A Preliminary Assessment of Building Codes/Standards in India for Energy Conservation Buildings

[Excerpts from the article "India: The Way Towards Energy and Resource Efficient Buildings" from the website http://www.asiabusinesscouncil.org/docs/BEE/papers/BEE_Policy_India.pdf]

1.0 Introduction

India has many central and local authorities and bodies that help compile building codes and standards that are applicable at local and national levels. As of now, there are different codes that have been developed by bodies such as:

- The Bureau of Indian Standards – National Building Code (NBC), 2005
- The Bureau of Energy Efficiency(BEE)–Energy Conservation Building Code (ECBC), 2009
- Ministry of Environment and Forests – Environmental Impact Assessment and clearance.

The code which as most significant impact on energy efficiency in buildings is the ECBC, has a prescriptive and performance based part. The prescriptive route calls for adoption of minimum standards and efficiencies for building envelope and systems (lighting, HVAC, service water heating and electrical). The performance based approach requires whole building simulation approach to prove efficiency over base building as defined by the code. This leaves the code inherently flexible and easy to adopt.

To ensure the success of the Code and its adoption we need to ensure that activities such as strengthening of institutional frameworks, inter-departmental linkages, capacity building of Urban Local Bodies are undertaken urgently.

1.1 Assessment and apprehension

The national building code and ECBC should be integrated. This would lead to uniformity and larger adoption of energy code (as NBC is mostly adopted by State governments in their building byelaws).

1. Most of the large developers are still unaware of ECBC.
2. Large-scale availability of appropriate materials and equipment to meet requirement of ECBC is urgently needed. The Energy codes are relatively new in India and the products (insulation, efficient glass, efficient HVAC systems etc) and services required by buildings to comply with the code requirements are not readily and abundantly available.
3. The architects who are aware of the ECBC are very apprehensive of increased initial cost vis-à-vis life cycle cost of some high cost measures recommended by the code e.g. insulation (which is still largely imported and the technical expertise for installation is with a handful of companies) and efficient glazing (low 'U' glass for windows is increasing in demand in India but the supply is largely met via imports). This leads to increased initial costs varying between 10% to 40% depending on the technologies/materials/equipments adopted and the skill set (technical and labor related) required to deliver the same.
4. There is lack of knowledge among designers to analyze designs based on code requirements due to the novelty of the concept of energy efficiency. This is because the whole concept of a building code is new. Energy simulation capability to quantify savings based on energy efficiency parameters as defined by the code is very limited. The building construction industry (contractors, services providers) is not geared to apply these measures practically on site.
5. The energy conservation act empowers the state government to amend the energy conservation building codes to suit the regional and local climatic conditions. This provision may in longer run lead to large deviations from the ECBC that has been developed by the BEE. This may lead to confusion among builders/developers /designers.
6. As initial boost on promotion of energy efficient products and services is required in form of import duty relaxation, reduced tax, excise duty. The government could play a major role in realizing the same. There is no concrete plan for implementation of the code, or monitoring and verification.
7. The BEE has introduced the code on a voluntary level and slowly make it mandatory with adequate data to justify the benefits of doing so. The code may be made mandatory in larger cities logically where the savings potential is significant in comparison to smaller towns followed by smaller ones.
8. The builders and developers who have to get environmental clearance from the Ministry of Environment and Forests feel that it leads to additional delays as the clearance process is very time and resource consuming. Also due to absence of normative guidelines for the same they are often left unsure of the options that they have to adopt in their projects to make the projects environmentally sensitive

2.0 Appliance labeling and standard

Due to a multiplicity of manufacturers of electrical equipment all over the country, there is significant variation in the energy consumption and resultantly efficiency of household electrical equipment. To make the situation worse, information pertaining to a piece

of equipment's energy consumption is either not known or difficult to understand. The Bureau of Energy Efficiency's standards and labeling (S&L) program aims to ensure the availability of only energy efficient equipment and appliances to the people.

Initially, the program shall aim to help the people in taking informed decisions towards purchasing an appliance based on its energy consumption and efficiency. This will help to identify appliances that perform poorly with respect to energy consumption. After the initial stage, the program shall help establish a minimum energy performance standard to ensure that all the appliances available to the purchasers necessarily conform to a prescribed standard. This will provide the necessary pull in the market to enable the transition from the current. The first few equipment and appliances that have been short-listed for the program are as follows:

- Refrigerators with or without a low temperature compartment
- Room air conditioners (unitary)
- Stationary storage type electric water heaters
- Electric motors up to 100kW
- Agricultural pump sets up to 10kW
- Fluorescent tube lights
- Ballasts
- Compact Fluorescent lamps
- Distribution Transformers
- Industrial Fans and Blowers up to 100kW
- Air compressors up to 100 kw

2.1 Financial / fiscal incentives

Energy efficiency is still not largely incentivized in India. However, there are several incentives offered of renewable energy technologies by the central as well as some progressive state governments. The various kind of incentives are made available under the Ministry of New and Renewable Energy Sources' schemes.

