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Country Report on Building Energy Codes in India

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S Somasundaram

April 2009

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Foreword

Buildings account for about 30% of all energy consumption globally and a significant share of greenhouse gas emissions. Building energy codes help ensure that new buildings use energy efficiently, and this can reduce building energy use by 50% or more compared to buildings designed without energy efficiency in mind. This is important because buildings typically last 30-50 years, and it is much less expensive and time-consuming to design for energy efficiency than to retrofit a building later. Based on the experience of the Asia-Pacific region, it is clear that building energy codes, when implemented, save energy and improve comfort in new buildings. By design, most building energy codes are cost-effective, saving consumers significant amounts of money on their energy bills.

The Asia-Pacific Partnership on Clean Development and Climate (APP) is a public-private collaboration to accelerate the development and deployment of clean energy technologies. APP partners include Australia, Canada, China, India, Japan, Republic of Korea, and the United States (the U.S.). APP countries account for more than half of the global economy, energy consumption, and greenhouse gas emissions. APP's Buildings and Appliance Task Force (BATF) provides a forum for APP partners to work together on energy efficiency in buildings and appliances. This report was prepared under the framework of BATF, in particular a BATF project called "Survey building energy codes and develop scenarios for reducing energy consumption through energy code enhancement in APP countries" (BATF-06-24).

At the request of the U.S. Department of Energy, the Pacific Northwest National Laboratory's Joint Global Change Research Institute has prepared a series of reports surveying building energy codes in the seven APP countries. These reports include country reports on building energy codes in each APP partner country and a comparative report based on the country reports. This particular report is the country report on building energy codes in India.

Acknowledgements

This report owes its existence to the Asia-Pacific Partnership on Clean Development and Climate. We would like to thank all the APP partner countries and experts who collaborated on this project. We are particularly grateful to Dr. Seung-Eon Lee at the Korean Institute of Construction Technology for his oversight of the APP project under which this report was prepared (BATF 06-24). We would also like to thank Mark Ginsberg, Jean Boulin and Marc LaFrance from the U.S. Department of Energy for their leadership and financial support of this work.

Diana Shankle, manager of the PNNL Building Energy Codes Program, has provided moral and intellectual support for this project. Mark Halverson reviewed this report. Kate Williams and Alison Delgado provided editorial assistance. We would also like to express our gratitude to several other individuals who supported or participated in the APP building energy code assessment in various capacities including Joe Huang, Bipin Shah, Satish Kumar, Ravi Kapoor, Anurag Bajpai, Elizabeth Malone, Kay Killingstad, Paulette Land and Kim Swieringa.

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1. Introduction and Background

1.1 A Glance at the Economy and Energy

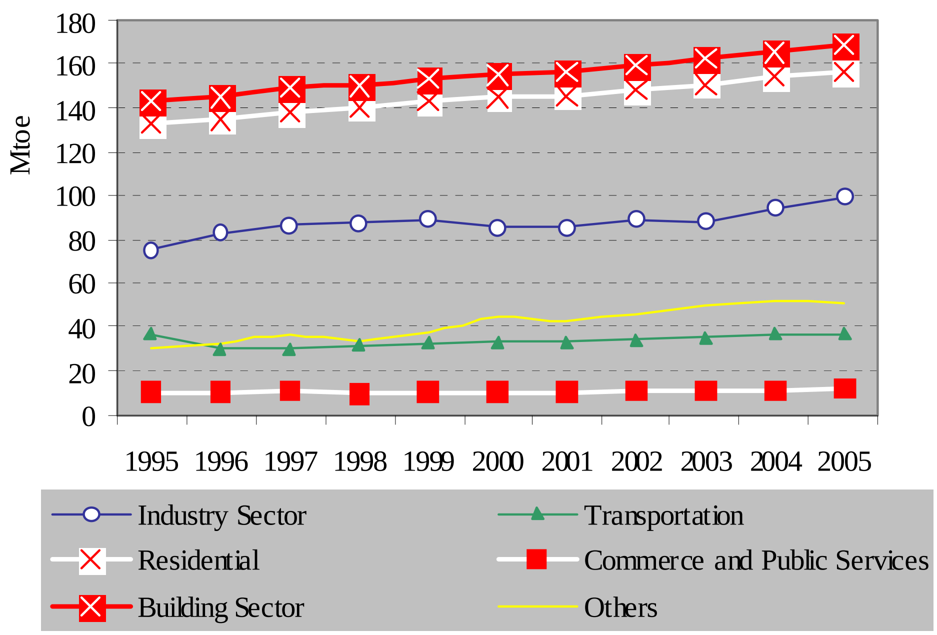
India has seen strong economic growth in recent years. In 2007, its gross domestic product was US$1.1 trillion[1] on a nominal basis, though on a purchasing power basis, it was the fourth largest economy in the world at $4.7 trillion (IMF, 2008). As the fifth largest energy consumer in 2006, India emitted 1,293.2 Mt of carbon emissions, or 4.4% of the global total that year (EIA, 2008).

