Closing the Policy Gap
Building Energy Code Lessons from Andhra Pradesh

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Buildings have significant ecological footprint. But they could also be sources of energy savings. This potential of buildings, however, remains untapped. Andhra Pradesh is among the first Indian states to adopt a mandatory building energy policy. This paper analyses the reasons for the state's success. It argues that Andhra Pradesh's success owes to the state identifying the constraints of the sector's underlying institutional and technical arrangements, as opposed to following a top-down policymaking approach. These constraints were addressed during regulatory design through a participatory process involving state and non-state actors. As a result, local solutions have bridged the gap between existing structures and policy goals. In drawing from Andhra Pradesh's example, this paper offers lessons for ways to overcome the gridlock in building energy efficiency and the need to embed policy goals in their broader implementation context.

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How India plans for future patterns of energy use will largely determine the sustainability of its development. Demand-side energy planning forms an essential part of this process, and yet currently lacks strategic direction, as the case of India's building sector makes evident. Buildings consume more than a third of the country's electricity, a number that will increase with development and greater access to improved lifestyles (Kapoor et al 2011). However, for reasons that this paper explores, the sector has not yet delivered on its potential to enable energy and cost savings, improve energy security and the local environment, and mitigate climate change.

It is worth locating the buildings sector within the context of the large-scale transitions taking place in the country. The most salient of these is urbanisation, with one of the largest shifts to urban centres in world history projected to occur in India in the next few decades (United Nations 2011). It is estimated that the middle class in Indian cities will grow from 31 million in 2013 to 114 million in 2025 (*Economic Times* 2011). An analogous transformation is taking place in infrastructure, which is slated to attract an investment of $1 trillion over the Twelfth Plan period (2012–13 to 2017–18) (Ahluwalia 2011). In the real estate market, floor area is projected to escalate 400% by 2050 (Urge-Vorsatz et al 2012). The next 15 years will form the core of this growth, and two-thirds of the commercial and high-rise buildings to exist between 2010 and 2030 are yet to be built (Kumar et al 2010). Within this context, the way India develops and implements its strategy on energy use in buildings will be pivotal to the energy concerns underlying its development agenda.

The opportunity from buildings is critical for three reasons. First, the sector is largely untapped in India's energy planning. The scale of unexploited energy efficiency potential is of the order of 2,988 megawatts (MW) of generation capacity and $42 billion in costs savings each year (NRDC 2012). If addressed strategically, building efficiency could offer substantial savings, at low or even no long-term cost.

Second, timing is of essence. The bulk of real estate development is yet to occur, and maximum savings come from the construction of new efficient buildings. The lock-in effect, or the potential energy savings which will go unrealised by 2050, is over 400% for India. This is amongst the highest in the world, far ahead of China, and points to the tangible rewards of a policy focus on the sector (Urge-Vorsatz et al 2012).

Third, unlike traditional pathways to meeting energy goals, energy efficiency in the built environment offers multiple benefits that go well beyond energy savings. This makes the sector fall squarely within India's co-benefits framework, as articulated in the National Action Plan on Climate Change (NAPCC) and the Intergovernmental Panel on Climate Change (IPCC). The benefits range from significant energy savings, carbon mitigation, improved energy security, jobs creation, and increased socio-environmental outcomes. However, if unaddressed, it is estimated that 1.2 gigatonnes of carbon dioxide (CO_2) emissions will be locked in as India's building energy demand increases fivefold over 2005 levels by mid-century (Urge-Vorsatz et al 2012; Shnapp and Laustsen 2013).

While policymakers recognise the high energy saving potential of buildings and the sector emphasised in two of India's NAPCC missions, it is paradoxical that policy outcomes remain mediocre at best. Building energy codes too, for the most part, are voluntary in nature with weak uptake by states.

As this paper argues, the key to a transition towards more effective results lies in closing the gap between policy goals and their eventual adoption and implementation. From a policy-making perspective, these can be summed into three categories to address: institutional coordination across governance levels; questions of technical capacity; and the need for accountability frameworks.

