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Current Market Scenario For Energy Efficiency In India

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Abstract: Energy efficiency is very specific to end-use applications or particular systems. However, on an aggregate economy wide basis, energy efficiency does not provide a useful measure for comparison due to variations in the structure of energy supply and the end-use energy applications. Reduction in energy intensity is a part of the sustainable development program since it is closely linked to the management of climate change. With recent economic expansion, construction investment growth in India is forecasted at 12% overall and 23% in the commercial sector. India will add 80% of the total floor space estimated for 2030. Without a concerted effort to reduce energy intensity in buildings, the additional demand for electricity will exacerbate the chronic power shortage situation in India. Indian policymakers have started a three-pronged approach to market transformation, i.e. rating systems to recognize leaders in energy efficiency, financial incentive programs to move the middle of the market, and codes and standards to raise the entire market to desired efficiency levels. This paper reviews the status of these activities and the infrastructure for setup, scaling and compliance for each market transformation approach. Recognizing the challenges in India and using lessons learned from past experiences, we present recommendations for Indian policymakers to enable rapid market transformation in the building energy efficiency sector.

Keywords : Energy Efficiency, Energy Intensity, Sustainable Development.

1 Introduction

Energy efficiency is simple in concept. Doing more with less is an attractive environment friendly energy strategy. Using energy rationally is the crux of energy efficiency. Progress towards that objective is termed as improvements in energy efficiency which implies a reduction in the energy used for a given energy service (heating, lighting, etc.) or level of activity. Such reductions in the energy consumption can be due to a number of factors including technological changes, better organization and management of the energy system, or a conscious change in lifestyles. Clearly the way our habitations are built, the manner in which cities are planned, the system for transportation of goods and passengers, the rate of obsolescence for end-use equipment, the nominal price of different types of energy, the consciousness of the people with respect to energy conservation; these, and many more, are all significant factors in determining the efficiency with which we use energy. Progress can begin immediately because knowledge and technology exist today to slash the energy buildings use, while at the same time improving levels of comfort. Behavioral, organizational and financial barriers stand in the way of immediate action, and three approaches can help overcome them: Encourage interdependence by adopting holistic, integrated approaches among the stakeholders that assure a shared responsibility and accountability towards improved energy performance in buildings and their communities, make energy more valued by those involved in the development, operation and use of buildings, and transform behavior by educating and motivating the professionals involved in building transactions to alter their course toward improved energy efficiency in buildings. Improving the energy efficiency of a system is synonymous with reducing the energy losses, which occur at every point of conversion or transportation/transmission along the energy chain; from primary energy to secondary energy, from secondary energy to final energy and finally to energy services. The reduction of energy loss during conversion or transmission is largely technology dependent though better maintenance and management of the equipment used at every stage also contributes to improvements in energy efficiency. These are essentially supply side interventions which aim at improving the efficiency with which energy is supplied. Over the last four decades, technology has intervened to enable the gradual replacement of fossil fuel based energy resources with renewable sources of energy, which have contributed directly towards the implementation of sustainable development objectives. As significant are demand side factors, which reduce the demand for energy by rationalising the mix of energy services or the time when these are consumed. The time differentiated pricing of electricity, for example can induce a shift in demand away from the peak hours, thereby averaging out the flow of energy through the system and reducing energy loss in transmission and generation. The use of appropriate architectural designs and building materials can reduce the demand for lighting and heating. Appropriate city planning can reduce the distance and time of travel and thereby the demand for energy. Multi-modal transportation can rationalise the demand for energy in transportation. A stricter version of demand side management is “energy conservation”, which places a positive value on saving energy by cutting back if necessary on the use of energy services.

2 Factors Supporting Energy Efficiency

In India, the reduction in EI since 1970-71 is partly accounted for by improvements in energy efficiency associated with an increase in the share of commercial energy in total energy consumption from 41.02% to 68.23% over the same period. On average commercial energy sources are at least twice as efficient as non commercial sources in the delivery of energy services. The reduction in Energy Intensity occurred despite the significant increase, both in the per capita and aggregate consumption of energy in the domestic sector and transportation. Improving the efficiency of energy extraction, conversion, transportation/ transmission and the efficiency of end-use applications of energy are financially cheaper and socially preferable options for meeting the energy demand. The financial constraint operates at two levels. Firstly, enhanced capacity building requirements put pressure on the availability of investment capital. Secondly, spending more than required on incremental capacity drastically reduces the competitiveness of the concerned industry or service. The high cost of electric power in India for industry makes energy intensive industries like the minerals sector, uncompetitive in the global market-place. Promoting energy efficiency is both an opportunity and a challenge for developing economies. Within the three areas of the market, the early adopters need little motivation and respond without a need for financial incentives. They are the risk takers and experimenters, and typically respond well to recognition. Market transformation strategies include awards and recognition programs that provide publicity to this part of the market. The middle of the market tends to be risk averse and fiscally conservative. Transforming this part of the market typically requires reducing their exposure to risk; market transformation strategies include having early adopters report their success and providing financial incentives or discounts. The laggards of the market represent its bottom. In terms of building energy efficiency they represent the most difficult customers to change, who do not respond to cash incentives or recognition. Market transformation for this area is achieved by rules and regulations that introduce minimum standards or codes to make inefficient products and practices illegal. The benefit of severe under supply and low energy intensity levels is that efficiency levels can improve, over time, merely because of the addition of more efficient capital stock to meet the incremental demand associated with economic growth. The Fertiliser Industry is an example where change in technology and feedstock have reduced the EI both through modernization of the existing capacity and addition of more efficient incremental capacity. Simultaneously, high interest rates inhibit capital investment. Low levels of capital investment and delayed obsolescence of consumer durables slow down the pace of equipment turnover thereby retarding the efficiency enhancing impact of economic growth. The positive impact of low interest rates, easy availability of capital and rationalisation of taxes can best be illustrated by the consumer durables sector in India which has seen an explosion of demand in the 1990's.

