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Transforming Cities: Building Efficiency Lessons from Hyderabad

Prepared by:
Natural Resources Defense Council and
Administrative Staff College of India

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EXECUTIVE SUMMARY

India's real estate market is experiencing tremendous growth. This trajectory is significant because buildings already account for nearly a third of India's total electricity consumption (according to the Bureau of Energy Efficiency), energy demand outweighs energy supply and power cuts are commonplace. As thousands of new buildings are constructed across India every year, the country's booming real estate market stands at a historic crossroads: to build using yesterday's approaches and guarantee an unprecedented increase in energy use and greenhouse gas emissions or to implement money-saving, energy efficient strategies that will lead to cleaner, safer cities of the future. Hyderabad—the current shared capital city of Andhra Pradesh and Telangana—has made the choice to build smart and lock in those savings for years to come, establishing itself as an energy efficiency leader in India.

Energy efficiency is the fastest, cleanest, and cheapest way to keep pace with Indian cities' expanding energy needs. In fact, stronger building efficiency codes and ratings programs in India's commercial buildings would create enormous energy and cost savings by 2030 according to analysis by the Natural Resources Defense Council (NRDC) and the Administrative Staff College of India (ASCI).

If states across India adopted the Energy Conservation Building Code (ECBC) and developers participated in strong programs for rating commercial buildings, an estimated 3,453 terawatt hours (TWh) of cumulative electricity could be saved by 2030, the equivalent of powering as many as 358 million Indian homes annually between 2014 and 2030 based on the current annual consumption level for electrified homes.[1] Additionally, 1,184 million tons of CO_2 emissions could be avoided by 2030, equivalent to the annual emissions from more than 17 coal-fired power plants (500 megawatts each) over that same period of time.[2]

Even minimal code compliance by commercial buildings in Andhra Pradesh (40 percent complying with the ECBC, 5 percent exceeding the code) translates into **86 TWh of cumulative energy saved by 2030**, enough to power as many as 8.9 million Indian households per year over the next 17 years based on the current level of annual energy consumption. These calculations were completed before Andhra Pradesh and Telangana split into two states. As these huge potential savings demonstrate, widespread adoption of the ECBC in Indian states and greater participation in ratings programs could provide powerful energy savings as demand rises, while fighting climate change.

With these goals in mind, NRDC and ASCI have partnered to create building efficiency solutions for the urban Indian context. Utilizing the lessons learned in Hyderabad, this report provides tools to accelerate implementation of energy efficiency measures, including information about how efficiency pays for itself in short order and incentives to move the developer market towards achieving these savings.

Section one focuses on stakeholder engagement in the recently bifurcated states of Andhra Pradesh and Telangana and their currently shared capital city of Hyderabad, offering a detailed look at what stakeholders are doing on the ground to move the market. Developers, building owners, and tenants are essential to achieving the energy efficiency benefits of reduced energy use, cost savings, increased worker productivity, higher asset value, and market advantage. As detailed in this section's case studies from Hyderabad, incorporating energy efficiency measures in new and existing buildings is helping the city achieve a reliable energy future and save money while addressing the threat of climate change.

Section two features the comprehensive and innovative Andhra Pradesh Energy Conservation Building Code (APECBC) for commercial and high-rise residential buildings, adopted in January 2014 by Government Order. The APECBC was tailored to offer phased-in implementation and a flexible compliance framework. Adoption of this efficiency code will generate enormous energy savings for both the states of Andhra Pradesh and Telangana.

Section three leverages these lessons from Hyderabad into the national context, highlighting the huge potential energy savings if the ECBC is widely adopted by Indian states and participation in rating programs is increased. This section also features summaries of three case studies from major Indian cities proving that building efficiency pays and saves energy. Case studies of three commercial buildings—Godrej Bhavan, Mahindra Towers, and AECOM (formerly Spectral Services headquarters)—showcase tangible proof of the strong business case for constructing green buildings and retrofitting the building stock to save energy and costs.

Accelerating energy efficiency while India experiences skyrocketing growth in its buildings market provides a singular opportunity to generate tremendous financial benefits, while the reduced demand for energy also improves public health, combats climate change, and closes the widening gap between India's energy production and demand. With these tools, India can transform its building market to become an energy efficiency leader and construct sustainable cities for the future.

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View of Hyderabad's Hi-Tech City.

STAKEHOLDER ENGAGEMENT: LESSONS FROM HYDERABAD

ANDHRA PRADESH OVERVIEW

Prior to bifurcation with the state of Telangana, Andhra Pradesh had India's third highest GDP and generated much of its revenues from the services sector.[3] Real estate development in Andhra Pradesh grew dramatically in the past decade; Hyderabad's property development has increased by five-fold. Much of the development boom is tied to the expanding services sector, including IT parks and ITES, pharmaceuticals, biotechnology and telecommunications that were created via government-established SEZs. As a result of the IT boom, major national and international developers have entered Hyderabad's real estate market to build premium commercial complexes and luxury high-rise housing. Recognizing the significant profit that energy efficiency yields, some progressive developers are constructing energy-efficient buildings to gain a market edge.

Building Efficiency Initiatives in Andhra Pradesh and Telangana

Awareness of building efficiency best practices is rising in Andhra Pradesh through progressive builders and in large part because of the IGBC in Hyderabad, which Andhra Pradesh currently shares with Telangana.[4] State and local officials have coordinated with stakeholders, including ASCI and NRDC, to create a Steering Committee on Energy Efficiency to support code adoption and implementation.[5]

Steering committee members boast governmental expertise (Commissioner, Hyderabad Metropolitan Development Authority (HMDA) and the Greater Hyderabad Municipal Corporation (GHMC)); private sector expertise (Confederation of Real Estate Developers' Associations of India (CREDAI) and Andhra Pradesh Real Estate Developers Association); technical expertise (building science and software experts); policy expertise (IGBC, ASCI, NRDC); and real-world construction expertise. The committee worked in tandem with the municipal government to implement the ECBC in 2014.

