Taking Energy Efficiency to New Heights:

Analysis and Recommendations for the Buildings Sector from the Hyderabad Experience

NRDC Issue Paper I February 2011

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Acknowledgments

The authors of this report would like to thank the following organizations and their staff for their valuable assistance and insights: APCPDCL, HMDA, Alliance to Save Energy, DuPont, Mantri Developers, YesSV, TERI, Terra Viridis, National Academy of Construction, IIIT, Institute of Engineers, Prayas Institute for Social Development, A. P. Transco, ICLEI, CDI, DCIC, CPR Environment Education Centre, JNAFAU School of Planning & Architecture, The Hindu, PDMG Consultancy, WWF, GHMC, AP Chapter Builders Federation, and Manjeera Constructions. We would especially like to thank Dr. Ajay Mathur (BEE), Minister Jaipal Reddy and Secretary A. K. Mehta (MoUD), Sanjay Seth (BEE), M. Anand and S. Srinivas (CII-IGBC), Aalok Deshmukh (ECO-III), Satish Kumar (Schneider Electric), Mili Majumdar (TERI), Gretchen Gordon (NRDC Extern UC Berkeley Law School), Michael Thompson (NRDC and TERI), Pierre Bull (NRDC), Ashok Gupta (NRDC), Christopher Bennett (Stanford University), and Pallavi Nadimpalli.

Methodology

The methodology for this report included an initial identification of key building efficiency stakeholders in India, with a focus on Hyderabad, to better understand efficiency initiatives, stakeholder perspectives, and barriers to implementing efficiency measures. Primary research was conducted through extensive discussions and information sharing during in-person meetings, phone calls, and written communication over a period of nine months. The author organizations, ASCI and NRDC, conducted discussions in workshops and stakeholder meetings in Hyderabad from May to December 2010, bringing together key players to identify the successes and barriers to energy efficiency. Primary and secondary research was also involved in developing national and international case studies.

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List of Abbreviations

AEEE Alliance for an Energy Efficient Economy
AP Andhra Pradesh
APCPDCL Andhra Pradesh Central Power Distribution Company Limited
APREDA Andhra Pradesh Real Estate Developers Association
ASCI Administrative Staff College of India (in Hyderabad)
ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
BEE Bureau of Energy Efficiency
CDM Clean Development Mechanism
CFL Compact Fluorescent Lamp
CII Confederation of Indian Industries
CSR Corporate Social Responsibility
DSM Demand Side Management
EBRG Environment Building Regulation Guidelines
ECBC Energy Conservation Building Code
ECO-III Energy Conservation and Commercialization - III
ESCO Energy Service Company
FDI Foreign Direct Investment
GHMC Greater Hyderabad Municipal Corporation
GRIHA Green Rating for Integrated Habitat Assessment
HCFC Hydrochlorofluorocarbon
HMDA Hyderabad Metropolitan Development Authority
HUDA Haryana Urban Development Authority
HVAC Heating, Ventilation, Air-Conditioning
ICICI Industrial Credit and Investment Corporation of India
IDBI Industrial Development Bank of India
IGBC Indian Green Building Council
IPMVP International Performance Measurement and Verification Protocol
IT Information Technology
LEED Leadership in Energy and Environmental Design
MEP Mechanical Electrical Plumbing
MoEF Ministry of Environment and Forests
MoP Ministry of Power
MoUD Ministry of Urban Development
NGO Nongovernmental Organization
NRDC Natural Resources Defense Council
NMSH National Mission for Sustainable Habitat
PACE Property Assessed Clean Energy
SBI State Bank of India
SEZ Special Economic Zone
TERI The Energy and Resources Institute
USGBC U.S. Green Building Council

Executive Summary

India has the second-fastest growing economy in the world and is committed to minimizing the impacts of climate change. The nation has adopted a National Action Plan on Climate Change to guide its efforts in building a low-carbon economy. Strong energy efficiency measures—in buildings of all types—are a key focus of India's actions to reduce its carbon trajectory.

India's Building Boom Provides Opportunities to Increase Efficiency

India's building sector is expected to increase five-fold from 2005 to 2050. Two-thirds of the commercial and high-rise residential structures that will exist by 2030 have yet to be built.[1] Buildings already account for more than 30 percent of India's electricity consumption. It is cheaper and easier to build efficiency into new construction than to address it through retrofitting, as many developed countries are now being forced to do. Thus, the booming building sector provides a singular opportunity to lock in energy savings for decades through efficient traditional and modern design. To ensure that the coming wave of commercial and high-rise residential buildings avoids energy losses and costly retrofits in the future, the time to integrate robust and effective efficiency measures is now.

Efficiency Provides Benefits for the Economy, the Environment, and Civil Society

Energy efficiency is a tremendous resource. It is the fastest and cheapest way to significantly reduce energy demand and provides for numerous additional benefits. In addition to reducing emissions, efficient buildings enhance energy security and reduce dependence on oil and coal imports. Energy-efficient buildings protect consumer pocketbooks from high energy bills and local governments from increasing energy prices. Utilities also benefit from energy efficiency and demand-side management programs by being able to better manage peak demand. Efficient buildings are particularly beneficial in energy-scarce regions that face increased energy demand from rapid urbanization and experience routine power cuts. Improving building efficiency can also work to generate green jobs, to protect public health by decreasing pollution from power generation and providing healthier work environments, and to encourage innovation in India's businesses.

The Indian Government is Expanding the Reach of its Efficiency Programs

The Ministry of Power (MoP) through the Bureau of Energy Efficiency (BEE) and the Ministry of Urban Development (MoUD) are leading the way for advancing building efficiency in India. In 2007, MoP through BEE established the Energy Conservation Building Code (ECBC) for voluntary implementation in the broader building sector. The government is currently focused on increasing ECBC implementation at state and local levels through the National Mission for Sustainable Habitat (NSHM). While these efforts are a commendable start, the lack of widespread implementation of energy efficiency programs is a significant barrier to their effectiveness. The urgency to implement energy efficiency measures is compounded by growing global energy consumption, which is projected to increase by 49 percent from 2007 levels by 2035 in a business-as-usual scenario.[2] Thus, it is imperative to find solutions that are efficient, cost effective, and conducive to economic growth.

Hyderabad Provides a Valuable Case Study

The city of Hyderabad, with its booming high-tech industry and growing population provides a useful case study of the challenges and successes of implementing building efficiency in India. In this report, we present some of the roadblocks to wide-scale implementation identified by public officials, developers, efficiency and policy experts, and project and site managers in Hyderabad. We also highlight some of the pioneering efficiency success stories in Hyderabad, including several innovative design projects as well as specific strategies that managers have devised to change occupant behavior and decrease energy use. Drawing on examples of energy-efficiency incentive programs internationally, we present a toolbox of financing and market-expanding measures which can be used to facilitate greater adoption of efficiency measures.

Collaboration Among Stakeholders is Critical to Spurring Action and Achieving Long-Term Goals

What our research has shown is that stakeholders and communities can work together to scale building efficiency. The challenge is to motivate the diverse stakeholders—owners, developers, tenants, utilities, local governments, banks, and civil society groups—to take collective action toward advancing efficiency in buildings. Coordinated action is needed since individual stakeholders cannot implement wide-scale efficiency measures alone. With greater awareness, accurate information, and effective government policies, all stakeholders can take action to overcome barriers to building low-carbon, energy-saving communities in India. Both immediate action to implement solutions now and long-term programs that promote continuous improvement in technologies and building codes are needed. Based on our experiences in Hyderabad, this report aims to equip stakeholders throughout India with practical and directed information to take action, and to motivate them to implement solutions. Finally, it presents a roadmap with recommended actions for each stakeholder group to accelerate building efficiency within their communities.

A Guide to this Report

This report is divided into five sections. In section 1, we provide an overview of energy efficiency programs in India. Section 2 highlights the challenges and opportunities that the city of Hyderabad faces in implementing efficiency measures in a growing economy and how its experience compares with other cities. Section 3 explores the specific benefits and barriers that energy-efficient construction presents for the various stakeholders involved. Section 4 presents case studies from Hyderabad and internationally of efficiency initiatives, the obstacles faced, benefits derived, and lessons learned. Lastly, Section 5 presents a roadmap for accelerating energy efficiency in buildings, laying out concrete action steps for each stakeholder group: federal and local governments, utilities, developers, tenants, financial institutions, skilled workers, vendors of efficiency products, and civil society.

CHAPTER 1

Energy Efficiency Programs

Both the government and private sector have launched initial programs designed to promote energy efficiency in buildings. These programs are expanding to include larger segments of the building sector and overcome roadblocks to wide-scale adoption of efficiency measures. The key programs—the Energy Conservation Building Code, the National Mission for Sustainable Habitat, and the labeling programs LEED and GRIHA—are highlighted below.

Energy Conservation Building Code

The ECBC was developed by the BEE as a first step towards promoting energy efficiency in buildings.[3] In 2010, the connected load requirement for buildings to comply with the ECBC was decreased to 100 kW or 120 kVA, from 500 kW or 600 kVA, thus significantly increasing the number of buildings, such as smaller offices and high-rise residential buildings that come under its purview.

The ECBC establishes minimum requirements for energy-efficient building design and construction for new and major retrofits of many types of buildings—including commercial buildings, offices, hospitals, IT parks, and high-rise residential buildings. The ECBC provisions apply to:

- Building envelopes, except for non-air-conditioned storage spaces of warehouses
- Mechanical systems and equipment, including heating, ventilating, and air-conditioning
- Hot water heating
- Interior and exterior lighting
- Electrical power and motors

The ECBC remains voluntary, and states and local governments are responsible for its implementation and enforcement. The Ministry of Power and BEE are working towards encouraging state level adoption of this code with the Ministry of Urban Development. The Ministry of Environment and Forests already requires ECBC compliance for environmental clearances for major projects.

National Mission for Sustainable Habitat

One of the explicit goals of the National Mission for Sustainable Habitat is to accelerate adoption of the ECBC at state and local levels. The aim is to transform the design of new construction and major retrofits of commercial and high-rise residential buildings to optimize their energy demand. The National Mission for Sustainable Habitat is

one of the eight missions under the National Action Plan on Climate Change. Its objective is to shift the direction of India's modernizing landscape to sustainable cities through improvements in energy-efficient buildings, solid waste management, and public transport expansion. In the context of energy efficiency, the mission's plan is to encourage local and regional governments to adopt the ECBC and other efficiency measures in India's rapidly urbanizing cities.

