

CHAPTER 16

ENERGY

The Government of India accords highest priority to capacity addition in the power sector as growth of an economy in particular and development in society in general is closely dependent on energy security. The frame work for induction of super critical technology in large capacity power plants of National thermal Power Corporation (NTPC) is new in place. The Mega Power Policy has been modified and is now consistent with the National Electricity Policy 2005 and Tariff Policy 2006. It will help in lowering the cost of generation and the cost of power purchased by distribution utilities.

The National Electricity Policy 2005 aims at achieving the following objectives:

Access to Electricity – available for all households in next five years

Availability of Power – Demand to be fully met by 2012. Energy and peaking shortages to be overcome and adequate spinning reserve to be available.

Supply of Reliable and Quality Power of specified standards in an efficient manner and at reasonable rates.

Per capita availability of electricity to be increased to over 1000 units by 2012.

Minimum lifeline consumption of 1 unit/household/day as a merit good by year 2012.

Financial Turnaround and Commercial viability of Electricity Sector.

Protection of consumers' interests.

The policy seeks to address the following issues:

Rural electrification, generation, transmission & distribution of electricity, recovery of cost of services & targeted subsidies, technology development and research and development (R&D), competition aimed at consumer benefits, financing power sector programmes including private sector participation, energy conservation, environmental issues, training and human resource development, protection of Consumer interest etc.

Generation

Inadequacy of generation has characterized power sector operation in India. To provide availability of over 1000 units of per capita electricity by year the Government of India has initiated several reform measures to create a favorable environment for addition of new generating capacity in the country.

Hydro Power Generation

Hydroelectricity is a clean and renewable source of energy. Maximum emphasis is laid on the full development of the feasible hydro potential in the country. Harnessing hydro potential speedily also facilitates economic development of States, particularly North-Eastern States, Sikkim, Uttarakhand, Himachal Pradesh and J&K, since a large proportion of our hydro power potential is located in these states. The States with hydro potential need to focus on the full development of these potentials.

Thermal Generation

Coal is the ministry of Indian energy sector and 75% of the power generation is currently coal based. Even with full development of the feasible hydro potential in the country, coal would necessarily continue to remain the primary fuel for meeting future electricity demand. Imported coal based thermal power stations, particularly at coastal locations, is encouraged based on their economic viability. Use of low ash content coal also helps in reducing the problem of fly ash emissions.

Significant Lignite resources in the country are located in Tamil Nadu, Gujarat and Rajasthan and these should be increasingly utilized for power generation. Lignite mining technology needs to be improved to reduce costs.

Use of gas as a fuel for power generation depends upon its availability at reasonable prices. Natural gas is being used in gas Turbine/Combined Cycle Gas Turbine(GT/CCGT) stations, which currently accounts for about 10% of total capacity. Power sector consumes about 40% of the total gas in the country. New power generation capacity could come up based on indigenous gas findings, which can emerge as a major source of power generation if prices are reasonable.

Nuclear Power

Nuclear power is an established source of energy to meet base load demand. Nuclear power plants are being set up at locations away from coalmines. Share of nuclear power in the overall capacity profile is increased significantly.

The 11th plan envisaged capacity addition of 78,700MW in the power sector, of which 19.9% was Hydro, 75.8% thermal and the rest nuclear power. Subsequently, this was revised to 62,374MW comprising of 8237 MW hydro, 50757 MW thermal and 3380 nuclear power.

Non-conventional Energy Sources

Feasible potential of non-conventional energy resources, mainly small hydro wind and bio-mass need to be exploited fully to create additional power generation capacity. The Jawaharlal Nehru National Solar Mission envisages establishing India as a global leader

in solar energy. An ambitious target of 20,000MW of solar power by the year 2022 has been set under the Mission.

Ultra Mega Power Projects (UMPPs)

The Ministry of Power had launched an initiative for development of coal-based super critical UMPPs each of about 4000 MW capacity under Case II bidding route. Four UMPPs, i.e Sasan in Madhya Pradesh, Mundra in Gujarat, Krishnapatnam in Andhra Pradesh, and Tilaiya in Jharkhand have already been transferred to the identified developers and are at different stages of implementation. Two units of 800 MW each of the Mundra UMPP are expected to be commissioned in the Eleventh Five Year Plan.\

The Definitions of the terms in this chapter 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, middling, 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.