© Bhaskar Deol

India's first commercial radiant cooled building, Infosys Software Development Building, in Hyderabad.

© Sarah Klug

CII's Sohrabji Godrej Green Business Center's Green Roof in Hyderabad.

While developing strategies for efficiency implementation, the steering committee is engaging with local municipalities, the central power distribution authority, the New & NREDCAP, financial institutions and private citizens.[6] The committee has focused on developing, and with other agencies, implementing, a roadmap for three main activities: revising the current building bylaws to incorporate a locally adapted ECBC tailored to local climate conditions; developing a framework for third-party verification and software tools to check ECBC compliance and enforcement; and capacity building of municipal bodies, architects, engineers and third party verifiers. The committee also works on increasing awareness of compliance software, including developing pilot projects to test software tools and third-party verification frameworks.

In addition to the state's ECBC-focused activities, the HMDA developed voluntary Environmental Building Regulations & Guidelines in 2009.[7] These guidelines establish parameters to reduce the environmental impact of new buildings. Despite readily available information, the guidelines have not been implemented broadly. The GHMC created a Green Channel to incentivize the construction of buildings that are designed according to the established National Building Code and the Hyderabad Master Plan. The Green Channel provides ease, transparency and accountability to fast-track building permits and certifications and encourages compliance with regulations.[8] This Green Channel does not yet include measures for building efficiency and should be modified in the immediate future to encourage such construction.

It also promotes energy efficiency through broad sustainability practices, which include offering incentives to affordable-housing developers.[9] The state utilities also have energy conservation awareness-building programs for consumers.

Examples of Efficient Buildings and Developers in Andhra Pradesh and Telangana

Aliens Group:[10] Promotes IGBC LEED ratings for projects (e.g., Aliens Space Station pre-certified and on track to be registered as LEED Platinum). Address: Plot no # 57, sVittal Rao Nagar, Madhapur, Hyderabad - 500 081; http://www.aliensgroup.in/.

DuPont Knowledge Center:[11] CFL and LED lighting systems with sensors; building model simulations indicate 16.39 percent energy savings compared to ASHRAE 90.1-2004. Address: Genome Valley, Survey No. 542/2, DS-9, ICICI Knowledge Park, Turkapally Village, Shameerpet Mandal, Ranga Reddy District - 500 078; http://www2.dupont.com/Tyvek_Weatherization/en_US/products/building_knowledge/building_knowledge_center.html.

HMDA Annexe II Building:[12] Reflective roof with a minimum solar reflective index of 78; 50 mm Styrofoam insulation sheets; optimized natural light and ventilation; no mechanical systems as naturally ventilated building. Address: Block 'A', District Commercial Complex, Tarnaka, Secunderabad - 500 017; Tel: +91-04-2700-3313; http://hmda.gov.in/.

Manjeera Group:[13] Employs green technological solutions (e.g., Manjeera Majestic Commercial project); LEED certified construction (e.g., LEED Gold certification for Platina project). Address: #304 Aditya Trade Centre, Aditya Enclave Road Ameerpet, Hyderabad – 500 038; Tel: +91-40-6617-6617; www.manjeera.com.

S and S Constructions and Elite Properties:[14] Certifies projects with IGBC Green Homes (e.g., Green Grace, Green Meadows pre-certified LEED Platinum). Address: Plot No.1299/D, T1, Green View Plaza, Road No.1, Jubilee Hills, Hyderabad - 500 033; Tel: +91-40-2355-5112; http://greengrace.in/.

Infosys Pocharam Campus: Infosys' 447-acre complex at Pocharam in Hyderabad is the first office building to use radiant cooling technology in India (radiant cooling optimizes the cooling processes used for air conditioning in the buildings) and has shown impressive energy savings. Address: Special Economic Zone - Developer, Survey No. 50 (Part), Pocharam Village, Singapore Township Post Office, Ghatkesar Mandal, Ranga Reddy District, Hyderabad - 500 088. http://www.infosys.com.

Rajiv Gandhi International Airport, Hyderabad: The passenger terminal of the new RGIA, developed by the GMR group, is the only Asian airport to get LEED Gold rating. Address: GMR Hyderabad International Airport Ltd., Shamshabad – Hyderabad 500 409, A.P., India. Tel: +91-40-6676 4000. http://www.hyderabad.aero/traveller.

SPOTLIGHT ON HYDERABAD: IMPLEMENTING ENERGY EFFICIENCY

The shared hi-tech 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 current shared administrative and financial capital of recently bifurcated states, Andhra Pradesh and Telangana. 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 Hi-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.[15] Demand for office space in India by 2013 was estimated to grow to 196 million square feet, of which between 15 and 20 million square feet lay in Hyderabad.[16] 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.[17]

The unprecedented economic growth in Hyderabad, and its location amongst the numerous Special Economic Zones in Andhra Pradesh (prior to the state's split with Telangana), 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.

An building efficiency market leader, the Park Hotel, Hyderabad.

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.[18] The following tables list the residential and commercial utility load and consumption details from 2008-2010 for the State of Andhra Pradesh (prior to the state's bifurcation).[19] Under a business-as-usual scenario, current production capacity will be unable to meet expected energy demand in Hyderabad.

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.

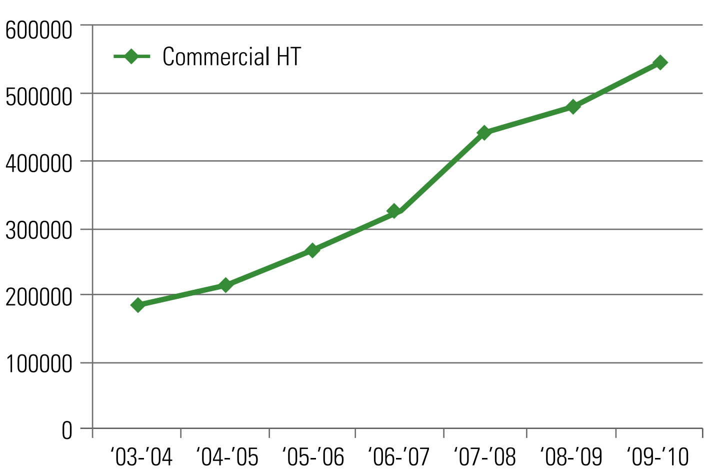
Residential Electricity Use Data

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

High Tension Commercial Load Growth (in kW)



Non-ECBC 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.[20] 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.[21] 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 m2 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.

