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ANALYSIS OF ENERGY REQUIREMENT IN THE PUBLIC SECTOR BY USING NEW INOVATIVE TECHNIQUES

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ABSTRACT

The International Energy Agency (IEA) recognizes that buildings are the largest consumers of energy worldwide (40 per cent) and will continue to be a source of increasing energy demand in the future. Enhancing energy efficiency in buildings is one of the priority areas recognized by the Government of India. Over the past few years, Bureau of Energy Efficiency has introduced initiatives to promote design of energy-efficient commercial buildings based on Energy Conservation Building Code; energy conservation in buildings and municipalities through performance contracting by Energy Service Companies; adoption of energy-efficient consumer appliances through energy labelling.

Date has been the institutionalization of the training activities within the state. To develop institutional capacities and make skilled manpower available at comply with Energy Conservation Building Code. To translate energy-saving opportunities in buildings to tangible benefits, there is a continuous need to encourage public policies, enhance awareness and capacity building, and adopt new trends and technologies.

KEYWORDS: **International Energy Agency, tangible benefits, public policies for energy efficient building.**

INTRODUCTION

Over the years, electricity use has increased significantly in the commercial sector. Globally, building sector is responsible for 40 per cent energy use. The annual energy consumption in the commercial buildings in India is in excess of 200 kWh per square meter per year. Air-conditioning and lighting are the two most energy consuming end-use applications within a building. This has led the Government of India to include them as 'designated consumers' under the Energy Conservation Act (2001). 'Designated consumers' as identified by BEE are energy-intensive industries or similar establishments recognized under the EC Act (2001). Buildings having connected load of 100 kW and above or contract demand of 120 kVA and above are defined as commercial buildings (as per amendment of the Energy Conservation Act 2001 in the year 2010).

The building sector is the second largest employment provider next to agriculture. Its size is expected to reach 60 billion USD in 2010 and commercial real estate market was to reach 12 billion USD. The building construction industry at present contributes about 10 per cent of the GDP, and is expanding rapidly at over 9 per cent per year, spurred largely by the strong growth in the services sector.

The building industry alone is also one of the biggest emitter of GHG in India. Electricity consumption in the building sector in India is 7 per cent of the country's total electricity consumption. In the building sector, commercial building space accounts for 33 per cent. The building sector is growing at 8–10 percent annually.

SCOPE

The Energy Conservation (EC) Act of 2001 provides the framework for energy efficiency imperatives in India followed by the National Mission for Enhanced Energy Efficiency (NMEEE) in 2008. India's Intended Nationally Determined Contributions (INDC) aim to reduce the emissions intensity of our GDP by 33–35 per cent by 2030 from the 2005 level; mandates promotion of energy efficiency in the economy, notably in industry, transportation, buildings and appliances; as well as development of climate-resilient infrastructure.

Over the past few years, BEE has introduced initiatives to promote design of energy-efficient commercial buildings based on ECBC; energy conservation in buildings and municipalities through performance contracting by ESCOs; adoption of energy-efficient consumer appliances through energy labelling; market transformation towards energy-efficient appliances through demand side management programmes; energy efficient motors; and enhanced focus on energy-efficiency investments in industry due to energy data reporting and benchmarking practices.

ENERGY EFFICIENCY IN NEW COMMERCIAL BUILDINGS:

The Energy Conservation Building Code (ECBC) was developed by BEE for new commercial buildings in May 2007. It establishes minimum requirements for energy-efficient design and construction for buildings with a connected load of 100 kW or greater or a contract demand of 120 kVA or more, and provides guidelines for building design, including the envelope, lighting, heating, air-conditioning and electrical systems. The state governments have the flexibility to modify the code to suit local or regional needs and notify them. It is important to note that while the ECBC has been developed by BEE, its enforcement lies with the state governments and urban local bodies through notification within their states. About 22 states in the country are at various stages of implementation of the code with eight states and union territories (Rajasthan, Odisha, Uttarakhand, Punjab, Karnataka, Andhra Pradesh, Telangana and UT of Pondicherry) being notified and have adopted the code.

