Energy Efficiency in Buildings for National Energy Policy[1]

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Preliminary Draft for Inputs to Niti Aayog's National Energy Policy – Compiled by AEEE and LBNL[2]

1. Energy Use

According to IEA (IEA Web Site, 2015), India's Total Primary Energy Supply (TPES) is 788 Mtoe in 2012. Total TPES for residential sector is 216.09 Mtoe (27.42% at country level - out of which 17.34% is for biomass and 6.77 is for electricity and 2.92% is for petroleum derived fuels, primarily kerosene and natural gas). Total TPES for commercial sector is 33.34 Mtoe (4.23% at country level - out of which 0.84 % is for biomass and 2.7 % is for electricity and 0.57 % is for coal + petroleum derived fuels). Out of total electricity consumption of 882,592 GWh, approx. 22% of electricity is used in the residential sector and 9% in the commercial sector (Central Statistics Office, 2015).

2. Current Status and Projected Growth

India is experiencing an unprecedented construction boom. The country doubled its floorspace between 2001 and 2005 and is expected to add 35 billion m2 of new buildings by 2050 (Shnapp and Laustsen, 2013). Buildings account for 35% of total final energy consumption in India today, and building energy use is growing at 8% annually (Rawal et al., 2012). Chaturvedi et al. (2014) predicted that, if there are no specific sectoral policies to curb building energy use, final energy demand of the Indian building sector will grow over five times by the end of this century, driven by rapid income and population growth. The growing energy demand in buildings is accompanied by a transition from traditional biomass to commercial fuels, leading to an increase in electricity use. Overly rapid growth in building energy use would pose a challenge for the Indian government and energy efficiency in the built environment needs to be looked at in holistic framework as it offers multiple benefits that go beyond energy savings. These include carbon mitigation, improved energy security, improved air quality, job creation and better socio- environmental outcomes. As energy consumption from residential buildings is predicted to rise by more than eight times by 2050 under the business as usual scenario, it is of vital importance for India to develop energy-efficiency strategies focused on the residential sector to limit the current trend of unsustainable escalating energy demand (GBPN/CEPT University, 2014).

3. Prioritisation

From Section 1, it is clear that residential sector uses 6.5x than commercial (incl. public services) sector from a primary energy use perspective and 2.5x from an electricity end-use perspective. As India pondered over policy choices to promote energy efficiency the buildings sector, it is understandable that India prioritized commercial buildings initially to start where capacity is stronger, market was less fragmented, institutional challenges less daunting, and policy mandates clearly articulated for one

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ministry – at least in the domain of regulating electricity use through the enactment of the EC Act. However, it is important to recognize that residential buildings make up the majority of energy use, and there is tremendous scope for saving energy in residential buildings. Much of the primary energy use intensity comes from the use of biomass and kerosene in the residential sector. To take a holistic approach towards energy efficiency policy in the building sector, it will be important to look at the various fuel sources being used in the sector and its impact on the energy security and their environmental impact on one side and India's commitment towards its developmental agenda and the need to replace the use of biomass and kerosene with more modern fuels. At the same time, the anticipated growth in the building stock creates a priority need to enhance efficiency in new construction. Because of overlapping authority and jurisdictions at the ministerial level when it comes to regulating energy use and since electricity is a concurrent subject, a holistic energy efficiency policy framework for the building sector has been missing in India and a much more pragmatic and do-what-you-can approach has been adopted. Considering the above scenario and almost naturally, the thrust of the efforts under the Bureau of Energy Efficiency, which comes under the Ministry of Power, has been on regulating the use of electricity in the buildings sector - primarily through Standards and Labeling of appliances and Bachat Lamp Yojana , Energy Conservation Building Code, and some efforts to promote ESCO development and Demand Side Management programs in the agricultural and municipal sector.