State Government Initiatives: Before splitting with the state of Telangana, the Andhra Pradesh state government promoted 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.[22] 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. In 2014, Andhra Pradesh and Telangana both adopted a building efficiency code for implementation in their rapidly growing cities.

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. Implementation 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.

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

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.

Contact information: Hyderabad Metropolitan Development Authority, Block 'A', District Commercial Complex, Tarnaka, Secunderabad- 500017, Andhra Pradesh, India. Telephone: 91-04-27003313, Fax: 91-04-27001880; Email: hmdahyd@hmda.gov.in.

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

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.

DuPont Knowledge Center

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.

Contact information: Genome Valley, Survey No. 542/2, DS-9, ICICI Knowledge Park, Turkapally Village, Shameerpet Mandal, Ranga Reddy District 500078.

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

View of the Aditja Sarovar Premier Hotel.

Introduction

The project is owned and constructed by Manjeera Hotels and Resorts Ltd., and operated by the Sarovar Group. 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.

© Manjeera Constructions Limited

View of the Aditja Sarovar Premier Hotel.

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.

Contact information: Manjeera Hotels and Resorts Limited, #304, Aditya Trade Centre, Aditya Enclave Road, Ameerpet, Hyderabad-500 038, Contact No: 040 2373 5194/0231.

THE ENERGY CONSERVATION BUILDING CODE

INNOVATIVE BUILDING CODE LOCKS IN SAVINGS

In 2014, Andhra Pradesh adopted a comprehensive and innovative adaptation of the Energy Conservation Building Code (ECBC) for commercial and high-rise residential buildings, named the Andhra Pradesh Energy Conservation Building Code (APECBC). The state of Telangana—which currently shares the capital of Hyderabad—has this same energy efficient building code. This tailored version of the ECBC is unique in three key ways:

Expert-developed code with extensive stakeholder consultation

The state of Andhra Pradesh collaborated with real estate developers including the Confederation of Real Estate Developers' Association of India (CREDAI) and the Andhra Pradesh Real Estate Developers' Association (APREDA) and experts at NRDC, ASCI and the Indian Institutes of Information Technology to develop an innovative approach to compliance. The government-organized steering committee ensured extensive stakeholder consultation and technical expertise throughout the code's development.

Phased-in implementation

The APECBC helps guarantee compliance by providing a phased-in approach to implement the code's technical and practical aspects. In its initial phase after it becomes effective, the state will ramp up and build capacity through trainings with the municipal officers who will implement code. Workshops with real estate developers will also be held to build awareness and broader engagement before complete code roll-out. After this phase, the code will be ready for full implementation and compliance will be enforced.

Flexible compliance framework

The APECBC can be complied with in one of two ways, either through a "Prescriptive Method"—which lists requirements for energy efficiency measures—or through a "Whole Building Performance Method"—which entails using design software to optimize building energy performance while minimizing cost. This flexibility encourages developers, architects, and designers to respond to changing technologies and prices over time, easing compliance challenges.

With the code operationalized in Andhra Pradesh and Telangana, India is closer to meeting BEE's targeted annual national savings of 1.7 billion kWh by 2017. Many other Indian states are currently in the process of adopting the ECBC into state laws.

THE ANDHRA PRADESH ENERGY CONSERVATION BUILDING CODE

The following Government Order, Notification and Amendment to Andhra Pradesh's building code was published on January 28, 2014, officially adopting the APECBC, and can be retrieved from the state's Government Order Issue Registrar at *http://goir.ap.gov.in*.

GOVERNMENT OF ANDHRA PRADESH

ABSTRACT

MA&UD Department – Adoption of Energy Conservation Building Code (ECBC) – Amendment to Andhra Pradesh Building Rules, 2012 – Notification – Issued.

MUNICIPAL ADMINISTRATION & URBAN DEVELOPMENT DEPARTMENT

G.O.Ms.No. 30 **Dated: 28.01.2014**

Read the following:

1. G.O.Ms.No.168 MA&UD Dept., Dated: 07.04.2012
2. G.O.Ms.No.38, Energy (Res-A2) Department, dated: 26.09.2012
3. Minutes of the Meeting held in the Chambers of Chief Secretary to Government on 18.09.2012
4. G.O.Rt.No.1328 MA&UD Dept., Dated: 04.10.2012
5. Technical Committee report on adoption of ECBC

* * *

ORDER:

Government in G.O. 1st read above have issued Andhra Pradesh Building Rules, 2012 applicable to all Urban Development Authority areas and Urban Local Bodies together with Gram Panchayat areas which are covered in Master Plans/ General Town Planning Schemes/ Outline Development Plans.

2. Due to non - availability of adequate fuel supply, the ever increasing demand for power; and the resultant mismatch between demand and supply; there is need to promote energy efficiency & energy conservation measures in the country. Energy Conservation measures also make overall economic sense. In this connection, the Government of Andhra Pradesh in the G.O.2nd read above constituted the State Energy Conservation Mission (SECM) to enhance awareness on energy conservation measures among various stakeholders, to develop a comprehensive communication strategy, and also to promote energy conservation & energy efficiency activities in various sectors in the state.

3. Building Sector, especially large commercial and residential segment, offers a unique opportunity for energy conservation. Towards this goal, there is a need to take various measures for energy conservation in the State.

4. Based on the recommendations of the meeting 3rd read above, the Government vide G.O.Rt.4th read above constituted a Technical Committee to suggest the energy conservation measures & to identify the changes so required in the Acts and building bye-laws.