This work draws from the case of Andhra Pradesh (AP), one of the first states to address the policy gap in the energy efficiency practices of the built environment. By exploring the underlying institutional and technical constraints, the state made the shift from a voluntary to a mandatory building energy code. The gap was overcome by (1) constituting a technical committee for institutional coordination; (2) making code technicalities accessible to non-specialists and increasing its effectiveness; and (3) emphasising implementation and capacity building during code adoption. The consultative process by which these solutions were arrived at was equally salient. It brought on board stakeholders with conflicting interests to ultimately enable a successful regulatory outcome. The success of compliance to the adopted regulation remains to be observed in the near future as the policy comes into effect.

An examination of these dynamics at the local level in AP sheds light on why the success of energy efficiency in India's buildings has thus far been mediocre. It also demonstrates how state and non-state actors can jointly create policy which responds to the underlying institutional and technical arrangements within which policies operate. In addition, the study offers lessons about the technological bridges, stakeholder capacities and leadership processes by which difficult regulatory outcomes can be made possible. Existing literature of India's buildings sector has not adequately dealt with these issues and the paper aims to help fill this gap.

Methodologically, the paper is based on work done by the author over a two-year period (2011–13) during which she was directly involved with AP's code adoption as a member of the knowledge partner agency working with the state. The work is based on extensive technical and policy engagement in the form of conducting national and state-level workshops, and individual meetings with stakeholders: state and central government officials; urban local bodies; national and international technical experts; real estate developers and their state and national associations; industry, academic and civil society groups; and financial institutions. The work also draws on official documents and minutes of internal and external meetings accessed via direct involvement in the process.

The next section provides the policy context of building energy efficiency in India. The AP case study is discussed subsequently. The concluding section describes future directions for implementation and observations on shifting the status quo of India's built environment.

Building Energy Efficiency

The evolution of energy efficiency policies in India took place over the last four decades, with a well-defined apparatus of laws and institutions that have grown over time, including for buildings. The operation of these institutions has, however, given rise to issues of federalism that make it difficult to implement a building energy strategy, as described in this section.

Historically, energy efficiency in India was first viewed in the context of global concerns on the scarcity of fossil fuels, then as a means towards cost effectiveness, and finally to mitigate climate change. In the 1970s, the first initiative towards integrating energy policy into national development policy took place, followed by the post-economic liberalisation period in the 1990s, when the government kick-started an array of energy conservation initiatives and programmes. The beginning of the 21st century marked concerns about sustained supply of conventional energy sources in light of maintaining growth and keeping with socio-economic priorities. This realisation is reflected in the Energy Conservation Bill of 2001, the Eleventh (2007–12) and Twelfth (2012–17) Five Year Plans, and the NAPCC (2008) (Balachandra et al 2010). Further, since the early 2000s, energy efficiency, including in buildings, has formed the agenda of various international bilateral and strategic partnerships.

As per the Energy Conservation (EC) Act of 2001, the Bureau of Energy Efficiency (BEE) was set up under the Ministry of Power as an autonomous, nodal statutory body at the central level. The BEE coordinates regulatory and promotional functions with designated consumers, agencies, and other organisations to leverage existing resources and infrastructure towards energy efficiency. The BEE developed the first voluntary national Energy Conservation Building Code (ECBC) in 2007 to set a minimum standard for energy performance in commercial buildings.

The ECBC addresses major energy usage components such as the building envelope (walls, roofs, windows), lighting, heating, ventilation and air-conditioning (HVAC), electrical distribution (powers and motors), and water heating and pumping systems (BEE 2007). It is applicable to commercial buildings with a connected load of 100 kilowatt (kW) or 120 kilovolt-ampere (kVA) contract demand or greater. It offers two compliance pathways to building owners: (1) a prescriptive approach for code requirements; or (2) a whole building

performance method, which requires energy simulations to test compliance.

