

ENERGY CONSERVATION IN INDIA

✓ POLICY AND INSTITUTIONAL

✓ END-USERS

✓ TECHNOLOGY

Introduction

In India has made rapid strides towards economic self-reliance over the last few years. Impressive progress has been made in the fields of industry, agriculture, communication, transport and other sectors necessitating growing consumption of energy for developmental and economic activities. If India is to achieve the targeted growth in GDP, it would need commensurate input of energy, mainly commercial energy in the form of coal, oil, gas and electricity. However, India's fossil fuel reserves are limited. The known reserves of oil and natural gas may last hardly for 18 and 26 years respectively at the current reserves to production ratio. India has huge proven coal reserves (84 billion tonnes), which may last for about 200 years but the increasing ash content in Indian Coal as well as associated greenhouse gas emissions are the major concern. In the business as usual scenario, the exploitable coal may last hardly for about less than 100 years.

Energy being an important element of the infrastructure sector, has to be ensured its availability on sustainable basis. On the other hand, the demand for energy is growing manifold and the energy sources are becoming scarce and costlier. Among the various strategies to be evolved for meeting energy demand, efficient use of energy and its conservation emerges out to be the least cost option in any given strategies, apart from being environmentally benign.

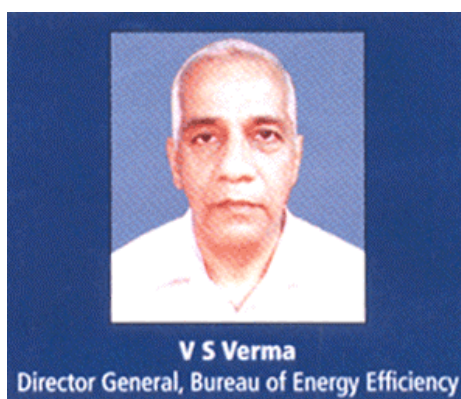
The steps to create sustainable energy system begin with the wise use of resources and energy efficiency is the mantra that leads to sustainable energy management. Energy conservation and energy efficiency is the part of the Government's strategy to decouple economic growth from growth in energy consumption.

Energy Demand and Supply

On the energy demand and supply side, India is facing severe shortages. 70% of the total petroleum product demand is being met by imports, imposing a heavy burden on foreign exchange. Country is also facing Peak power and average energy shortages of 12% and 7% respectively.

To provide power for all, additional capacity of 100,000 MW would be needed by 2012, requiring approximately Rs 8,000 billion investments. Further, the per capita energy consumption in India is too low as compared to developed countries, which is just 4% of USA and 20% of the world average. The per capita consumption is targeted to grow to about 1000 kWh per year by 2012, thus imposing extra demand on power system.

Table I: Installed Capacity (MW) of Power Sector in India (as on October, 2004)								
Region	Hydro	Thermal				Nuclear	Wind	Total
		Coal	Gas	Diesel	Total			
Northern	10597	16165	3213	15	19393	1180	61	31231
Western	5152	20731	5036	17	25844	760	597	23253
Southern	10328	13893	2650	939	17482	780	1209	29799
Eastern	2459	15237	190	17	15444	0	3	17907
N.Eastern	1135	330	751	143	1223	0	0	2358
Islands	5	0	0	64	64	0	0	69
All India	29676	66416	11840	1196	79451	2720	1870	113717



Importance of Energy Conservation

In a scenario where India tries to accelerate its development process and cope with increasing energy demands, conservation and energy efficiency measures are to play a central role in our energy policy. A national movement for energy conservation can significantly reduce the need for fresh investment in energy supply systems in coming years. It is imperative that all-out efforts are made to realize this potential. Energy conservation is an objective to which all citizen in the country can contribute. Whether a household or a factory, a small shop or a large commercial building, a farmer or a office worker, every user and producer of energy can and must make this effort for his own benefit, as well as that of the nation.

Progress Made in Energy Conservation in India

The progress made by India in energy conservation can be seen in the following three areas:

- Policy and institutional,
- End-users, and
- Technology.

Policy and Institutional

Recognizing the fact that efficient use of energy and its conservation is the least-cost option to mitigate the gap between demand and supply, Government of India has enacted the Energy Conservation Act -2001 and established Bureau of Energy Efficiency.