1.2 Buildings Sector

Construction is a major economic driver in India. Between 2004 and 2005, about 22 million square meters were added for commercial buildings, and 19 million square meters for residential buildings. Most new commercial buildings are equipped with air conditioning (Mathur, 2006).

According to the International Energy Agency (IEA), the buildings sector accounted for the largest share of India's final energy use[2] between 1995 and 2005 (Figure 1).

Figure 1 Energy Consumption by Sector in India, 1995-2005



Notes: Energy consumption in this figure refers to final energy use, which includes consumption of renewable and waste energy; the sector "Others" includes agriculture, forestry, fishing, and non-specified and non-energy use.

Source: IEA, 2007

[1] In current U.S. dollars.
[2] Final energy use includes consumption of renewable and waste energy.

In 2005, this sector consumed 169 million toe (Mtoe)[3], or 47% of the total final energy use, compared to the next largest sector, the industrial sector, which consumed 28% of the total. Residential buildings accounted for the lion's share (93%) of the total building energy use the same year (IEA, 2007).

Air conditioning and lighting are the top two energy end uses within the buildings sector. Studies have indicated that energy efficient lighting, air conditioning and electrical systems could save about 20% of the energy used in existing buildings. In addition, some simulation studies also indicate that new buildings can save up to 40% of energy with design interventions and stronger building energy standards (BEE, 2007).

1.3 Relevant Regulations

Recognizing that energy use and air pollution are important issues in India's buildings, India issued the National Housing and Habitat Policy in 1998. The Policy acknowledged the importance of construction techniques and materials in energy conservation. It also emphasized that the government should specify energy efficiency levels for different categories of buildings (IEA, 2008b).

In 2001, the Indian government enacted the Energy Conservation Act (ECA 2001), which promotes energy efficiency and conservation domestically. ECA 2001 mandated the creation of the Bureau of Energy Efficiency (BEE), which was established under the Ministry of Power in 2002. ECA 2001 also authorized BEE to establish an Energy Conservation Building Code (ECBC).

The Bureau of Indian Standards (BIS) issued National Building Code of India (NBC) in 2005, or NBC 2005, which covered a range of structural, safety and other design issues. Energy efficiency was marginally addressed (IEA, 2008a).

Under the direction of the Prime Minister, the government's Planning Commission issued the Integrated Energy Policy in 2006. This document identifies major areas with large potential for energy savings. Five of the thirteen areas are related to the buildings sector, including building design, construction, HVAC, lighting and household appliances.

In 2007, the Ministry of Power and BEE issued ECBC —the first stand alone national building energy code in India. While it is currently voluntary, ECBC establishes minimum energy efficiency requirements for building envelope, lighting, HVAC, electrical system, water heating and pumping systems. To develop ECBC, BEE collaborated with a diverse group of domestic and international technical experts.

