

2.3.1 Energy Conservation Building Codes (ECBC)

Energy Conservation Building Codes (ECBC) was developed to deal with rapidly increasing energy consumption in commercial buildings. ECBC sets minimum energy efficiency standards for design and construction of commercial buildings.

ECBC encourages energy efficient design or retrofit of buildings so that



- Building function, comfort, health and the productivity of the occupants is considered
- Life cycle costs (i.e. construction and energy cost are minimized)

ECBC defined the norms of energy requirement per sq.metre of area and takes into consideration the climatic region of the country, where the building is located. The owners or occupiers have to comply with energy consumption norms and standards and / or to prepare and implement schemes for its efficient use and conservation. Central Government can prescribe energy conservation building codes and direct owners/ occupiers to comply with them. State Governments can modify the codes to suit regional and local climatic conditions.

For details on energy conservation in buildings and ECBC, reader is advised to refer Book-3, Chapter 10.

2.3.2 Standards and Labeling (S&L)

There is a wide variation in energy consumption of similar products by various manufacturers. Also information on energy consumption is often not easily available. This leads to continued manufacture and purchase of inefficient equipment and appliances.

The objectives of Standards & Labeling Program is to provide the consumer an informed choice about the energy saving and thereby the cost saving potential of the marketed household and other equipment. This is expected to impact the energy savings in the medium and long run while at the same time it will position domestic industry to compete in such markets where norms for energy efficiency are mandatory.

The main provision of EC act on Standards and Labeling are:

- Recommend to the Central Government, the norms for processes & energy consumption
- standards for any equipment which consumes, generates, transmits or supplies energy.

- Recommend to the Central Government the particulars required to be displayed on label of equipment or an appliances and manner of their display.
- Prevent manufacture, sale and import of such equipment, which does not comply with the notified standards.
- Promote use of energy efficient processes, equipment, devices and systems;
- Spread information on the benefits to consumers

Standard: Energy-efficiency standards are procedures and regulations prescribing the energy performance of manufactured/commercially sold products sometimes prohibiting the sale of products that are less efficient than a minimum level. The term “standards” commonly encompasses two possible meanings:

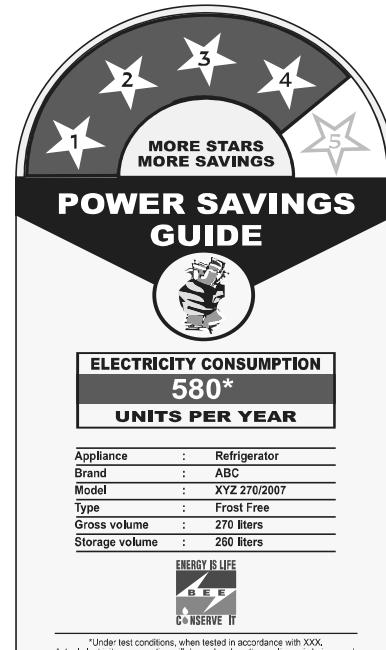
- a well-defined test protocols (or test procedures) to obtain a sufficiently accurate estimate of the energy performance of a product, or at least a relative ranking of its energy performance compared to that of other models; and
- b) target limits on energy performance (usually maximum use or minimum efficiency) based on a specified test protocol.

Labels: Energy-efficiency labels are informative labels affixed to manufactured products to describe the product’s energy performance (usually in the form of energy use, efficiency). These labels give consumers the data necessary to make informed purchases. Mainly there are two types of labels namely,

- a) Comparative label: allow consumers to compare efficiency of all the models of a product in order to make an informed choice. It shows the relative energy use of a product compared to other models available in the market.
- b) Endorsement label: define a group of products as efficient when they meet minimum energy performance criteria specified in the respective product schedule/regulation/statutory order.

Minimum Energy Performance Standards (MEPS): MEPS prescribe minimum efficiencies (or maximum energy consumption) that manufacturers must achieve in each product, specifying the energy performance(or output) but not the technology or design details of the product. The MEPS will be reviewed and upgraded periodically to enhance & ensure the availability of energy efficiency product in the market.

Star Ratings: A ranking system based on energy efficiency of an appliance declared by manufacturer. Depending upon the performance of an appliance, they are rated on a scale of star 1 to star 5. The number of stars depends on the highest pre-set threshold for energy performance that the appliance is able to meet. Therefore, Star 1 is the least energy efficient (and hence the least money saved) and star 5 is the most energy efficient (and hence more money saved).



*Under test conditions, when tested in accordance with XXX, Actual electricity consumption will depend on how the appliance is being used.

Label period: The validity period of the energy efficiency label under the energy consumption standard specified by the Central Government under clause (a) of Section 14 and in case the end period of the energy efficiency label is not specified, it shall be deemed to be valid until a new energy efficiency level is announced by the Central Government.

Appliances/equipment covered under S&L program:

In the 11th plan, S&L Programme has been expanded to 18 equipment out of which 4 equipment are introduced for mandatory S&L scheme from 7th January 2010. The equipment under the mandatory labeling program are:

1. Household Frost Free Refrigerators
2. Room Air Conditioners
3. Tubular Fluorescent Lamps
4. Distribution Transformers (up to 200 KVA)

			
Frost-free Refrigerator	TFL	AC	Distribution Transformer

The following equipment have been introduced under voluntary labeling scheme:

1. Direct Cool Refrigerators
2. Induction Motors
3. Ceiling Fans
4. Agricultural pump Sets
5. Color Televisions
6. Electric Water Geysers
7. Laptop & Notebook
8. Office equipments
9. LPG Stoves
10. Cassette/Floor standing ACs
11. Solid State Inverters
12. Diesel Generators
13. Ballast
14. Diesel Engine driven moonset pumps for agricultural purpose
15. Washing Machine

(Note: More Details are available at www.beestarlabel.com)

Example: Energy & Cost Savings estimation for Star rated appliance**Comparison of Star Rated Refrigerator with Non Star rated Refrigerator (220 Liters)**

S No	Parameter	Star Rated Refrigerator	Non Star Rated Refrigerator
1.	Cost	Rs 17,000/-	Rs 10,000/-
2.	Star level	5 star	No star
3.	Annual Electricity consumption	204 Units	520 Units
4.	Annual Electricity savings	316 Units	
5.	Annual Electricity Cost (@Rs 5/ Unit)	Rs 1020/-	Rs 2600/-
6.	Annual Money Savings	Rs 1580/-	
7.	Payback Period	1-1.5 Years	

Note: The cost of refrigerators & electricity consumption non star refrigerator is an assumption for savings estimation. The actual value may vary.