What are Green Buildings?

Green buildings, which are sometimes called sustainable buildings, are structures that are designed to be environmentally responsible and resource efficient throughout a building's life cycle from siting to design, construction, operation, maintenance, renovation, and deconstruction.[4] The benefits of green buildings include energy savings, utility, durability, and comfort.

Although new technologies are constantly emerging in creating greener structures, the common objective among green building designs is to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting and enhancing occupant health and improving employee productivity
- Reducing waste, pollution, and environmental degradation

Energy efficiency is one of the many components of green buildings. Yet, it is a very important component in that it can often provide the greatest and most accessible cost savings and emissions reductions. Thus, the design of new buildings and major retrofits can focus on energy efficiency measures and reap significant savings in lower utility bills.

Leadership in Energy and Environmental Design (LEED)

LEED is an internationally recognized green building certification system.[5] LEED provides third-party verification that a building was designed and built using strategies aimed at improving performance across metrics such as: energy savings, water efficiency, carbon dioxide emissions reduction, improved indoor environmental quality, stewardship of resources and sensitivity to environmental impacts. Developed by the U.S. Green Building Council (USGBC), LEED is intended to provide building owners and operators a concise framework for identifying and implementing practical and measurable green building design, construction, operations, and maintenance solutions. LEED India is the indigenized version of the LEED rating system and is administered by the Indian Green Building Council (IGBC).

In order for a building to be LEED certified, the energy design and use of the building must meet or exceed the referenced (or locally prescribed) building efficiency code requirements. The LEED India rating system refers to local and national codes wherever available and to international benchmarks in absence of an Indian equivalent. Currently, LEED India projects have to meet and exceed the ASHRAE 90.1-2007 standards, and in the near future these will be updated to ASHRAE 90.1–2010 standards. Projects that comply with the ECBC also suffice for LEED India ratings provided they are equivalent to ASHRAE 90.1-2007 standards.

Green Rating for Integrated Habitat Assessment (GRIHA)

GRIHA is the national rating system for green buildings.[6] GRIHA has been developed and operationalized by The Energy and Resources Institute (TERI) in partnership with the Ministry of New and Renewable Energy. It is a green building design evaluation system and is suitable for various buildings in different climatic zones. GRIHA allows assessment of building performance against certain nationally acceptable benchmarks.

GRIHA rates air-conditioned, naturally ventilated or mixed-mode conditioned buildings (those with hybrid systems). If the building contains a fully air-conditioned interior environment, ECBC compliance is mandatory for a GRIHA rating. If the building is naturally ventilated, the approach varies and it may require only partial ECBC adoption. GRIHA evaluates the environmental performance of a building holistically over its entire life cycle and is revised every three years to take into account latest scientific developments.

CHAPTER 2

Hyderabad Overview

The city of Hyderabad provides a useful example of how some of these energy efficiency programs can be utilized, and some of the challenges they present in practice. While not as large as megacities like Delhi and Mumbai, Hyderabad faces many of the challenges experienced by large and midsized cities—including rapid urbanization, massive migration, energy shortages, increased pollution, and rising energy costs. Like other cities, Hyderabad is working to meet these challenges and is developing some pioneering programs to promote energy efficiency measures and build a low-carbon economy. This section outlines an overview of the city and the different initiatives designed to scale-up energy efficiency in new buildings and major retrofits at the local level.

Building Boom in Hyderabad

Hyderabad is the administrative and financial capital of Andhra Pradesh. A former Nizam capital, the city is a leading destination for IT and IT-enabled services in India. Many software companies, software consulting firms, and business process outsourcing firms have established their offices and facilities in High-Tech City, Hyderabad. Large Indian IT corporations, such as Mahindra Satyam, HCL, Infosys, Wipro, Cognizant Technologies, and Tata Consultancy Services have major operations in Hyderabad. Some examples of Fortune 500 companies with a significant presence in the city are Microsoft, Accenture, Amazon, Bank of America, Dell, Deloitte, DuPont, Facebook, Fidelity Investments, GE, Google, Hewlett-Packard, Honeywell, Hyundai, IBM, Motorola, and Oracle Corporation.

Hyderabad's urban space is rapidly expanding. In 2005, its real estate development occupied an area of 1.95 million square feet; which has grown to 5.3 million square feet in 2010.[7] Demand for office space in India by 2013 is estimated to grow to 196 million square feet, of which between 15 and 20 million square feet will lie in Hyderabad.[8] The city's rapid development combined with massive migration has dramatically increased Hyderabad's need for energy to supply to its growing population and businesses.

Increased Population

Hyderabad's population has nearly doubled in the past 20 years, increasing from 4.3 million in 1991 to 8 million in 2010. It is projected to increase to 13.6 million by 2021. In the last five years, the city has expanded to the "Greater Hyderabad" area which is five times its original size. It is ranked the sixth-largest urban agglomeration in India.[9]

The unprecedented economic growth in Hyderabad, and its location amongst the numerous Special Economic Zones in Andhra Pradesh, has attracted and continues to attract a large influx of people. As opportunities,

employment, population, and investments grow, city officials are working to meet the continued challenge of providing sufficient infrastructure and energy development, as set forth in Hyderabad's 2020 Master Plan.

Increased Energy Demand

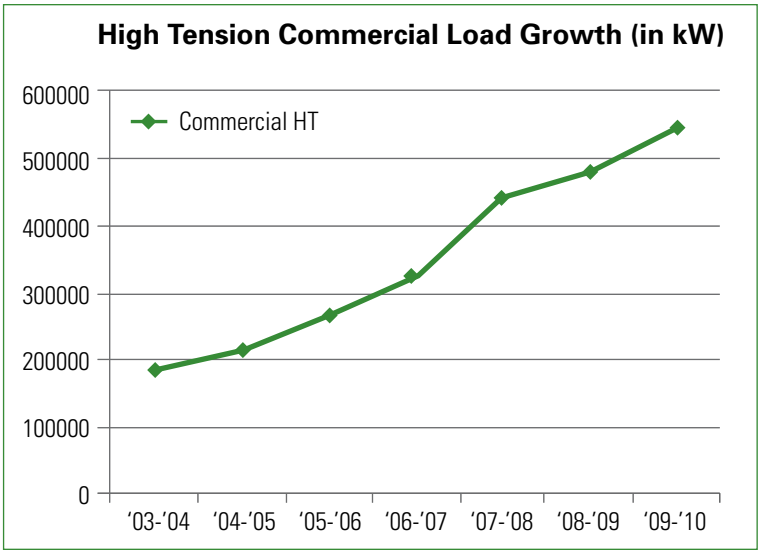
Hyderabad's growth has resulted in exponential increases in energy use. In the commercial high tension category alone, there has been an unparalleled growth of 220 percent in energy intensity and 148 percent in sales.[10] The following tables list the residential and commercial utility load and consumption details from 2008-2010 for the State of Andhra Pradesh.[11] Under a business-as-usual scenario, current production capacity will be unable to meet expected energy demand in Hyderabad.

Residential Electricity Use Data

YEAR	NO. OF SERVICES	CONNECTED LOAD (kW)	CONSUMPTION (MILLION kWH)
2008	1,730,107	2,271,501	201,945,708
2009	1,858,951	2,461,755	231,791,774
2010	1,996,681	2,696,655	242,558,987

Commercial Electricity Use Data

YEAR	NO. OF SERVICES	CONNECTED LOAD (kW)	CONSUMPTION (MILLION kWH)
2008	334,785	764,393	79,196,200
2009	356,545	869,454	87,973,941
2010	374,401	960,547	89,796,968



Efficiency in buildings can quickly reduce increases in connected load and consumption because much of this increased demand is generated by the new construction of commercial and high-residential buildings. To good approximation, if building codes can cut energy use in new construction and major retrofits by 50 percent, Hyderabad can cut the growth rate of building-sector electricity use by half as well. The lead time for implementing building codes (typically two years in the United States) is much shorter than that required for securing additional power sources.

Energy Efficiency Initiatives in Hyderabad

Hyderabad Metropolitan Development Authority Initiatives: The Hyderabad Metropolitan Development Authority (HMDA) developed the Environmental Building Regulations & Guidelines (EBRG) in 2009.[12] These voluntary guidelines establish parameters that can be followed to reduce the environmental impact of new buildings in the Hyderabad metropolitan area. While the guidelines include a component on building energy efficiency, they also discuss water use, waste management, and other ecological issues. Though information on these guidelines is readily available, the guidelines have yet to be implemented and adopted broadly in Hyderabad.

Greater Hyderabad Municipal Corporation Initiatives: The Greater Hyderabad Municipal Corporation (GHMC) has introduced a "Green Channel" initiative to incentivize the construction of buildings that are designed according to the established National Building Code and the Hyderabad Master Plan. However, it has yet to include measures for energy efficiency. The Green Channel is a fast track channel that provides ease, transparency, and accountability for building permits.[13] Under Green Channel, building permits and certifications are expedited for owners and builders from zonal and circle offices in four working days (in plots with an area up to 1,000 m^2 and a height up to the ground plus three floors). The channel encourages compliance with regulations. The Green Channel should be modified in the immediate future to include energy efficiency requirements so as to encourage efficient building construction.

Government of Andhra Pradesh Initiatives: Currently, the Andhra Pradesh state government promotes energy efficiency through broad sustainability practices. The state government encourages rain water harvesting, solar heating, and solar lighting through voluntary and mandatory building rules that have been in place since 2000.[14] The state utilities are involved in awareness-building programs with their consumers about the benefits of saving electricity in their homes and offices. The state government also offers incentives to affordable-housing developers to implement sustainable practices. However, so far the incentives offered to the end user are not substantial and the up-front cost of many efficiency investments remains high, leaving the current market unchanged. So far, the state government has not adopted a building efficiency code for implementation in its rapidly growing cities.