[3] The term of "million toe" means million tones of oil equivalent and is based on the energy content of the fuel.

1.4 Implementation

BEE is supporting efforts to implement ECBC, including policy formulation and technical support for the development of the codes and standards. As noted, ECBC is currently voluntary, but in the future, either the central or state governments can decide to adopt it as a mandatory standard. State governments that choose to adopt ECBC can modify the code to adapt it to local climatic conditions, and inform BEE accordingly (IEA, 2008a). No states have adopted it yet. The ECO III project of the U.S. Agency for International Development (USAID) is providing technical assistance in support of implementation. BEE also works closely with national and state-level government agencies to promote ECBC.

Once ECBC becomes mandatory at either the central or state level, one can assume that the implementation and enforcement approach will be similar to that employed for other, mandatory building codes. The mechanism for enforcing existing mandatory building codes is well-established in India. Municipal authorities review all building designs for compliance with the code. Municipal inspectors must visit all building sites during the construction phase to ensure that construction matches the approved design. While these mechanisms all exist, in actual practice, there are many challenges with enforcement and monitoring: the existing enforcement system needs strengthening. In addition, inspectors would need additional training and experience in the energy aspects of buildings.

India is in the early stages of implementing the new building energy code. Few buildings in India today meet the code. Effective implementation of the code is hindered by the lack of (Hong et al., 2007; Huang and Deringer, 2007):

- Implementation guidelines,
- Local administrative infrastructure for energy code enforcement, including field inspectors for code checking and inspections,
- Incentives from the government,
- Technical expertise to assist in compliance,
- Technical support materials and equipment to help meet the code requirements, though the USAID ECO III project has prepared several ECBC awareness documents and put them in the public domain (www.eco3.org/downloads.htm), and
- Supply of suitable building materials (linked in part to the lack of demand currently).

BEE is considering developing code compliance software and training programs for code inspectors and enforcers. Also, to increase interest in ECBC and experience in its implementation, BEE is considering mechanisms to make compliance with ECBC mandatory in all new government facilities.

2 *Energy Conservation Building Code*

2.1 Overview

In India, national bodies have developed three different building codes (Hong et al., 2007):

- BIS developed NBC, a comprehensive national instrument providing guidelines for regulating the building construction activities across the country. It serves as a model code for adoption by all agencies involved in building.
- BEE developed ECBC which is the only national building energy code. ECBC is currently voluntary (Subsections 1.3 and 1.4 of this country report).
- Ministry of Environment and Forest (MoEF) developed the Environment Impact Assessment and Clearance (EIA). Builders and developers need to obtain an EIA clearance before construction.

NBC contain some provisions that are relevant to energy efficiency, although it does not specifically aim to improve energy efficiency. For example, requirements for sounder structural materials also typically mean more energy-efficient materials with lower U-values.

As the first stand-alone national building energy code, ease of the use, in terms of both code requirements and language, was the major consideration for the ECBC development (Mathur, 2006). In addition, the development of ECBC involves broad stakeholder participation. For example, several members of the ASHRAE 90.1 committee participated in the development of ECBC.

The structure of ECBC is patterned against that of the ASHRAE Standard 90.1-2004. The contents of ECBC (Table 1) cover building envelope, HVAC, service hot water and pumping, lighting, and electric power. The word “mandatory” in Table 1 is directly from ECBC, referring to those provisions that should be satisfied regardless of whether the designer opts for the prescriptive or trade-off approach to the rest of the code compliance. In practice, of course, all the provisions of ECBC are voluntary today.