While the code technical requirements are clear, the responsibility to implement the ECBC is divided amongst the centre and states and between different government departments, which can lead to operational issues. As per the EC Act, power is given to the central government, via the BEE, to prescribe and amend the ECBC for states (MLJCA 2001). The state government, meanwhile, has the authority to enforce certain EC Act provisions and amend the ECBC to suit regional and local climate zones upon BEE consultation. Importantly, the centre does not have the power to mandate states to implement building efficiency targets. Instead, the decision to promulgate building efficiency takes place at the state level, in consultation with the BEE. The states, however, often do not prioritise efficiency investment, resulting in a neglect of the issue.

Institutionally, buildings (as part of urban development) fall under India's concurrent list of subjects, placing them under the purview of both the central and state governments. For the ECBC, this translates to the code issued according to the central EC Act but its enforcement determined at the municipal level. An issued code is thus often disengaged from the local challenges of ensuring compliance with it. The result is the delineation of dual responsibility for building efficiency at the central and state level, without either taking on its onus. These issues of federalism combined with the voluntary nature of the ECBC itself makes it difficult to guarantee wide-scale implementation.

A Model Code Takes Shape

AP bridged the policy–practice gaps described above to be one of the first states to adopt a mandatory building energy code. While its economic conditions were not unique, the successful policy was achieved by a locally-driven process which addressed constraints from underlying institutional and technical arrangements. This section illustrates its key features. It also brings to bear reasons why building energy efficiency as a whole remains stalled in India, in spite of its prominence in some high level policies. AP's solutions are broadly relevant to other states as well that are at similar levels of development and want to regulate building energy use.

This paper applies to AP, before a part of it became the new state, Telangana. The process of code adoption took place during 2011–13 and the adopted code applies to both states equally with the same rules under which it was originally notified unless legally modified by either state.

Economically, AP grew at an average rate compared with other states over the last decade (Planning Commission 2014a, 2014b). Real estate development was integral to the growth and property increased fivefold between 2005 and 2010, making buildings a major consumer of electricity (NRDC 2012). The state's burgeoning services sector drove real estate and attracted national and international developers to build high-end commercial offices and luxury housing.

Real estate growth was juxtaposed with a worsening energy scenario, making the lack of reliable power a concern. AP's power sector declined markedly in the last decade, with incommensurate capacity addition compared with the increase in energy demand and the structural and governance issues in the electricity sector. The energy deficit was 17.6% during 2012–13, and the peak power deficit was 6.5% during 2013–14 (AP Government 2014).

None of these conditions, however, are unique to AP. Nor do they fully explain why the state adopted a building energy code. The shared economic and energy scenario has not naturally resulted in states responding by mandating the ECBC. Instead, the answer lies in a state and non-state actor led building energy efficiency effort, which examined the underlying regulatory constraints by stakeholder consultations. The state's commitment to energy policy was also motivated by a major power outage in 2012, which negatively impacted the services industry. Other supporting factors were the state's chief secretary's ongoing engagement with energy conservation via the 2012 State Energy Conservation Mission and increased awareness due to the Indian Green Building Council headquarters in Hyderabad. The subsequent sections describe the identified constraints to building energy policy, which are shared across state boundaries, and AP's approach to overcoming them. These sections are followed by a discussion on the participatory process.

Regulatory Constraints

The built environment presents a complex web of interrelated issues involving real estate and investments, technology and behaviour, energy and carbon considerations, and development and aspirations. Within this ecosystem, three sets of constraints mark the lukewarm success of building efficiency from a regulatory perspective. These are at the crux of the sector not meeting its policy goals and the long lag periods between policy formulation, adoption and implementation.

As this study illustrates, any serious addressal of buildings needs to be rooted in identifying how these limitations play out within a state and by developing local solutions to overcome them. The absence of such an approach risks no change in the status quo, even if energy policies are made mandatory. Consequentially, business as usual suggests that the country will get locked into inefficient infrastructure for decades, challenging its development objectives.