4. Coordinating Actions

ICLEI, in a recent report commissioned by Shakti Foundation, mapped 27 government organisations having authority to regulate energy use in the built environment, primarily buildings, if one looks at both the central (ministerial) and state government level. Buildings are part of built environment, consuming different types of fuels and are subject to a number of policies, laws, regulations and handled in different capacities by a range of agencies/players. While each individual component has a clear governance structure in place, the integration of the different components is lacking leading to multiple agencies being involved in the built sector in India and often with overlapping and unclear roles and responsibilities in those areas leading to policy paralysis. At the national level, at least four ministries of the central government are involved through different programmes and in different roles. At the state level, relevant departments linked to the respective national level ministries execute the work within their state. At the local level, municipal bodies, development authorities (state government players at the local level), etc are in charge of city activities. The scope of these policies and by-laws often overlap and sometimes even cut across each other. For example, there are a large number of policies, regulations and codes currently in play for the built sector such as the National Building Code (under Bureau of Indian Standard, Ministry of Commerce), the Energy Conservation Buildings Code (under Bureau of Energy Efficiency, Ministry of Power), Environmental Impact Assessments (Ministry of Environment and Forest), policies governing housing for economically weaker sections of society, integrating rooftop solar scheme by prefacing it with energy efficiency requirements for better and optimum utilisation of scarce resources, etc. which regulate the development of buildings at the local level. These codes serve as guidelines to state level development control regulations which incorporate relevant and context-specific aspects of the national codes. Thus, it is apparent that in order to have more efficient buildings at the local level, it is important to understand and unravel the gamut of policies with regards to the urban built environment (ICLEI, 2015).

Recommendations:

The multi-level nature of India's building energy sector (at the national, state and local level) requires a much higher level of coordination (both vertical and horizontal) to overcome existing operational issues. It would also help if facilitation role between any two levels of governance needs to be prioritized, articulated and some system of accountability put in place (e.g. State designated agencies are supposed to facilitate between the center and the state, however this does not play out in practice). At present, poor or often no accountability structures exist between the local and the state, or the state and the national level. This is a tough one because of the systemic nature of the challenges that go beyond the building sector and is also very much affected by politics and the relationship between center and state government. There is a pressing need to review all the building level policies that affect energy use to ensure proper alignment and prioritization clearly indicating the roles and jurisdiction of the different line ministries and how to resolve issues in case of jurisdictional disputes. A policy implementation plan/roadmap detailing how the building energy policies will be implemented in the states, how state programmes will be funded and how administrative and technical capacity crunch will be scaled to support the policy implementation agenda, must be developed and actions should be taken to address the key challenges.

5. Existing Policy Framework

1. **Building Energy Code**: The Energy Conservation Building Code (ECBC) sets minimum energy standards for new commercial buildings and eight states have already adopted and notified the ECBC, and over 300 new commercial buildings have become compliant (India's INDC, 2015). Bureau of Energy Efficiency showed great foresight by initiating the development of commercial building energy code in 2004 to tackle the rising energy intensity in this sector owing to a major shift where a significantly larger portion of the newly built space was air-conditioned. However, even after the national launch of the Energy Conservation Building Code in 2007, its adoption in the states and subsequent enforcement through the municipal structure has been painfully and frustratingly slow. While the building industry might have, on its own adopted some efficiency practices and technologies and some states have formally adopted the ECBC through government notifications, there is no formal compliance to the ECBC that has been put in place by any municipality laying out the compliance process. Even the buildings that have claimed compliance implicitly by adhering to green building certification requirements are not doing it very strictly and there is no compliance check or verification being done by the state or municipal authorities. Several organisations, working on the ground to help states adopt the ECBC has attributed this to a myriad of reasons related to the budget, capacity in terms of administrative and technical manpower, willingness of the architectural and developers community to fully embrace the ECBC, lack of availability and adoption of IT-enabled tools to complement the compliance and enforcement process and checks and inability to learn from and deploy the best practices related to building energy code from around the world (CEPT/TWGI, 2012, PNNL 2013 and GBPN 2014).
India is expected to continue to build and add to its existing commercial building stock at 3-5% per year for the next couple of decades. The vision outlined in "Smart Cities Mission" and the "Atal Mission for Rejuvenation and Urban Transformation (AMRUT)" requires ECBC enforcement to underpin all new construction to counter a real and imminent threat of India locking itself into a very inefficient building infrastructure that will greatly hamper its efforts to mitigate climate change, to maintain a reliable electric grid, and to create profitable and affordable real estate. Against this backdrop, focusing on building energy code still offers the biggest bang for the buck but success will entail closer coordination