The Act provides for institutionalizing and strengthening delivery mechanism for energy efficiency services in the country and provides the much-needed coordination between the various entities.

Important features of Energy Conservation Act include:

- Standards and Labeling
 - Evolve minimum energy consumption standards for notified equipment and appliances.
 - Prohibit manufacture, sale and import of equipment and appliances not conforming to standards.
 - Introduce mandatory labeling to enable consumers to make informed choice.
- Designated Consumers
 - Schedule to EC Act provides list of 15 energy intensive industries and other establishments to be notified as designated consumers (DC). DCs to appoint or designate energy managers.
 - Get energy audits conducted by accredited energy auditors and Implement techno-economic viable recommendations.
 - Comply with norms of specific energy consumption fixed, and
 - Submit report on steps taken.
- Energy Conservation Building Codes
 - Central Government to prepare guidelines on ECBC.
 - To be modified by States to suit local climatic conditions.
 - To be applicable to new buildings having connected load of 500 KW or more.

Promotional Provisions to support EC Act

Various promotional provisions in support of the EC Act have, been initiated by the Bureau of Energy Efficiency, which are briefly explained below:

- Indian Industry Program for Energy Conservation (IIPEC).

This voluntary program of sharing of best practices, undertaking and specific energy consumption targets has full acceptance in the 8 sectors of industry including aluminium, cement, chlor-alkali, fertilizer, pulp and paper, petrochemicals, refinery and textile sector. Best practices have been recorded and published through CDs and also incorporated in BEE's website which is being updated periodically for use of designated consumers. Participating Industrial units have taken voluntary targets for saving energy of worth Rs 400 crores annually.

Table II: Actual Electrical Energy Supply Position (2003-2004)				
Region	Requirement (MU)	Availability (MU)	Surplus (+) (MU)	Deficit (-) (MU)
Northern Region	161595	152743	-8852	-5.5
Western Region	191680	171236	-20444	-10.7
Southern Region	144372	136844	-7528	-5.2
Eastern Region	54977	52287	-2690	-4.9
N. Eastern Region	6640	6288	-352	-5.3
All India	559264	519398	-39866	-7.1

Table III: Actual Peak Power Supply Position (2003-2004)				
Peak Demand				
Region	Projected (MW)	Met (MW)	Surplus (+) (%) (MW)	Deficit (-) (%) (MW)
Northern Region	23817	22271	-1546	-6.5
Western Region	29704	23657	-6047	-20.4
Southern Region	23183	21928	-1255	-5.4
Eastern Region	8694	7710	-884	-10.3
N. Eastern Region	1259	1070	-188	-14.9
All India	86657	76634	-10020	-11.5

Table IV: Summary of Capacity Addition (MW) during 10th Plan (As on March, 2003)				
	Hydro	Thermal	Nuclear	Total
Sector Wise				
Central	8742	12790	1300	22832
State	4481	6676	0	11157
Private	1170	5951	0	7121
Total	14393	25417	1300	41110
Region Wise				
Northern	7274	5046	0	12320
Western	3752	6604	1080	11436
Southern	1158	5998	220	7376
Eastern	1860	7075	0	8935
North Eastern	349	669	0	1018
A & N Island	0	25	0	25
Total	14393	25417	1300	41110
Status Wise				
Sanctioned on going	8088	7634	1300	17022
CEA Cleared	3504	10502	0	14006

State Cleared	130	648	0	778
New Schemes	2671	6636	0	9304
Total	14393	25417	1300	41110

- Voluntary EC Policy Declaration by Indian Industry

Industries have been approached to declare their top management commitments on energy conservation. Industries like Reliance, INDAL, Rashtriya Ispat Nigam Limited, Moral Overseas Ltd, BK BIRLA Group of Companies, and many industrial units of Aditya Birla Group have committed to reduce their specific energy consumption levels.

- Development of Dedicated Energy Manager Website.

To support the capacity building of Energy Managers and Energy Auditors, an interactive dedicated website, www.energymanagertraining.com has been launched in March 2003. Currently, website has recorded more than 2,00,000 hits.