National and Subnational Institutional Coordination: As discussed previously, a separation in the responsibility of building efficiency exists at multiple levels of governance: between the central BEE, the state government and municipalities. The BEE determines the regulatory framework for code notification, and its designated agencies in each state are directed to play the facilitative role between the centre, state and substate level. However, the state designated agencies coordinate inadequately with the BEE regarding the status and needs of building efficiency initiatives. At the same time, they also have poor communication with, and little influence over, state and municipal departments that are tasked with code enforcement.

Coordination is also insufficient between different state level departments and between the spearheading ministries. This severely impacts policy implementation, which requires the combined expertise of multiple departments. For example, a

state's energy department ensures that building connected loads meet code requirements, while the urban development department monitors compliance in the pre- and post-construction stages. The absence of either department makes code implementation invalid. Simultaneously, it is not clear which department anchors the responsibility for ensuring compliance. The result is weak synchronisation at different levels: between state departments, state departments and BEE's state-designated authority, the state-designated authority and the BEE, and lastly between central ministries, leading to a shifting of tasks between different regulatory actors.

Technical Capacity: Current institutional structures do not mirror the technical requirements of the code. Successful implementation of an energy code requires a cadre of skilled professionals in the government and private sector. However, there is a lacuna in technical know-how, which manifests itself in a number of ways. Few building professionals have the expertise to implement energy efficiency measures and monitor and assess performance. This includes engineers, architects, and building science graduates who are familiar with code requirements, such as the modelling approaches to test compliance laid out in the ECBC. At present, the limited technical knowledge is housed with few private companies and academics, but there is no mechanism to link this expertise with the requirements of the regulatory structure. An equivalent gap in technical ability exists within the public sector. The technical staff of urban local bodies consists mainly of civil engineers who do not possess the required building science knowledge (Rawal et al 2012). Further, staff numbers within urban local bodies and state-designated agencies are incommensurate with the needs of scaling up the ECBC. Professionals are also needed who can speak to stakeholders from different governance levels.

The technical capacity constraints are compounded by the small market for energy efficiency measures and limited availability of testing standards and facilities, which make technology access difficult for the end-user. Poor awareness about existing incentives for and benefits of energy efficiency, in turn, limit the demand for technology options and their associated skilled personnel.

Accountability: Minimal accountability mechanisms undermine successful and extensive code implementation. The ECBC itself does not provide a blueprint for state-level compliance frameworks. As a result, even if policies are mandated, it does not necessitate a machinery to ensure the code is enforced or to penalise non-compliance. In addition, there is limited accountability within the institutional set-up. The performance of state-designated agencies, who are BEE's nodal bodies in each state are not monitored or evaluated. Nor are they held accountable to the BEE to deliver on targets, as the federal structure inhibits BEE to mandate requirements from states. The accountability gap is also reflected at the municipal level, who are similarly not answerable to the state designated agency regarding the progress of code compliance.

The non-existence of formal accountability structures is not made up for by individual regulatory actors at the state and sub-state levels. This is because building energy decisions are made and executed at different levels, often with differing agendas. The overall result is a neglect of policy follow-through.

Apart from the regulatory constraints mentioned above, there are other obstacles specific to the private sector. Developers, banks, and end-users associate financial risk with the higher cost of efficiency investments and have a limited understanding of the new market for efficient technologies and energy service companies. In addition, there are misaligned incentives for non-owner occupied buildings, as developers or owners who invest in efficiency measures do not reap the economic savings which instead accrue to tenants over the building's operation. The private sector is an important lobby for or against building energy policies, and their perspectives are thus important to account for when developing regulation.

Each of these economy-wide constraints were explicitly addressed in AP during code adoption and are discussed in the next section.

Local Solutions to Overcoming Constraints

The regulatory constraints described above make it difficult for building efficiency policy to see large-scale progress. Unless these limitations are addressed, the reality of the sector is unlikely to change, irrespective of additional energy or climate-related emphasis. AP's solutions point to possible ways forward.