2.3.3 Demand Side Management (DSM)

Demand Side Management (DSM) means managing of the demand for power, by utilities / Distribution companies, among some or all its customers to meet current or future needs. DSM programs result in energy and / or demand reduction. For example, under this process, the demand can be shifted from peak to off peak hours thereby reducing the need for buying expensive imported power during peak hours. DSM also enables end-users to better manage their load curve and thus improves the profitability. Potential energy saving through DSM is treated same as new additions on the supply side in MWs. DSM can reduce the capital needs for power capacity expansion.

Pilot study undertaken by BEE has indicated energy saving potential of 40% by replacement of inefficient pumps with Star rated pump sets. BEE has prepared an Agricultural DSM (Ag. DSM) programme in which pump set efficiency upgradation could be carried out by an Energy Service Company (ESCOs) or distribution company. The implementation for replacement of inefficient pumps with Star rated pump sets will be done through the ESCO/Utility who would invest in energy efficiency measures on a rural pump set feeder on which supply quality enhancements (such as feeder segregation & High Voltage Direct Supply (HVDS) have already been carried out.

Almost all municipal bodies depend on government support to meet their development and operating expenses. Government of India, through the Bureau of Energy Efficiency has initiated a municipality DSM programme to cover 175 municipalities in the country by conducting investment grade energy audits and preparation of detailed project reports. Energy Service Companies are being encouraged to take up the implementation of the programme with the help of financial institutions.

2.3.4 Bachat Lamp Yojana (BLY)

The “Bachat Lamp Yojana”, which literally means “Save Lamp Scheme”, aims at the large scale replacement of inefficient incandescent bulbs in households by Compact Fluorescent Lamps (CFLs). It seeks to provide CFLs to households at the price similar to that of incandescent bulbs and plans to use the Clean Development Mechanism (CDM) to recover the cost difference between the market price of the CFLs and the price at which they are sold to households.

The Bachat Lamp Yojana is designed as a public-private partnership between the Government of India, Investors/private sector CFL suppliers and State level Electricity Distribution Companies (DISCOMs). The CFL suppliers would sell high quality CFLs to households at a price of Rs. 15 per CFL within a designated project area in a DISCOM region of operation.

The CFL supplier/Investor would be selected by the DISCOM from a list of CFL suppliers empanelled by BEE. Under the scheme 60 Watt and 100 Watt incandescent Lamps would be replaced with 11- 15 Watt and 20 - 25 Watt CFLs respectively. It is estimated that 80% energy savings can be achieved without affecting lumen intensity.

Till date, 50 small scale BLY projects from various parts of India have been included in this registered umbrella framework and 43 projects have been implemented. As a result, about 29.5 million CFLs have been distributed during XI plan period.

2.3.5 Promoting Energy Efficiency in Small and Medium Enterprises (SMEs)

Energy Efficiency in the SME sector assumes importance because of the prevailing high costs of energy and supply related concerns. It will be useful to build their energy efficiency awareness by funding/subsidizing need based studies in large number of units in the SMEs and giving energy conservation recommendations including technology upgradation opportunities. It is envisaged that such interventions supported by diagnostic studies and pilot projects at cluster level focusing on energy/resource efficiency, energy conservation and technology upgradation would be helpful in addressing the cluster specific problems and enhancing energy efficiency in SMEs.

Bureau of Energy Efficiency (BEE) is implementing a program (BEE's SME Program) to improve the energy performance in selected SME clusters. The objective of the program is to accelerate the adoption of energy efficient technologies and practices in the chosen SME clusters through knowledge sharing, capacity building and development of innovative financing mechanisms. The project is envisaged to be driven by market based mechanism that include facilitating knowledge creation at the local level, capacity building of local service providers and technology providers and thereafter facilitation of energy efficiency measures implementation through collateral funding by lead banks. The project is thus entirely market driven. Examples of clusters chosen for this project are Ahmedabad (chemicals), Surat (textiles), Warangal (rice milling) etc.



2.3.6 Designated Consumers (DC)

The Central Government has notified the following 9 energy intensive industries as designated consumers under The EC Act 2001:

No.	Industry	Energy consumption
1.	Thermal Power Stations	30,000 metric tonne of oil equivalent (MTOE) per year and above
2.	Fertilizer	30,000 metric tonne of oil equivalent (MTOE) per year and above
3.	Cement	30,000 metric tonne of oil equivalent (MTOE) per year and above
4.	Iron & Steel	30,000 metric tonne of oil equivalent (MTOE) per year and above
5.	Chlor-Alkali	12,000 metric tonne of oil equivalent (MTOE) per year and above
6.	Aluminium	7,500 metric tonne of oil equivalent (MTOE) per year and above
7.	Railways	Electric traction Sub-Section (TSS), diesel loco shed, Production units and Workshops of Indian Railways having total annual energy consumption of 30,000 MTOE or more under Ministry of Railways
8.	Textile	3,000 metric tonne of oil equivalent (MTOE) per year and above
9.	Pulp & Paper	30,000 metric tonne of oil equivalent (MTOE) per year and above

Energy Conversion values used for working out annual energy consumption in terms of metric tonne of oil equivalent
For the purpose of this table

- i) 1 kg of Oil Equivalent: 10000 kcal
- ii) 1 Metric Tonne of Oil Equivalent (MTOE): 1×10^7 kcal
- iii) In case of coal, petroleum products and other fuels in absence of supplier certificate, GCV of the above fuel (fuel sample) will be considered as per the test Certificate from a NABL Accredited Lab or State Government Laboratory or Government recognized Laboratory

As per the Act, Designated consumers have to fulfill the following criteria:

- Designated consumers have to appoint Energy managers with prescribed qualifications.
- The designated consumer has to get an energy audit conducted by an accredited energy auditor. Designated consumers would comply with prescribed norms and standards of energy consumption for the industrial sectors.
- Designated Consumers are required to adhere to energy efficient consumption norms stipulated.
- Designated Consumers are required to submit the status of energy consumption information every financial year as prescribed.

