

# CHAPTER 16

## ENERGY

Energy sector is one of the basic infrastructure sectors of an economy. Growth of economy in particular and development of society in general is closely dependent on energy security, which in turn depends on proper energy planning and policy to optimize the production/consumption of energy from various sources. In order to meet the demands of various economic sectors like household, agriculture, industry and commerce etc., it is essential to collect updated data on the production and consumption of energy from different sources like coal, crude, petroleum, natural gas and electricity. Energy statistics, apart from providing extremely important data as mentioned above, also assists to monitor energy losses, control environmental damage due to energy processes and improve the overall efficiency of energy generation and use.

At international level, United Nations has set up a "City Group" on Energy Statistics, which is popularly known as "Oslo Group" in 2006. The purpose of forming the City Group is to establish a forum for the countries to address issues related to energy statistics and contribute to improve international standards and improve methods for official energy statistics by pooling expertise in the energy community. Presently, 24 different countries namely, Australia, Austria, Azerbaijan, Canada, China, Denmark, Egypt, Finland, France, Germany, Greenland, India, Ireland, Italy, Mexico, The Netherlands, Norway, Poland, Russia, South Africa, Sweden, United Kingdom, USA and Yemen and International bodies namely, United Nations Statistics Division, International Energy Agency (IEA), Eurostat, International Atomic Energy Agency (IAEA) and International Monetary Fund Statistics Departments were the participants. The first meeting of City Group was held in 2006 at Norway (Oslo) followed by second meeting at India (Delhi) in 2007. The third meeting of this group was held at Austria (Vienna) in 2008, whereas, fourth and fifth meetings were held in Canada (Ottawa) and Ireland (Cork) in 2009 and 2010 respectively. The Topics considered are:

- User needs for energy statistics
- Scope of official energy statistics
- National best practices
- Selected methodological and quality problems in energy statistics
- Needs for harmonization of important energy statistics systems
- Key content provider for the new UN manuals on energy statistics, International Recommendation on Energy Statistics (IRES) and Energy Statistics Compilers Manual (ESCM)
- Methods for improving consistency in different statistical systems and reducing response burden

**The Definitions adopted by United Nations and India are as follows:**

**Hard Coal:** Coal has a high degree of coalification with a gross calorific value over 24 MJ/Kg (5700 Kcal/kg) on an ash-free but moist basis. Included are fines, middlings, slurry produced in the installations at pitheads.

**Lignite:** Brown coal is a coal with a low degree of coalification. Its gross calorific value is 5,700 K.cal/kg or less on an ash-free but moist basis.

**Coke:** The solid product obtained from carbonization of coal or lignite at high temperature.

**Crude petroleum:** Data for crude petroleum include shale oil and field condensate but exclude natural gas liquids from plants and oils obtained from the distillation of solid fuels.

**Liquified petroleum gases:** include (i) hydrocarbons extracted by stripping of natural gas at crude petroleum and natural gas sources; (ii) hydrocarbons extracted by stripping of imported natural gas in installations of the importing country; and (iii) hydrocarbons produced both in refineries and outside refineries in the course of processing of crude petroleum or its derivatives. Included are mainly propane, butane, isobutane and ethane.

**Motor gasoline:** comprises of a mixture of relatively volatile hydrocarbons with or without small quantities of additives, which have been blended to form a fuel suitable for use in spark-ignition internal combustion engines. Natural gasoline, aviation gasoline and naphtha's are excluded.

**Naphtha's:** are refined or partly refined light which are to be further blended or mixed with other materials to make high grade motor gasoline or jet fuel, or to be used as raw materials for town gas or feed stocks to make various kinds of chemical products, or to be used as various solvents, depending on the character of naphtha's derived and the demands of various industries.

**Kerosene:** It is used as an illuminant and as a fuel in certain types of spark-ignition engines such as those used for agricultural tractors and stationary engines. The data include those products; commonly named as burning oil, vaporizing oil, power kerosene and illuminating oil. Jet fuel, white spirit and naphtha's are excluded.

**Jet fuels:** comprise of fuel meeting of the required properties for use in jet engines and aircraft-turbine engines, mainly refined from kerosene. Gasoline-type jet fuel (light hydrocarbons, also naphtha's type, intended for use in aviation gas-turbine units as opposed to piston power units) is included.

**Gas-diesel oils:** comprise of gas oils, fuel oils and domestic fuel oil. It is used as a fuel for internal combustion in diesel engines, as burner fuel in heating installations such as furnaces and for enriching water gas to increase its luminosity. The data refer to those products commonly called diesel fuel, diesel oil, gas oil, solar oil, etc.

**Residual fuel oil:** It is crude petroleum residues, such as viscous residuum obtained by the refinery operations of crude petroleum after gasoline, kerosene and sometimes heavier distillates (such as gas oil or diesel oil) have been removed. It is commonly used by ships and industrial large scale heating installations as a fuel in furnaces of boilers. It is also known as mazout.