5. The Technical Committee after series of consultations has prepared draft Energy Conservation Building (ECB) code. The draft Energy Conservation Building Code was again discussed with various Stakeholders. After considering various suggestions, the Technical Committee in the reference 5th read above have submitted its report along with draft Energy Conservation Building code.

P.T.O

6. The Government after careful examination of the report, have decided to amend the Andhra Pradesh Building Rules, 2012 issued in the G.O. 1st read above. Further in order to ensure smooth implementation of various provisions, it was also decided to empanel Architects/ Architectural Firms with MAUD and NREDCAP and to train concerned Municipal Officials and Engineers on implementation of Energy Conservation Building Code in coordination with Administrative Staff College of India, Hyderabad, Bureau of Energy Efficiency (BEE) and International Institute of Information Technology, Hyderabad, before the Energy Conservation Building Code comes into force.

7. A copy of this Order is available on the Internet and can be accessed at the address http://goir.ap.gov.in/.

8. Accordingly the following notification will be published in an Extraordinary issue of Andhra Pradesh Gazette Dated:30.01.2014 and these orders will come into force from 01.08.2014.

NOTIFICATION

In exercise of the powers conferred by section 585 read with 592 of the Greater Hyderabad Municipal Corporation Act, 1955; Proviso under sub - section (2) read with sub - section (1) of section 14 and sections 32, 46 and 58 of the Andhra Pradesh Urban Areas (Development) Act, 1975, section 56 (1) of the Hyderabad Metropolitan Development Authority Act, 2008; section 18 of the Andhra Pradesh Municipal Corporations Act, 1994; section 326 of the Andhra Pradesh Municipalities Act, 1965 and section 44 (1) of the Andhra Pradesh Town Planning Act, 1920 the Government of Andhra Pradesh hereby makes the following amendment to the Andhra Pradesh building Rules, 2012 issued in G.O.Ms.No.168 MA&UD Dept., Dated: 07.04.2012 applicable to all Urban Development Authority areas and Urban Local Bodies together with Gram Panchayat areas which are covered in Master Plans / General Town Planning Schemes / Outline Development Plans.

AMENDMENT

(I) In the said rules, after clause (a) of rule 2 the following shall be inserted namely-

"(aa) **'Energy Conservation Building Code' or ECBC** is the energy code adopted by the Bureau of Energy Efficiency in 2007 and revised in 2008, that provides the minimum requirements for energy-efficient building design and construction.

The Energy Conservation Building Code (2008) when locally adapted to Andhra Pradesh's climate is termed as the "Andhra Pradesh Energy Conservation Building Code (APECBC)." All definitions included in the Energy Conservation Building Code (2008) and not otherwise defined herein are applicable to the Andhra Pradesh Energy Conservation Building Code."

(II) After Clause (b) of rule 15 the following shall be added namely:

"(C) Compliance with Andhra Pradesh Energy Conservation Building Code

Contd..3.

(i). The code shall be applicable to commercial buildings and other Non Residential Buildings that have a plot area of more than 1000 Square Meters or built up area of 2000 Square Meters and certain categories of buildings such as Multiplexes, Hospitals, Hotels, and Convention Centers irrespective of their built up area shall comply with the APECB Code as given in Annexure XIII.

(ii). The code is mandatory for all new buildings, as stated above, to comply with AP* (AP ONE STAR) with prescriptive/whole building performance method of compliance for the buildings. The prescriptive method format is given in Appendix G of APECBC, as given Annexure XIII. The whole building performance method is given in Appendix B of APECBC, as given Annexure XIII.

(iii). At the time of plan approval, the Owner and Builder/developer shall submit the AP* (AP ONE STAR) compliance, sealed and signed by AP Empanelled Architect with MAUD and NREDCAP or Bureau of Energy Efficiency Empanelled Architect against the mandatory requirement of compliance of APECBC to respective Urban Local Body. The details of compliance documentation, administration and energy analysis is given in the APECBC in chapter 3 as given Annexure XIII.

(iv). At the time of issuance of occupancy certificate, the builder/owner/developer shall submit the professional statement by AP Empanelled Architect with MAUD and NREDCAP / BEE Empanelled Architect verifying that the building has been built in accordance with the approved design and plan approval. Once the professional statement is submitted along with any other necessary approvals under rules 25 and 26 of the AP Building Rules, 2012, the occupancy certificate will be issued.

(v). In accordance with rules 25 and 26 of the AP Building rules 2012, the Urban Local Body may conduct random unscheduled progress inspections throughout the construction phase of a building for any new building, addition or alteration project, to ensure that the building complies with the APECBC. "

(III) After Clause (ii) of rule 22, the following shall be added namely-

"(iii). For the Buildings adopting APECB Code, building approvals may be given on priority".

(IV) After Annexure – XII the Andhra Pradesh Energy Conservation Building Code Annexure XIII shall be added.

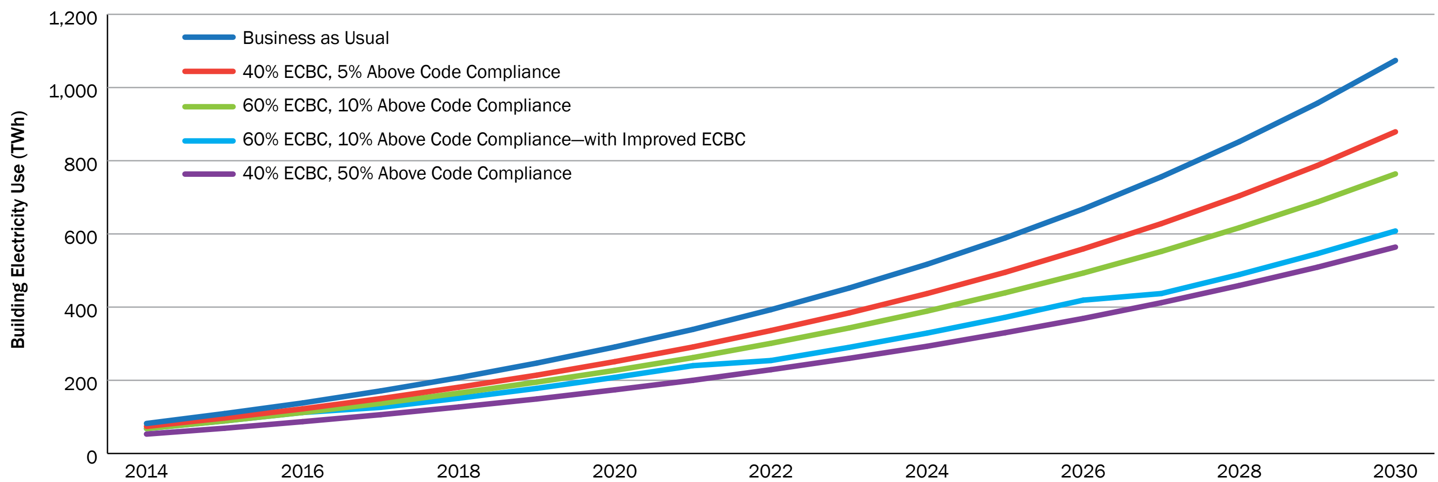
(BY ORDER AND IN THE NAME OF THE GOVERNOR OF ANDHRA PRADESH)