Perform, Achieve and Trade (PAT) Scheme is a market based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities, through certification of energy savings that could be traded. The genesis of the PAT mechanism flows out of the provision of the Energy Conservation Act, 2001 (amended in 2010).

The key goal of PAT scheme is to mandate specific energy efficiency improvements for the most energy intensive industries. Sector wise breakup of 478 Designated Consumers, which have

been notified under the Energy Conservation Act, 2001, and covered under PAT Scheme, is as given below:

Sector	Minimum annual energy consumption for the DC (tons of oil equivalent)	No. of DCs
Aluminium	7500	10
Cement	30000	85
Chlor-Alkali	12000	22
Fertilizer	30000	29
Iron and Steel	30000	67
Pulp and Paper	30000	31
Textile	3000	90
Thermal Power Plant	30000	144
Total		478

The scheme builds on the large variation in energy intensities of different units in almost every sector. The scheme envisages improvements in the energy intensity of each unit covered by it. The energy intensity reduction target mandated for each unit is dependent on its operating efficiency: the specific energy consumption reduction target is less for those who are more efficient, and is higher for the less-efficient units.

Further, the scheme incentivizes units to exceed their specified SEC improvement targets. To facilitate this, the scheme provides the option for industries who achieve superior savings to receive energy savings certificates for this excess savings, and to trade the additional certified energy savings certificates with other designated consumers(energy intensive industries notified as Designated Consumers under the Energy Conservation Act and included under PAT Scheme) who can utilize these certificates to comply with their specific energy consumption reduction targets. Energy Savings Certificates (ESCert) so issued will be tradable at Power Exchanges. The scheme also allows units which gain ESCerts to bank them for the next cycle of PAT, following the cycle in which they have been issued. The number of ESCerts which would be issued would depend on the quantum of energy saved over and above the target energy savings in the assessment year (for 1st Cycle of PAT, assessment year is 2014-15).

After completion of baseline audits, targets varying from unit to unit ranging from about 3 to 7% have been set and need to be accomplished by 2014-15 and after which new cycle with new targets will be proposed. Failing to achieve the specific energy consumption targets in the time frame would attract penalty for the non-compliance under Section 26 (1A) of the Energy Conservation Act, 2001 (amended in 2010). For ensuring the compliance with the set targets, system of verification and check-verification will be carried out by empanelment criteria of accredited energy auditors.

Accreditation Advisory Committee constituted by BEE for the purpose of grant of certificate of accreditation shall assess the energy audit experience and competence of energy auditor who has applied for certification of accreditation on the basis of an oral interview.

2.4 Electricity Act, 2003

The government has enacted Electricity Act, 2003 which seeks to transform and develop the electricity sector by distancing Government from the task of regulation.

Before enactment of this act, electricity supply in India was governed by Indian Electricity Act, 1910, the Electricity (Supply) Act, 1948 and the Electricity Regulatory Commissions Act, 1998. There was a need to consolidate the provisions of above act and consequently, Electricity Act was introduced in 2003.

The objectives of the Act are

- To consolidate the laws relating to generation, transmission, distribution, trading and use of electricity
- To take measures suitable for development of electricity industry
- To promote competition
- To protect interest of consumers and supply of electricity to all areas,
- To ensure transparent policies regarding subsidies
- To promote efficient and environmentally benign policies
- To constitute Central Electricity Authority (CEA), Regulatory Commissions

Main features of Electricity Act 2003

- Generation free from licensing
- Captive generation free from control
- Re-structuring of State Electricity Boards
- Mandatory establishment of Regulatory Commissions
- Open access in transmission
- Open access in distribution to be allowed by State Regulators in phased manner
- Recognition of electricity trading as a distinct activity
- Stringent provisions for violation of grid discipline and theft of power
- Supply of electricity to all areas and specific provisions for supply in rural areas
- Rationalization of electricity tariff

Role of Government

Central Government will prepare National Electricity Policy and Tariff Policy, focus on rural areas permitting stand alone systems and non-conventional energy in consultation with States, bulk purchase

of power and distribution through Panchayats, Cooperative Societies, non-Government organisations, franchisees etc. The constitution of State Regulatory commission is a mandatory requirement. If subsidy is provided by Central /State Government, provision has to be created in the budget.

Rural Electrification

Goal of Government is to extend supply of electricity to all villages/hamlets. No licence is required for generation and distribution in rural area.

Generation

Generation is freed from licensing. Captive Generation is free from controls. Open access is allowed to Captive generating plants subject to availability of transmission facility. However, clearance of CEA for hydro projects is required due to concern of dam safety and inter-State issues. Generation from Non-Conventional Sources / Co-generation will be promoted. Minimum percentage of purchase of power from renewable energy sources may be prescribed by Regulatory Commissions.

Transmission

Transmission Utility at the Central as well as State level, to be a Government company with responsibility for planned and coordinated development of transmission network.

However, load despatch would be under control of Government as it is critical for grid stability and neutrality. Open access to the transmission lines would be provided to distribution licensees, generating companies. This would promote competitions and lead to gradual cost reduction. Private licensees would be allowed in transmission.

Distribution

Distribution would be licensed. Distribution licensees would be free to undertake generation and generating companies would be allowed to take up distribution businesses. Open access in distribution would be introduced in phases. Retail tariff would be determined by Regulatory commission. Metering of all electricity supplied would be made mandatory. Private licensees would be allowed in distribution.

Renewable energy

A significant regulatory impact on renewable energy was made by the Electricity Act, 2003, which provides for the determination of quotas or Renewable Purchase Obligation (RPO) by the State Electricity Regulatory Commissions (SERC). Internationally, this is commonly referred to as the Renewable Portfolio Standard (RPS). The RPS is a policy instrument that ensures that a minimum amount of renewable energy is included in the portfolio of resources.