between central government, states and ULBs for policy implementation and will also involve finding simpler approaches to adopt new policies more rapidly since ECBC adoption has been the exception rather than the rule so far. *India must redouble efforts to develop more stringent building energy code on a recurring cycle, make compliance mandatory in all Indian States and set aside capacity building efforts in the form of a campaign to ensure evaluation and enforcement. In parallel, simplification of and close coordination among the myriad policy and regulatory framework at central and state government level must be addressed at the highest priority if India has to make much greater progress in the next 10 years and not be stuck in the same morass that plagued the implementation of ECBC over the last 10 years.*

Recommendations

- While India has set a target to make ECBC fully compliant in all the states by 2016-17, It also needs to set a recurring timeline to revise ECBC every 3-5 years and make it 25% more rigorous than the previous version, which is eminently doable for the next two decades because India's ECBC is more than 10 years old and overdue for a major revision. Further, implementation of ECBC should lead to at least 20-30% of energy reduction over the baseline where no energy code is being implemented over a suitable time frame. In order to achieve and reward exceptional organisations, incentives should be considered for achieving "beyond code" performance in the form of relaxation in property taxes, increased floor area ratio, etc.
- At an operational level, Best practice in building energy code implementation requires strong focus on implementation mechanisms. By stronger implementation, it is meant that a system be developed and enforced where each building goes through plan review and construction cannot proceed until the designer demonstrates compliance. In addition, there should be checks during and/or immediately after construction to show that the building as built is as efficient as the code requires. Involving third parties with robust, transparent systems to ensure independence can help build implementation capacity rapidly. Easy-to use software can also mainstream compliance. Typically, countries have specialized software to demonstrate compliance with trade-off provisions in the code, and clear rules for using commercial simulation software if designers want to use the whole building approach to compliance. It also integrates ECBC with other non-code programs, such as transparency and labeling of building energy performance, non-code-based programs such as LEED and the Star rating system, financing and financial reporting that considers energy costs, etc.
- Government of India must set aside adequate resources for ECBC implementation and execute a plan to build administrative and technical capacity in 10 largest metropolitan areas (e.g. develop quality and outcome-based online tools, training workshops, code compliance manuals, FAQs and other literature, etc.) on a war footing by actively seeking help of bi-lateral and multi-lateral organisations who can provide high quality technical assistance.

2. Energy Efficiency in Residential Buildings: Bureau of Energy Efficiency's efforts has largely been focused through Standards and Labeling of appliances. BEE has also come out with an energy-efficient guideline for high-rise residential buildings in India, which is a good start and something that can be expanded to bring more residential floor space under the jurisdiction of the energy code. Lessons from other countries clearly highlight the need to develop Building Energy Codes for residential buildings as well, a recommendation made in the ECBC section. Most countries include residential buildings in the energy codes and India is perhaps the only large country to limit the code to commercial buildings. There is a very strong compelling case since they make up the vast majority of

the Indian building stock. Adopt a pre-established schedule to reduce the size threshold of buildings over a period of years (a decade or so) such that eventually, a large share of the residential building stock is covered.