3 Current Rating Systems in India

Rating systems and award programs give recognition to the leaders in the building industry. The overall market penetration of this mode remains limited since this addresses a small portion of the market, and thus the overall energy savings impact is similarly small. However the recognition of the leaders is an important market transformation strategy for building energy efficiency in the larger picture. The recognition assures market leaders that they are providing value and are on the right track. Market leaders and risk takers feel rewarded when they are recognized. For the rest of the market, the recognition of the leaders moves them from the bleeding edge to the leading edge by sending the message that they have proven performance accepted by the industry. In India, the first major legislation that focuses on efficient use of energy and its conservation is the Electricity Conservation Act of 2001 (referred to as EC). Under the EC, the Bureau of Energy Efficiency (BEE) at the central-government level, and designated agencies at the state level were created. According to the EC, the main responsibilities of BEE include – planning, managing, and implementing provisions of the EC through creation of appliance labeling/standards and energy conservation building codes; benchmarking energy use of commercial and industrial facilities; monitoring energy consumption of “designated” (high consumption) consumers; and certifying/accrediting energy auditors, managers, and service companies. BEE also creates and disseminates relevant information, facilitates capacity building, and develops pilot/demonstration projects. Recognition to market leaders and early adopters in buildings has been introduced through three main avenues. BEE has introduced a star rating program to recognize buildings that operate more efficiently than the program benchmarks. Currently BEE has launched this program for Office Buildings and has 27 buildings that have been awarded the star rating. In future BEE will expand the star rating program to other building types. Leadership in Energy and Environmental Design (LEED-India) rating for new-buildings was launched in 2001. Since 2012, LEED-India has certified 223 buildings (a total for 1.10 billion square feet), and 1537 buildings are registered for future certification. The Green Rating for Integrated Habitat Assessment (GRIHA) actively promoted by MNRE, aims at non-air conditioned or partially air conditioned buildings. Currently, 179 projects are being evaluated by GRIHA and 8 have been awarded certification (GRIHA, 2012).

4 Integrated Energy Policy for India

The complex allocation of legal jurisdiction and authority between the Union, State Governments and possibly in future through devolution, between the State Government and Local Bodies, along with the multitude of Ministries, Departments and State level agencies that are concerned directly and indirectly with energy efficiency indicate the need for integration of the Energy Policy. Energy conservation is an objective in most Government programs. It is also given implemented by consumers to increase the overall efficiency of their operations and to reduce the cost of energy usage. However, the enhancement of energy efficiency is unlikely if left only to market sources due to the multiple market failures, which have been recorded in the literature. Administrative interventions are needed. However, without appropriate integration, administrative interventions can often work at cross purposes or may function sub-optimally. A study of options for meeting the incremental power demand of 5278 MW in Maharashtra estimated that if the conventional path of adding new capacity is avoided and instead least cost power planning principles are adopted 40% of the incremental demand can best be met by DSM options, 15% by decentralized generation options and only the remaining 45% would need incremental centralized capacity. The least cost planning alternative would result in a 33% savings in life cycle costs and reduce the use of fossil fuel equivalent to 12 million tones of coal per year. Similarly meeting the demand for rural energy required that attention be focused not only on the supply aspects of the energy system but also towards demand side management. The rural energy system is an integrated fuel cycle from energy sources through energy carriers via transmission/ transport to distribution to end-users for utilization in end-use devices to provide energy services. The thrust must be on energy sources that are renewable, universally acceptable, affordable, reliable, high-quality and safe. At the national level, there are choices to be made with respect to the trade-offs between the transmission of electricity at very high voltage as opposed to the physical transportation of secondary energy sources like petroleum products or primary energy sources like coal for the generation of electricity. Integration of decentralized generation sources is another aspect of energy planning, which requires appropriate policy support. Due to the unequal spatial spread of energy resources, including wind energy and bio-mass, there may be a local gap between the demand for a particular energy source, like renewable energy, and the supply of such energy resources. Meeting this gap may require appropriate regulations that seek to integrate the costs and benefits of re-

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newable energy at the national and State level. It would be a mistake to equate the need for an integrated Energy Policy with the decision making process for technology and scale choice for specific investments and creation of additional capacity. Clearly investment and capacity creation decisions need to be taken by those who will be meeting the cost of such investments, which indicates the need for decentralization of such investments. However, consensus and uniformity in the use of tax policy for promoting energy efficient outcomes, regulatory policy for promoting energy conservation, the evolution of standards for household appliances and end-used equipments and the broad direction and thrust of public finance led investments are issues which need to be discussed and decided centrally.