Building designers can take several approaches to compliance with ECBC. While they must ensure compliance with the mandatory measures, they have flexibility in meeting the prescriptive requirements. They can comply either by directly meeting the prescriptive criteria, trading off these criteria in a particular section of the code, based on the trade-off options of that section, or by using the Whole Building Performance Method. The Whole Building Performance Method sets an energy budget for a building design, so a building complies as long as it stays within the budget, even if it does not meet the prescriptive requirements or trade-off options within any given section of the code. The budget is set based on the average annual electricity use (in kWh) of a building with the standard design as outlined in the code. For example, a building could have more windows than otherwise allowed if it had more insulation in the roof.

BEE released a revised version of ECBC 2007 in May 2008. This report draws on that revised version of ECBC 2007.

Table 1 Essential Features of ECBC (May 2008 revised version)

Section Number and Title	Description
1 & 2. Purpose and Scope	Minimum requirements for energy-efficient design and construction of buildings and building complexes with a connected load of 500 kW or greater, or a contract demand of 600 kVA or greater and a conditioned area of >1,000 square meters[4]
3. Administration and Enforcement	Mandatory[5] compliance for all applicable new buildings, additions and major renovations to existing buildings
4. Envelope	Mandatory provisions and either the prescriptive criteria or trade-off options
5. HVAC	Mandatory provisions and prescriptive criteria
6. Service Hot Water and Pumping	Mandatory provisions, including solar water heating for at least 1/5 of design capacity, unless systems use heat recovery
7. Lighting	Mandatory provisions and prescriptive criteria for interior and exterior lighting features
8. Electrical Power	Mandatory requirements for transformers, motors, and power distribution systems
9. Appendix A – Definitions, Abbreviations and Acronyms	Definitions of terms, abbreviations and acronyms in the context of this code
10. Appendix B – Whole Building Performance Method	An alternative to the prescriptive requirements of the code
11. Appendix C – Default Values for Typical Constructions	Procedure for determining window efficiency (also known as fenestration product U-factor), and the Solar Heat Gain Coefficient (SHGC), as well as typical thermal properties of common building and insulating materials (from ASHRAE Fundamentals Handbook, 2001)
12. Appendix D – Building Envelope Tradeoff Method	Procedure for calculating envelope performance factor (EPF) and tables for EPF coefficients for the five climate zones and the two building occupancy schedules[6]
13. Appendix E – Climate Zone Map of India	From the National Building Code 2005, Part 8, Figure 2
14. Appendix F – Air-Side Economizer Acceptance Procedures	Construction inspection and procedure for equipment testing
15. Appendix G – Compliance Forms	Envelope summary, building permit plans checklist, mechanical summary, mechanical checklist, lighting summary and lighting permit checklist

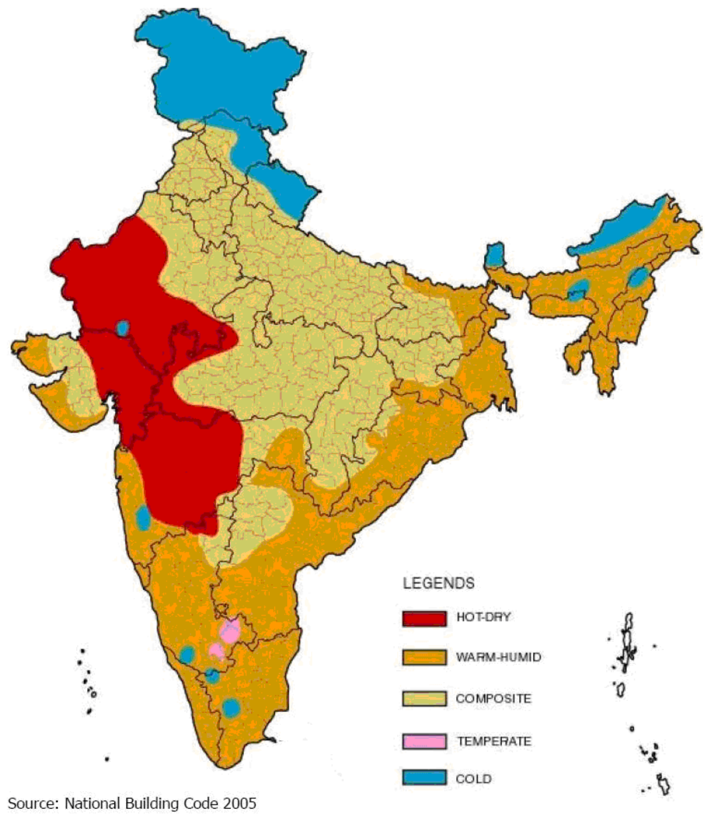
Sources: ECBC 2007 May 2008 version and correspondence with ECO III