Recommendations

- Introducing a residential energy with an initial focus on large, multi-family buildings and homes that receive some subsidies for construction is urgently needed. This could allow for building capacity before larger-scale implementation is introduced. Also, given India's unique conditions regarding low-income housing, standards and incentives might target cooking and lighting in households without air conditioning as this would also address the equity issue which some studies have emphasized need to be looked at through policy measures to facilitate the use of electricity in less privileged homes (Shripad Dharmadhikary, Rutuja Bhalero, 2015).
- Considering that energy consumption from residential buildings is predicted to rise by more than eight times by 2050 under the business as usual scenario, a policy framework to improve performance of envelope in residential buildings, emphasis on improving thermal comfort and backed up with cost-effective and aggressive energy efficiency standards for the most widely used appliances (room air-conditioners, ceiling fans, refrigerators, etc.) need to be pursued on an urgent basis for urban households.
- For the rural homes, a holistic strategy linking the use of traditional methods of construction to provide adequate thermal comfort and a simple code promoting the use of super-efficient lighting, fans, and other basic appliances that can be powered by rooftop solar or renewable-powered mini or micro-grid need to be put in place. Concurrently, aggressive promotion of energy-efficient cook stoves to drastically reduce the use of biomass thereby reducing GHG emissions from black carbon and having a positive influence on the health of occupants by significantly reducing indoor pollutants should be urgently adopted by coordinating policy actions across the concerned ministries.

3. Energy Efficiency in Existing Buildings: Compared to ECBC that has been the focus of BEE and several bi-lateral technical assistance efforts, there has been relatively less focus accorded to energy efficiency in existing buildings. BEE has launched **Star Labeling for Office Buildings** in 2010 and subsequently expanded it to cover IT parks, hotels and hospitals. However, this policy initiative has suffered because of the absence of technical capacity at BEE and the ad-hoc efforts to collect and analyze data that is needed to revise and update the performance levels specified in the Star Labeling program. Building Energy Performance and Energy Disclosure has been seen as important policy tool globally to improve energy efficiency in the building sector. As compared to Energy Star in the US or NABERS in Australia or Building Energy Performance Directive in the European Union, there is no clear policy pronouncements on why building energy performance is important and what policy actions will be deployed to achieve this. In order to put more emphasis on energy efficiency in existing buildings and consolidate the stand alone efforts related to benchmarking and labeling of commercial buildings, energy audits, energy efficiency project implementation through ESCO route and measurement and verification, a Key Performance Indicator based reporting and decision making culture needs to be developed.

Recommendations:

- For all commercial buildings and large homes (area more 250 m2), mandatory energy disclosure at the time of real estate or rental transactions should be considered. In addition, an

annual disclosure of energy use can be clubbed with the filing of property taxes that should be made publicly available.

- There is a need to develop a data and institutional framework to collect and analyze sectoral level data at the national level that would provide the technical basis and underpin the Star Labeling Building program. Simultaneously, BEE should take the responsibility for publishing building-level energy consumption benchmarks for offices, IT-parks, hotels, hospitals and retail malls every two years and strive towards developing system-level benchmarks (lighting, HVAC, plug loads, etc.) to help drive better and best energy efficient practices in the sector. In order to help with data collection, energy audit, decisions related to energy retrofits, there should be a campaign to promote Sub-metering (Advanced) and Energy Management System for all commercial buildings that are more than 5,000 m2 as this is one of the most cost-effective investments leading to multiple co-benefits through increased visibility of energy consumption and 5-10% reduction in energy use.
- There should be redoubling of efforts to create and support the energy services market – both on the technical and legal side and on the financing side. There has been some positive developments that have taken place with EESL taking the lead in helping implement large EE projects, the World Bank and the Government of India signing a $43 million grant and guarantee agreement towards the Partial Risk Sharing Facility for Energy Efficiency (PRSF) at SIDBI, that will help enterprises and Energy Service Companies (ESCOs) mobilize commercial finance for investments in energy efficiency initiatives and the Alliance for an Energy Efficient Economy leading a sustained capacity building exercise to scale up the ESCO industry by providing standardized tools, templates and providing technical assistance on simplified and yet rigorous M&V procedures to be used in Energy Performacne Contracts.

