage Cooler and Grid Connected Solar Inverter was launched during 2023-24. Deep Freezer, Light Commercial Air Conditioners (LCAC), UHD Television (UHD TV/4K), Chillers and Washing Machine have been made mandatory during 2023-24. Till March, 2024, a total of 3426 brands and 25598 models were registered under S&L program.

### **Energy Managers and Energy Auditors**

Under the EC Act, 2001 it is mandatory for the designated consumers to get energy audit conducted by an “accredited energy auditor” (under clause 14(h) and 14(i)) and to designate or appoint an energy manager (under clause 14(1)).

National Level Certification Examination has to be passed to qualify as a Certified Energy Manager and Certified Energy Auditor, to be appointed or designated by the designated consumers under the Energy Conservation Act.

Responsibilities of Energy Managers:

1. Prepare an annual activity plan and present to management concerning financially attractive investments to reduce energy costs.
2. Establish an energy conservation cell within the firm with management’s consent about the mandate and task of the cell.
3. Initiate activities to improve monitoring and process control to reduce energy costs.
4. Analyze equipment performance with respect to energy efficiency.
5. Ensure proper functioning and calibration of instrumentation required to assess level of energy consumption directly or indirectly.
6. Prepare information material and conduct internal workshops about the topic for other staff.
7. Improve disaggregating of energy consumption data down to shop level or profit center of a firm.
8. Establish a methodology how to accurately calculate the specific energy consumption of various products/services or activity of the firm.
9. Develop and manage training programme for energy efficiency at operating levels.
10. Co-ordinate nomination of management personnel to external programs.
11. Create knowledge bank on sectoral, national and international development on energy efficiency technology and management system and information denomination.
12. Develop integrated system of energy efficiency and environmental upgradation, Wide internal & external networking.
13. Co-ordinate implementation of energy audit/efficiency improvement projects through external agencies.

14. Establish and/or participate in information exchange with other energy managers of the same sector through association.

## **POWER EXCHANGES**

During the FY 2022-23, there are three Power Exchanges operational in India, namely M/s Indian Energy Exchange Ltd (IEX), Power Exchange India Ltd (PXIL) and Hindustan Power Exchange Ltd. (HPX). IEX and PXIL started their operations from June, 2008 and October, 2008, respectively. The Commission granted registration to the third Power Exchange, namely Hindustan Power Exchange (HPX) IN 2021 and it commenced its operations from July 2022. The Commission notified the Central Electricity Regulatory Commission (Power Market) Regulations, 2021 in February 2021 to develop and regulate the power market for keeping pace with the developments in the power sector.

### INDIAN ENERGY EXCHANGE

<http://www.iexindia.com/>

Indian Energy Exchange Limited (IEX) is India's first-ever, nationwide, automated, and online electricity trading platform. It has been conceived to catalyse the modernisation of electricity trade in the country by ushering in a transparent and neutral market through a technology-enabled electronic trading platform.

CENTRAL ELECTRICITY REGULATORY COMMISSION (CERC) accorded approval on 9th June 2008, to IEX to commence its operations. IEX is a demutualised exchange that will enable efficient price discovery and price risk management in the electricity market.

On 6th February 2007, the CERC issued guidelines for grant of permission to set up power exchanges in India. Financial Technologies (India) Ltd responded by proposing

then tentatively named 'Indian Power Exchange Ltd' and applied for permission to set it up and operate it within the parameters defined by CERC and other relevant authorities. Based on the oral hearing on July 10, the CERC accorded its approval vide its order dated 31st August, 2007. IEX thus moved from the conceptual level to firmer grounds. On 9th June 2008 CERC accorded approval to IEX to commence its operations and 27th June 2008 marked its presence in the history of Indian Power Sector as Indian Energy Exchange Ltd (IEX), India's first-ever power exchange.

### **USEFUL WEBSITES**

Ministry of Power

<http://www.powermin.nic.in/>

Bureau of Energy Efficiency

<http://www.beeindia.in/>

Ministry of Petroleum and Natural Gas

<http://petroleum.nic.in/>

Ministry of Coal

<http://www.coal.nic.in/>

Ministry of New and Renewable Energy

[www.mnre.gov.in/](http://www.mnre.gov.in/)

Department of Atomic Energy

[www.dae.gov.in/](http://www.dae.gov.in/)

Niti Aayog – India Climate & Energy Dashboard

<https://iced.niti.gov.in/>