- Small Group Activities on Energy Conservation

BEE supports designated consumers in improving their energy efficiency through launch of voluntary programs. BEE launched small Group Activity focused on energy conservation in 4 industrial units in textile and cement sector. Feed back received from the units indicate that about 5% savings through housekeeping and no cost measures is possible through this concept. Small group activity is planned to be expanded to cover more sectors.

- National Energy Conservation Awards

Industrial units have been motivated through National Energy Conservation Award scheme. In EC Award 2003, 191 participating industrial units saved Rs 5390 millions per year against an investment of Rs 10710 millions, on account of implementation of various energy conservation projects. Electricity savings achieved by the participating industrial units resulted in saving in avoided capacity equivalent to 103 MW. For the EC Award 2004, a record number of 295 industrial units are participating, which is an all time record since the inception of scheme.

Mandatory Provisions of the EC Act

- Strengthening Energy Management and Energy Auditing Capabilities of Energy Professional

To strengthen the energy management and energy auditing capabilities in the country, first National Certification examination for Energy Managers and Energy Auditors has been successfully conducted on 22-23 May, 2004 in 23 centers all over country in which 2560 candidates appeared. To assist candidates, Course books and question bank were also prepared and uploaded on Bureau's web sites www.bee-india.com and www.energymanagertraining.com. Certified energy managers will be required to be appointed or designated by designated consumers whereas certified energy auditors will be considered for accreditation.

Accreditation of Energy Auditors

Process for temporary accreditation of energy auditors for a limited period (3 years) has been initiated in order to gain experience. In total 104 applications from ESCOs and individuals were received for temporary accreditation. Two separate high level committees were constituted for evaluating the above applications on the basis of their energy auditing capabilities and institutional set up. Condition of the availability of certified energy auditors with energy auditing agencies was not considered at this stage as the certification system is under developmental phase. 62 energy auditing agencies have qualified for temporary accreditation.

- Fixation of Norms for Different Industrial Sector.

To start with, Cement and Pulp & Paper sectors have been selected for fixation specific energy consumption norms. The process is expected to be completed by March, 2005.

- Manuals and Codes for Standardizing the Process of Energy Auditing

Draft code on 7 Technologies (Equipment) Lighting Systems; Dryers; Cogeneration Plants; Electric Motors; Electric Transformers; Fluid piping systems (network), insulation and Air Conditioners/Chillers (HVAC) are prepared. The energy performance codes would provide a definite method of field testing of utility equipment in the designated consumer premises. The energy performance codes would improve credibility of energy audits & provide industry and energy managers as to what to expect from the energy audit.

- Notification of Designated Agencies

18 States Governments and union Territories have notified State level Designated Agencies for the purpose of implementing EC Act within the state, which are as under:

List of Designated Agency to co-ordinate, regulate and enforce the provisions of Energy Conservation Act 2001