NATIONAL PERSPECTIVES: SAVING MONEY AND ENERGY THROUGH EFFICIENCY

HOW STRONGER EFFICIENCY BUILDING CODES AND RATINGS PROGRAMS CAN SAVE ENERGY USE BY 2030

Stronger building efficiency codes in commercial buildings and greater participation in ratings programs such as LEED and GRIHA would create enormous energy and cost savings by 2030, according to a new analysis conducted by NRDC and ASCI.[23] If states across India adopted the ECBC and developers participated in strong programs for rating commercial buildings, an estimated 3,453 TWh of cumulative electricity could be saved by 2030, the equivalent of powering as many as 358 million Indian homes annually between 2014 and 2030 based on the current annual consumption level for electrified households. Additionally, 1,184 million tons of CO_2 emissions could be avoided by 2030, an amount equivalent

Figure 1: Electricity consumption by scenario by 2030



Code Compliance and Rating Participation Scenarios

To measure the potential energy savings and carbon emission reductions in India, NRDC and ASCI developed five scenarios contemplating various levels of building code compliance and participation in ratings programs demonstrated in Figure 2:

(1) "Business as Usual," (dark blue curve) with no compliance with the ECBC or ratings programs;

(2) "40% ECBC, 5% Above Code Compliance," (red curve) in which 40 percent of commercial buildings comply with the ECBC and an additional 5 percent go beyond the code through a rating certification program, such as LEED or GRIHA;[24]

(3) "60% ECBC, 10% Above Code Compliance," (green curve) in which 60 percent of commercial buildings comply with the ECBC and an additional 10 percent go beyond the code through a rating certification program;

(4) "60% ECBC, 10% Above Code Compliance with Improved ECBC, (light blue curve)" in which 60 percent of commercial buildings comply with an ECBC that is improved every five years and an additional 10 percent go beyond the code through a rating certification program; and

(5) "40% ECBC, 50% Above Code Compliance," (purple curve) in which 40 percent of commercial buildings comply with the ECBC and an additional 50 percent go beyond the code through a rating certification program.

Methodology:

NRDC and ASCI modeled these scenarios on the basis of published assumptions. For example, energy savings depend on the floor area of new buildings. The analysis in this paper relied on the McKinsey and Company estimate of commercial floor space in India (1,022 million square meters in 2010), growth rate, and other inputs.[25]

The floor space estimate is for total commercial area, including retail, office space, and hospitals, and does not segregate the type of buildings for which the ECBC is not applicable. This estimate could be refined if more detailed data were made available. The NRDC-ASCI analysis also supports phased-in compliance over time instead of only high initial compliance as contemplated in these models.

© Bhaskar Deol

Exemplifying a market champion, India's first commercial radiant-cooled building, Infosys Software Development Building, located in Hyderabad, Andhra Pradesh, India.

to the annual emissions from more than 17 coal-fired power plants (500 megawatts each) over the same time period.

The detailed analysis of code compliance and ratings programs in Figure 1 demonstrates:

Savings Through Minimal Effort (see red curve in Figure 1): If just 40 percent of commercial Indian buildings complied with the ECBC and 5 percent exceeded the ECBC through ratings programs, 1,254 TWh of electricity would be saved cumulatively within 17 years. In other words, by 2030, minimal ECBC compliance across India could save the amount of cumulative energy needed to power more than 130 million households in India per year over that time period. Additionally, this level of code compliance and ratings program participation could avoid 430 million tons of CO_2 emissions by 2030, equivalent to the annual carbon emissions produced by 6.5 coal-fired power plants (500 MW each) for the next 17 years.

Savings Through Widespread Adoption of Codes and Ratings Programs (see purple curve in Figure 1): Savings increase dramatically if more Indian buildings comply with the minimum efficiency code. If 40 percent of commercial buildings complied with the ECBC and 50 percent exceed the code through ratings programs, India would lock in 3,453 TWh of cumulative electricity savings by 2030, the equivalent of powering as many as 358 million Indian homes annually over that time period. Also, 1,184 million tons of CO_2 emissions savings could be locked in by 2030, an amount equivalent to the annual emissions from 18 coal-fired power plants (500 megawatts each) over the same period of time.

State Snapshot—Andhra Pradesh: Looking at building energy use in the state of Andhra Pradesh, before bifurcation with Telangana, minimal code compliance by commercial buildings (40 percent ECBC, 5 percent beyond) translates into 86 TWh of cumulative energy saved by 2030, enough to power as many as 8.9 million Indian households per year over the next 17 years based on current annual energy consumption levels. This scenario could save 29 million tons of CO_2 emissions. Even more impressive, if 40 percent of commercial buildings complied with the ECBC and 50 percent exceed the code in Andhra Pradesh, 236 TWh of cumulative energy would be saved by 2030, the equivalent of powering as many as 24 million Indian households per year between 2014 and 2030 based on the current annual energy consumption. This scenario would avoid 81 million tons of CO_2 emissions, equivalent to the emissions of 1.2 coal plants (500 MW each) over the same time frame.