The policy obligates each retail seller of electricity to include in its resource portfolio a certain proportion of power from renewable energy resources, such as wind, solar, small hydro and various forms of biomass energy. The retailer can satisfy this obligation by both owning a renewable energy facility and producing own power or purchasing power from someone's facility.

Consumer

- Consumer to be given connection within stipulated time.
- Penalty in case of failure to give connection
- Ombudsman scheme for consumers grievance redressal
- Regulatory commission to specify Electricity supply code to be followed by licensees
- Appellate Tribunal to hear appeals from consumer against the decision of the State and Central Regulatory commissions
- Licensees are required to meet standards of performance specified by Regulatory Commission. Failure to meet standards makes them liable to pay compensation to affected person within ninety days.

Trading / Market Development

Trading is being permitted with licensing under the safeguard of the Regulatory Commissions. Regulatory Commissions also have authority to fix ceilings on trading margins, if necessary to avoid artificial price fluctuations.

Role of Central Electricity Authority (CEA)

- to continue as the main technical Advisor of the Govt. of India/ State Government with the responsibility of overall planning.
- to specify the technical standards for electrical plants and electrical lines
- to be technical adviser to CERC as well as SERCs
- to specify the safety standards

Tariff Principles

- Regulatory Commission is responsible to determine tariff for supply of electricity by generating company on long/medium term contracts.
- No tariff fixation by regulatory commission if tariff is determined through competitive bidding or where consumers, on being allowed open access, enter into agreement with generators/traders.
- Consumer tariff should progressively reduce cross subsidies and move towards actual cost of supply.

- State Government may provide subsidy in advance through the budget for specified target groups if it requires the tariff to be lower than that determined by the Regulatory Commission.
- Regulatory Commissions may undertake regulation including determination of multi-year tariff principles, which rewards efficiency and is based on commercial principles.
- Regulatory Commission will look at the costs of generation, transmission and distribution separately.

2.5 Integrated Energy Policy

Overview

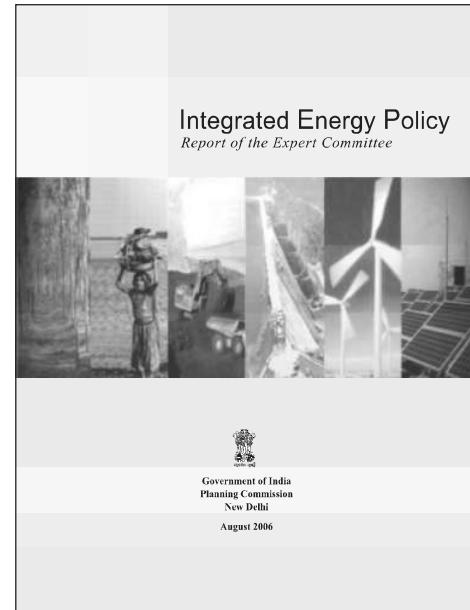
The power supply position prevailing in the country is characterized by persistent power shortages, unreliability and also high prices for industrial consumer. India depends on imported oil to extent of over 70% and this raises energy security concerns. Also consistency in policies governing each sector and consistency in pricing of different types of energy is lacking. There is a need to establish clarity in the direction which we must follow in aspects like energy security, addressing environmental concerns, energy conservation and Research and Development. To achieve these objectives, Expert Committee has made a comprehensive review to make recommendations for integrated energy policy.

India needs to sustain 8% to 10% economic growth rate, over the next 25 years, if it is to eradicate poverty and meet its human development goals. To deliver a sustained growth rate of 8% through 2031-32 and to meet the lifeline energy needs of all citizens, India needs to increase its primary energy supply by 3 to 4 times and, its electricity generation capacity/supply by 6 to 7 times of their 2003-04 levels.

By 2031-32, power generation capacity must increase to nearly 8,00,000 MW from the current capacity of around 1,60,000 MW. Similarly requirement of coal will need to increase to over 2 billion tonnes/ annum based on domestic quality of coal.

This demand must be met through safe, clean and convenient forms of energy at the least cost in a technically efficient, economically viable and environmentally sustainable manner. Considering unpredictable nature of energy supply and disruptions, assured supply of energy is essential to providing energy security.

Coal will remain India's most important energy source till 2031-32 and beyond. Thus, India must seek clean coal combustion technologies and, given the growing demand for coal, also pursue new coal



extraction technologies such as in-situ gasification to tap its vast coal reserves that are difficult to extract economically using conventional technologies.

Need for Integrated Energy Policy

- Policies affecting energy are determined by different Ministries: Petroleum & Natural Gas, Coal, Power, Water Resources, Atomic Energy, New and Renewable Energy and Finance Ministry for tax purposes
- Policies in each sector have evolved independently across sectors and they do not take into account responses arising from climate change.
- Globally energy prices are rising and domestic energy prices have to reflect these changes to encourage energy efficiency, and to encourage domestic investment in expanding energy supply.

The main features of the Policy can be summed up as follows:

Reducing Energy Requirements through Energy Efficiency and Conservation

The focus is on lowering the energy intensity of GDP growth through higher energy efficiency for meeting India's energy challenge and ensuring its energy security.

Currently, India consumes 0.16 kg of oil equivalent (kgoe) per dollar of GDP. India's energy intensity is lower than the 0.23 kgoe of China, 0.22 kgoe of the US and a World average of 0.21 kgoe. India's energy intensity is even marginally lower than that of Germany and OECD at 0.17 kgoe. However, Denmark at 0.13 kgoe, UK at 0.14 kgoe and Brazil and Japan at 0.15 kgoe are ahead of India.

Many sectoral studies confirm that there is scope to improve and energy intensity can be brought down significantly in India with current commercially available technologies. Lowering energy intensity through higher efficiency is equivalent to creating a source of untapped domestic energy.