Comparisons with Other State and Local Governments

Several cities and states are leaders on regional energy efficiency programs. This section highlights examples of these various initiatives. In addition to the programs outlined below, the states of Rajasthan, Chattisgarh, and Madhya Pradesh are also planning to implement the ECBC in their government buildings in the next five years.

Gujarat

- Surat established an Energy Efficiency Cell in 2001 focused on energy audits and reducing energy bills.
- The ECO-III program (collaboration between the governments of India and the United States) provides technical assistance to utility-led demand side management (DSM) initiatives, including an energy load research study on more than 200 commercial and 400 residential customers in Gujarat. ECO-III also provides assistance to the Gujarat Urban Development Company to implement its state-wide Municipal Energy Efficiency Program based on energy performance contracts for municipal street lighting for more than 160 urban local bodies.

Haryana

- Owing to various energy conservation measures, Haryana has saved 1,161 million kWh of electricity in 2009-2010. Haryana is the only state to receive the National Award in Energy Conservation for the third consecutive year.
- The state government formulated a five-year state energy conservation action plan in December 2007 aimed at achieving energy savings of 500 MW through energy conservation and efficiency measures.

- Haryana Renewable Energy Development Agency has initiated an energy audit of 25 central government buildings.

Karnataka

- Bangalore is developing energy efficiency guidelines designed by TERI for incorporation into building bylaws, which would lead to mandatory standards.
- Bangalore has municipal incentive schemes to encourage residential solar water heating use.

Kerala

- Kerala has proposed tax incentives to promote green buildings as part of its housing policy.
- The Kerala Sustainable Urban Development Project targets urban environmental improvement in five municipal corporations in Kerala.

Maharashtra

- In Mumbai and other tier-II cities and towns, private developers are partnering with the government to implement efficiency measures.
- Maharashtra is partnering with the IGBC to develop environmental guidelines for area development projects.
- Pimpri-Chinchwad Municipal Corporation has adopted GRIHA as the rating system for new buildings and offers concessions to developers and property tax rebates to residents.

Orissa

- Orissa formed a core team to spearhead a local code that incorporates the ECBC into existing building regulations.
- Orissa is planning to expand GRIHA ratings to government and other buildings, such as the five-star GRIHA-rated Reserve Bank of India's building.

National Capital Region, Delhi

- The Municipal Corporation of Delhi is adopting green building guidelines for several of its new buildings.
- Delhi Transco Ltd. is constructing a 9,000 m^2 corporate office that is ECBC compliant and will cut its current energy consumption by 30 percent.
- The Public Works Department is adopting green building guidelines for GTB Hospital, Dwaraka Hospital, Thiagraja Sports Complex, and the Delhi Institute of Pharmaceutical Sciences and Research.

Punjab

- Punjab Energy Development Authority has developed a state energy conservation action plan for each district, with five-year implementation roadmaps.
- The Chandigarh administration has submitted a draft plan to the Ministry of New and Renewable Energy for the status of a solar city, to reduce the city's energy consumption by 10 percent in 2012 and 20 percent by 2018.

Tamil Nadu

- Many private projects have been rated as green in Chennai; one of these is RMZ Millennia Park, India's largest LEED Gold-rated Core and Shell green building.
- The Tamil Nadu Legislative Assembly building is the first senate building to be awarded with the LEED India Gold rating.

CHAPTER 3

Energy Efficiency in Buildings: Benefits and Barriers

All stakeholders stand to benefit from investing in energy efficiency, though in different ways. During discussions and meetings with owners, developers, tenants, utilities, local governments, banks, and civil society in Hyderabad, these stakeholders identified various benefits and barriers to implementing building energy efficiency.

Exploring the Benefits of Energy Efficiency in Buildings

The benefits of energy efficiency are wide-ranging and multi-faceted, including:

Cost Savings: Energy efficiency results in lower utility bills and a positive return on investment, making it an excellent financial decision. Annual cost savings often exceed annual depreciation charges incurred. Long-term programs, such as projects to retrofit all of the nation's buildings over a 10-20 year period and adopt efficiency in all new construction, encourage continuous improvement in products, technology, and buildings. For example, owners that retrofit in 2010 will save money on energy bills that can then be invested in further savings through updated retrofits in 2020 when newer technologies are available. In this way, the cost-savings—as a percent of current energy use—keep growing over the decades.

Energy Savings, Higher Security, and Lower Prices: Energy efficiency results in lower energy use for the same or better quality result. It protects against the increasing energy demand from rapid urbanization and from peak demand shortages that result in routine power cuts. India's commercial energy consumption is projected to double by 2035.[15] The country currently imports approximately 77 percent of its oil, 26 percent of its natural gas, and 15 percent of its coal.[16] Energy efficiency will reduce dependence on energy imports and limit the volatility seen in energy prices.

Profits: Efficient buildings command higher premiums from both buyers and tenants and enjoy higher occupancy rates. Green buildings, including energy-efficient buildings, are increasingly attracting building tenants, owners, and users.

Job Creation: Scaling-up building efficiency will spur a market for new services and technologies, creating green jobs in the process. Companies that pioneer efficiency will gain competitive advantages in the market for efficient products and services.

Health Benefits: Well-designed efficient buildings result in increased health benefits and higher productivity for inhabitants due to better indoor environmental quality. Lower energy use can also result in lower power plant pollution, improving local air and water quality.

Address Climate Change: Energy savings lower greenhouse gas emissions, thus effectively addressing climate change and giving the country greater credibility as a global environmental leader.

Leadership: Efficiency targets are becoming more stringent and the ECBC is expected to become mandatory in the next two years. Investing in efficiency now will enable timely compliance with these measures and pave the way for the rest of the market to follow.

Understanding Barriers to Energy Efficiency

Despite these important benefits, barriers exist to wide-scale adoption of building energy efficiency. Based on extensive research and discussions with stakeholders, these barriers are:

Lack of Information and Awareness: Profound misconceptions and information gaps about the cost-savings and benefits of energy efficiency prevent owners, banks, building operators, developers, and architects from having reliable, comprehensive information at their disposal about energy use, improvements, technologies, marginal costs, benefits, and return on investment. The lack of accessible information is a major impediment to broad-scale adoption of energy efficiency measures.

Lack of Technical Expertise and Availability of Products: The lack of skilled expertise, energy-efficient products, and modeling tools impedes the development of an able workforce that an energy-efficient economy requires. The shortage of skilled know-how—on both modern and traditional energy saving techniques—among architects and engineers inhibits implementation of efficiency practices.

Significant Initial Investment: The relatively higher price of efficiency technologies constrains adoption of efficiency measures because of up-front capital costs, coupled with a desire to see quick returns on investment. In spite of visibly high returns on efficiency upgrades, the implied discount rates remain high.

The Split-Incentives Problem: Building owners and tenants have different sets of incentives when considering efficiency upgrades. Building owners and developers are hesitant to invest in efficiency since tenants are the ones who will benefit from operating cost savings during the life of the building. Likewise, tenants are transient and do not expect to realize long-term gains.

Inertia and Confusion: Convenience and inertia of the status quo are powerful forces that prevent early adoption of energy efficiency practices. Since most government guidelines are voluntary and few government incentives for efficiency exist, builders lack motivation to invest in efficiency. Lack of transparency, accountability, and speed within the permitting process also deter builders, developers, and owners from investing in efficient buildings.

Experiences in other countries shows that these barriers must be overcome together: simply solving one of these barriers will not achieve a meaningful improvement in scaling efficiency implementation. A combination of standards, incentives, labeling, information, financing, metering, leasing reform, and direct intervention with equipment suppliers and designers can help overcome all of these barriers.

CASE STUDIES: NATIONAL AND INTERNATIONAL EXPERIENCES

Early movers that recognize the value of investing in efficient buildings are forging ahead with exciting energy efficiency achievements both nationally and internationally. The following case studies—locally from Hyderabad and internationally from the United States and China—demonstrate that energy efficiency is an achievable and valuable energy source. The studies discuss project descriptions, motivations, barriers, successes, and lessons learned, and can serve to showcase the many benefits of energy-efficient buildings to wider stakeholder groups.

The CII Godrej Green Business Centre was India's first LEED Platinum-certified building. CREDIT: CII SOHRABJI GODREJ GREEN BUSINESS CENTRE

Case Studies from Hyderabad

Hyderabad's IGBC-CII Godrej Building started the initial green building movement in India with the first LEED Platinum-certified office building in 2004. Since then several large companies, such as the Park Hotel Group, TCS, Cisco, Infosys, ITC, and Wipro, have lead the top of the market in improving efficient building design in their hotels, IT campuses, and businesses parks. While more movement is needed with large companies at the top of the market, the middle and bottom of the building efficiency market has had limited attention and focus. Adoption of the ECBC by all segments of the market, with special attention to the middle and bottom, is critical to transforming India's buildings into efficient ones. The three Hyderabad case studies highlighted below examine efficient buildings at various local levels, including a government building, a multinational company's campus, and a local developer's project.

The Park Hotel, Hyderabad CREDIT: THE PARK, HYDERABAD

CASE STUDY 1

HMDA ANNEXE II BUILDING	
Owner	HMDA: Hyderabad Metropolitan Development Authority
Architect	Jamal Darvish Innovative Design Group
Location	Paigah Palace, 1-8-323, Chiran Fort Lane, Begumpet, Secunderabad, 500 003
Year of Completion	2008
Building Typology	Government Office Building (Currently Consulate General of the United States)
Type of Construction	New Construction
Square Footage	21,356 square feet
Construction Cost	Rs. 3.65 crores or $800,000
Rating System	LEED New Construction Version 2.2

HMDA Annexe II Building

CREDIT: HMDA

Introduction

The HMDA Annexe II was proposed within the existing Paigah Palace complex in Begumpet, which housed the former HUDA offices for over two decades. The HMDA Annexe II Building is a demonstration project that implemented the then proposed HMDA's green building guidelines. With the experience of efficiency improvements from this project, HMDA further developed the EBGH guidelines for Hyderabad in 2008.

Project Details

The Annexe II building is a ground plus three floors structure with extensive detail given to the façade elements. As the building was constructed within the premises of a historic building, it was required to satisfy the Historic Preservation Authority criteria.