Building Codes Versus Ratings Programs: On both the state and national levels, similar energy savings could be achieved by 2030 through stronger codes or a greater number of LEED- or GRIHA-compliant buildings. In other words, energy could be saved either through policy-based programs that modify and improve codes every five years, in a scenario in which 60 percent of buildings comply and 10 percent go beyond the minimum through ratings programs (see Figure 1's light blue curve); or through more market-based programs, such as the LEED and GRIHA rating systems, with 40 percent of buildings complying with ECBC and 50 percent going beyond (see Figure 1's purple curve). Both scenarios result in huge potential energy savings and lowered carbon emissions. Together, both government policies with strong code compliance and robust ratings programs can drive energy savings to even greater levels.

As shown in Table 1, the impressive electricity savings accumulate to different levels, depending on the level of code compliance and participation in ratings programs.

Table 1. Cumulative energy savings locked in at various levels of ECBC compliance and ratings program participation by 2030					
	Building Electricity Use (TWh)				
Year	**Business as Usual**	**40% ECBC, 5% Beyond**	**60% ECBC, 10% Beyond**	**40% ECBC, 50% Beyond**	**60% ECBC, 10% Beyond with Improved ECBC**
2014	82	74	68	53	68
2015	109	97	89	69	89
2016	138	122	112	87	112
2017	171	150	137	106	126
2018	207	181	165	127	151
2019	247	214	195	149	178
2020	291	251	227	174	208
2021	339	291	262	200	240
2022	393	336	301	229	254
2023	452	384	343	260	290
2024	517	437	389	293	329
2025	589	495	439	330	372
2026	668	559	493	369	419
2027	756	628	552	412	437
2028	852	704	617	459	489
2029	957	787	687	509	546
2030	1,074	879	764	564	608
Total Electricity Use	**7,843**	**6,589**	**5,840**	**4,390**	**4,917**
Electricity Savings Relative to Business as Usual		**1,254**	**2,003**	**3,453**	**2,925**

Table 2. Inputs into the analysis and energy-saving models provided for compliance scenarios	
Inputs into Analysis and Model	
Source of Estimate of Commercial Floor Space	McKinsey
Estimate of Commercial Floor Space in 2010	1,022,000,000 m^2
Compounded Annual Growth Rate of Buildings	8%
Business-as-Usual Average Building Energy Consumption	210 $kWh/m^2/yr$
ECBC Average Building Energy Consumption	180 $kWh/m^2/yr$
Beyond ECBC Average Building Energy Consumption	100 $kWh/m^2/yr$
5-Year Improvement in ECBC Energy Consumption	15%
Business-as-Usual Annual Energy Consumption Growth Rate	1.6%

Sources: McKinsey & Company, Environment and Energy Sustainability— An Approach for India (2009), www.indiaenvironmentportal.org.in/ content/290851/environmental-and-energy-sustainability-an-approach-for- india/ (accessed December 11, 2013). United Nations Development Programme – India, Bureau of Energy Efficiency, "Energy Efficiency Improvements in Commercial Buildings," 2012, http://www.undp.org/content/dam/india/docs/energy_efficiency_improvements_in_commercial_buildings_project_document.pdf (accessed January 24, 2014).

INDIAN BUILDING CASE STUDIES: ENERGY EFFICIENCY LESSONS FROM DELHI AND MUMBAI

Saving Money and Energy: Case Study of the Cost-Saving Retrofit of the Godrej Bhavan in Mumbai

The landmark case study of South Mumbai's Godrej Bhavan office building shows energy efficiency is money in the bank. Just two years after the company Godrej & Boyce upgraded its iconic, six-story building, electricity costs have plummeted by 28 percent, while total electricity use has dropped by 12 percent. The company stands to recover the costs of its energy-efficiency retrofits (Rs. 5,384,000/USD $99,704) in as little as 4.7 years. The building will start paying accumulate savings and 15 years after the 2010 upgrade, Godrej & Boyce could realize up to Rs. 6,980,000 in electric bill savings.

Saving Money and Energy: Case Study of the Energy-Efficiency Retrofit of the Godrej Bhavan Building in Mumbai is empowering news for India's real estate community. As the study makes clear, the upgrades to Godrej Bhavan are common-sense and pay for themselves over time. Three measures—HVAC (heating, ventilation and cooling), lighting and the building maintenance system—account for the bulk of the energy savings.

The upgraded HVAC system alone represents an average of 32 percent in the overall electricity savings for FY 2010-2012. This new system, equipped with a screw chiller, water-cooled condenser, and electronic expansion valve, has a double coefficient of performance (COP) of 5.5, compared to the former 35-year old direct-expansion unit with 2.2 COP. Elsewhere in the building, high-efficiency T-5 fluorescent tube lamps and increased natural lighting improve lighting efficiency. Double-glazed clear windows and shading devices also reduce heat. With the newly installed Building Energy Management System, the building's maintenance managers can now track and adjust electricity usage for maximum efficiency (See Table 1 below).

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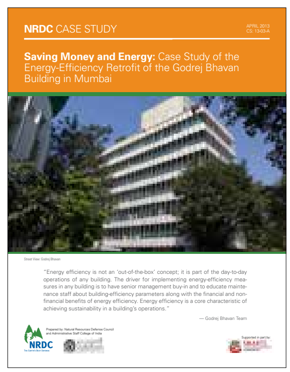
The message in *Saving Money and Energy* comes at a critical time, with India facing an energy crisis and severe power cuts. India's building-occupied area is estimated to climb sharply, from 8 billion square meters in 2005 to a projected 41 billion square meters in 2030, according to McKinsey & Company. With Godrej Bhavan as a key example, energy efficiency can help building owners and real estate developers to save on costs and gain market advantage from the start.