By implementing energy efficiency and conservation, it is possible to reduce energy intensity by up to 25% from current levels. Efficiency can be increased in energy extraction, conversion, transportation, as well as in consumption. Further, the same level of output or service can be obtained by alternate means requiring less energy. The major areas where efficiency in energy use can make a substantial impact are mining, electricity generation, electricity transmission, electricity distribution, water pumping, industrial production processes, haulage, mass transport, building design.

Other policy measures include,

- Establishing benchmarks of energy consumption for all energy intensive sectors.
- Increasing the gross efficiency in power generation from the current average of 30.5% to 34%. All new plants should adopt technologies that improve their gross efficiency from the prevailing 36% to at least 38-40%.

- Promoting minimum life cycle cost purchase instead of minimum initial cost procurement by the government and the public sector.
- Promoting urban mass transport, energy efficient vehicles and freight movement by railways through scheduled freight trains with guaranteed, safe and timely deliveries.
- Enforcing minimum fuel efficiency standards for all vehicles.
- Instituting specializations in energy efficiency/conservation in technical colleges and commence certification of such experts.

Ensuring Adequate Supply of Coal with Consistent Quality

The dominance of coal in India's energy mix will continue till 2031-32. Since decontrolling of price, the coal sector has become profitable as a result of price increases and increasing share of open cast production. India would need to augment domestic production and encourage thermal coal imports to meet its energy needs.

Along the coastal belts (especially western and southern coasts), cost of imported coal is cheaper than domestic coal. Necessary infrastructure must be created to handle thermal coal imports. This will facilitate coastal power generation capacity based on imported thermal coal. Imports of thermal coal will also put competitive pressure on the domestic coal industry to be more efficient.

For increasing domestic coal production, the plan seeks to release coal blocks held by Coal India Limited (CIL) that cannot be brought into production by 2016-17 to other eligible candidates (i.e. central and state public sector units) for bringing into production by 2011-12.

The Coal Mines (Nationalization) Act, 1973, to be amended to facilitate: (a) private participation in coal mining for purposes other than those specified in the Act and (b) offering of future coal blocks to potential entrepreneurs.

Other measures proposed are:

- To introduce a system of pricing coal based on its gross calorific value.
- To follow international practice of washing coal before use.
- To replace the current system of coal linkages by long-term coal supply agreements with strict penalties for not meeting contracted supplies, quality and off takes commitments.
- To bring coal under independent regulation to improve exploitation and allocation of available resources; to regulate e-auctions and coal prices; and to enable competitive market (proposed to sell 20% of domestic production to be sold through e-auction)

Ensuring Availability of Gas for Power Generation

There is a total generation capacity of over 12000 MW based on gas and liquid fuels, mostly under combined cycle operation. However, gas supplies have been restricted and the overall utilisation is low. Any new gas based power plant would be allowed to be built only with firm and bankable gas

supply agreements. Domestic gas would be allocated to fertilizer, petrochemicals, transport and power sector at prices that yield fair return to suppliers.

Other proposed measures include:

- Private investment will be sought in all energy sectors.
- Explore possibility of acquiring energy assets abroad
- Clarity and stability in policy to attract investment

Rationalization of Fuel Prices for Efficient Fuel Choice and Substitution

- Tax Policy should be uniform across sectors with specific differences for externality
- Regulation of coal prices to be replaced with market driven price.
- Coal price to be fully variable based on Gross Calorific value and other quality parameters
- Rational State and Central taxes on commercial energy supplies
- Environmental taxes and subsidies to affect choices of fuel

Accelerating Power Sector Reforms

Power Sector Reforms: The reforms focus on controlling the aggregate technical and commercial (AT&C) losses of the state transmission and distribution utilities. This is needed to create a financially sound power sector in each state. Only financially healthy state power distribution utilities can sustain the growing generation and transmission of Central Power Sector.

Accelerated Power Development and Reform Programme (APDRP) has to be restructured to ensure energy flow auditing at the distribution transformer level through automated meter reading, a Geographical Information System (GIS) mapping of the network and consumers and the separation of feeders for agricultural pumps.

Investment in developing a Management Information System (MIS) that can support a full energy audit for each distribution transformer is essential for reduction in AT&C losses. This will also fix accountability and provide a baseline which is an essential prerequisite to management reform and/or privatization.

It is proposed to rehabilitate thermal stations to raise capacity as a least cost short-term measure. Similarly, rehabilitation of hydro stations would be taken to yield peak power at lowest costs.

Rehabilitation of existing thermal stations to raise capacity at least cost as a short-term measure. Similarly, rehabilitations of hydro stations would yield peak power at lowest costs.

Reduction in Cost of Power

In terms of purchasing power parity, the power tariffs in India for industry, commerce and large households are among the highest in the world. It is important to reduce the cost of power to increase both the competitiveness of the Indian economy and also to increase consumer welfare.

The following measures are suggested:

- All generation and transmission projects should be competitively built on the basis of tariff-based bidding.
- Where tariff continues to be determined on the basis of costs and norms, regulators may either adopt a return on equity approach or return on capital approach, whichever is considered better in the interest of consumers.
- Unit sizes should be standardized and global tenders invited for a number of units to get substantial bulk discount.

Role for Renewable Energy

Renewable energy will play a key part in developing energy security. Even if renewable energy contribution is small, distributed nature of renewable energy provides various benefits such as environmental friendly nature of technology, less time for setting up the project. The main focus will be on solar power to attain energy independence in the future. For promoting renewable energy, incentives / capital subsidy would be linked to actual energy generated and not on capacity installed.

Several initiatives are proposed to boost renewable energy:

- Grid connected renewable to improve quality of supply and provide system benefits by generating energy at the ends of the grid where supply would have been poor.
- Other forms of renewable energy to be promoted include fuel wood plantations, bio-gas plants, wood gasifier based power plants, solar thermal, solar water heaters, solar photovoltaics, biodiesel and ethanol.
- Incentives should be linked to energy generated and not on capacity installed. Subsidy in the form of Tradable Tax Rebate Certificate (TTRC) proposed based on actual energy generated. The rebate claim would become payable depending upon the amount of electricity / energy certified as having been actually supplied.
- Mandatory feed-in-laws or differential tariffs to encourage utilities to integrate wind, small hydro, cogeneration into their systems.
- Feed in tariff or RPS (Renewable Portfolio Standard) for efficiency proposed.