**Lubricants:** They are heavy liquid distillates obtained by refining crude petroleum and are used for lubricating purposes. They may be produced either from petroleum distillates or residues at refineries. Solid lubricants (e.g. grease) are excluded.

**Petroleum coke:** is a solid residue consisting mainly of carbon, obtained by the distillation of heavier petroleum oils; used mainly in metallurgical process (excluding those solid residues obtained from carbonization of coal).

**Bitumen (Asphalt):** is a brown to black solid or semi-solid material obtained as a residue in the distillation of crude petroleum. It is used mainly in road construction. Natural asphalt is excluded.

**Natural Gas:** is a mixture of hydrocarbon compounds and small quantities of non-hydrocarbons existing in the gaseous phase, or in solution with oil in natural underground reservoirs. It may be sub-classified as associated gas (that originating from fields producing both liquid and gaseous hydrocarbons), dissolved gas, or non-associated gas (that originating from fields producing only hydrocarbons in gaseous form). Included are methane (CH<sub>4</sub>) recovered from coal mines, sewage gas and natural gas liquefied for transportation. Excluded, however, are gases used for re-pressuring and re-injection, as well as gas flared, vented or otherwise wasted, and shrinkage accruing to processing for the extraction of natural gas liquids.

**Coke-oven gas:** is a by-product of the carbonization process in the production of coke in coke ovens.

**Bio-gas:** is a by-product of the fermentation of biomass, principally animal wastes by bacteria. It consists mainly of methane gas and carbon dioxide.

**Installed capacity:** The net capacity measured at the terminals of the stations, i.e., after deduction of the power absorbed by the auxiliary installations and the losses in the station transformers.

**Utilities:** undertakings of which the essential purpose is the production, transmission and distribution of electric energy. These may be private companies, cooperative organisations, local or regional authorities, nationalised undertakings or governmental organisations.

**Hydro Electricity:** as energy value of electricity is obtained by dividing the electricity generation by the average efficiency of all hydro-power stations.

**Thermal Electricity:** comprises conventional thermal plants of all types, whether or not equipped for the combined generation of heat and electric energy. Accordingly, they include steam-operated generating plants, with condensation (with or without extraction) or with back-pressure turbines, and plants using internal combustion engines or gas turbines whether or not these are equipped for heat recovery.

**Nuclear Electricity:** is defined as the heat released by the reactors during the accounting period and is obtained by dividing the generation of nuclear electricity by average efficiency of all nuclear power stations.

**Production:** comprises gross production, i.e. the amount of electric energy produced, including that consumed by station auxiliaries and any losses in the transformers that are considered integral parts of the station. Included is the total production of electric energy produced by pump storage installations.

**Imports:** refer to the amounts of electric energy transferred to the countries concerned, which are measured at the metering points on the lines crossing the frontiers. Included are imports of electric energy made by means of high voltage lines crossing frontiers as well as imports of electric energy made by means of low-voltage lines for use in the immediate vicinity of the frontier, if the quantities so transferred are known.

**Exports:** refer to the amounts of electric energy transferred from the countries concerned, which are measured at the metering points on the lines crossing the frontiers. Included are exports of electric energy made by means of high voltage lines crossing frontiers as well as exports of electric energy made by means of low-voltage lines for use in the immediate vicinity of the frontier, if the quantities so transferred are known.

**Station use & loss:** included are consumption by station auxiliaries and losses in transformers which are considered as integral parts of the electric energy generating plants.

**Losses in transport & distribution:** comprise of the losses in transmission and distribution of electric energy and losses in transformers which are not considered as integral parts of the electric energy generating plants. Included also is the electric energy consumed in pumping for pump storage installations.

**Fuelwood:** comprises of the volume of all wood (coniferous and non-coniferous) in the rough use for fuel purposes.

**Charcoal:** comprises of the solid residue consisting mainly of carbon obtained by the destructive distillation of wood in the absence of air.

**Bagasse:** is a cellulosic residue of the sugar-cane industry, which is often used as a fuel within the sugar milling industry.