NRDC CASE STUDY

APRIL 2013
CS: 13-03-A

Saving Money and Energy: Case Study of the Energy-Efficiency Retrofit of the Godrej Bhavan Building in Mumbai

Street View: Godrej Bhavan

"Energy efficiency is not an 'out-of-the-box' concept; it is part of the day-to-day operations of any building. The driver for implementing energy-efficiency measures in any building is to have senior management buy-in and to educate maintenance staff about building-efficiency parameters along with the financial and non-financial benefits of energy efficiency. Energy efficiency is a core characteristic of achieving sustainability in a building's operations."

— Godrej Bhavan Team

Prepared by: Natural Resources Defense Council and Administrative Staff College of India

Supported in part by:

The complete study is located at: *http://www.nrdc.org/international/india/files/energy-retrofit-godrej-bhavan-CS.pdf.*

KEY STUDY FINDINGS

Electricity costs down by 28%
Total electricity usage down by 12%
Costs recouped in as little as 4.7 yrs
Potential 15 yr. savings of Rs. 6,980,000

Table 1: Energy Efficiency Retrofit Component Costs

Energy-Efficient Measures and Audit	Cost (INR)	Cost ($)
HVAC system replacement, including the building energy management system (Trane)	5,000,000	92,593
Water flow meters	24,000	444
Energy metering system	52,000	963
Auto-blow down controller at the cooling tower	29,000	537
High reflectance paint for the terrace surface	62,000	1,148
Energy audit	45,000	833
Replaced lights with energy efficient tube lights (Phillips)	172,000	3,185
Total cost of installed energy efficiency measures	**5,384,000**	**99,704**

Retrofitting Mahindra Towers: How an Innovative ESCO Model Lowers Energy Bills with No Upfront Cost

The case study *Retrofitting Mahindra Towers: How an Innovative ESCO Model Lowers Energy Bills with No Upfront Cost* highlights the strong business case for the Energy Service Company (ESCO) model to implement energy efficiency improvement measures into a Mumbai headquarters building. As the Mahindra Towers retrofit demonstrates, ESCOs are a key tool to advance India's efficient buildings market. With an overall investment of Rs. 18,90,000 ($39,375) for implementing energy conservation mechanisms (ECMs) that focused on improving efficiency in the building's lighting and cooling systems, the Mahindra Towers had an impressive **payback period of less than six months**. The ESCO model enabled Mahindra to make payments over time through the energy savings rather than make any upfront payments for the energy efficiency improvements. The corporation now continues to profit from those energy and cost savings for the life of the building.

An ESCO is a company that provides integrated energy services to its customers, including undertaking energy audits and implementing energy efficiency improvement projects on a turn-key basis. The earnings of the ESCO can be contingent on the savings that accrue to the customer from the project. Therefore, ESCOs secure the project risk and may cover upfront costs to ensure improved energy efficiency in a customer's facility and their payment for the services are delivered based (either in part or in whole) on the achievement of those energy efficiency improvements. Mahindra hired an ESC) certified by the Bureau of Energy Efficiency, ENCON Energy Management Services Pvt. Ltd. (ENCON), to audit and implement the building's energy efficiency retrofit. As a result of the energy performance contract (EPC) taken up between ENCON and Mahindra, Mahindra Towers reduced its power consumption by 14 percent in the first 12 months of the retrofit. **The Mahindra Towers saved 543,108 kWh and Rs. 40,73,310 ($66,200) from March 2009 to February 2010.**

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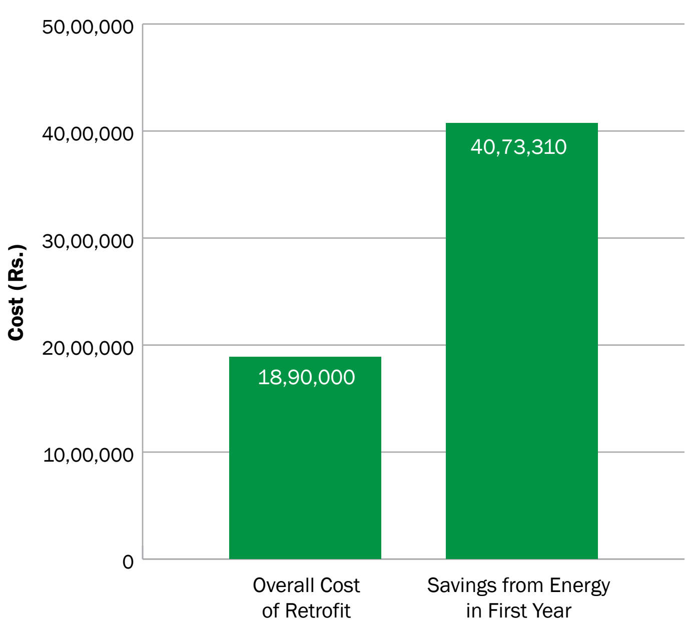
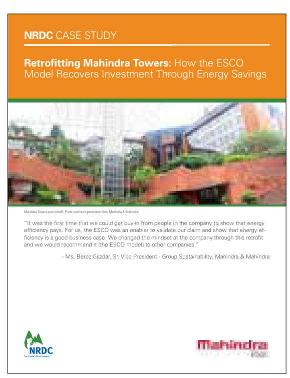
Mahindra Towers post-retrofit.

Cost of Energy Efficiency Measures Compared to Savings in the First Year of Retrofit



As the case study makes clear, the upgrades to the Mahindra Towers building are common sense and pay for themselves over time. Efficiency measures incorporated into the HVAC (heating, ventilation and cooling), lighting and the building maintenance system account for the bulk of the energy savings. In the first year after the upgrade (FY 2009–10), the Mahindra Towers' electricity use dropped by an average of 45,259 kWh per month, for a 14 percent saving in average monthly electricity use, including the period while ECMs were being implemented. In the second year after the upgrade (FY 2010–11), average monthly consumption dropped by 59,207 kWh per month, for an 18 percent saving in electricity use compared with the baseline.

