

# Towards a New Prosperity in India: the Clean & Sustainable Economy solutions through the lens of Energy Efficiency

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**Abstract**— Energy is a vital input in production and this means that if India is to move to the higher growth rate that is now feasible, we must ensure reliable availability of energy. As India is targeting 8- 10% of growth rate, the quantity and quality of energy has to increase substantially. Thus the energy challenge is of fundamental importance. The Government of India committed to meet the growing energy needs at affordable rates to meet the objectives of economic development. Highlighting the efforts, the Government of India launched various energy efficient schemes and policies. This paper reviewed national initiatives of these policies and also links with various other sustainable green practices and environmental policies. The research findings clearly indicate that selected stakeholders are complying well with the existing environmental standards. It can be linked to their commitments for greener practices and can be seen in their environmental management plan that explains the execution of environmental policies to reduce the operational cost – by making their products environmental friendly and through reduction of emission from their manufacturing activities. Also, study focus on the status of Energy Conservation Building Codes (ECBC) release by BEE, Ministry of Power beside many energy efficiency measures that recommended environmental sensitive design for buildings to reduce operating cost through energy efficiency in heating, ventilation and air conditioning system, lighting, water heating, refrigeration and electronics. The full implementation of these recommended building designs can lead to saving of around 25% -65%.

**Keywords**— BEE, Energy Conservation Building Codes, Energy Efficiency, Environment Sensitive Building Design.

## I. INTRODUCTION

Indian economy is the fastest and largest growing economy; with continuing rapid urbanization and economic development. Owing to economic growth, there would be a 70% increase in the buildings in IT sector, 15% financial service sectors, 15% for other sectors (TERI Report No.2007GL01). This growth is at the cost of environmental degradation and represents major challenges like: - rising consumption and demand for energy, and pressure on already limited resources such as land and water. Therefore India, like other countries need to find a sustainable solution for energy and environment without compromising its economic and social development. To achieve its twin objective, India needs to increase its focus on clean and efficient technologies and practices to meet these objectives.

This research paper is based on a segment covered in a report prepared by The Energy Resource Institute (TERI) under project namely “Sustainable Public Procurement: Towards a low carbon economy” for International Institute for Sustainable Development (IISD). It reviewed the existing sustainable business practices along with their energy efficient options for three selected stakeholders (representing three different types of industries) as a case study from the network of stakeholders covered under this report. As it reflects their awareness towards existing

various government environmental policies. Also, their considerable interest for new evolving policies for energy efficiency like Green Building Practices, Energy Conservation Building Code and current regulatory instrument PAT (Perform Achieve and Trade) to reduce specific energy consumption by the Bureau of Energy Efficiency (BEE). The voluntary based instrument such as Energy Conservation Building Code plays an important role in promoting sustainable practices. Therefore, this review study mainly focuses on Energy Conservation Building code for energy efficiency. ([http://www.iisd.org/pdf/2007/state\\_procurement.pdf](http://www.iisd.org/pdf/2007/state_procurement.pdf))

The findings of the study are based on the information collected through questionnaire and the format of the questionnaire is given in Annexure 1. The Company's profiles are also prepared through this information to know the existing green initiatives of selected stakeholders. The literature review was done to read and understand the various standards and labeling programs and other green practices.

## II. APPROACH TOWARDS ENERGY EFFICIENCY: FINDINGS FROM CASE STUDY OF SELECTED STAKEHOLDERS

ECBC lists specify maximum and minimum limitations on a number of key building features that affect building energy use. ECBC has both prescriptive and performance-based compliance paths. The prescriptive path calls for adoption of minimum requirements for the building envelope and energy systems (lighting, HVAC, service, water heating and electrical). The performance-based compliance path requires the application of whole building simulation approach to prove efficiency over base building as defined by the code.

The development of ECBC had participation of all major stakeholders: government, international agencies, NGOs, architects, industry and financing institutions to ensure that all aspects of the building sector are covered. Currently, ECBC is implemented on a voluntary basis for buildings having a connected load of 500 kW or a contract demand of 600 KVA. To achieve the desired objectives the three major companies were selected on this basis. These companies represent the implementation and benefits out of it at both large and small scale.

## III. COMPANY'S PROFILE AND ENVIRONMENT POLICIES

### **Bharat Heavy Electrical Limited, New Delhi**

#### *Company's Profile*

BHEL is the largest engineering and manufacturing enterprise in India in the energy-related / infrastructure, today. BHEL was established 40 Years ago.

BHEL manufactures over 180 products under 30 major product groups and caters to core sectors of the Indian Economy viz. Power Generation and Transmission, Industry, Transportation, Telecommunication, Renewable Energy etc.