[4] Such buildings are typically for commercial use or are large residential facilities.
[5] The use of the word “mandatory” in Table 1 and texts of the Sections 2.2 to 2.8 comes directly from the text of ECBC 2007. Despite the use of this word, ECBC is voluntary at present.
[6] BEE is currently reviewing the possibility of adopting tables with default values for U-factors for typical roof and wall construction.

2.2 Climate Zones

ECBC covers India's five climate zones (Figure 2), including (1) composite, (2) hot and dry, (3) warm and humid, (4) moderate and (5) cold.

Figure 2 Climate Zones in ECBC



Source: NBC 2005

2.3 Envelope

ECBC aims to improve the energy performance of building envelopes in new construction through better building design, such as day lighting and natural ventilation. It also emphasizes the integration of construction practice and local conditions (Mathur, 2006).

In ECBC, the building envelope should comply with the mandatory provisions and either the prescriptive criteria or the trade-off options. Building designers can also use the whole building performance provisions of the code to compensate high performance in one area of compliance, such as the envelope, with somewhat lower performance in another (for example, lighting).

2.3.1 Mandatory Requirements

The mandatory requirements cover provisions for fenestration (U-factors, SHGC, and air leakage for fenestration and doors), opaque construction (U-factors) and building envelope sealing (to minimize air leakage).

2.3.2 Prescriptive Requirements

The prescriptive requirements (which are open to trade-offs with alternate paths of compliance) cover requirements for roofs, opaque walls, vertical fenestration and skylights. The code provides the requirements for roofs and opaque walls (maximum U-factors of the overall assembly and minimum R-values of insulation alone) for the five climate zones and two different building occupancy schedules (24-hour use and daytime use only). There is also a requirement for a "cool roof" (initial solar reflectance of no less than 0.70 and an initial emittance of no less than 0.75) for roofs with slopes of less than 20 degrees.

Requirements for vertical fenestration (such as windows and glass doors) are given in terms of maximum area weighted U-factors and maximum area weighted SHGC requirements in two categories: (1) window-to-wall ratios (WWR) of less than 40%, and (2) WWR of between 40% and 60%. There are certain minimum requirements for visual light transmittance (VLT) of vertical fenestration as a function of the WWR (ECBC Table 4.5).

Skylight requirements are also provided in terms of maximum U-factors and SHGC for the five climate zones. In addition, skylights cannot take up more than 5% of the gross roof area (ECBC Table 4.6).

2.3.3 Building Envelope Trade-Off Option

The building envelope complies with the code if the building envelope performance factor (EPF) of the proposed design is less than the standard design (which exactly complies with the prescriptive requirements). Appendix D provides an envelope trade-off equation to calculate whether a design using the trade-off options has a lower EPF than the standard design. BEE is reviewing the possibility of setting EPF coefficients based on climate zone.

2.4 Heating, Ventilation and Air Conditioning (HVAC)

All heating, ventilation, and air conditioning equipment and systems should comply with both the mandatory provisions and the prescriptive criteria.

2.4.1 Mandatory Requirements

The mandatory requirements are for natural ventilation, minimum efficiency levels of chillers, controls, piping and ductwork, system balancing and condensers. The building's specifications for natural ventilation[7] and cooling equipment[8] should comply with related design standards or minimum efficiency requirements. In addition, there are specific Indian standards (IS) that are applicable to each of the specifically listed types of equipment, namely: unitary air conditioners (IS 1391, Part 1), split air conditioners (IS 1391, Part 2), packaged air conditioners (IS 8148) and boilers (IS 13980).