The building was built along the LEED V 2.2 Principles for New Construction and achieved 28 out of a total of 69 points, making it LEED certified.

ENERGY EFFICIENCY MEASURES IMPLEMENTED	
Energy Achievements	**Techniques**
Building Envelope	90 percent of the roof is low sloped and covered with reflective roofing material having a minimum solar reflective index of 78.
	The final roof is composed of 50 mm Styrofoam insulation sheets to avoid heat radiation inside the building.
	Atriums are provided on either side of the building to ensure maximum natural light and ventilation, thereby significantly reducing energy costs.
HVAC/Other Mechanical Systems	No mechanical systems were used because the building was constructed as a completely naturally ventilated building.
Interior and Exterior Lighting	Individualized task lighting is provided for work stations and the common spaces are lit with CFL tubes.

Methodology

The HMDA Annexe II Building followed a prescribed path set by the USGBC to achieve the rating. This involved an initial registration of the project under the relevant LEED category. Each LEED credit and prerequisite has a unique set of documentation requirements that must be completed as a part of the application process. While preparing the application, the project team selects the credits it has chosen to pursue and assigns the credits to respective team members. Once the credits are decided upon, the respective templates are submitted with supporting documentation and calculations. After evaluation, the rating is awarded.

Motivations

HMDA's primary motivation was to set an example and promote awareness of the importance and benefits of green buildings and environmentally conscious city planning. Also, the rating awarded is a matter of pride and recognition, and thus of tremendous value.

Obstacles

- HMDA Annexe II was built on the premises of a historic landmark. One of the problems faced was to balance the requirements of preserving the historic building in addition to satisfying the rating criteria.
- As HMDA is a government body it required extensive procedures for interdepartmental approvals regarding design, material specifications, and new technologies.
- Lack of technical understanding was a major hurdle in the process.

Benefits

- In spite of the obstacles faced, stakeholders found that the underlying principles of the rating system simplified the application of energy efficiency techniques. Once the technicalities of a credit were understood its implementation was less of a hurdle.
- At the time of construction, HMDA expected to save 30 percent in energy consumption and 30 percent in water consumption compared to before the retrofit.[17] Rupees 3.65 crores/$800,000 were invested in efficiency measures in this project and a short payback time of 3-4 years was anticipated.

Lessons Learned and Recommendations for Other Builders

- ***Traditional design and local conditions:*** From the builder's and designer's perspective, there should be greater appreciation for and implementation of traditional architectural principles as these are designed for local conditions. Integration of these practices with innovative technologies can result in better, energy-efficient buildings.

- ***Mandatory regulations:*** Many codes and regulations in practice are voluntary. Having compulsory regulations can increase the application of energy saving practices in building design.
- ***Financial incentives:*** From a builder's perspective, there is a need for more incentives and rebates to offset part of the high initial expenditure.
- ***Increased awareness:*** Greater awareness needs to be created not only by the government authorities but also by organizations like CII and TERI that promote green building practices (IGBC and GRIHA respectively) to enable informed decision making.

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CASE STUDY 2

DUPONT KNOWLEDGE CENTER	
Owner	E. I. DuPont India Pvt Ltd
Architect	Venkatraman and Associates, Bangalore
Location	Shameerpet Mandal, Ranga Reddy District
Year of Completion	2008
Building Typology	Research Lab and Office
Type of Construction	New Construction
Square Footage	2,48,459 square feet
Construction Cost	Rs. 128 crores or $28,000,000
Rating System	LEED New Construction Version 2.2
Rating Achieved	LEED Silver

DuPont Knowledge Center

CREDIT: E.I. DUPONT INDIA PVT. LTD.

Introduction

The DuPont Knowledge Center houses research activities, engineering and administrative functions, and biotechnology lab facilities. DuPont aims to be the world's most dynamic science company, and creating sustainable solutions extends to generating a sustainably built environment.

Project Details

The 15-acre campus has various blocks, of which three buildings—the Biotechnology Lab, the Material Research Lab, and the Administration and Engineering building—have been certified LEED V 2.2 for New Construction. These buildings meet seven of the prerequisites and achieved 34 out of a total of 69 points, making it a LEED Silver-rated campus. The following table highlights the efficiency techniques implemented in the building design and construction.

Methodology

The DuPont Knowledge Center applied for 37 credits for LEED-IGBC certification, of which 34 were awarded. These credits involved several stages, from the initial selection of the site to post-completion functioning of the campus and through the construction phase. Separate energy simulations for the three individual blocks with similar plans were conducted, and a weighted average was then used for completing the LEED templates. The site credits for parking, storm water management, and site lighting for the entire campus were also used to obtain the rating.

ENERGY EFFICIENCY MEASURES IMPLEMENTED	
Energy Achievements	**Techniques**
Lighting	Extensive use of CFL and LED lighting systems, with sensors.
Energy Use	Building energy model simulations indicate that the energy cost savings are 16.39 percent higher than that of ASHRAE 90.1-2004 standards.
Indoor Environmental Quality	Provision of additional outdoor ventilation created 30 percent better ventilation rates than required by ASHRAE 62.1.

Motivations

One of DuPont's core values is to create shareholder and societal value while reducing the environmental footprint in the value chains in which they operate. Hence, the new DuPont campus focuses on creating a sustainable model for pharmaceutical labs that saves energy, cuts costs, and reduces waste.

Obstacles

- The construction labor needed on a project of this nature was highly skilled. Finding appropriate workers was not easy, so the company set up a training unit for workforce skill development.
- The migrant nature of the labor workforce made it difficult to maintain consistent quality and therefore the trainings were prolonged, which further delayed construction activity.
- The location of the site (outskirts of the city) had poor infrastructure. To save water costs, the project managers opted for air-cooled chillers, which are less efficient in comparison to the water-based chillers.

Benefits

- DuPont has benefited from a sense of pride at having achieved a sustainable campus that is energy efficient and saves energy costs.
- As DuPont manufactures many products like thin film photovoltaic modules that meet LEED-IGBC requirements, the upgrade benefited the company's businesses.

Lessons Learned and Recommendations for Other Builders

- DuPont's Knowledge Center in Hyderabad, the first of its kind globally, has enabled the company to become more efficient. The company plans to implement such improvements in their campuses across the world.
- As a recommendation to other builders, DuPont suggests incorporating efficiency methods not just for achieving external ratings but also for the benefits derived from energy savings and sustainable building designs. As a recommendation to the agencies involved in creating and implementing these policies, they suggest a simplified rating system, a product support framework, and effective incentives to motivate developers.
- Involving employees to sustain green office management is a key factor in the success of efficient buildings; awareness and educational outreach programs are necessary for this.

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CASE STUDY 3

ADITYA SAROVAR PREMIERE	
Owner	Manjeera Hotels and Resorts Ltd.
Architect	Matrix Consultants
Location	Near Botanical Gardens, Gachhibowli, Hyderabad
Year of Completion	2010
Building Typology	5 Star Hotel
Type of Construction	New Construction
Square Footage	2,25,000 square feet
Construction Cost	Rs. 115 crores or $25,000,000
Rating System	LEED New Construction Version 2.2
Rating Achieved	LEED Certified Gold

Views of the Aditja Sarovar Premier Hotel.

CREDIT: MANJEERA CONSTRUCTIONS LIMITED

Introduction

The project is owned and constructed by Manjeera Hotels and Resorts Ltd., and operated by the Sarovar Group. It is set to be fully functioning by early 2011. This five-star hotel will be the group's first LEED-rated building.

Project Details

This 13-floor building with a three-floor basement has a total air-conditioned area of 75.5 percent. The designing and rating were initially geared toward the LEED India Principles for New Construction Version 1.0; however, the final rating awarded was the LEED Version 2.2 in 2007. Presently, the project has achieved a total of 42 of the 51 points and received a Gold rating. The group is aiming to apply for a Platinum rating by implementing further green building strategies.

ENERGY EFFICIENCY MEASURES IMPLEMENTED	
Energy Achievements	**Techniques**
Energy Use	To optimize the energy performance, the HVAC system has low kW/TR screw chillers; variable air volume is based on CO_2 sensors in parking lots; and efficient fan motors have been installed, saving up to 15 percent of the energy costs.
	A measurement and verification plan with a central monitoring mechanism following the IPMVP protocol has been devised.
Lighting	Individual lighting controls are available for 90 percent of occupants. Group controls have been provided to regulate thermal comfort for all guest rooms and in multiple user spaces via a building management system.
	For 75 percent of the spaces, a daylight factor of 2 percent has been achieved.

Methodology

The decision to apply for a green building certification in this project was made after the initial design and excavation stages had been completed. An audit was carried out to determine the feasibility of certification and the achievable rating. The consultants estimated an increase in expenditure of 15 percent, when compared to a standard building, was necessary.

Motivations

Manjeera Constructions has been in the industry for 25 years (as a part of their long-term planning and approach they have also invested in offshore renewable energy generation systems in Tamil Nadu). The additional capital expenditure for energy efficiency was not a deterrent for them as they recouped this through savings from an earlier energy-efficient project, Aditya Park, in a time period of three years. Manjeera was also motivated to make efficiency improvements since the certification process would take little additional effort.

Obstacles

The major obstacle was the need for extensive documentation. Small contractors who were involved in areas where the certification required work that was difficult to measure and calculate, like excavation and site waste disposal, were unaware of the certifying procedures, which necessitated education to convince them to follow the guidelines.

Benefits

- Having already implemented energy efficiency measures in their earlier project, Manjeera Hotels had first-hand experience with the benefits from efficiency improvements, and thus, Manjeera could build on its expertise to gain additional cost and energy savings.
- Following the certification guidelines made the implementation process simpler. Manjeera Hotels is confident that they can recover their extra capital expenditure in the next five years.

Lessons Learned and Recommendations for Other Builders

- As there was a clear mandate from the leadership that energy efficiency investments were very important, the exact quantification of additional costs was not calculated. This made it easier to fund these initiatives without analyzing expenses excessively at every stage, which allowed the project to move forward on a quicker timeframe.
- It was better to get green building certification by the owner/developer in the initial stages of the project.