BHEL has

- Installed equipment for over 90,000MW of Power generation – for utilities, captive and Industrial users
- Supplied over 2, 25,000 MVA transformer capacities and other equipment operating in Transmission and Distribution Network up to 400 kV (AC and DC)
- Supplied over 25,000 Motors with Drive Control System to Power Projects, Petrochemicals, Refineries, Steel, Aluminum, Fertilizer, Cement plants etc
- Supplied Traction electrics and AC/DC locos to Power over 12000 kms Railway Networks
- Supplied over one million values to power plants and other Industries

#### *Environmental Initiative*

BHEL shares the growing concern on issues related to Environmental and Occupational Health and Safety costs and is committed to protecting Environment in and around its own establishments and to providing safe and healthy environment to all its employees. For fulfilling these obligations, a Health, Safety and Environmental policy has been formulated and implemented through Management Systems.

#### *Environmental Policy:*

To strive to be an environmental friendly company in its Activities, Products and Services through –

- Compliance with applicable Environment legislation/Regulation
- Continual Improvement in Environment Management System to protect our natural environment and control pollution
- Promotion of activities for conservation of resources by environment management
- Enhancement of environment activities, offering the Company's capabilities in this field
- Assist and co-operate with concerned Government Agencies / Regulatory bodies engaged in

environmental activities, offering BHEL'S capabilities in this field.

BHEL is also the member of CORE (Corporate Roundtable on Development of Strategies for Environment) launched by The Energy Research Institute (TERI).

BHEL's commitment to environmental issues can be seen as an integral part of its core business. In the field of Non – Conventional and Renewable Energy, BHEL has successfully launched products like Wind electric generators, Solar heating systems, solar photovoltaic systems, solar lanterns and battery powered road vehicles. Technology up gradation has been done to minimize environmental impact of fossil energy products, by way of low NOx oil/gas burners, circulating fluidized bed combustion boiler etc.

### **INDIAN OIL CORPORATION LIMITED (IOCL)**

#### **IOCL**

##### **Company's Profile**

IOCL is an Indian Public – Sector Petroleum Company. It is India's largest commercial enterprise, ranking 135<sup>th</sup> on the fortune Global 500 listing. It began operation in 1959 as Indian Oil Company Ltd.

The IOCL was formed in 1964, with the merger of Indian Refineries Ltd. Indian Oil and its subsidiaries account for a 47% share in the petroleum products markets, 40% share in refining capacity and 67% downstream sector, pipelines capacity in India. The Indian Oil Group of Companies own and operates, 10 of India's 19 refineries with a combined refining capacity of 60.2 million metric tons per year. The sales turnover for the year 2007-2008 is Rs. 2, 47,479 crore and profit of Rs. 6, 963 crore.

##### **Environmental Initiative**

Protection of the environment is the core commitment of its business and fully focused on "sustainable development". Because of this all operating units and installations have a comprehensive safety, health and environment management system in place. The management system and major marketing installation terminals are certified to ISO-14001 Standards. The facilities are periodically reviewed and upgraded from time to time for better performance. It is also the Active Partner of the Global Compact Program.

All Indian Oil Refineries comply with the prescribed environmental standards and incorporate State-of-the-Art effluent technologies that further improved these standards. These Refineries are accredited for Occupational Health and Safety Assessment Series (OHSAS -18001) and also rated under International Safety Rating System (ISRS). The Refineries provided with full- fledged effluent treatment

plants consisting of physical, chemical, biological and tertiary Treatment facilities. Oilivorous-S and Oilivorous-A technologies are being used for the treatment of Oily Sludge and Acid Tar. Various measures and Ambient Air Monitoring Stations are established for control of gaseous emission and to minimize the impact on Air quality.

##### **Green Initiatives**

- Low Sulphur (0.5%) Diesel was introduced in Metros from April 1996 and Diesel with 0.05% Sulphur content introduced in 2001.
- Extra –low Sulphur (0.2%) Diesel in eco- sensitive areas.
- Unleaded Motor Sprit (petrol or Gasoline) was made available all over the country since Feb 1, 2000
- Invested Rs. 7,000 crore in green fuel projects
- R& D Centre engaged in the formulation of Eco – friendly biodegradable lube of formulations and also certified under ISO-14000:1996 for Environment Management System.
- Fully geared to meet the target of reaching EURO-III compliance fuels by the year 2010.

### **ANDHRA PRADESH PAPER MILLS LIMITED,**

#### **HYDERABAD**

##### **Company's Profile**

The Company was incorporated on 29<sup>th</sup> June 1964 as "The Andhra Paper Mills Ltd." at Rajahmundry. The Certificate of Commencement of business was obtained on 10<sup>th</sup> July 1964

In 2001, Coastal Paper Ltd. was taken over by the Company. The Production capacity of both the units put together is 1, 53,500 TPA. The estimated paper production will increase to 1, 74,500 TPA after the completion of paper modernization plan in the year 2007.