[7] See NBC 2005 Part 8, 5.4.3 and 5.7.1.
[8] See Tables 5.2.2-1 through 5.2.2-5 of ECBC.

There are requirements for time-clock controls and temperature controls (thermostats) for all heating and cooling equipment. In addition, all cooling towers and closed circuit fluid coolers should have two-speed motors, pony motors or variable speed drives controlling the fans.

There are piping insulation requirements for heating systems with a design operating temperature greater than 40°C (104°F), cooling systems with temperatures less than 15°C (59°F) and refrigeration suction piping on split systems. Piping insulation exposed to weather and cellular foam insulation should be protected appropriately. Ductwork insulation requirements cover supply and return ducts depending on their location.

System balancing requirements for air and hydronic[9] space-conditioning systems call for a written balance report be provided to the owner (or designated representative) for HVAC systems serving zones with a total conditioned area exceeding 500 square meters.

Condensers should be located such that their heat sink is free of interference from heat discharge by nearby devices and systems. All high-rise buildings using water-based centralized cooling systems should use soft water for the condenser and chilled water systems.

2.4.2 Prescriptive Requirements

HVAC systems comply with the prescriptive requirements when they: (1) serve a single zone, (2) use a unitary packaged or split-system air conditioner, heat pump, fuel-fired furnace, electric resistance heater, or baseboards connected to a boiler, and (3) use less than 1,400 liters/second of outside air, and this air is less than 70% of supply air at design conditions.

All other HVAC systems must comply with ASHRAE Standard 90.1-2004, § 6.5, "Prescriptive Path" under § 6 HVAC Systems.

There are also additional requirements about economizers and variable flow hydronic systems.

2.5 Service Hot Water and Pumping

All service water heating equipment and systems should comply with the mandatory provisions.

2.5.1 Mandatory Requirements

The mandatory requirements in this section of the code cover solar water heating, equipment efficiency, supplementary water heating systems, piping insulation, heat traps and swimming pools. Residential buildings, hotels and hospitals with centralized water heating systems should have solar water heating or heat recovery to meet demand for at least 1/5 of the design capacity. Wherever gas is available, electric hot water heating can cover no more than 20% of the demand.

[9] Hydronic space-conditioning systems use water to cool or heat the space, instead of forced air.

Water heaters should meet or exceed the minimum efficiency requirements given in Indian standards. Supplementary water heating systems should incorporate maximum heat recovery from hot discharge systems, like condensers of air conditioning units, or use gas-fired heaters wherever gas is available, and use electric heaters only as a last resort.

Swimming pools should have a vapor retardant pool cover. Pools heated to more than 32°C (90°F) should have a pool cover with a minimum insulation value of R-2.1 (R-12 in imperial units). Exceptions are for pools deriving more than 60% of their energy from site-recovered energy or solar energy sources.

2.6 Lighting

Lighting systems and equipment that apply to interior spaces of buildings, exterior building features and exterior building grounds should comply with the mandatory provisions and the prescriptive criteria.

2.6.1 Mandatory Requirements

Mandatory requirements address lighting controls, exit signs and exterior building grounds lighting.

2.6.2 Prescriptive Requirements

Prescriptive requirements describe interior lighting power (based on a building area method or a space function method) and exterior lighting power requirements. These follow the format of ASHRAE Standard 90.1-2004. In fact, ECBC and ASHRAE Standard 90.1-2004 have identical requirements for lighting power densities.

2.7 Electrical Power

Electric equipment and systems must comply with the mandatory requirements.

2.7.1 Mandatory Requirements

Mandatory requirements cover transformers, energy efficient motors, power factor corrections, check metering and monitoring, and power distribution systems.