3.0 Implementation of building energy efficiency policies in India

3.1 Need of an effective management system/ implementation infrastructure for new buildings and for upgrades in existing buildings

As mentioned in the sections above, there is no integrated framework for management and implementation of energy efficiency. India is still in very early stages of energy code implementation. There is a strong need felt for an institutional framework with well-defined authority and responsibility. The capacity of the state level bodies, which would be responsible for the final adaptation and implementation of the energy code, should be strengthened. There is need to develop to a set of code official who would understand the energy code thoroughly along with its enforcement requirements.

Demonstration projects are required at key geographical locations of the country to test the effectiveness code recommendations on real time projects. TERI GRIHA has adopted the ECBC within its framework and thus promises to deliver buildings in conformance to the ECBC. In addition to new buildings, there is also a large chunk of existing buildings that need overhauling from an energy efficiency point of view. The BEE has started mandate energy auditing for all commercial buildings above a certain threshold of connected load and has developed mechanisms to ensure that the recommendations of the audit are implemented in a stipulated time.

3.2 BEE energy rating certification

All buildings or building complexes with connected load of 100KW and above are considered and their energy performance index is being calculated. This is being derived from a formula of kilowatt per hour/per square meter/per year consumption of power. The data which are required to calculate energy performance index are built up area, conditioned and non-conditioned area, type of building, types of energy saving measures for various equipment and climatic zone in which building is located. Those showing index below 100 are given five-star rating indicating the most efficient. The rating ranges from one star to five star, based on energy conservation method adopted by the installations and the quantum of energy saved per year. Initially the programme is targeted for three climatic zones-warm and humid, composite and hot and dry for air-conditioned and non-air-conditioned office buildings which will be followed by other two climatic zones and night-duty offices. However this rating should be started immediately for other segments like industries and housing societies and thereafter for hotels, hospitals, retail malls, and IT parks. So far 49 of buildings in India are eligible for energy-saving status and another 62 are to be included very soon in this list. Mumbai has maximum 10 nos. of energy saving buildings and Cement House (ACC) on Maharshi Karve road (Fig. 1) is the only five star rating building. New Delhi has eight nos. of rated building followed by four in Hyderabad and three each in Pune, Ahmedabad, Jaipur and two in Chennai and one each in Cochin, Ambala Cantt, Bhopal, Bhubaneswar, Kanpur, Thirivanthapuram, Lucknow, Tiruchirapalli.

3.3 Barriers for owners/developers to implement energy efficient measures

There has been general lack of interest among builders to implement energy efficiency in their buildings because of the sheer dichotomy of the fact that "he who invests does not reap benefits of the investment". According to some leading builders in India the following are the main deterrents:

Fig. 1: Cement House (ACC) on Maharshi Karve road, Mumbai

There are planning constrains on the site, the individual plots are pre allocated by the state development authorities. Therefore, passive features like right orientation are difficult to achieve. The builders are not ready to sacrifice on maximum optimization of the space and design in order to adopt energy efficiency features in the building design.

- In a colony developed by the builders, he only constructs 5-10%. Rest of the land is sold to different buyers and stakeholders in the market, and thus has no control on the energy efficiency of those buildings. In a colony the builder just builds public buildings, community halls, where they could implement the energy efficiency measures.
- Increase in initial building cost restricts the builders from not adopting energy efficiency measures in their buildings. The builders mostly look at the project from commercial aspects rather than from its efficiency aspect. Moreover the customer being mostly unaware of its advantages does not demand energy efficiency.
- Unavailability of efficient equipments in India is another major barrier. Equipment imported from abroad example from China, increases the cost of the equipment and also results into more time consumption for installation, which delays the project.
- No incentives from the government. There should be tax rebate or duty rebates from the government to the developer; otherwise the developer has no reason to invest more capital in making the buildings energy efficient.
- Back up industry in terms of materials, equipments and technical expertise is not coming up as fast as the construction industry.
- Lack of infrastructure to provide power and gas from the state government forces the developer to invest in 100% power backup. If the state provides reliable power supply, this chunk of money could be shifted to incorporate energy efficiency measures in the buildings.