##### **Environmental Initiative**

APPM has shown a dedicated concern for Safety, Health & Environment and has taken adequate precautions for ensuring health and safety of its employees and the responsibility of controlling and preventing pollution.

***For enhanced environmental care, APPM has taken various steps like:***

- Installing devices such as dust collector and Electrostatic Precipitators
- Utilizing solid wastes like wood/bamboo dust as auxiliary fuel in its Coal Fired Boilers

- Reclining lime sludge in its Rotary Lime Kiln to regenerate the required burnt lime for re-use in the preparation of cooking liquor

APPM keenly considers every element and process wherein environment can be protected. In the year FY 2005-06, there has been a considerable reduction in consumption of power and chemicals. There has also been a marginal reduction in consumption of raw materials, along with arrangements for alternate source of raw materials. Coal dependency and external power have also experienced a marginal drop in consumption. Modern technology has also been deployed for recycling and reusing water. The decrease in the consumption of these resources as well as cost-effectiveness has led to an overall lower manufacturing cost this year.

#### IV. ENERGY CONSERVATION CODES FOR BUILDINGS

Energy Conservation Building Code ECBC sets minimum energy performance standards for commercial buildings. The Code has been prepared in pursuant to section 14(p) of the Energy Conservation Act, 2001 which empowers the Central Government to prescribe ECBC for commercial buildings and building complexes for efficient use of energy and its conservation. The states Government have the flexibility to amend ECBC to suit local or regional needs.

##### *Applicable Building Systems*

- Building envelopes , except for unconditioned storage spaces or warehouses
- Mechanical systems and equipment ,including heating, ventilating and air conditioning,
- Service hot water heating
- Interior and Exterior lighting, and (e)
- Electric power and motors

**Exemptions** – The provision of this code don't apply to:

- Buildings that don't use either electricity or fossil fuel
- Equipment and portions of building system that use energy primarily for manufacturing processes, and
- Multi – family buildings of three or fewer stories above grade, and single – family buildings.

Initially, implementation of the codes will be voluntary but will be made mandatory soon under the Energy Conservation Act 2001 for the buildings having connected load of 500 kW or more. The implementation of the codes will reduce energy consumption from 25% to 40% and will yield annual saving of about 1.7 billion units.

[HTTPS://BEEINDIA.GOV.IN/CONTENT/ECBC](https://BEEINDIA.GOV.IN/CONTENT/ECBC)

##### **Issues:**

- 1) There are little incentive for a building developer to invest in it as the benefits are reaped by the user
- 2) There are state designated agencies for code implementation; the institutional framework to support the same is yet to be in place. There is no defined Mechanism within the states, as to how the code shall be enforced
- 3) There are not enough architects/ designers who can analyze plans based on code requirements. There also is not enough low- energy building material products available in the market.

The study targeted the selected stakeholders for their sustainable business practices. This aspect allows us to examine their awareness and perspective for adopting new energy efficient measures such as ECBC by BEE. The Bureau of Energy Efficiency (BEE) under the ministry of Power is the regulating agency for institutionalizing energy efficiency services and providing leadership to energy efficiency in all sectors of the country. Moreover, BEE has already launched certain initiatives such as energy star rating, labeling programs and Ecomark schemes etc. and implemented also by the Government that ensure Energy Efficient Equipment and Appliances would be made available to consumer. Therefore, study also try to link these environmental policies with the existing energy efficient measures and other environmental initiatives by the selected stakeholders considered for analysis.

#### V. LINKAGE WITH EXISTING ENVIRONMENTAL POLICIES

##### **Labeling Program for Appliances: Enhancing Sustainable Development**

An energy labelling program for appliances was launched in 2006, and comparative Star based labelling has been introduced for fluorescent tube lights, air conditioners, and distribution transformer. The labels provide information about the energy consumption of an appliance and thus enable consumers to make informed decisions. Almost all fluorescent tube light sold in India and about two thirds of the refrigeratos and air conditioners are now covered by the labelling program.

##### **Green Building Practices**

It is the practice of increasing the efficiency with which buildings use resources – energy, water and materials \_while reducing building impacts on human health and environment, through better site design, construction, operation, maintenance, and removal \_the complete building life cycle.

**Green building can lead**

- 1) Reduce Operating Costs
- 2) Improved Public and Occupant health
- 3) Reduced Environmental Impact

Amount of Natural Resources: Buildings Consume and the amount of pollution given off is crucial for **future Sustainability**.

It also contains vast array of practices and to reduce and ultimately eliminate the impacts of buildings on the environment and human health.