- All the players involved—the design team, structural consultants, mechanical, electrical and plumbing team, and project management consultants—should be brought on board along with the green building consultants, so that the documentation process is more comprehensive.

- The first hand experience with the certification process, which includes the whole building and focuses on all aspects of construction and operation, including energy, encouraged the owners to apply this gained expertise to their other projects.

- The certification process could become more widely accepted if there is more encouragement from the utilities or government agencies in the form of incentives, easier processing of building permits, or rebates on development charges.

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Case Studies from the United States and China

Energy efficient building is taking root in countries across the world. Though building needs, environmental conditions, and regulatory frameworks vary from country to country, the use of standardized rating systems allows for easier comparison. Here, the experiences of China's first LEED-certified building, and two leading U.S. office buildings provide successes and challenges which can inform India's efficiency efforts.

CASE STUDY 1

CHINA: FIRST GREEN OFFICE BUILDING[18]

Project Summary: Agenda21, in Beijing, is China's first LEED certified green building. It opened in 2005 after careful development by NRDC and its partner, the American-Chinese Coalition Organized for Responsible Development in the 21st Century. Built at no additional cost, Agenda21 won China's first LEED Gold certification and the first Green Building Innovation Award from the Chinese government. Agenda21 houses two agencies of China's Ministry of Science and Technology. The Chinese government uses Agenda21 as a model for retrofitting government buildings.

Project Description: Agenda21 saves energy from roof to basement, from an insulating roof garden to office lights with sensors. Reflectors lower lighting bills by bringing daylight inside, and ledges lower cooling bills by shading south-facing windows. Solar panels produce 5 percent of the building's power, and a rooftop heat-recycling system captures almost 78 percent of heat loss. Nearly 80 percent of the rainwater that falls on the building is captured and used for irrigation.

Energy Savings: To date, the 130,000-square-foot building has achieved an energy savings of 73 percent and wastewater savings of 60 percent, compared with typical office buildings. Experts have calculated that if all of China's office buildings were retrofitted to this level of efficiency, enough energy would be saved to render the Three Gorges Dam unnecessary. Additionally, people who work in the building speak highly of its comfortable, productive environment.

CASE STUDY 2

UNITED STATES: USAA REAL ESTATE COMPANY[19]

Project Summary: ABM Engineering partnered with USAA Real Estate Company to improve USAA's operational practices throughout its commercial portfolio. Performance metrics and goals were developed and implemented, including measurement and tracking of electricity, gas, and water data, through the use of the Energy Star Portfolio Manager tool.[20]

Energy Savings: USAA's FBI Chicago office building began occupancy in 2006, and within the first year ABM achieved a baseline Energy Star performance rating of 78. By the end of 2007, the rating improved to 87. This was accomplished by the entire building management staff working as a team in locating areas for potential energy savings. In 2008, the building's Energy Star rating improved to 95 - representing a 20 percent improvement in efficiency since 2007.

Investment: The investment cost in 2008 totaled approximately $328,000 in energy efficiency retrofits.
Financial Return: The FBI Chicago office building is saving $90,000 annually in energy costs. Programs established to shut down the boiler system and adjust the air handling units and relief fans after hours when outside air is above 50 degrees result in an estimated savings of $44,640 annually. Additional energy-saving measures implemented include updating the fluorescent lighting, installing a submetering pilot program, and procuring gas from an independent source versus a local utility.

Monitoring and Verifying Energy Savings: ABM's use of the Energy Star Portfolio Manager tool to measure and track performance metrics allowed USAA to engage in a process of continuous improvement in terms of tenant and employee comfort, energy efficiency, asset value, and positive impacts to the environment.

Distinguishing Value: USAA Real Estate Company's average Energy Star rating was 82 in 2008, up from 48 in 2000. USAA has saved more than $12 million as the company works toward the goal of reducing its total energy consumption by 25 percent.

The FBI Chicago Office Building won the Chicago Outstanding Building of the Year (TOBY) Earth Award 2010.

CREDIT: DAVID SEIDE, DEFINED SPACE INC.

CASE STUDY 3

UNITED STATES: WEST OFFICE, INC.[21]

Project Summary: Servidyne performed energy and sustainability audits at 25 commercial office buildings for a global institutional investment manager, West Office, Inc., to lay the basis for energy improvements and energy certification. Energy Star Portfolio Manager was used at the onset of each audit to identify high-performing assets that could earn the Energy Star and achieve LEED certification, improving market position. Benchmarking was also used to pinpoint buildings with opportunities for energy savings. Servidyne identified savings measures in the audits, including low- and no-cost adjustments and capital retrofit projects.

Project Description: The property teams at two commercial office buildings—100 West Road in Baltimore and Maitland Promenade in Orlando—immediately began to capture savings opportunities identified in audits. The Baltimore building quickly and inexpensively corrected system control issues discovered during the audit, reducing energy use by 25 percent and increasing its Energy Star rating by 28 points—from 46 to 74. The owners of the Orlando building invested in recommended retrofits, including control system upgrades, variable frequency drives, and demand-controlled ventilation, resulting in a 15 percent reduction in energy use and an 18 point Energy Star rating increase—from 69 to 87. The Orlando building earned the Energy Star for superior energy performance, and both buildings are pursuing LEED certification.

Energy Savings: The Baltimore building saved 23 kBtu/sq. ft. and $53,000 annually, and the Orlando building saved 13 kBtu/sq. ft. and $58,000 annually.

Investment: The Baltimore building pursued low- and no-cost system control adjustments totaling less than $10,000. The Orlando building invested $82,000 in upgrades and retrofits.

Financial Return: Both buildings achieved near immediate payback on investments—with less than three months simple payback for the Baltimore building, and approximately 1.4 years for the Orlando building.

Monitoring and Verifying Energy Savings: Energy usage and costs are tracked on an ongoing basis in Energy Star Portfolio Manager to ensure that savings achieved are maintained and to work toward continuous energy performance improvement. To promote energy awareness and best practices, each property distributes tenant newsletters that describe energy goals and accomplishments.

100 West Road in Baltimore, Maryland, and Maitland Promenade in Orlando, Florida. CREDIT: WEST OFFICE, INC.

Distinguishing Value: Servidyne's use of Portfolio Manager to benchmark customer buildings helps property teams better understand how their building is performing over time, as compared with others in a portfolio and relative to similar buildings nationwide, and also to identify where additional improvement opportunities lay—saving energy, money, and the environment.

Providing a Measure for Performance: Learning from Building Labels and Independent Third-Party Raters in the United States

One of the chief concerns among Indian building owners and tenants is "How do we know that our building is *actually* energy efficient?" Many Indian developers are concerned about the lengthy process for obtaining building permits and demonstrating code compliance in the face of slow-paced bureaucracy. Indian builders and developers are also concerned about the lack of a well-trained workforce that an energy-efficient economy requires.

One of the solutions for providing more information is through a building label. Building labels, like labels for sellers advertising cars, disclose details about performance and thus allow prospective owners or tenants to effectively compare the energy use of different buildings. BEE has recently developed the Star Rating Program for Buildings.[22] The program currently focuses on office buildings and IT parks in five climate zones, and is developing programs for hotels, hospitals, and retail malls. Similarly, GRIHA and LEED rating systems function as building labels by communicating to potential owners or tenants that the building has energy saving features. However, energy efficiency experts agree greater efforts are needed to expand building labeling in light of the commercial building boom expected in Indian cities by 2030.

In the United States, the Residential Energy Service Network, RESNET (www.resnet.us) for residential buildings and the Commercial Energy Services Network, COMNET (http://www.comnet.org) for commercial buildings have emerged as private initiatives to accelerate building efficiency. COMNET is a new initiative of RESNET to support ratings for commercial buildings.[23] RESNET and COMNET develop standards to be used for rating buildings on energy consumption and certify independent third-party raters. The RESNET scale starts at zero for a net-zero-energy building, and a rating of 100 is given to a building that meets national models for energy codes.[24] A rating above 100 means the building is less efficient than the model code and a rating below 100 means the building is more efficient. The RESNET standards are employed in a software system that is used for modeling building performance to determine building ratings.

RESNET standards are recognized by:

- State governments as equivalents for code compliance
- U.S. government for federal tax credits and Energy Star-labeling
- Banks and financial institutions to qualify for green loans

RESNET certification and testing requirements for third-party raters provides for creditability and uniformity in rating buildings. In order to be certified, each rater must be trained by an accredited instructor, pass a national online test, and perform five ratings under the supervision of a certified rater. RESNET also has standards for quality assurance within the rating industry.

National Financing Options for Energy Efficiency

Financing is an effective tool for overcoming the up-front cost barriers to efficiency. If a building costs more initially but generates enough energy savings to fully pay for the monthly incremental payment for these costs, it can be financed on the same terms. Implementing these finance options for both residential and commercial occupancies will allow developers to be better off whenever they invest in efficiency options with paybacks of less than 12 years.

Indian financing institutions have yet to create large-scale programs that allow customers to opt for financing options, loans, and other products while they are building efficient projects. However, the National Housing Bank is proposing a new development loan, to be announced in 2011, that brings affordability in synchrony with sustainability. It is expected that this scheme will nudge the nationalized public sector banks to come up with their own products along similar lines.

The following table lists some of the public and private banks that offer specific products for consumers adopting green practices.

BANK	DESCRIPTION
State Bank of India (SBI)[25]	The new Green Home Loan Scheme from SBI supports environmentally friendly residential projects and offers various concessions.
	These loans will be sanctioned for projects rated by the IGBC and offer several financial benefits such as a 5 percent concession in margins, 0.25 percent concession in interest rates, and processing fee waivers.
	A single point delivery of services related to carbon credits under the Kyoto Protocol's Clean Development Mechanism (CDM) is in place and includes financing to implement CDM projects, advisory services, and value-added products like escrow mechanisms for carbon credits.
State Bank of Mysore	To the extent feasible, environmental and social aspects are internalized into the lending assessment/pricing.
	Energy-efficient, green housing, renewable energy, and waste management projects are eligible for small interest concessions and liberalized margin norms.
	The entire cost for the construction of a rainwater harvesting system (subject to a maximum limit of less than or equal to Rs.2,5000) can be financed as an additional package included in housing loans with no additional margins.
Industrial Credit and Investment Corporation of India (ICICI) Bank[26]	ICICI Home Finance offers reduced processing fees to customers who purchase LEED-certified buildings.
Industrial Development Bank of India (IDBI) Ltd	An advisory service relating to CDM investments is offered to customers.
	The Bank offers a refinance scheme for energy saving projects for micro-, small-, and medium-enterprises.