Ensuring Energy Security

India's energy security is primarily about ensuring the continuous availability of commercial energy at competitive prices to support its economic growth and meet the energy needs of its households with safe, clean and convenient forms of energy even if that requires directed subsidies.

India's growing dependence on energy imports exposes its energy needs to external price shocks and hence, domestic energy resources must be expanded. All available domestic energy resources have to be exploited to the maximum as long as they are competitive.

Reducing energy requirements and increasing efficiency are the two very important measures to increase energy security.

Energy security risks can be reduced by lowering the requirement of energy by increasing the efficiency in production and use; by substituting imported fuels with domestic fuels; by diversifying fuel choices (gas, ethanol, tar sands etc.) and supply sources; and by expanding the domestic energy resource base. Risks can also be reduced by increasing the ability to withstand supply shocks through creation of strategic reserves, the ability to import energy and face market risk by building hard currency reserves and by providing redundancy to address technical risks (generator failure, transmission line trips, oil pipe line leaks etc.).

Recommendations include,

- Increasing exploration to find more coal, oil and gas
- Maintaining a reserve, equivalent to 90 days of oil imports for buffer stock purposes and/or buy options for emergency supplies from neighbouring large storages such as those available in Singapore.
- Addressing short-term price volatility through creation of buffer stocks. Operating the strategic/buffer reserves in cooperation with other countries who maintain such reserves could also increase their effectiveness.
- In-situ coal gasification
- Extracting coal bed methane from coal mines
- Adopting enhanced oil recovery technologies
- Extracting isolated deposits of all hydro carbons including coal through private sector
- Developing the thorium cycle for nuclear power
- Exploiting non-conventional energy, especially solar power

In addition, India can access cheap natural gas overseas under long-term agreements (i.e. 20-30 years) and it can consider setting up captive fertilizer and / or gas liquefaction facilities in such countries.

Role of Nuclear and Hydro Power

The developments of hydropower, especially storage schemes, are critical for India as our per capita water storage is the lowest among other comparable countries. Reducing such storages is critical to India's water security, flood control and drought control. However, the environmental concerns and the problem of resettlement and rehabilitation must be suitably addressed.

India is poorly endowed with Uranium. Available Uranium can meet needs of only upto 10000 MW of nuclear power. Uranium ore is of low grade containing only upto 0.1% Uranium compared with 12-14% Uranium in resources abroad. Hence, our nuclear power is 2-3 times costlier than international supplies.

Three stage strategy of development of nuclear power from pressurized heavy water reactor to fast breed reactor and finally to Thorium based reactors is being planned.

Promoting and focusing energy related R&D

National Energy Fund is being planned to finance energy R&D on a competitive basis as it is felt that energy related R&D is not being allocated the resources that it needs. Such R&D would help in raising energy security and delivering energy independence over long-term. It is also proposed to develop number of research institutions as centres of excellence in energy research.

A number of technology missions should be mounted for developing near commercial technologies and rolling out new technologies in a time bound manner. These include coal technologies for efficiency improvement; in-situ gasification, IGCC and carbon sequestration, solar technologies covering solar thermal and photovoltaic, bio-fuels such as bio-diesel and ethanol, bio-mass plantation and wood gasification, and community based bio-gas plants.

Climate Change Concerns

Concern and the threat of climate change has been an important issue in formulating the energy policy. Initiatives suggested to reduce the green house gas intensity of the economy by as much as one third are:

- Energy efficiency in all sectors
- Emphasis on mass transport
- Active policy on renewable energy including bio-fuels and fuel plantations
- Accelerated development of nuclear and hydro-electricity
- Technology Missions for clean coal technologies
- Focused R&D on many climate friendly technologies

2.6 National Action Plan on Climate Change (NAPCC)

India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change. This threat comes from accumulated anthropogenic greenhouse gas emission in the atmosphere generated through long term, energy intensive industrial growth and high consumption lifestyle. India is very vulnerable to climate: floods, droughts, vector borne disease, cyclones, ocean storm surges, etc. and at the same time the country does neither have the sufficient infrastructure nor the resources to face its impacts.

Climate change may drastically alter the distribution and quality of India's natural resources and harm the livelihood of its people. With an economy closely linked to its natural resources base and climate sensitive sector such as agriculture, water & forestry, India may face a major threat because of climatic change.

India needs a national strategy to firstly, adapt to climate change and secondly to improve the ecological sustainability while pursuing India's development path. Recognizing the urgency to chart an action plan to address the consequences of climate change, NAPCC document was released in 2008 and it identifies measures to advance India's development without affecting climate change related adaptation and mitigation.

Guiding Principles of NAPCC

- Protecting the poor and vulnerable sections of the society through sustainable development strategy sensitive to climate change.
- Achieving national growth objectives, while enhancing ecological sustainability leading to mitigation of greenhouse gas emissions.
- Devising efficient and cost-effective strategies for Demand Side Management.
- Deploying appropriate technologies for both adaptation and mitigation of greenhouse gases emissions extensively as well as rapidly.
- Engineering new and innovative forms of market, regulatory and voluntary mechanisms to promote sustainable development.
- Effecting implementation of programmes and projects through local government institutions and public private partnership.

NAPCC outlines a number of steps to simultaneously advance India's development and climate change-related objectives of adaptation and mitigation.

Eight National Missions

There are eight National Missions which form the core of the National Action Plan are:

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
- National Mission for Sustaining the Himalayan Ecosystem
- National Mission for Green India
- National Mission for Sustainable Agriculture
- National Mission for Strategic Knowledge on Climatic Change

National Solar Missions : India is a tropical country, where sunshine hours are long and with high intensity. Solar Energy, therefore, has great potential as a future energy source. At present efficiency levels, 1% of land area is sufficient to meet electricity needs of India till 2031. It also has the advantage of permitting a decentralized distribution of energy, thereby empowering people at the grassroots level. There is need to create affordable and more convenient solar power systems and enable storage of solar power for sustained long term use.