4.0 Local Level Implementation Successful cases

4.1 Initiative of local Municipal Corporation of Thane (TMC), Maharashtra

The municipal corporation of Thane, covering an area of 147 sq. km and population of nearly 1.7 million is one of the most progressive municipal corporations located in western India. The municipality has taken consistent actions over past years and has demonstrated energy savings by application of no-cost and cost effective energy conservation techniques. TMC has an energy conservation cell responsible for identifying energy conservation opportunities and implement projects to effect savings. TMC has been able to make a savings of ₹ 32 million during last 3 financial years. The basic approach followed to ensure maximum outreach and benefits out of their efforts are:

1. Large-scale awareness generation among own employees and residents of the municipality. The awareness generation stresses use of no cost or low cost options. For e.g., avoid wastages by switching of gadgets when not required.
2. Implement cost effective energy saving measures in municipal services and public buildings e.g. 33% energy saving was achieved in street lighting through introduction of energy efficient lamps and ballasts, municipal water pumping efficiency was enhanced through suitable retrofits.
3. Waste to energy projects have been commissioned with private participation.
4. TMC is also taking innovative initiatives and has started implementing solar energy based A.C. systems for few public buildings and also encouraging the builders to implement it. TMC has also modified the development control rule (building bye law) to mandate use of solar water heating system(SWH) (Fig. 2) in certain building typologies. In order to promote use of SWH, TMC also offer property tax incentives to residential users. Having realized that implementation of most of the projects based on non-conventional power sources do not offer attractive returns instantly, TMC is exploring CDM (Clean Development Mechanism) route and availing benefits there from. This can genertate opportunities for carbon credit trading in the international market and help avail the financial benefits accrued from that, not to mention the mitigation of Green House Gases released into the atmosphere due to use of conventional technologies. TMC is one of the most revered municipalities in the country, which has also

received several state level and national awards for in energy conservation activities.

Fig. 2: Solar water heater

4.2 Initiative by a private developer in Bangalore, T-ZED homes

T-ZED homes have been promoted by one of India's largest 'sustainably built environment' [SBE] enterprise, BCIL Builders, Bangalore. A cluster of 95 homes built over an area of 5 acres in the city of Bangalore, these homes aims to set new standards for residential housing. The basic features and highlights of the complex are:

- Energy efficient homes built using materials and technologies that have low embodie energy.
- Ergonomically designed.
- These homes come with built-in energy efficient lights, solar hybrid fans in each of the washrooms, intelligently switched lighting systems for corridors and other areas, master controller operable through mobile, offsite green power generation using is a biomass gasifier that uses wood chip as fuel, grown or procured in a sustainable way, customized environment-friendly (brine-based), zero electricity refrigerator cum freezer and home air-conditioning that is fully controlled, and is based 100 per cent on fresh air .
- The campus also have a 24-hour DG backup made up of two 125 KVA genset modules that will be powered by bio-diesel.
- Extensive water conservation measures coupled with rain water harvesting and reuse
- These homes do not cost higher than conventional homes and yet promises attractive returns on investment through power and water savings
- These home owners have been involved in the entire design and construction process and have made valuable additions to the design.
- The project is considering applying for carbon credits under CDM.
- The project demonstrates that it is possible to deliver sustainable homes at no added costs with help of a dedicated team of intelligent professionals and a well-informed Clientele.

5.0 Recommendations

There are several cross-cutting issues that need to be addressed holistically in order to ensure energy efficiency in building. The current policy framework does not support the same. For example, enforcement of energy conservation building codes under the purview of Ministry of Power and designated state nodal agencies, while sanctioning power for building plans rests with local development authority or municipal corporations. There is no worked out modality for integration of energy conservation building code with local building bye-laws. The energy conservation act empowers the state government to amend the energy conservation building codes to suit the regional and local climatic conditions. This provision may in longer run lead to large deviations from the ECBC that has been developed by the BEE. The renewable energy programs and incentives are not integrated with policies and programs of the Ministry of Power. To promote energy efficiency and conservation, we need to create an appropriate set of incentives through pricing and other policy measures.

List of some of the building energy codes/standards/ policies programs in India and their websites

Energy Efficiency Plan/Policy:

The Electricity Act of 2003:

http://www.beeindia
http://powermin.nic.in/acts_notification/energy_

The Ministry of Environment and Forestry notification issued on July 2004

http://www.pcra.org/English/aboutus/default.ht

Renewable Energy Plan/Policy:

http://mnes.nic.in/frame.htm
http://www.beeindia

Appliance testing & (comparison) labeling:

http://www.bis.org.in

National Energy Labeling Programme in May 2006:

http://www.clasponline.org/countryinfosummary.php

Building sector voluntary agreements:

www.ecohousingindia.org
http://www.epa.gov/eeBuildings/india/index.htm
http://www.teri.res.in/core/griha
http://www.dc.lbl.gov/india/buildings/index.html