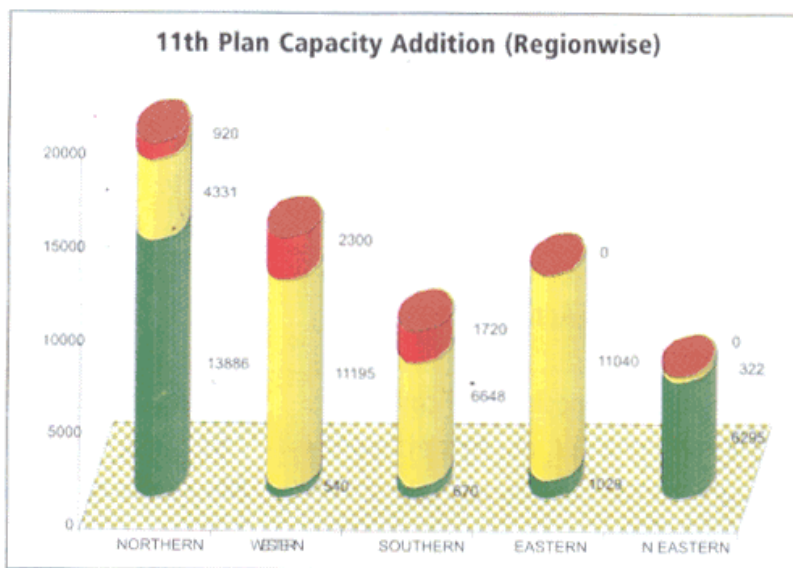
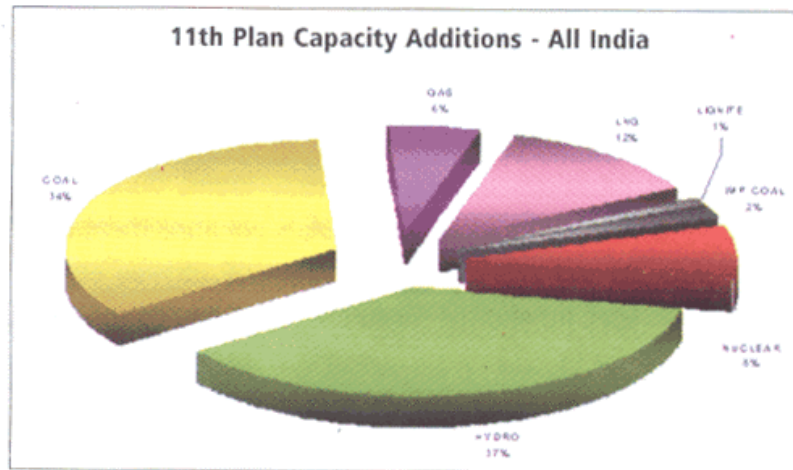
- Andaman and Nicobar UT Electricity Department, UT of Andaman and Nicobar, Port Blair;
- Andhra Pradesh: Non-Conventional Energy Development Cooperation of Andhra Pradesh Ltd. (NEDCAP);
- Arunachal Pradesh: Arunachal Pradesh Energy Development Agency (APEDA);
- Assam: Electricity Department, Government of Assam, Guwahati;
- Haryana: Department of Non-conventional Energy Sources (DNES), Haryana, Chandigarh;
- Chhattisgarh: Chhattisgarh State Renewable Energy Development (CREDA), Raipur;
- Kerala: Energy Management Centre, Kerala, Thiruvananthapuram;
- Lakshadweep UT: Department of Electricity, Union Territory of Lakshadweep, Kavaratti;
- Madhya Pradesh: M.P. Urja Vikas Nigam Limited (MPUVNL);
- Maharashtra: Maharashtra Energy Development Agency (MEDA), Pune;
- Rajasthan: Rajasthan Renewable Energy Cooperation, Jaipur;
- Uttaranchal: Electricity Safety Department, Government of Uttaranchal, Haldwani;
- West Bengal: West Bengal State Electricity Board, Kolkata;
- Gujarat: Gujarat Energy Development Agency (GEDA), Gujarat;
- Himachal Pradesh: Director (Enforcement and Energy Audit), Office of the Chief Engineer (Commercial), HP State Electricity Board, Shimla;
- Mizoram: Chief Engineer (Power), Power and Electricity Department, Government of Mizoram, Mizoram;
- Karnataka: Karnataka Renewable Energy Development Limited(KREDL);
- Tripura: Department of Power, Tripura, Agartala.

- Standards and Labeling

The preparatory work relating to standard and labeling program of electrical appliances including household refrigerators, window air conditioners, distribution transformers, fluorescent tube lights and ballasts has been initiated. Notification empowering manufacturers to affix energy labels is planned to be issued during March 2005 for one product (household refrigerator).

- Energy Conservation Building Codes (ECBC)

ECBC structure and analysis methodology has prepared. Data collection and stringency analysis is in progress and the first draft of ECBC for stakeholder review expected to be ready by March, 2005



Policy and Institutional – Results achieved/ expected

- 62 Accredited Energy Auditing firms in place by January 2005.
- 800 Certified Energy Managers and Certified Energy Auditors in place by November, 2004.
- Norms for cement and pulp and paper industry in place by August, 2005.
- Two interactive Websites in place.
- Target of energy saving worth Rs 40 million committed by participating industries.
- Capacity building of 750 energy managers through IIEEC and familiarization programmes.
- 7 energy auditing codes for utility equipment in place by March, 2005.
- Saving of 460 MW of electric power, as equivalent avoided capacity, achieved during 1999-2003 through National Energy Conservation Award Scheme.
- Notification empowering manufacturers to affix energy labels to be issued during March 2005 for one product (household refrigerator).
- Accreditation of laboratories is under progress.
- Rating plan for air conditioners and refrigerators is in final stages.
- 18 States Governments and union Territories have notified State level Designated Agencies for the purpose of implementing EC Act within the state.