Although these products deal with different aspects of green buildings, there are no specific products for energy efficiency in commercial buildings.

International Financing Options for Energy Efficiency

There are some innovative financing options in place in the United States that are customized for rapid adoption of energy efficiency by end users.[27] These options benefit hard-to-reach market segments and end-user groups that currently lack creative financing structures (e.g., residential, small, medium, and large commercial and industrial customers, including multitenant buildings).

The following financing options encapsulate many of the major trends in the efficiency marketplace and can be utilized to overcome existing barriers to energy efficiency without any initial capital outlay by customers.

TYPE OF CUSTOMER	FINANCING OPTION	DESCRIPTION	SOURCE OF FUNDING
Residential (single-family homes)	Clean Energy Works program (Portland, Oregon)	City-wide program that provides comprehensive technical assistance and long-term financing through project loans that are repaid through a customer's regular utility bill.	City budget, federal Energy Efficiency and Conservation Block Grant, Energy Trust of Oregon
Residential and small commercial	Property Assessed Clean Energy (PACE) program (Palm Desert, California)	A tax lien is placed on a property that enables customers to receive long-term financing (up to 20-year loans) to finance energy efficiency measures that are then repaid through property tax assessments.	Municipal bonds, recent loan from Wells Fargo Bank
Small/medium commercial and municipal facilities	On-bill Financing program (San Diego Gas & Electric, California)	100 percent financing for efficiency measures with customer loan repayments to their utility made via a surcharge on a customer's utility bill.	Historically, Sempra Energy's working capital; current proposal is a revolving fund using rate-payer money
Commercial (including small business) and retail	Aggregated Deployment of Thermal Energy Storage (Ice Energy)	Aggregated deployment of individual thermal energy storage units, with a participating utility that covers the equipment and installation costs. Thermal energy storage units are installed at no cost to customers.	Private capital, tax exempt bond, or capital lease. Program costs will likely be rate based
Large industrial and commercial facilities	Efficiency Services Agreement (Metrus Energy)	Power purchase agreement-style product that enables customers to avoid all capital outlay with an efficiency project. Metrus is repaid on a cost per avoided unit of energy basis ($/avoided kWh of electricity).	Private sources of equity and debt
Large commercial facilities	Managed Energy Services Agreement (Transcend Equity)	Customers pay a sum equal to their historical energy bill. Transcend then pays all utility bills and finances and implements efficiency upgrades with its repayment being based on resulting energy savings.	Private sources of equity and debt

CHAPTER 4

Recommendations for Accelerating Energy Efficiency in Buildings

Energy efficiency improvements are the cheapest way to reduce energy demand and spending, increase energy security, create a new generation of green jobs, and curb rising greenhouse gas emissions. While programs to advance energy-efficient buildings in India are increasing, as seen in the Indian Green Building Council's goal to have a green footprint of a billion square feet by 2015, many challenges remain. Overall, the vast majority of the building sector is far behind in incorporating energy conservation measures into their building designs, with the result that many cities face energy shortages and high electricity bills.

Given India's building boom and both the need and opportunity to save energy through efficiency, the following section sets forth an action roadmap for the buildings sector. This guidance is based on experiences with building efficiency in Hyderabad. It outlines opportunities, roles, and key steps to align diverse stakeholders to facilitate faster implementation and greater expansion of the efficient buildings movement.

Energy Efficiency Stakeholders

Identifying the key groups that are responsible for the successes and obstacles to energy efficiency is critical in building a roadmap with targeted actions for each of the stakeholders. These groups, listed below, all benefit from increased building energy efficiency.

- Central government agencies, like the Bureau of Energy Efficiency (BEE), Ministry of Environment and Forests (MoEF), Ministry of Power, Ministry of Urban Development (MoUD)
- State government
- Utilities, public or private
- Real estate developers
- Private sector companies
- Tenants of commercial and high-rise residential buildings
- Financial institutions
- Relevant skilled workforce, like architects, engineers, construction workers
- Vendors of efficiency products
- Civil society, including nongovernmental organizations and the media

Each stakeholder group plays an important role in advancing energy-efficient buildings. By acting individually and collaboratively, stakeholders can work together to benefit from and transform the surge of commercial buildings, office space, hospitals, and high-rise residential homes into energy-saving buildings. The following section highlights key actions that each stakeholder group can take to move toward building efficient communities.

State and Local Government Action Steps

Leading state and local governments are already working to develop policies and structures to promote efficient buildings, as outlined earlier in this report. A critical step in supporting local action is the adoption of the ECBC, as established by BEE. The central government's expansion of the ECBC to include buildings with a greater connected load of 100 kW is also an important step. While these provide a good start, the actions outlined below can accelerate momentum—especially addressing the slow movers and bottom of the buildings market.

1. ***Code Adoption and Implementation:*** State and regional governments should effectively adopt and implement the ECBC for all new construction by modifying it to meet local conditions. Although the ECBC provides direction for building efficiency, the code is still voluntary. Most states have yet to develop, adopt, and implement these minimum building efficiency standards. A few states, such as Haryana, are leading by making the code mandatory. Other states can follow suit and strengthen compliance with efficiency standards throughout the country. The recently released USAID-ECO III ECOnirman ECBC Compliance Tool is an effective means for designing efficient buildings by allowing builders to use a computer program to check for code compliance during the design phase.[28] Governments can encourage widespread adoption and use of the ECOnirman by builders, developers, and architects by requiring its use as part of building permits. The processes and additional documentation involved with code compliance should also be accessible and easy to understand so as to encourage compliance.

2. ***Awareness Programs:*** Awareness and training are needed within local governments on building efficiency and the consequences of wasteful energy use. Currently, local governments perceive the code as very technical and not easily understandable. In order to accelerate efficient construction, this must change. Training programs are needed from the highest level of state principal secretaries to municipal engineers who issue building certificates and permits. An easy first step is for local governments to establish efficiency awards within different agencies, like HMDA, GHMC, APCPDCL in Hyderabad, and urban local bodies. Municipalities should also focus on coordinated awareness building and region-specific concerns, both internally and externally within their constituencies and through local workshops.

3. ***Disclosing Building Energy Use:*** State and regional governments should enact benchmarking practices for public disclosure of annual building energy use (through a building's utility bills) to buyers, lenders, and tenants. Collecting annual energy use—benchmarking—creates a much needed baseline that then can be used to compare the energy use of "similar" buildings.[29] Releasing benchmarking results to prospective buyers, lenders, and tenants will drive competition among owners to achieve leadership in efficiency. As a first step, local governments can introduce pilot programs to make benchmarking mandatory and conduct energy audits for their own buildings. For example, in Hyderabad, APCPDCL can perform mandatory energy audits on buildings with a connected load of more than 500 kW.

4. ***Commercial and Residential Building Ratings:*** Building ratings and labels are essential for prospective owners to understand a building's energy use (these are asset, not operational, ratings). Starting today, state and local governments can adopt BEE's five-star rating system, or encourage LEED/GRIHA implementation for efficiency in buildings. These building labels can create a market brand for efficient buildings. Creating rating labels as brands rewards the leaders in the market and incentivizes others toward efficient construction. Ratings can also be extended to include companies that provide efficient technologies required for building

construction. By branding efficient buildings, local governments can create jobs and new vendors in the market.

5 ***Long-term Programs to Encourage Continuous Improvement:*** State and regional governments can create programs designed to implement efficiency measures in all new construction, and retrofit all of the nation's buildings over a 10-20 year period. These long-term programs encourage continuous improvement in products and designs. For example, owners that retrofit in 2010 will accumulate cost savings and are likely to find that by 2020 new technologies make a second retrofit worthwhile. In this way, the savings—as a percent of current energy use—keep growing over the decades.

6 ***Creating Incentives for Builders:*** State, regional, and local governments can encourage efficient building construction and upgrades by creating incentives for builders and real estate developers. Actions that state, regional, and local governments could take now are:

- Expedite permitting processes and fee reductions for high efficiency performance projects. Local governments could also include building density and height bonuses (e.g., increased floor area ratio) in permitting and fee reductions.
- Create a tiered property tax structure that favors efficient construction, with the base tax rate calculated using the ECBC. This will embed the value of upgrades into the building and not assign costs and benefits to a particular owner who may choose to sell the building. For example, Pune's Ecohousing Scheme includes property tax incentives for residential homes and this can be expanded to commercial buildings.
- Provide tax abatement, exemption, or credits for higher cost purchases (e.g., efficient windows or lighting systems, solar panels, smart technologies) with large up-front capital costs. These should be based on the performance of the system and not depend on the costs an individual paid for them.
- Provide significant financial incentives to developing special economic zones (SEZs) that achieve compliance beyond the ECBC. These sites will be operational for at least a few decades, and locking in energy efficiency at the time of construction will lead to significant energy reductions.

Utility Action Steps

Utility demand side management (DSM) programs started in India about a decade ago, however, their scale and adoption is limited. Revamping DSM programs is essential because they directly target the significant up-front cost barrier to energy efficiency. DSM programs are a mechanism to move the middle of the market to exceed the minimum ECBC requirements. DSM programs can also reduce power cuts and the need for load shedding. This extra energy source will allow utilities to meet the power needs of existing customers and increase their customer base. In addition, DSM programs reduce rates over the long term by avoiding the need to build expensive power plants to meet the increased peak demand and by taking price pressure off generation fuels.

1 ***DSM Schemes:*** State utility boards should require DSM proposals from utilities to explicitly address peak power demand. The energy and monetary benefits of DSM programs should be emphasized when new connections are sought by consumers. While step tariffs and time-of-day tariffs exist for some states they should be made more competitive and include penalties (such as higher rates) for increased energy use to motivate customers to change behavior. Electricity boards should commit to spending a fixed percent of their revenues on DSM and energy efficiency, and the progress of these schemes should be monitored carefully. The state electricity boards (such as APCPDCL in Hyderabad) and banks can collaborate to create a DSM scheme for a pilot project targeting energy use in banks, multiplexes, and retail chains. In the long run, utilities should have their profits decoupled from their sales through annual automatic adjustments to tariffs to assure that they are financially indifferent to the success of DSM programs.