6. Suggested New Policy Recommendations

Regulatory

1. **Simplify and strengthen the regulatory and policy structure** so that number of ministries having jurisdiction on sustainable built habitat is minimized and clear guidelines set to coordinate policy making and resolve issues as and when they arise. Specifically, departments responsible for developing and implementing National Building Code, Energy Conservation Building Code, Environmental Impact Assessment must coordinate actions to have a uniform code and associated policies to avoid ambiguity and confusion in the market thereby making code adoption and compliance easier and faster.
2. **EE Financing:** Clean Development Finance is a much bigger topic and has received much attention in India's INDC as well. EE Financing has some unique characteristics such as small ticket size as compared to other infrastructure focused financing need and an absence of collateral – both can work against the sector if not properly addressed in a policy framework. There are two complementary ways to allow financing for EE projects. The first is to consider the issue as a self-contained project, the second is to integrate energy costs into the financing and appraisal of the whole building. Concerning the first, although NMEEE provides the framework for developing financing of EE programs but a lot of work is needed to unlock the full potential of energy efficiency that are stuck because of lack of financing. These should include a) up-skilling of EE professionals to speak the language of finance - fluency describing EE measures in finance terms - NPV, IRR, risks, etc. b) building capacity and awareness of finance professionals on EE topics and metrics - working knowledge of EE concepts and applications;

and c) Institutionalize 3 entities like Hannon Armstrong, schemes like Energy Efficiency Financing (Carbon Trust + Siemens) and instruments like Private Finance for Energy Efficiency (PF4EE) (EIB and EC) by learning from international success stories. The second approach requires the creation of a recognized method for predicting energy costs of a building and treating them on an equal footing to other expenses and to income. This method can be a naturally occurring outcome of the performance-based compliance methods for ECBC: it would naturally allow all compliant buildings to use their compliance calculation in valuation.

Technical

1. **Data Driven Building Energy Efficiency Policy Framework**: Efforts must be made to institutionalize data collection and analysis of building sector data for major typologies (residential and commercial - existing and projected floor space sub-divided into major sub-categories, energy intensity of residential and commercial sector along with sub-categories and develop building system level benchmarks from existing building stocks that will help compare calculated energy use targets using ECBC methodology with metered data and allow normalization of the calculations and will help set the building performance levels of national star labeling program.
2. **Launch a Sustainable Space Cooling Policy Initiative** to reduce space cooling intensity by at least 50% by 2030 as compared to 2010 levels through a combination of load reduction (e.g. lighting and IT equipment efficiency improvements, better solar control fenestration systems, and adoption of adaptive thermal comfort standards (Manu et. al. 2014), mandatory standard to have white or cool roof on all residential and commercial public sector buildings), develop rigorous evaluation programs and technology accelerators by taking help of R&D Centers and reputed academic institutions to help identify and adopt proven technologies at both materials and systems level (e.g. AC Challenge Programme to help design super-efficient air-conditioners in India) leading to quantifiable and measurable improvements in cooling effectiveness (e.g. 500 sq. ft./ton of refrigeration).
3. **Adopt a "Be Lean, Be Mean, and Be Green"** policy initiative to promote energy efficiency practices with a target to reduce energy intensity in commercial buildings by 50% and in residential buildings by 30% by 2030 over 2010 levels. These targets could be made even stronger by institutionalizing tracking methods for energy performance that encourage better O&M behaviors. Be Lean ((e.g. building physics driven design and construction to reduce cooling load and enhance thermal comfort), Be Mean (adoption of most energy-efficient technologies and follow a Key Performance Indicators driven appliance, system and building performance approach to drive and achieve real energy savings) and Be Green (e.g. integration of renewable energy technologies in buildings to achieve the goal of Net or Near Zero Energy Building) should be the mantra.

Behavioral

1. Behavior and awareness generation for residential energy users through voluntary and market led initiatives need to be launched as technical interventions will come up short if proper awareness is not created (need to give concrete example).
2. All commercial building owners should be required to bill the tenants based on actual energy consumption data based on utility bill.

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