2.8 Whole Building Performance Method

This is an alternative compliance method to the prescriptive requirements of the Code. It applies to all building types covered by ECBC. (It follows the format of Appendix G of ASHRAE Standard 90.1-2004). A building complies as long as it meets all the mandatory criteria and when the estimated annual energy use of the proposed design is less than that of the standard design, calculated as per the procedure described in Appendix B of the code.

3 *Other Developments*

3.1 <u>The Indian Green Building Council and LEED-India</u>

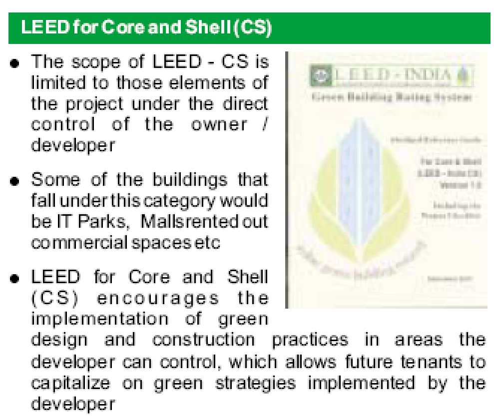
IGBC: Snapshot of Accomplishments
464 members 300 registered buildings 34 certified buildings 170 million square feet green buildings *(IGBC, 2008)*

The Indian Green Building Council (IGBC) is actively promoting green buildings in India. As a part of the Confederation of Indian Industry, IGBC is comprised of construction companies, architects, product manufacturers and research institutions.

Similar to the Leadership in Energy and Environmental Design (LEED) rating system, developed by the U.S. Green Building Council (USGBC), LEED-India promotes a whole-building approach to sustainability by addressing performance in the following five areas: (1) sustainable site development, (2) water savings, (3) energy efficiency, (4) materials selection and (5) indoor environmental quality.

In addition, LEED-India has adopted several benchmarks for building performance. The rating levels "Platinum," "Gold," "Silver," and "Certified" indicate the extent to which a building excels the requirements of the national codes. LEED-India rated buildings would meet the specifications of ECBC, the NBC 2005, the MoEF guidelines and the Central Pollution Control Board norms (IGBC, 2008).

There are two specific LEED-India programs: (1) LEED India for New Construction (LEED India NC) and (2) LEED India for Core and Shell (LEED India CS).



Source: Confederation of Indian Industry, 2008

For more information, please see www.igbc.in/site/igbc/index.jsp.

3.2 The Energy and Research Institute and the GRIHA System

The Energy and Resources Institute (TERI), established in 1974, is a renowned energy think tank in India, with comprehensive national and international R&D experience. TERI developed the Green Rating for Integrated Habitat Assessment (GRIHA) to encourage design, construction and operation with green building principles for new commercial, institutional and residential buildings (Majumdar and Kumar, 2006).

GRIHA aims to integrate various national standards and policy frameworks into one building rating system, including ECBC, IS codes such as NBC, IS codes for concrete, steel, water quality and functional requirements, guidelines of Central Ground Water Board, solid waste handling rules and local regulations (Majumdar and Kumar, 2006).

GRIHA has developed a rating system with a set of 34 criteria, totaling 100 points. The 100 points are grouped into a five-star system. A one star rating equates to 50 to 60 points, and receiving five stars requires 91 to 100 points. The rating criteria are categorized according to three aspects:

- Site selection and site planning, including conservation and efficient utilization of resources,
- Building planning and construction, including designing for efficiency use of energy and water, embodied energy use in the building materials and construction activities, use of renewable or recycled materials, the reuse of water, waste management, and health and well-being, and
- Building operations and maintenance, including energy audits and validation, building operations and maintenance, and innovation.

Innovation covers up to four bonus points. These points are awarded based on the integrated options for alternative transportation, environmental education, company policy on the green supply chain, lifecycle cost analysis, enhanced accessibility for the physically or mentally disabled, and any other criteria proposed by the client.