A National Solar Mission is being launched to significantly increase the share of solar energy in the total energy mix as well to increase the use of other renewable and non-fossil fuel options such as nuclear energy, wind energy and biomass.

National Mission for Enhanced Energy Efficiency: The Energy Conservation Act of 2001 provides a legal mandate for the implementation of the energy efficiency measures through the institutional mechanism of Bureau of Energy Efficiency (BEE) in the Central Government and designated agencies in each state. A number of schemes and programmes have been initiated under the Act and implemented by BEE has resulted in avoided capacity addition of 10836 MW the XI Plan.

The National Mission for Enhanced Energy Efficiency (NMEEE) aims to strengthen the market for energy efficiency by creating conducive regulatory and policy regime and has envisaged fostering innovative and sustainable business models to the energy efficiency sector.

The mission was approved for two years of the 11th Plan period (2010 -11 and 2011-12) with an outlay of Rs.235.50 crore and continuation of the mission for XII Plan was approved with an outlay of Rs. 775 crores.

The NMEEE spelt out four initiatives to enhance energy efficiency in energy intensive industries which are as follows:

1. **Perform Achieve and Trade Scheme (PAT)**, a market based mechanism to enhance the cost effectiveness in improving the Energy Efficiency in Energy Intensive industries through certification of energy saving which can be traded.
2. **Market Transformation for Energy Efficiency (MTEE)**, for accelerating the shift to energy efficient appliances in designated sectors through innovative measures to make the products more affordable.
3. **Energy Efficiency Financing Platform (EEFP)**, for creation of mechanisms that would help finance demand side management programmes in all sectors by capturing future energy savings.
4. **Framework for Energy Efficient Economic Development (FEEED)**, for development of fiscal instruments to promote energy efficiency.

The Mission seeks to upscale the efforts to unlock the market for energy efficiency which is estimated to be around Rs. 74,000 crore and help achieve total avoided capacity addition of 19,598 MW, fuel savings of around 23 million tonnes per year and green house gas emissions reductions of 98.55 million tonnes per year at its full implementation stage.

PAT is currently under implementation and nearing completion of its first cycle of three years that started in 2012-13 after the notification of mandated specific energy consumption reduction targets for 478 Designated Consumers from 8 energy intensive sectors that include Aluminum, Cement, Chlor- Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Thermal Power, Textile. The SEC reduction targets aim to secure an energy saving of 6.686 million tonne of oil equivalent. PAT is a multicycle

scheme and in the subsequent cycles more units within the existing sectors and more sectors will be included to bring the energy efficiency of the economy to a higher level.

Under MTEE, two programmes have been developed i.e. Bachat Lamp Yojana (BLY) and Super Efficient Equipment Programme (SEEP) to bring market transformation for highly efficient appliances/equipment. The Bachat Lamp Yojana (BLY) that was instrumental in the market transformation of CFLs, its institutional structure is envisaged to be used for promotion of LEDs. The other component under MTEE is a new programme called SEEP which is designed to bring accelerated market transformation for super efficient appliances by providing financial stimulus innovatively at critical point/s of intervention. Under this program, ceiling fan has been identified as the first appliance to be adopted. The goal is to support the introduction and deployment of super efficient 35W ceiling fans, as against the current average ceiling fan sold in Indian market with about 70W rating by providing incentives to fan manufacturers.

EEFP provides platform where financial institutions, ESCOs and government work together for the development of energy efficiency market and for the identification of issues related to this market development. MOUs are signed with financial institutions to promote financing for energy efficiency projects. Further, capacity building exercises such as development of training modules, and training for financial institutions on energy efficiency project financing.

Two funds have been created viz. Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) and Venture Capital Fund for Energy Efficiency (VCFEE) under FEEED to provide partial coverage of risk involved in extending loans for energy efficiency projects provide guarantee and to provide equity capital for energy efficiency projects respectively.

National Mission on Sustainable Habitat : A National Mission on Sustainable Habitat is planned to make habitat sustainable through improvements in energy efficiency of buildings, management of solid waste and shift to public transport. The mission will promote energy efficiency as an integral component of urban planning and urban renewal through three initiatives.

The Energy Conservation building code, which addresses the design of new and large commercial building to optimize their energy demand, will be extended in its application and incentives provided for retooling existing building stock.

Recycling of material and Urban Waste Management will be a major component of ecologically sustainable economic development. India already has a significantly higher rate of recycling of waste compared to developed countries. A special area of focus will be the development of technology for producing power from waste. The national Mission will include a major R&D programme, focusing on bio chemical conversion, wastewater use, and sewage utilization and recycling options wherever possible.

Better urban planning and modal shift to public transport. Making long-term transport plans will facilitate the growth of medium and small cities in ways that ensure efficient and convenient public transport.

National Water Mission: National Water Mission focuses on ensuring integrated water resource management to conserve water, minimize wastages and ensuring equitable distribution across and within States.

Under provisions of National Water Policy, the following goals are set:

- Enhancing water use efficiency by 20%
- Recycling of waste water to meet large part of water needs of urban areas
- Adoption of new and appropriate technologies such as low temperature desalination for coastal cities
- Basin level management strategies such as rain water harvesting etc.
- Improving efficiency of existing irrigation systems, recharging of underground water sources, and adoption of large scale irrigation programmes.

National Mission for Sustaining the Himalayan Ecosystem: This mission focuses on sustaining and safeguarding the Himalayan glacier and mountain ecosystem. The extent to which Himalayan glacier is receding and problems to be addressed will be studied. Observation and monitoring network will be set up to assess fresh water resources and health of ecosystem. Community based management of Himalayan ecosystems will be promoted with incentives to community organizations and panchayats for protection and enhancement of forest lands.

National Mission for a Green India: Green India initiative will focus on enhancement of ecosystem services including carbon sinks. Green India campaign is already being launched for afforestation of 6 million hectares. The Mission aims to increase land area under forest and tree cover from the current level of 23% to 33%.

National Mission for Sustainable Agriculture: The Mission aims to make Indian agriculture more resilient to climate change. It would identify and develop new varieties of crops and especially thermal resistant crops and alternative cropping patterns, capable of withstanding extremes of weather, long dry spells, flooding, and variable moisture availability.