Consequent to the notification by the states for the mandatory adoption of the code, integration of the provisions of the code into the bye-laws would provide an enabling framework for its enforcement. The National Mission on Sustainable Habitat (NMSH) was launched by the Ministry of Urban Development to promote energy efficiency as a core component of Urban Planning. The NMSH stresses the need for awareness, incentives for wide-spread adoption of energy-efficiency programmes, promoting a mix of voluntary guidelines and mandatory rules for energy efficiency in buildings, and capacity building of state and city-level bodies for implementing and enforcing these rules. In view of this, model building byelaws to mandate minimum energy standards for residential and commercial buildings/ complexes as per National Sustainable Habitat parameters on energy efficiency have been framed and circulated by the Ministry of Urban Development for their integration into the existing government orders. Simultaneously, an addendum to the National Building Code (NBC) 2005 has been finalized by including a chapter on sustainable building design, namely, 'Approach to Sustainability', so that it is adopted in all future constructions, including the same in the rate schedules of the Public Works Department/construction
agencies. Similarly, amendments in the Central Public Works Department (CPWD) Schedule of Rates and Plinth Area Rates have been carried out to incorporate energy-efficiency aspects. Developing various standards like NBC, ECBC, BEE rating programmes for appliances and existing buildings have been encouraging steps in this direction. The market-driven voluntary Green Building Rating programmes such as LEED and GRIHA, have significantly transformed the way buildings are designed. Green Buildings have the potential to save 40 to 50 percent energy vis-à-vis the conventional practices. The target for the 12th plan period is that 75 per cent of all new commercial buildings are constructed compliant to ECBC. The 12th plan period proposes to support several activities like adoption and facilitation for ECBC implementation, development of test standards for building components, creation and augmentation of building material test facilities, creation of a cadre of professionals through a testing & certification programme to check compliance to ECBC, etc. The process of ECBC update in view of technological advancement, market change in regard to energy demand and the supply scenario has been initiated.

BARRIERS LIMITING INCREASING ENERGY EFFICIENCY IN COMMERCIAL BUILDINGS IN INDIA:

Identifying the importance of building sector, especially commercial buildings, the Government of India has developed ECBC. This was made voluntary, as many barriers identified were to be addressed before they are mandated. The barriers identified at the baseline (2010) are as mentioned below.

A. POLICY AND INSTITUTIONAL BARRIERS

ABSENCE OF MANDATORY STANDARDS: ECBC WAS developed by the government of India to encourage increasing energy efficiency in commercial buildings. however, this was voluntary. there were no minimum energy performance codes for most buildings and building components in any of the building BYLAWS.

absence of policy guidelines for building bylaws: municipalities are entities that are responsible for building plan approvals. most municipalities do not have a uniform and practicable building energy codes. municipalities and states do not have clear guidelines for developing and implementing building energy-efficiency programmes and policies.

no structure for ECBC implementation: there are no institutional structure at the national, state and local levels for handling ECBC administration and enforcement, and hence not ready to be made mandatory yet.

lack of government champions due to knowledge gap: there is lack of knowledge about benefits from energy efficiency in buildings among politicians and policy makers at all levels. 'success stories' have not yet been disseminated widely. not many governmental agencies have made energy efficiency mandatory in their own buildings.

B. TECHNICAL AND MANAGERIAL CAPACITY BARRIERS

strong first cost bias: the building market is diverse and characterized by fragmentation into various players. the complexity of interaction among these participants is one of the barriers to energy efficient buildings. for example, building owners tend to under invest in energy efficiency during building design and construction. the developers do not gain from the initial investments in building energy efficiency.

lack of awareness of energy savings opportunities: there were no energy use baselines for most building types. building designers and owners are unaware of energy-efficiency opportunities and techniques. information on energy-saving potential in buildings is also not available. building audit methodologies need to be improved.

lack of technical expertise: there are very few technical experts and consultants providing building energy efficiency related services. this forces many builders to hire international consultants at a high cost impacting the choices around design and construction.

C. MATERIALS AND TECHNOLOGY BARRIER

non-availability of energy efficient equipment/materials in the local marketplace: most energy efficient equipment and materials are imported, often with high cost mark-ups and duties imposed.

lack of equipment testing/certification: programmes for standards and testing equipment for energy-saving features of building materials and equipment are not in place.