**The present mechanisms for collection of energy data are as under:**

**Coal and Coal Derivatives:** The Coal Controller's Organisation is a Subordinate Office of the Ministry of Coal, having its headquarters at Kolkata and field offices at Dhanbad, Ranchi, Bilaspur and Nagpur. Statistics Division of Coal Controller's Organisation, functioning in Kolkata HQs under the overall guidance of Coal Controller is doing all works related to Coal Statistics under Ministry of Coal. The data are collected from different coal / lignite companies under the statutory power vested with the Coal Controller under the provisions of the Collection of Statistics Act, 1953, the Colliery Control Rule, 2004 & Coal Mines (Conservation & Development) Act, 1974 and publications of CIL, SAIL, and DGCIS. Data are collected from coal companies (Pvt. & Public) on monthly basis on some major parameters. Besides, Annual survey is carried out on the basis of complete enumeration (through mailed questionnaire) and sample check by physical inspection for Annual survey of Coal and Lignite Industries. Major role of Statistics Division may be summarised as follows:-

- Collection, Compilation, Analysis and Dissemination of Coal Statistics.
- Undertakes Annual Survey of Coal Industry to assess the coal production, despatch and stock at pithead
- To monitor the progress of captive coal and lignite blocks.
- To maintain a database of washeries in India.

- To provide no objection certificate in the matter of IEM (Industrial Entrepreneurs Memorandum) from SIA(Secretariat for Industrial Assistance) of D/o Industrial Promotion and Policy of M/o Commerce and Industry and to maintain corresponding database.

**This organisation is collecting data on the following items on a regular basis:-**

Item	Periodicity
1. Reserve(from GSI)	Annual
2. Production ( from coal/lignite company)	Monthly
3. Despatches ( from coal/lignite company)	Monthly
4. Pit head closing stock,	Monthly
5. Price ( from non-captive coal companies)	Monthly
6. Wagon loading (Rail) (from CIL/SCCL)	Monthly
7. Export and import( from DGCI&S)	Monthly
8. Coal consumption in steel (from SAIL/RINL/TSL)	Monthly
9. Coal consumption in power, cement etc sector	Annual
10. Captive coal and lignite mining (from CEA etc.)	Monthly
11. Washery in India(from different washery operators)	Monthly
12. World coal statistics(from International Energy Agency)	Annual
13. Colliery/Lignite-wise Production data	Annual

**Petroleum and Natural Gas:** The Ministry of Petroleum and Natural Gas is mandated to take measures for exploration and exploitation of petroleum resources including natural gas and coal bed methane, and also distribution, marketing and pricing of petroleum products. An exhaustive data base is maintained by Ministry of Petroleum on production and trade of crude oil, natural gas, petroleum products and stages of capacity creation by the petroleum industry. Statutory returns are collected on crude oil and natural gas under the provisions of Principal Legislation “Oilfields (Regulation And Development) Act, 1948” and Subordinate Legislation “Petroleum And Natural Gas Rules, 1959 (as amended from time to time)”. Also, statutory returns are collected on refinery output (petrol, diesel etc) under the provisions of Principal Legislation “Industries (Development and Regulation) Act, 1951, (Act no. 65 of 1951)” and Subordinate Legislation “Scheduled Industries (Submission of Production Returns) Rules, 1979”. However, collection of data is also governed by the Gazette of India (Extraordinary) Part II-Section 3-Sub Section (i) order No.G.S.R.272(E) dated 16.04.1999 wherein clause 8 states that “Every oil refining company shall furnish to the Central Government or an agency nominated by Central Government any and every information that may be asked for in regard to the procurement, stocking, movements (onshore or offshore), transfers, imports, exports and sales of crude oil and or all products at such period, in such manner and from such of the sources, as may be specified from time to time”. As periodicity and sources of data are concerned, the information is collected on monthly, quarterly, annual basis from all Public Sector Undertakings and Private Oil Companies including oil refineries. The data on Production of Crude Oil, all Petroleum Products, Natural Gas, LNG, Imports/Exports of Oil & Petroleum products, Consumption of Petroleum Products and Refinery intake etc. are collected monthly and apart from these data other related data for publication of “Basic Statistics on Indian Petroleum & Natural Gas Products” and “Indian Petroleum & Natural Gas Statistics” are collected annually. Monthly, Quarterly and Annual Progress Reports circulated to all concerned and also uploaded on Ministry’s web site for the public users.

**Electricity:** The Central Electricity Authority (CEA) is the nodal authority for supply of electricity data. It is a statutory organization under M/o Power constituted under Section 3 of the repealed Electricity (Supply) Act, 1948. With the objective of reforming the Power Sector, the Electricity Act, 2003 (No. 36 of 2003) has been enacted and the provisions of this Act have been brought into force with effect from 10th June, 2003. In exercise of the powers conferred by the Electricity Act, 2003, the Central Electricity Authority published the regulations ‘Central Electricity Authority (Furnishing of Statistics, Returns and Information) Regulations, 2007’. All licensees, generating companies and person(s) mentioned below, but not limited to, shall furnish to the Authority such statistics, returns or other information relating to generation, transmission, distribution, trading and utilization of electricity at such times and in such form and manner as specified under these regulations-

**New and Renewable Energy:** Ministry of New and Renewable Energy (MNRE) is the nodal Ministry of the Government of India at the National 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. It is broadly organized into eight Groups dealing with 'Bio-Energy, Research & Development and TIFAD(Technology Information Forecasting, Assessment and Databank ), Solar Energy', and Remote Village Electrification', Biomass and Wind Power', 'Energy for Urban, Industrial & Commercial Applications', 'Small Hydro and Information & Public Awareness', 'Hydrogen Energy' and 'Administration and Coordination'. In addition, the Ministry has an Integrated Finance Division. The basic data being compiled includes year wise and month wise no. of systems installed, their capacities, locations, etc. and is obtained from various stakeholders i.e. State Government Departments/Nodal Agencies, NGOs, Private Entrepreneurs, etc.