Agriculture will need to be progressively adapted to projected climate change and the agricultural research systems must be oriented to monitor and evaluate climate change and recommend changes in agricultural practices accordingly.

This will be supported by the convergence and integration of traditional knowledge and practice systems, information technology, geospatial technologies and biotechnology. New credit and insurance mechanisms will be devised to facilitate adoption of desired practices.

Focus would also be on improving productivity of rainfed agriculture.

National Mission on Strategic Knowledge for Climate Change: Mission would identify challenges and responses to climatic change through enlisting global community in research, technology development and collaboration. It will ensure funding of high quality and focused research into various aspects of climate change.

The Mission will also have on its research agenda, socio-economic impacts of climate change including impact on health, demography, migration patterns and livelihoods of coastal communities. It would also support the establishment of dedicated climate change related academic units in Universities and other academic and scientific research institutions in the country which would be networked.

A Climate Science Research Fund would be created under the Mission to support research. Private sector initiatives for development of innovative technologies for adaptation and mitigation would be encouraged through venture capital funds. Research would be undertaken through identified centres to support policy and implementation. The Mission will also focus on dissemination of new knowledge based on research findings.

List of Acts, Rules & Regulations relevant to Energy Managers and Energy Auditors

No	Title
1.	THE ENERGY CONSERVATION ACT, 2001 [Act 52 of 2001, dt. 29-9-2001] [As amended by Act No. 28 of 2010, dt. 4-8-2010]
2.	THE ENERGY CONSERVATION (THE FORM AND MANNER FOR SUBMISSION OF REPORT ON THE STATUS OF ENERGY CONSUMPTION BY THE DESIGNATED CONSUMERS) RULES, 2007 [GSR 174(E), dt. 2-3-2007]
3.	THE ENERGY CONSERVATION (FORM AND MANNER AND TIME FOR FURNISHING INFORMATION WITH REGARD TO ENERGY CONSUMED AND ACTION TAKEN ON RECOMMENDATIONS OF ACCREDITED ENERGY AUDITOR) RULES, 2008 [GSR 486(E), dt. 26-6-2008]
4.	THE ENERGY CONSERVATION (INSPECTION) RULES, 2010 [GSR 645(E), dt. 27-7-2010, w.e.f. 30-7-2010]
5.	THE BUREAU OF ENERGY EFFICIENCY (QUALIFICATIONS FOR ACCREDITED ENERGY AUDITORS AND MAINTENANCE OF THEIR LIST) REGULATIONS, 2010 [Notification No. 02/11(7)/09-BEE, dt. 31.3.2010]
6.	THE BUREAU OF ENERGY EFFICIENCY (CERTIFICATION PROCEDURES FOR ENERGY MANAGERS) REGULATIONS, 2010 [Notification No. 2/11(2)/07-BEE, dt. 15-10-2010]
7.	THE BUREAU OF ENERGY EFFICIENCY (MANNER AND INTERVALS OF TIME FOR CONDUCT OF ENERGY AUDIT) REGULATIONS, 2010 [Noti. No. 02/11(6)/05-BEE, dt. 28-4-2010]
8.	ENERGY CONSUMPTION NORMS AND STANDARDS FOR DESIGNATED CONSUMERS, GSR 269 (E) dt 30th March, 2012
9.	ENERGY CONSERVATION (MINIMUM QUALIFICATION FOR ENERGY MANAGERS) RULES, 2006. G.S.R. 309 dt. 8th December, 2006

10.	ENERGY CONSERVATION (FORM AND MANNER AND TIME FOR FURNISHING INFORMATION WITH REGARD TO ENERGY CONSUMED AND ACTION TAKEN ON RECOMMENDATIONS OF ACCREDITED ENERGY AUDITOR) RULES, 2008. G.S.R. 486 (E) dt 26th June, 2008
11.	(ALTERED) LIST OF ENERGY INTENSIVE INDUSTRIES AND OTHER ESTABLISHMENTS SPECIFIED IN THE SCHEDULE TO THE SAID (EC) ACT S.O. 394 (E) dt 12th March, 2007
12.	APPELLATE TRIBUNAL FOR ENERGY CONSERVATION (PROCEDURE, FORM, FEE AND RECORD OF PROCEEDINGS) RULES, 2012 GS.R. 510(E) dt 28th June, 2012

The full references of these are available in the BEE website.

Solved Example:

In a textile plant the average monthly energy consumption is 7,00,000 kWh of purchased electricity from grid, 40 kL of furnace oil (specific gravity =0.92) for thermic fluid heater, 60 tonne of coal for steam boiler, and 10 kL of HSD (sp.gravity = 0.885) for material handling equipment.

Given data:

(1 kWh = 860 kcal, GCV of coal= 3450 kcal/kg, GCV of furnace oil= 10,000 kcal/kg, GCV of HSD= 10,500 kcal/kg, 1kg oil equivalent = 10,000 kcal)

- a) Calculate the energy consumption in terms of Metric Tonne of Oil Equivalent (MTOE) for the plant.
- b) Calculate the percentage share of energy sources used based on consumption in MTOE basis.
- c) Comment whether this textile plant qualifies as a notified designated consumer under the Energy Conservation Act?

Ans:

$$\text{a) } (40000 \times 0.92 \times 10000) + (60000 \times 3450) + (7,00,000 \times 860) + (10,000 \times 0.885 \times 10,500)$$

$$\text{MTOE} = \frac{(36.8 \times 10^7) + (20.7 \times 10^7) + (60.2 \times 10^7) + (9.2925 \times 10^7)}{10^7}$$

$$= 127 \text{ Metric Tonnes of Oil Equivalent per month}$$

- b) Electricity % = 47.4, Furnace oil% =29.0, Coal % =16.3, HSD% =7.3
- c) Annual energy consumption of the textile plant = $127 \times 12 = 1524$ MTOE which is less than 3000 MTOE cut off limit as notified under the EC act. Therefore this textile plant is not a designated consumer for the present energy consumption levels.