D. FINANCE BARRIERS

lack of financial incentives for energy-efficient equipment: energy-efficiency of buildings is not given due consideration in funding and incentives from the government. revision of regulatory framework is required regarding duty relaxation, incentives and tax benefits. also, financing energy efficiency is not too lucrative for financial institutions due to uncertainty about returns. there is a need for innovative financing schemes to promote EE in buildings.

lack of awareness: the lack of awareness of the short amortization cycle and/or the lack of incentives for investors and contractors to build ECBC compliant buildings and/or lack of awareness that low energy bills can be a powerful marketing argument for future rental contracts.high cost of borrowing money: this can be a strong impediment to incremental funding in efficiency that would be offset by future savings of energy costs.

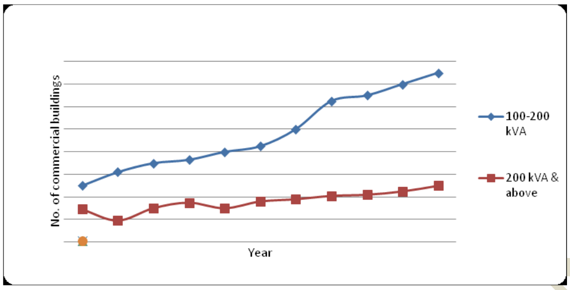

Figure analysis shows aggregate growth of commercial buildings

The above growth has triggered rapid increase in energy consumption in the commercial building sector. The share of energy consumption of commercial sector in the total consumption of the state is about 15–20 per cent.

STUDY INFERENCES

Salient points that emerged from the study, facilitating energy efficiency enhancement programmes and projects of commercial buildings in the state, are highlighted below.

A. SURVEYS, ANALYSES AND DATA HOSTING

• Conduct periodically, say, once in three years, survey of representative samples of commercial buildings in the state and present the finds in 'Building Characteristics Tables'; i.e., information on energy-related building characteristics in commercial buildings

• Provide online reports of such surveys, increasing transparency of best practices in energy efficiency

• Observe the energy demand vis-à-vis energy price elasticity, and relate with activities/use of building space, market behaviour/market economy and income distribution

• Benchmarking energy efficiency in EPI (modified) methods, suitable to building types

ANALYSIS OF ENERGY EFFICIENCY IMPACTS IN SELECTED COMMERCIAL BUILDINGS:

A detailed study to establish a baseline database, primarily focussing on EPI on selected existing and upcoming commercial buildings in the state that fall under the Energy Conservation Act (EC Act, 2001) has been conducted.

A concerted effort was taken to understand energy usage in selected commercial buildings to assess the energy-saving potential and plan strategies to ensure enhanced energy efficiency of the state as well as to arrive at appropriate intervention in existing and upcoming buildings.

The scope of the study included getting a general overview of the buildings sector in the state with geographical locations of the major existing, ongoing and future building projects and the expected region-wise growth in the build area across the state. There has been exponential decadal growth of commercial buildings in the state of Kerala. Analysis shows aggregate growth of commercial buildings, in the contract demand of 100 kVA – 200 kVA band and above is about three times in the last 10 years, i.e., about 12 per cent compounded annual growth rate (CAGR) (refer Figure).

B. EVALUATE THE POTENTIAL REGARDING THE FOLLOWING:

• Tax incentives and/or tariff incentives for targeted energy-efficiency benchmarks
• Renewable energy (RE) integration
• Net zero building design
•Dematerialization; waste-minimization; zero-discharge; 100 per cent recycling
• Carbon neutral concept in commercial complexes
• Building rating-sellers edge; image /brand building by EPI as parameter; comfort; building operating cost
• Identify impact of the growth of miscellaneous electric loads (MELs)— [mainly attributed to increased service demand for entertainment, computing, and convenience] —offsetting some of the efficiency gains made through technology improvements and minimum energy performance standard (MEPS) of appliances.
• Centralized monitoring of energy efficiency of public buildings and buildings owned by a single group/company/entity
• Micro-grid and distributed generation