For more information, please see www.teriin.org/index.php?option=com_content&task=view&id=77&Itemid=32.

4 Conclusions

The ECA 2001 led to the creation of ECBC, which was released in 2007. ECBC is an important milestone as it is the first stand-alone national building energy code for India. The structure of ECBC is patterned against that of the ASHRAE Standard 90.1-2004. ECBC aims to maximize the energy performance of buildings through better building design, such as day lighting and natural ventilation. It also emphasizes the integration of construction practice and local conditions.

ECBC is currently a voluntary code. The national government or the states must adopt it as a mandatory regulation before the government can begin enforcing it. That said, the government is considering ways to begin introducing ECBC in practice, for example, by requiring the new government buildings comply with it. In recent years, the Indian government, research institutes, universities and building industries have been working hard towards the improvement of building energy efficiency. With concerted domestic efforts and broad collaboration with international communities, India has a great opportunity to help improve its building energy efficiency in the near future.

List of Acronyms

APP	Asia-Pacific Partnership on Clean Development and Climate
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BEE	Bureau of Energy Efficiency
CII	Confederation of Indian Industry
ECA 2001	Energy Conservation Act of 2001
ECBC	Energy Conservation Building Code
ECO III	Energy Conservation and Commercialization Program (a joint effort between USAID and the Government of India)
EIA	U.S. Energy Information Agency
EPF	Envelope performance factor
GRIHA	Green Rating for Integrated Habitat Assessment
HVAC	Heating, ventilation and air conditioning
IEA	International Energy Agency
IGBC	Indian Green Building Council
IMF	International Monetary Fund
IS	Indian standards
kW	Kilowatt
kVA	Kilovolt-amps
LEED	Leadership in Energy and Environmental Design
MNRE	Ministry of New and Renewable Energy (India)
MoEF	Ministry of Environment and Forest
Mtoe	Million tons of oil equivalent
NBC	National Building Code of India
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
TERI	The Energy and Resources Institute
USAID	U.S. Agency for International Development
USGBC	U.S. Green Building Council
VLT	Visual light transmittance
WWR	Window-to-wall ratios

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The Asia-Pacific Partnership on Clean Development and Climate

The Asia-Pacific Partnership on Clean Development and Climate is an innovative new effort to accelerate the development and deployment of clean energy technologies.

Partner Countries

APP partners Australia, Canada, China, India, Japan, Republic of Korea, and the United States have agreed to work together and with private sector partners to meet goals for energy security, national air pollution reduction, and climate change in ways that promote sustainable economic growth and poverty reduction. The Partnership will focus on expanding investment and trade in cleaner energy technologies, goods and services in key market sectors. The Partners have approved eight public-private sector task forces covering:

- Aluminum
- Buildings and Appliances
- Cement
- Cleaner Use of Fossil Energy
- Coal Mining
- Power Generation and Transmission
- Renewable Energy and Distributed Generation
- Steel

The seven partner countries collectively account for more than half of the world's economy, population and energy use, and they produce about 65 percent of the world's coal, 62 percent of the world's cement, 52 percent of world's aluminum, and more than 60 percent of the world's steel.

Buildings and Appliances Task Force

Reducing our use of energy for buildings and appliances decreases the demand for primary energy and is a key means to deliver better economic performance, increase energy security and reduce greenhouse gas and air pollutant emissions. Partner countries have recognized for some time the importance of cooperating on energy efficiency for buildings and appliances, and have already taken a range of bilateral and other collaborative actions in this area. As the Partners represent a majority of the world's manufacturing capacity for a diverse range of appliances, we have the potential to drive significant regional and global improvements in energy efficiency in this sector. The Partners will demonstrate technologies, enhance and exchange skills relating to energy efficiency auditing, share experiences and policies on best practices with regard to standards and codes, as well as labeling schemes for buildings, building materials and appliances.