END-USERS

- Energy Efficiency in Indian Industry

Industry is the major energy consumer utilizing about 50% of the total commercial energy use in India. The six key industries – namely aluminium, cement, fertilizers, pulp and paper, petrochemicals and

steel – consumes about 65% of the total energy use in India. The energy intensity in some of these industries is reported to be higher than the industries in developed countries. One of the main reasons for higher energy use is the presence of obsolete and energy inefficient processes in some of these sectors. To promote adoption of energy efficient processes, they are planned to be notified as designated consumers under the Energy Conservation Act. By complying with various provisions of EC Act, as applicable to designated consumers – namely meeting specific energy consumption norms, conduct of regular energy audits and implementation of techno economic viable recommendations and establishment of energy management system through appointment of certified energy manager is expected to boost adoption of energy efficient processes and technologies.

➤ Energy Efficiency in Government Buildings

Bureau of Energy Efficiency has undertaken Energy audit studies in 9 Government Buildings to set up an example for private buildings to pursue similar efforts. The buildings included - Rashtrapati Bhawan, Prime Minister’s Office and Defence Ministry blocks in South Block, Rail Bhawan, Sanchar Bhawan, Shram Shakti Bhawan, Transport Bhawan, R & R Hospital, Terminal I, Terminal II and Cargo Sections of Delhi Airport, and AIIMS. Energy savings potential between 25 to 46% has been identified in the above buildings.

Table VIII: Energy Audit Result

Building Particulars	Annual Energy Consumption (Lakh kWh)	Annual Energy Savings (Lkha kWh)	% Savings (kWh)	Annual Energy Savings (RsLakhs)	Investment (Rs Lakhs)	Payback period (year)
PMO	8.3	2.7	32	18.9	50.5	3
Rashtrapati Bhawan	34.1	7.8	23	49.9	51.2	1
Sanchar Bhawan	25.6	11.9	46	76	147.1	1.9
Shram Shakti & Transport Bhawan	20.4	8	39	42.9	157.5	3.7
RR Hospital	100	28.8	28	88.3	44.9	0.5
Air Port	713	145	20	586	810	1.5
Rail Bhawan	23.5	6	25	40	163	4.2
AIIMS	369	93.1	29	712	1070	1.5

Implementation of energy audit studies has been planned through ESCO route. Rashtrapati Bhawan has already awarded the energy audit studies implementation contract and other buildings are expected to award the contact within two months time

Technology

The new generation industrial plants installed in India have excellent energy efficiency norms comparable with the best and most energy efficient plants in the World. This shows the deep penetration of advanced energy efficient technologies in many of the Indian industrial plants. For example, in Indian cement plants, the technology penetration is very high and the energy efficiency norms are comparable to the best energy efficient plants in the World. Further, some of the Indian Steel plants are already undergoing a process of modernization and are adopting more energy efficient practices. Technology updating is also positive in the Indian Power and Pulp and paper sector. There has been commendable progress in energy efficient technologies employed in thermal

and electric utilities. Use of fluidised bed boilers and furnaces, variable frequency drives, energy efficient pumps, fans, compressors and cooling towers are widely employed in Indian industries. Energy efficient compact fluorescent lamps and electronic ballasts are penetrating domestic, commercial and industrial sector at a very faster rate. Standard and labeling program of EC Act will further boost manufacturing and adoption of energy efficient technologies.

Conclusions

The increasing preference for commercial energy has led to a sharp increase in the demand for electricity and fossil fuels. Use of Fossil Fuels has resulted in emission of huge quantity of carbon dioxide causing serious environmental damages. There is still a considerable potential for reducing energy consumption by adopting energy efficiency measures at various sectors of our country. Energy efficiency will not only reduce the need to create new capacity requiring high investment, but also result in substantial environmental benefits. With the enactment of the Energy Conservation Act, 2001, a legal framework is now available for promoting energy efficiency in all sectors of the economy efficient use of energy and its conservation will succeed as a programme if opinion leaders and captains of industry take the lead in supporting the conservation programme.

Reference Book:

IEEMA Journal (Energy Conservation Week 14-21 Dec., 2004)
Energy Conservation Special Issue.