**Emphasize**

- Renewable Resources

For example; Using Sunlight through Passive Solar, Active, and photovoltaic techniques and using Plants and trees through green roofs, rain gardens and for reduction of rainwater runoff

**Key Steps**

In designing sustainable buildings: specify 'green building' materials from local sources, reduce loads, optimize systems, and generate on-site renewable energy.

**VI. ECOMARK SCHEME OF INDIA***A Scheme on labeling of Environment - friendly products*

To increase consumer awareness, the Government of India launched the eco-labeling scheme known as "ECOMARK" in 1991 for easy identification of environmental identification of environment-friendly product. Any product, which is made, used or disposed off in a way that significantly reduces the harm it would otherwise cause the environment, could be considered as Environment-friendly product.

The criteria follow a cradle-to-grave approach, i.e. from raw material extraction to manufacturing, and to disposal. The 'Ecomark' label is awarded to consumer goods which meet the specified environmental criteria and the quality requirements of Indian Standards. Any product with the Ecomark will be the right environmental choice.

**Ecomark Logo:** An *earthen pot* has been chosen as the logo for the Ecomark scheme in India. The familiar earthen pot uses a renewable resource like earth, doesn't produce hazardous waste and consumes little energy in making. Its solid and graceful form represents both strength and fragility, which also characterizes the eco-system.

As a symbol, it puts across its environmental message. Its image has the ability to reach people and can help to promote a greater awareness of the need to be kind to the environment.

Mechanism of the Scheme: There are three committees involved with the criteria development for each product category and the award of the Ecomark-

- i) A Steering Committees, set up in the Ministry of Environment and Forests
- ii) A Technical Committee, set up in the CPCB has become the member of Global Eco-labeling Network (GEN) since March 2000.
- iii) The Bureau of Indian Standards to assess and certify the products and draw up a contract with the manufactures, allowing the use of the label, on payment of a fee.

The Government of India has notified the final criteria for the following 16 product categories:

- a) Soaps and detergents
- b) Paper
- c) Food items
- d) Lubricating Oils
- e) Packaging Materials
- f) Architectural Paints and powder coating
- g) Batteries
- h) Electronic/Electrical Goods
- i) Food Additives
- j) Wood Substitutes
- k) Cosmetics
- l) Aerosol Propellants
- m) Plastic Products
- n) Textiles
- o) fire-Extinguisher
- p) Leather

**VII. CONCLUSION**

The qualitative assessment of the findings clearly indicates that the selected stakeholders have the fair knowledge of Energy Efficient measures and existing Government Environmental initiatives and policies. The execution of the environmental policies is clearly laid out in the Environmental Management Plan. This also fulfills their objective towards commitment for green practices. It also point out towards favorable impact in terms of enabling, supporting and even implementation of energy efficient measures and products under Energy Conservation Building Codes. But it doesn't show the scale of impact on energy savings.

Further analysis and detailed explanation of Energy Conservation Building codes and other environmental initiatives reveal that, ECBC as a compulsory measure for energy efficiency and conservation tool has the major limitation in the sense of skilled professionals required for

certification and monitoring all over the country. Also, the material required for such environmental sensitive design for buildings are either not available, if available then at a huge cost. So, the initial investment is high and therefore industries are reluctant to adopt such measures. But it does not rule out that we don't have ECBC standards compliant buildings. For eg. recently, state of Haryana vide notification no. 19/6/2016-5p dated 31.03.2016 made ECBC mandatory that in future no building plan in state shall be sanctioned by any prescribed authority unless those plan confirm to the specification provided in ECBC. Still, India requires a good business model for the successful implementation of ECBC and also to provide incentives to opt for ECBC compliant buildings.

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### ANNEX 1

#### FREMEWORK OF QUESTIONNAIRE

##### Contact Information of the Respondent

Country

Company

Name

Division

Title

Telephone No. (extension)

E-mail address

*Confidentiality:* Your reply to this questionnaire will be used only for the purpose of this survey and will not be used for any other purposes. In addition, no individual respondents or company name will be disclosed when making the results of this survey public. Please acknowledge that we may need to contact you if we have any queries in the process of summarizing the results

A.

– Briefly describe the type of industry and products (i.e. automobile manufacture etc.)

– Sectors

Aerospace and Defense

Automobile and Components

Chemicals

Construction materials and other

Construction Related Activities

Transportation

Energy Equipment and services

Metals and Mining

Oil, Gas and Consumable fuels

Paper and Forest Products

Pharmaceuticals

Utilities

Briefly describe the Company's size and number of plant and corporate locations.

Energy Costs

- 1) Please identify the total costs of your energy consumption from fossil fuels and Electric power.
- 2) What Percentage of your total operating costs does this represent?