**Highlights:**

- The estimated reserve of coal was 267.211 billion tonnes as on 31.03.2009. The production of coal increased from 313.70 million tonnes in 2000-01 to 492.76 million tonnes in 2008-09 (provisional), whereas, the availability of coal increased from 325.45 million tonnes in 2000-01 to 518.26 million tonnes in 2008-09 (provisional). The consumption of coal increased from 339.31 million tonnes in 2000-01 to 518.26 million tonnes in 2008-09 (provisional).
- The estimated reserve of lignite was 39.07 billion tonnes as on 31.03.2009. The production of lignite increased from 22.95 million tonnes in 2000-01 to 32.42 million tonnes in 2008-09 (provisional), whereas, the availability of lignite increased from 24.59 million tonnes in 2000-01 to 33 million tonnes in 2008-09 (provisional). The consumption of lignite increased from 24.82 million tonnes in 2000-01 to 31.79 million tonnes in 2008-09 (provisional).
- The estimated reserve of crude petroleum was 773.34 million tonnes, whereas, the installed capacity of refineries of Crude oil was 148968 TMT per annum and the Crude Oil processed was 160772 TMT as on 31.03..2009. The production of crude petroleum increased from 32.43 million tonnes in 2000-01 to 33.51 million tonnes in 2008-09 (provisional), whereas, the availability of crude petroleum increased from 106.52 million tonnes in 2000-01 to 166.28 million tonnes in 2008-09 (provisional). The consumption of crude petroleum increased from 103.44 million tonnes in 2000-01 to 160.77 million tonnes in 2008-09 (provisional).
- The estimated reserve of natural gas was 1115.29 billion cubic metres as on 31.03.2009. The production of natural gas increased from 29.48 billion cubic metres in 2000-01 to 32.85 billion cubic metres in 2008-09 (provisional), whereas, the availability of natural gas increased from 27.86 billion cubic metres in 2000-01 to 31.75 billion cubic metres in 2008-09 (provisional). The consumption of natural gas increased from 27.86 billion cubic metres in 2000-01 to 32.73 billion cubic metres in 2008-09 (provisional).
- The installed generating capacity of electricity in utilities and non-utilities enhanced from 117783 Mega Watt in 2000-01 to 174946 Mega Watt in 2008-09, whereas, installed generating capacity of electricity in utilities enhanced from 101626 Mega Watt in 2000-01 to 147966 Mega Watt in 2008-09. Both production and availability of Hydro & Nuclear electricity increased from 91264 GWh in 2000-01 to 142576 GWh in 2008-09. The consumption of electricity (including thermal) increased from 316600 GWh in 2000-01 to 553995 GWh in 2008-09 (provisional).
- The estimated potential of renewable power was 86188 MW, whereas, installed capacity of Grid interactive renewable power was about 14486 MW as on 31.03.2009

**This chapter contains the following tables:**

**Table 16.1** presents' data of estimated reserve and installed capacities of various of energies.

**Table 16.2:**Presents year-wise data of production, availability and consumption of primary sources of conventional energy.

**Table 16.3** presents year-wise data of production of coal and coal derivatives & coal by-products.

**Table 16.4** presents the year-wise data of consumption of raw coal by different industries.

**Table 16.5** presents year-wise data of domestic production of petroleum products.

**Table 16.6** presents the year-wise data of consumption of petroleum products.

**Table 16.7** presents data of consumption of selected petroleum products during 2008-09.

**Table 16.8** presents industry-wise off-take of natural gas.

**Table 16.9** presents year-wise gross generation of electricity in utilities and non-utilities.

**Table 16.10** presents year-wise consumption of electricity (from utility) by sector.

**Table 16.11** presents year-wise electricity generated (from utility), distributed, sold and lost.

**Table 16.12** presents year-wise and state-wise electricity-installed capacity, generation and consumption

**Table 16.13** presents year-wise and state-wise electricity sold to ultimate consumer.

**Table 16.14** presents state-wise number of towns and villages electrified as on 31.03.2008.

**Table 16.15** presents state-wise and source-wise installed capacity of grid interactive renewable power as on 30.3.2009.

**Table 16.16** presents state-wise installation of off-grid/decentralized renewable energy systems/devices during 2008-09.