C. PREPARE AND PUBLISH ENERGY-EFFICIENCY DESIGN AND OPERATION TEMPLATES FOR BUILDINGS COMING UNDER SAME TYPE OF/TYPICAL ACTIVITIES:

Hospitals Energy use of hospitals depends on how the building facility format is laid out and how the operation and maintenance is carried out; how many people such as employees, patients, and visitors occupy the buildings daily; and how the sophisticated air-conditioning (HVAC) systems, laundry, medical and lab equipment uses, sterilization, computer and server, food service etc. are energy intensive; how energy consumption is monitored and accounted is also important

D. GUIDELINES FOR MAJOR ENERGY CONSUMPTION CENTRES:

Lighting in commercial buildings Lighting is a major consumer of electricity in commercial buildings and energy savings through use of energy-efficient light sources, luminaire, advanced control technologies, day light maximization, etc., are important factors.

E. ISSUES TO BE RAISED

• Core and Shell buildings; main building owner/occupier has no control over energy consumption by 'occupants'; initial design may have least focus on energy-efficient design as building users are 'unknown'
• Creating demand for energy efficiency in commercial building sector
• Market trends in rating of buildings such as LEED, GRIHA, S&L (standards and labelling)
• Capacity building in energy efficiency of commercial buildings requirement—new construction; retrofits;
• Capacity building at LSG/ULB/UDD; builders/architects; proponents
• Traditional [indigenous] architecture
• Linkage of business growth to energy costs
• Commercial sector, in turn commercial building vs. states GDP and land use
• Drivers of investment in energy efficiency and preferred government policies

ANALYSIS OF HOSPITAL BUILDING IN SOLAPUR

Project		Shri. Markandeya Solapur Sahakari Rugnalaya & Research Center, Solapur
Location		Datta Nagar, Bhadravati Peth, Solapur
Total project area		224.04Sq.M.
Number of building		Single Building
Type of building		Hospital Building (cunsulting building only)
Climate		Hot and Dry
Occupancy		7 days a week
ANALYSIS OF BUILDING		
COMPONANT	**AS ON SITE**	**OPTION I**
WALL	1.out side plaster 15mm 2.normal brick wall size 230mm 3.inside plaster12mm	1.outside plaster 15mm 2.external aac wall 200 mm 3. inside cement plaster 12mm 4.xps insulation 50 mm
ROOF	1.rcc roof slab 150mm 2.suitable antitermite providing 3.suitable water proof- -ing memberan 4.0screed plaster 40mm 5.internal ceiling plaste -r 6mm	1.rcc roof slab125mm 2.puf insulation 50mm thick 3.suitable water proof- -ing memberan 4.screed plaster 40mm 5.internal celing plaste- -r 6mm
GLASS	planilux (clear glass)	skn 744ii(double glazing or insulated glazing)
HVAC	not provided	vrv system for the enti- -re building
LIGHTING	all tube lights	all led lights , occupancy sensors for corridors and waiting room and cunsulting room area , day light controlas for regularl -y occupied day lighte--d area
RENEWABLES	not provided	9kw solar photovoltaic(about 96.28sqm considered on top of building for installation of pv cell)
Energy used	485.45Kwh/Sq.m/year	303.28Kwh/Sq.m/year
Saving	-	37.52%

CONCLUSION

To translate energy-saving opportunities in buildings to tangible benefits, there is a continuous need to encourage public policies, enhance awareness and capacity building, and adopt new trends and technologies.
The most significant development through this project till date has been the institutionalization of the training activities within the state. To develop institutional capacities and make skilled manpower available at comply with Energy Conservation Building Code (ECBC).
It is observed that on the existing site of the no efficient HVAC system is provided so it is suggested to use VRV system for entire building which is very energy efficient and user friendly.It is observed that in the hospital consulting all tube provided tube lights are conventional but as per recommendation of ECBC use LED lights with occupancy sensor for corridors & waiting room.
It is observed that hospital consulting building has 96.28sq.m. area on which solar system can be provided which will generate approximately 10kW sustainable renewable energy .
By applying ECBC concept to the consulting building shri. markandeya solapur sahakari rugnalaya & research center,solapur upto 40% energy saving can be achieved per year .

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