6 Energy Intensity as an Index of Sustainability

Energy intensity can usefully be used to measure the overall efficiency with which an economy uses energy to create additional output. Changes in energy intensity can be brought about by changing the structure of the economy as for example by promoting industries and services with low energy intensity and by planning for the development of urban habitation that reduce the requirement of primary, secondary and final energy sources without compromising on the level of useful energy services. Energy intensity in India has declined at the rate of 2% per year. It is useful therefore to determine targets for the next 15 years, which would provide an aggregate check for assessing the success of energy efficiency programs. The decision to adopt energy intensity as a milestone measure would need to be supported by the development of a database which maps the baseline levels of energy consumption in different sectors across varying end-use applications. This data would need to be fit into a energy intensity model which would extrapolate results based on data collected through sample surveys and would aggregate this data at the national level. Energy efficiency can be used as a parameter for the allocation of the plan funds. State-wise targets could be prescribed, keeping in view the developmental needs of each State, which would have to be met for access to the earmarked funds. States could in turn earmark energy intensity targets at the sub-state level and would have the flexibility of designing their developmental schemes in a manner that met the energy intensity targets. There are principally three reasons why a developing country, like India, needs to be concerned about the efficiency of energy use. Firstly, energy efficient economies are also competitive economies and improving the competitiveness of the Indian economy is a prime concern. Secondly, so long as our energy systems remain dependent on the use of fossil fuels, there is a direct link between environmental degradation and energy use. While there may be no legal international compulsions on controlling energy emissions, national environmental considerations, in a continental sized economy, dictate prudence in management of the energy system. Thirdly, non-commercial energy resources form a significant portion of our energy supply. Increasing the efficiency with which these resources are used has a direct impact on poverty alleviation and improvement in the life style of the poor, since non-commercial energy, in traditional end-use applications, is inefficient and highly polluting. Active management and dynamic calibration of the Energy Intensity levels are justified on economic, environmental and equity considerations.

7 Vision of Net Zero Energy Buildings

Buildings account for nearly one third of the world's energy use today, and this share is expected to rise along with population growth and levels of prosperity. At the heart of the Zero Energy Building concept is the idea that buildings can meet all their energy requirements from low-cost, locally available, nonpolluting, renewable sources. At the strictest level, a ZEB generates enough renewable energy on site to equal or exceed its annual energy use. Net-zero energy buildings (NZEB) are the buildings that produce as much energy as they consume over a defined period offers the potential to substantially decrease building energy use and enable buildings to become energy self-sufficient. Achieving the vision of net-zero energy buildings will require the pursuit of multiple strategies, including development of new, cost-effective technologies and practices, revision of building codes, integration of renewable energy into building designs, and adoption of innovative strategies for using energy and resources within the building community. Buildings are complex systems with many interacting elements. Past improvements in the energy performance of integrated and interacting materials, components, and systems within buildings have not produced the expected reductions in overall energy use. An integrated portfolio of advanced technologies is needed that not only supports performance improvements in the design and manufacturing of individual components, but also captures the system complexities and interactions seen in real buildings. Additional reductions from 20 % to 40 % can be realized by using advanced technologies integrated holistically with the building design. Additional energy requirements, after current and advanced energy saving technologies are in place must be met through the use of renewable energy systems. The environment in which technologies are deployed must be addressed as well. Challenges include a complex industry and regulatory structure, imperfect information, high first costs, technical and market risks, and lack of a trained and experienced workforce. Technology advances, combined with new policies that address or eliminate some of these challenges, will be needed to achieve dramatic improvements in building energy efficiency.

4 Conclusion

In this paper we have summarized the current activities in India for energy efficiency in new construction in the three areas of market transformation. We respond to the challenges of energy code adoption, implementation and enforcement and the lack of baseline for new construction utility programs by proposing a practical approach that combines elements of the Energy Conservation Building Code in to voluntary utility sponsored rebate programs. The approach to market transformation makes the entry level programs low cost and easy for the customers with higher tier programs that reach ECBC levels of efficiency. Non-Commercial energy resources can be commercialized into decentralized energy systems which are accessible to the local people, relatively technologically unsophisticated and which can be locally managed. The development of an integrated rural energy planning would be strongly dependent on our ability to improve the efficiency, which these locally available natural resources are used. Currently there is no effective system for transfer of the avoided costs of a centralized energy system to be transferred to the stakeholders of a decentralized energy system. We have also identified the institutional framework required to implement these programs.

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