2 ***Energy Service Companies (ESCOs):*** Utilities should create partnerships with ESCOs to accelerate energy savings in their localities. The ESCO market has the potential for a huge business opportunity, but so far it is still young in India. Utilities can create ESCO partnerships with banks and real estate developers to implement performance guaranteed contracts that add momentum, decrease the risk associated with building improvements, and allow profit sharing between the owners, banks, and ESCOs.[30]

3 ***Demand Side Load Research Data:*** Utilities should expand data collection and research to better understand consumer demand. This research will allow utilities to understand the sectors, and the slabs within sectors, in which peak loads are occurring and then target those areas with specifically designed efficiency programs to reduce peak demand.

Real Estate Developer Action Steps

Involving building owners and developers is essential to accelerate efficient building construction because owners and developers drive demand. They are also the most affected by the up-front cost and split-incentive barriers of energy efficiency. While there has been some leadership shown by progressive builders in moving towards efficient construction, this group is largely unaware of the benefits of efficient buildings. Working with this stakeholder group provides a key opportunity to move the market.

1 ***Real Estate Network:*** Developers should create a network that brings together the real estate community to share best practices and support efficient building practices. This collaborative network can also work with government and financial institutions in finding solutions to the barriers to energy efficiency that building owners face. The network can convene annual conferences that share state-of-the art efficiency techniques and efficiency lessons and experiences among the real estate community and a wider network of architects and engineers.

2 ***Understand the Business Case:*** Raising awareness among real estate developers to better understand the costs and benefits that an efficient building provides is central to advancing efficient building design. Progressive builders that have in-house sustainability teams (e.g., DLF and Raheja Corp.) can showcase their experiences with efficient construction, thus raising awareness within the developer community on costs, benefits, payback times, increased premiums and occupancy rates, and shared project concerns.

3 ***Raise Awareness on Codes, Rating Systems, and Incentives:*** Capacity building for the real estate community to simplify the technicalities and understand the ECBC and the different (LEED India and GRIHA) rating systems is an important undertaking. Real estate developer associations can work together to understand and disseminate information on government programs and regulations that incentivize green building construction. In South India, the Andhra Pradesh Real Estate Developers Association (APREDA) is a potential forum for raising awareness among developers.

4 ***Energy Efficiency Leases:*** Real estate groups can develop "energy aligned leases" that divide the costs and benefits of building improvements and share savings between landlords and tenants to overcome the split-incentive.

Private Sector Company Action Steps

With a burgeoning private sector, building construction and development are expected to rapidly increase and will continue to rise for the next two decades. Since many large private sector buildings are owner occupied, they provide opportunities for cost savings from energy efficiency measures because the split-incentive problem does not apply to these owner-occupied projects. Further, the private sector has fewer financial constraints and tends to follow global trends that have already moved toward premiums on green construction. With incentives and

concrete measures, a large opportunity in the commercial building space can be realized by working with this stakeholder group.

1. ***Commitment from the Top:*** Companies can commit to reduce their energy consumption by a certain percent annually in both new and existing buildings. Intracompany competitions can also be established to reward the office buildings that achieve improvements in energy efficiency. Company efficiency programs save energy costs and build internal awareness as well as within competing companies. Infosys and Wipro have taken the lead in such commitments and are models for other organizations. The soon-to-be-issued ISO standard 50001 requires top-level commitment to an energy plan with quantitative goals and can be used to motivate improvements.

2. ***Corporate Social Responsibility (CSR):*** Companies should incorporate building energy efficiency in existing and new CSR programs. Starting today, companies can make lighter upgrades, like lighting improvements and monitoring energy costs. The resultant cost savings can be used to conduct pilot studies that can then be expanded to making deeper improvements (like HVAC). These initiatives can be extended from the companies' own facilities to their supply chains, resulting in deep cost savings for the company.

3. ***Employee Engagement:*** Company policies can engender behavioral changes in employees' energy use. Creating rewards based on energy efficiency and conservation can motivate energy savings. This is beneficial to the employees, who will be working in a healthier environment, and to the employer, who will profit from higher employee productivity because of increased indoor environmental quality. The Infosys facility in Bangalore provides an interesting case study of different ways to motivate employee behavior change, and this information should be made widespread to both IT and non-IT companies.

4. ***Showcasing Leadership:*** The top niche private sector companies with impressive energy-efficient buildings that are reaping economic and productivity benefits should widely disseminate their case studies to the broader public and business communities. For example, the DuPont facility in Hyderabad is the first Indian LEED-rated lab site and can serve as a model for new pharmaceutical and similar facilities around the country.

Tenant Action Steps

Tenant demand for efficiency upgrades is a critical driver for energy-efficient buildings. High performance build-outs of tenant work spaces result in value to these tenants through energy savings and increased employee retention and productivity, as a result of energy–efficient, healthy work environments. Building owners also benefit from efficient build-outs as a result of energy savings, increased rents, and improved occupancy, by attracting and retaining high profile tenants, thus enhancing overall asset values. Increased tenant demand for efficiency measures addresses split-incentive concerns since both tenants and building owners benefit from efficiency investments.

1. ***Creating Awareness:*** Government and independent agencies can partner with large commercial building tenants to raise awareness among renters about the economic and productivity benefits of energy-efficient buildings, along with the various financing options available to help share the costs and savings between the tenant and the building owners. Tenants should be well equipped to demand such efficient build-outs from building owners at times of lease renewal or turnover.

2. ***Commercial Tenant Demonstration Projects:*** Public or private partner agencies can identify pilot projects with large commercial tenants (>100,000 sq. ft.), across various building types, who are looking to either move to a new leased space or renew an existing lease and desire an energy-efficient space. Measuring and verifying the energy savings that result from these upgrades and making their added value accessible to tenants will drive building owners to invest in deep core system improvements, enabling these owners to better attract and retain

high profile tenants, and significantly enhance asset value. These results should be widely shared with other tenants and building owners to implement similar projects.

3 ***Measure and Verify Savings:*** Public or private partner agencies can drive tenants to invest in energy efficiency technologies and emphasize transparent and rigorous monitoring of energy conservation measures. Such monitoring will provide accessible data to other stakeholders about the particular benefits from each efficiency upgrade. Examples of investments are improved building envelope, lighting, appliances including office equipment, and HVAC systems.

Financial Institution Action Steps

Banks and financial institutions have the potential to be some of the most significant movers of the green building market. These institutions can develop financial products that bring down the up-front capital cost of energy efficiency improvements. Working with banks to include services for energy efficiency in their portfolio of products presents a largely untapped and significant opportunity for expanding the efficient buildings market. Financing efficiency in new buildings can work hand-in-hand with rating and labeling, since a profit-maximizing bank would want to base qualification for loans on the total costs of buildings—loan repayment plus energy costs—rather than just on loan costs. There is evidence that the failure to do so is one of the causes of the U.S. mortgage meltdown of 2007.[31]

1 ***Increase Stakeholder Interaction:*** Banks with existing green loans (e.g., State Bank of India) should engage with building certification groups, such as IGBC and TERI, to increase demand for green loan products. Banks and real estate developers can also work together to increase developer use of green financing options.

2 ***Financial Products for Energy Efficiency:*** Banks can provide and monitor a separate line of credit for efficient products and processes and also pilot financial products focused on ESCOs. By making these financial products available, the cost premium on efficiency improvements will be reduced, which can expand the market and eventually bring down prices. Further, for non-star-rated (inefficient) buildings and appliances, a higher rate of interest could be introduced to disincentivize their use. Some options for financial products are: mortgages and green leases with performance clauses structured to prefer efficiency investments, like a reduced interest rate on loans or a rebate at closing; higher qualifying ratios and higher allowable mortgage payments up to the amount of monthly energy savings, resulting from the customer's increased cash flow from these savings; and elimination of additional down payment for efficiency improvements. These financial products should be made available to customers at an early stage of building construction, as opposed to at the end of construction, so as to maximize efficiency measures in the building design.

3 ***Awareness of Business Opportunities:*** Financial institutions can work with business groups, like CII, to raise awareness about the business opportunities of green banking and obtaining carbon credits via CDM for efficient buildings. This significant business opportunity for banks is relevant given the global trend towards increasing efficiency in buildings that many multinational and large Indian companies are adopting.

4 ***Mandating Efficiency Investments from Insurance Companies and Funds:*** Pension funds and insurance companies can be required to disburse a fixed percentage of their portfolio into energy efficiency investments. To expedite this, rating agencies can include energy efficiency as one of the parameters in assigning credit ratings to these institutions.

Relevant Skilled Workforce Action Steps

Transitioning to a low-carbon building sector will require a skilled workforce trained to understand and implement the energy efficiency technologies that the new wave of construction will demand. This new growth phase presents a tremendous opportunity for generating green jobs, particularly in India where there is a large, young workforce readily available for technical and vocational training.

1. ***Energy Efficiency Curriculum:*** Universities and architecture schools should emphasize energy management and efficient building construction as part of their curriculum and work collaboratively with industry to provide theoretical and practical training to all students. USAID-ECO-III's recently launched building design curriculum focuses on energy use for 18 architectural and engineering institutes. The materials and associated training workshops should be adopted by architectural and engineering schools throughout India.

2. ***Construction Workforce Certification:*** The National Academy of Construction can use its platform to share best practices and create a skilled workforce proficient in energy efficiency at three levels: middle management, builders, and architects. It can also provide certification courses to enable the existing workforce to receive up-to-date training on efficiency technologies, measurement, and verification practices. The Alliance for an Energy Efficient Economy (AEEE) has conducted such trainings and it could work with partnership organizations to expand its reach to a larger portion of the workforce.