The real world example offered in the Mahindra Towers retrofit case study comes at a critical time, with India facing an energy crisis and severe power cuts. India's building-occupied area is estimated to continue climbing sharply, from 8 billion square meters in 2005 to a projected 41 billion square meters in 2030, according to McKinsey & Company. Mahindra Towers is a key example of how collaborating with ESCOs to input energy efficiency measures can help building owners and real estate developers to save on costs and gain significant market advantage.



The complete study is located at: *http://www.nrdc.org/international/india/files/esco-energy-retrofit-mahindra-CS.pdf.*

Building Smart from the Start: Spotlight on the Energy-Saving Commercial Office in Noida, India

The landmark case study of Noida's AECOM office building shows energy efficiency is money in the bank. The LEED Platinum certified, five-story building recovered the additional investment on energy efficient construction within the first four years. In the first year of operation, electricity consumed was 50.2 percent lower than the estimated ASHRAE 90.1-2004 base case. Today, seven years after the construction was completed, the company, now acquired by AECOM, has recovered the additional cost of its energy-saving measures (INR 3,63,000/USD $88,000) and is saving a minimum of INR 10,71,000 in annual energy bills.

Building Smart from the Start: Spotlight on the Energy-Saving Commercial Office in Noida, India is empowering news for the India's real estate community. As the study makes clear, the energy-saving measures considered at the building design and construction stage are common-sense and pay for themselves over time. The high performance efficiency measures including an energy management system, energy-saving lighting, natural lighting and a high-efficiency heating, ventilation and airconditioning (HVAC) system—account for the bulk of the energy savings.

There is a lightwell at the center of the building to maximize the use of natural light. The building envelope has been equipped with recessed windows, efficient window glass, a white roof and cladded efficient walls to allow less heat transfer as compared to a conventional building. Elsewhere in the building, the HVAC system is equipped with a screw chiller with a coefficient of performance (COP) of 4.48, cooling towers and air handling units (AHUs) with variable frequency drive, variable air volume (VAV) boxes that reduce cooling load variations, high efficiency motors and fans as well as a two stage Minimum Efficiency Reporting Value – 13 (MERV – 13) filters to remove air contaminants, to optimize energy use in the building. Most of the energy efficiency products are available throughout India.

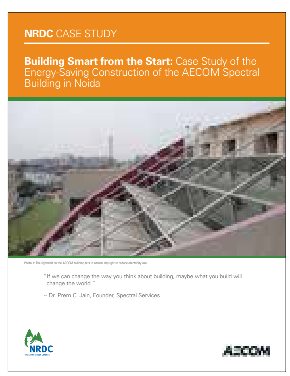
KEY STUDY FINDINGS

Added cost of energy saving construction 8%
Costs recouped in as little as 3.3 yrs
Energy Consumption 45% lower than estimated
Minimum 15 yr. savings of Rs. 16,065,000

© Anjali Jaiswal

The lightwell on the Legacy Spectral Building lets in natural daylight to reduce electricity use.

The message in *Building Smart from the Start* comes at a critical time, with India facing an energy crisis and severe power cuts. As thousands of new buildings are constructed across India every year, the country's booming real estate market stands at a historic crossroads: to build using yesterday's approaches and guarantee an unprecedented increase in energy use and greenhouse gas emissions or to implement money-saving, energy efficient strategies that will lead to cleaner, safer cities of the future. With the Noida green office building as a key example, energy efficiency can help building owners and real estate developers to save on costs and gain market advantage from the start.



The complete study is located at: *http://www.nrdc.org/international/india/files/energy-saving-construction-legacy-spectral-CS.pdf.*

CONCLUSION

India is at a unique crossroads in its development path where seventy percent of the buildings that will exist in India by 2030 have yet to be built. The states of Telangana and Andhra Pradesh are capitalizing on this opportunity by adopting the ECBC and leading the way for states to follow by building efficiently from the start. As stakeholders in the booming hi-tech city of Hyderabad have experienced, the benefits of energy efficiency reach far beyond cost savings, and include energy security, the reduced need for additional power plants, and improved reliability of the electric grid. The widely untapped energy resource of energy efficiency is key to meeting the rising demand for energy as construction skyrockets across the country, locking in energy and cost savings for the life of each energy efficient building constructed.

ENDNOTES

1 The average annual household energy consumption for electrified households in India in 2011 was 567 kWh/household. See GOI Central Electricity Authority, "All India Electricity Statistics, General Review 2012 (Containing Data for 2010-11)," p. 144, Table 9.1 (2012); 2011 Census of India, "Figures at a Glance," http://www.censusindia.gov.in/2011census/PCA/PCA_Highlights/pca_highlights_file/India/5Figures_at_glance.pdf (accessed January 14, 2014); World Bank, Residential Consumption of Electricity in India, p. 8 Table 4, (2008): http://moef.nic.in/sites/default/files/Residentialpowerconsumption.pdf (accessed January 14, 2014). An alternate source finds that the average household electricity consumption was 778 kWh/household in 2011. See World Energy Council, Energy Efficiency Indicators, www.wec-indicators.enerdata.eu/ world.php (accessed January 14, 2014).

2 See Clean Energy Resources: Greenhouse Gas Equivalencies Calculator, EPA, www.epa.gov/cleanenergy/energy-resources/calculator. html (accessed December 11, 2013).

3 The Economist, "Comparing Indian States and Territories with Countries: An Indian Summary," (Indian GDP 2009 summary), http://www.economist.com/content/indian-summary.

4 ASCI, NRDC, *Taking Energy Efficiency to New Heights*, February 2011, http://www.nrdc.org/international/india/efficiencynewheights.asp.

5 Times of India, "Soon, norms to preserve energy in commercial bldgs," September 23, 2012, http://articles.timesofindia.indiatimes.com/2012-09-23/hyderabad/34039618_1_ecbc-commercial-properties-norms.

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7 Hyderabad Metropolitan Development Authority (HMDA), "Environmental Building Guidelines for Hyderabad," 2009, http://www.hmda.gov.in/EBGH/home/hmdasinitiative.html.

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