Liquefied 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, isobutene 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.

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 (CH₄) 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.

Highlights:

- The estimated reserve of coal was 276.81 billion tonnes as on 31.03.2010. The production of coal increased from 313.70 million tonnes in 2000-01 to 532.06 million tonnes in 2009-10 (provisional), whereas, the availability of coal increased from 325.45 million tonnes in 2000-01 to 586.07 million tonnes in 2009-10 (provisional). The consumption of coal increased from 339.31 million tonnes in 2000-01 to 586.07 million tonnes in 2009-10 (provisional).
- The estimated reserve of lignite was 39.90 billion tonnes as on 31.03.2010. The production of lignite increased from 24.25 million tonnes in 2000-01 to 34.07 million

tonnes in 2009-10 (provisional), whereas, the availability of lignite increased from 24.59 million tonnes in 2000-01 to 33.96 million tonnes in 2009-10 (provisional). The consumption of lignite increased from 24.82 million tonnes in 2000-01 to 34.42 million tonnes in 2009-10 (provisional).

- The estimated reserve of crude petroleum was 1206.15 million tonnes, whereas, the installed capacity of refineries of Crude oil was 177968 TMT per annum and the Crude Oil processed was 160033 TMT as on 31.03..2010. The production of crude petroleum increased from 32.43 million tonnes in 2000-01 to 33.69 million tonnes in 2009-10 (provisional), whereas, the availability of crude petroleum increased from 106.52 million tonnes in 2000-01 to 192.95 million tonnes in 2009-10 (provisional). The consumption of crude petroleum increased from 103.44 million tonnes in 2000-01 to 160.03 million tonnes in 2009-10 (provisional).
- The estimated reserve of natural gas was 1453.03 billion cubic meters as on 31.03.2010. The production of natural gas increased from 29.48 billion cubic meters in 2000-01 to 47.51 billion cubic meters in 2009-10 (provisional), whereas, the availability of natural gas increased from 27.86 billion cubic meters in 2000-01 to 46.49 billion cubic meters in 2009-10 (provisional). The consumption of natural gas increased from 27.86 billion cubic meters in 2000-01 to 47.25 billion cubic meters in 2009-10 (provisional).
- The installed generating capacity of electricity in utilities and non-utilities enhanced from 117783 MW as on 31.03.2001 to 187872(P) MW as on 31.03.2010, whereas, installed generating capacity of electricity in utilities enhanced from 101626 MW in 31.03.2001 to 159398 MW in 31.03.2010. The availability of same increased from 91264 GWh in 2000-01 to 125316GWh in 2009-10(provisional). The consumption of electricity (including thermal) increased from 316600 GWh in 2000-01 to 568000 GWh in 31.03.2010(provisional).
- The estimated potential of renewable power was 90313 MW, whereas, installed capacity of Grid interactive renewable power was about 16817 MW as on 31.03.2010.

This chapter contains the following tables:

Table 16.1: Estimated reserve and installed capacities of various of energies.

Table 16.2: Production, availability and consumption of primary sources of conventional energy.

Table 16.3 Production of coal and coal derivatives & coal by-products.

Table 16.4 Consumption of raw coal by different industries.

Table 16.5 Domestic production of petroleum products.

Table 16.6 Consumption of petroleum products.

Table 16.7 Consumption of selected petroleum products during 2008-09.

Table 16.8 Industry-wise off-take of natural gas.

Table 16.9 Gross generation of electricity in utilities and non-utilities.

Table 16.10 Consumption of electricity (from utility) by sector.

Table 16.11 Electricity generated (from utility), distributed, sold and lost.

Table 16.12 Electricity-installed capacity, generation and consumption

Table 16.13 Electricity sold to ultimate consumer.

Table 16.14 Number of towns and villages electrified as on 31.03.2008.

Table 16.15 State-wise and source-wise installed capacity of grid interactive renewable power as on 30.3.2010.

Table 16.16 Installation of off-grid/decentralized renewable energy systems/devices during 2009-10.