3. ***Training through Professional Bodies:*** The Builders' Association of India, Institute of Engineers, Institute of Town Planners, Indian Institute of Architects, International Institute of Information Technology, IGBC, and Association of Indian Architects can work together as a forum to train engineers, architects, and construction workers through customized modules on energy efficiency, measurement, and verification practices. These professional bodies can modify their training materials to include information on energy efficiency. The groups can establish an award system for professionals to recognize efficient building implementation, which also further enhances the professionals' credibility.

4. ***Third-Party Verification:*** As ECBC compliance gets more stringent, there will be an increased need for professionally accredited third-party verifiers who can measure and verify the energy savings that are taking place. New and existing engineering and vocational education institutes can provide training in energy simulation and building certification services. Universities and professional networks can work together to establish an independent auditing organization that will verify ECBC compliance for new and existing buildings.

5. ***Vocation Training in Energy Efficiency:*** The Prime Minister's National Council on Skill Development has been established with a target of creating 500 million skilled people by 2022. The target should include a skilled, green workforce that can be trained at existing and new institutions involving public private partnerships. Industry groups like CII are already partnering with industrial training institutes and centers on skill development in other sectors and should extend this training to energy efficiency.

Vendors of Efficiency Products Action Steps

Companies that supply efficiency services and products, such as insulation, high-performance windows, motors, and HVAC equipment, can form a powerful group and work together to create a large market for new technologies by advocating for efficiency in buildings. Increasing the customer base for these products will drive down prices, further accelerating commercialization and demand.

1. ***Advocating for Efficiency Code Implementation:*** Insulation companies and window manufacturers can form strong alliances with groups such as AEEE to advocate for the enforcement of energy efficiency codes in buildings and increasing the industry's credibility.

2. ***Trade Law Reforms:*** Vendors can work with the central government on continuously updating foreign trade requirements for efficiency standards for imports of major products, such as light bulbs and heaters, to reflect international efficiency standards.

3. ***Promote Communication of Efficiency Benefits:*** Vendors of efficiency products can work with retailers and train sales representatives to understand the benefits from, and encourage the use of, their efficient products.

Civil Society Action Steps

Civil society, along with media and nongovernmental organizations (NGOs), is a powerful force for creating demand for energy efficiency. Civil society organizations can work with various stakeholders to highlight the cost savings and positive environmental impacts of energy-efficient buildings to motivate behavioral changes that create an energy conscious society.

1. ***Awareness Building by NGOs:*** NGOs can target stakeholder groups by organizing conferences and publishing materials that disseminate national and international best practices and implementation information. NGOs can bring together different key players (e.g., developers, tenants, banks, and government) to overcome actual and perceived barriers to energy efficiency.

2. ***Technology Centers and Websites:*** NGOs and other independent professional bodies can establish technology centers and websites that offer the latest information on efficient products and technologies. Such information dissemination can present customers, builders, engineers, and architects with updated best practices. The technology centers can provide lists of suppliers, prices, and benefits of available efficient products in local markets. The AEEE, an alliance of leading companies, could expand their involvement in sharing product information on manufacturing, distribution, and installation of various energy efficiency products and services.

3. ***Media Outreach:*** Media and civil society groups can raise awareness on the advantages of energy efficiency through print media, television, internet, and radio. Media can be an effective means to dispel myths about the high costs of building improvements and provide focus on the high rate of return of these improvements. Positive media coverage can also be an effective incentive for different stakeholder groups that demonstrate leadership in building efficiency programs.

4. ***Watchdogs:*** NGOs can play an important role as watchdogs to encourage development and successful implementation of and environmentally sound government policies and private sector initiatives.

5. ***Work with Youth:*** Civil society groups can engage with primary and secondary schools, engineering and architecture colleges, and planning institutes. Partnerships with groups, such as the Indian Youth Climate Network, can raise awareness on the many benefits of efficient buildings and technologies.

CHAPTER 5

Conclusion: Creating a Virtuous Circle for Energy Efficiency

The barriers to efficiency can lead to a vicious circle in which building owners cannot benefit from improved cash flow from efficiency improvements and are therefore resistant to specifying them. This lack of demand leads to a lack of supply of products and services to make buildings greener. It also leads to higher prices when products are unavailable in local markets. Lack of supply deters designers from specifying efficient products or services, or generates financial barriers. Information and market facilitation programs like labels are not demanded because there are no real differences in efficiency to distinguish. Financial institutions likewise ignore differences in energy costs because they are perceived to be small and uncommon, and labels are not widely available.

If, however, you can start to break this cycle on a modest scale through a combination of standards, incentives, labeling, information, financing, metering, leasing reform, and direct intervention with equipment suppliers and designers, which together bridge the implementation gap, then all the elements can work in concert. The purpose of energy efficiency policy should be to establish the *virtuous circle* by tracking which elements are evolving positively and working synergistically and which others require intervention.

Advancing energy efficiency measures in buildings is central to India's national goal of building a low-carbon economy. All stakeholders play essential roles in ensuring energy-efficient construction in their community. The experiences in Hyderabad as well as those nationally and internationally demonstrate that there are many leverage points and strategies for improving building efficiency. Each stakeholder group can take action now through the discrete and achievable steps we've identified. The costs of inaction are too high and slow down the improvement of the livelihoods of millions and deter economic growth. Building a green, efficient economy will have tremendous benefits in reducing power cuts, saving money, improving public health, and reducing carbon emissions.

Endnotes

1 70 percent of India's 2030 building stock is yet to be built. Energy Conservation and Commercialization (ECO-III), "Developing an Energy Conservation Building Code, Implementation Strategy in India," May 2010, http://eco3.org/wp-content/plugins/downloads-manager/upload/Developing%20an%20ECBC%20Implementation%20Strategy%20in%20India-%20Report%20No.1028.pdf; 80 percent of India has yet to be built. McKinsey Global Institute, "Environmental and Energy Sustainability: an approach for India," August 2009, http://www.mckinsey.com/clientservice/sustainability/pdf/India_Environmental_Energy_Sustainability_final.pdf.

2 Energy Information Administration, "International Energy Outlook 2010," http://www.eia.doe.gov/oiaf/ieo/index.html.

3 BEE, "Energy Conservation Building Code User Guide," http://www.bee-india.nic.in/content.php?page=schemes/ecbc.php.

4 U.S. Environmental Protection Agency, http://www.epa.gov/greenbuilding/pubs/about.htm.

5 U.S. Green Building Council, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988.

6 GRIHA, http://www.grihaindia.org/index.php.

7 Data from Cushman and Wakefield, personal communication, January 2011.

8 Cushman and Wakefield and Global Real Estate Institute, "Survival to Revival – Indian realty sector on the path to recovery," 2009, http://www.credai.org/Research/Cushman%20&%20Wakefield_Investment%20report%202009%20-%20Survival%20to%20Revival.pdf.

9 Data from HMDA, personal communication, December 2010.

10 APCPDCL Revenue Department, personal communication, December 2010.

11 Analysis by ASCI from Indiastat figures for Andhra Pradesh, http://www.indiastat.com/02/andhrapradeshstat/power/26/connectedload/66/stats.aspx and records from APCPDCL.

12 Hyderabad Metropolitan Development Authority, "Environmental Building Regulations & Guidelines," http://www.hmda.gov.in/EBGH/home/hmdasinitiative.html.

13 The Hindu, "Few takers for GHMC's 'Green Channel'," November 20, 2010, http://www.hindu.com/2010/11/20/stories/2010112065140800.htm.

14 Government of Andhra Pradesh, Comprehensive Building Regulations.

15 From 2008 levels. International Energy Agency, "World Energy Outlook 2010," 2010, http://wwwworldenergyoutlook.org/docs/weo2010/WEO2010_ES_English.pdf.

16 Data from International Energy Agency, 2008 Energy Balance for India, http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=IN.

17 HMDA has not occupied this building yet and thus has not been able to measure its savings. The American Consulate has been using this building for its offices since 2008.

18 NRDC, China's First Green Office Building, http://china.nrdc.org/chinas-first-green-office-building.

19 Case study reprinted from U.S. Environmental Protection Agency, Energy Star Program, "Service and Product Provider Success Story," http://www.energystar.gov/ia/partners/downloads/Success_Story_ABM_USAA.pdf.

20 Case study reprinted from U.S. Environmental Protection Agency, Energy Star Portfolio Manager, http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.

21 Case study reprinted from U.S. Environmental Protection Agency, Energy Star Program, "Service and Product Provider Success Story," http://www.energystar.gov/ia/partners/downloads/Success_Story_Servidyne.pdf.

22 BEE, "National ECBC Awareness Programme" presentation, http://www.bee-india.nic.in/schemes/documents/ecbc/NationalECBCAwarenessProgrammeJ/01-ECBC-SanjaySeth.pdf.

23 COMNET facts, http://www.comnet.org/comnet-intro.

24 RESNET facts, http://www.resnet.us/about/resnet.

25 State Bank of India, Home Loan Product Variants, http://www.statebankofindia.com/user.htm?action=viewsection&lang=0&id=0,1,20,115,741,750,786.

26 ICIC Bank, http://www.icicibank.com/pfsuser/webnews/go-green/Index.html#

27 CalCEF Innovations, "Energy efficiency paying the way: New financing strategies remove first-cost hurdles," February 2010, http://www.calcef.org/innovations/activities/EEfirstcosts_0210.pdf.

28 ECO-III, ECOnirman Tool, http://www.buildingenergytools.in/econirman.

29 Although benchmarking is valuable in comparing building energy use, it is important to note that it has some limitations. In the United States, data show large variations between similarly designed buildings, which may even have the same efficiency technologies installed, because of other factors like siting and usage.

30 Currently, opportunities for equity investment in India's ESCO industry are generally limited to direct investment in larger (vendor) energy service companies that are affiliated with an equipment manufacturer. Smaller ESCOs have difficulty because they lack the collateral to meet bank requirements. Prospective clients are also often unwilling to finance or cannot obtain financing for ESCO projects, owing to a lack of confidence in energy service companies' capabilities and/or reluctance to take risks. World Resources Institute, "Powering Up: The Investment Potential of Energy Service Companies in India," http://www.wri.org/publication/powering-up.

31 Goldstein, D., *Invisible Energy: Strategies to Rescue the Economy and Save the Planet* (Bay Tree Publishing: 2009).

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