Coordination across Departments: The lack of coordination between government departments, where each have discrete code-related responsibilities, is a serious constraint. High-level political support is a precursor to overcoming this, and in AP, the state's chief secretary led the charge to make the building energy policy politically saleable. The chief secretary formally constituted a technical and administrative lead agency, the "Technical Committee" (under government order 1328), marked by inter-departmental membership, regular meetings, and the specific goal to oversee mandatory code adoption. The Technical Committee (hereafter, Committee) consisted of senior representation from the departments of Municipal Administration and Urban Development (MAUD); Energy, Town and Country Planning; the state's chief architect; and non-state technical experts. Interestingly, the chief secretary leveraged existing civil society expertise to achieve the committee's goal by appointing the research head of a local knowledge partner organisation, the Administrative Staff College of India (ASCI), as the committee's convener. This appointment formalised the engagement of state and non-state actors to co-produce outcomes towards the policy goal as part of the state process.

The committee emphasised that new regulation be embedded in existing policies and reviewed state government orders to agree that prevailing initiatives did not address building energy as rigorously as the ECBC. As a result, the committee determined that AP should adapt the ECBC for its local conditions, with the new code termed the "APECBC" to be an amendment to the existing building guidelines in the state government

order 168. The committee's mandate included conducting regular consultations to identify and find solutions to stakeholder concerns and constraints.

Increasing Technical Accessibility and Capacity: The consultations revealed that municipal officials, with whom implementation rests, poorly understood the code. To make the regulation accessible to its key stakeholders, the committee recast technical terms into non-specialist language and developed a shared inter-departmental vocabulary. A prime example is the criterion for buildings that come under the code's purview. The original criterion is that of a building's connected load, which was changed in AP to a building's built-up area. The change immediately allowed the criterion to be comprehensible to urban local bodies and the MAUD who are not energy specialists but are responsible for monitoring construction. Thus, while the ECBC is applicable to commercial buildings with a connected load of 100 kw or greater, the APECBC instead is applicable to commercial buildings that have a plot area greater than 1,000 square metre (m^2) or a built-up area more than 2,000 m^2. Further, in the APECBC, certain categories of buildings such as multiplexes, hospitals, hotels and convention centres must comply irrespective of their built-up area, since they are amongst the largest users of energy. This creative switching of code criterion in AP instantly bridged the technical divide amongst government departments and enabled the state to move to the next step of its adoption plan.

Along with increasing technical accessibility, the committee sought to make the policy more attractive by increasing potential energy and cost savings for users. Discussions with building experts, architects, utilities, and the committee's review of the status and form of ECBC adoption in other states (Karnataka, Rajasthan, Odisha and Chhattisgarh) resulted in changes to increase the APECBC's overall technical efficacy. Table 1 describes the modifications to enhance the technical efficacy of the APECBC as compared to the ECBC. While making these modifications, an important consideration was not to fundamentally alter the ECBC to create the APECBC so that existing national-level capacity building efforts and compliance tools could be leveraged for AP as well—thus keeping track of the state's capacity constraints.

Table 1: Key Efficacy Updates to the ECBC 2007 in the APECBC

Parameter	APECBC Modification (Compared with the ECBC)
Star ratings	Introduction of APECBC star ratings to incentivise and create a premium for building efficiency. While no star ratings exist in the ECBC, for the APECBC, a building can apply for one to six stars based on the savings determined by energy simulations.
HVAC	The APECBC focuses on efficiency of HVAC systems, which are a significant energy users. It reduces the minimum area required for reporting HVAC system balancing from 500 m^2 (in the ECBC) to 250 m^2 Efficiency of split air conditioning units and specific air leakage criteria are also improved.
Mixed-use buildings	APECBC (unlike the ECBC) applies to commercial mixed-use buildings, requiring the built area to qualify for the code when the commercial part of the building independently meets APECBC requirements.
Automatic lighting	The APECBC reduces the minimum area required for automatic interior lighting control from 500 m^2 (in the ECBC) to 250 m^2.

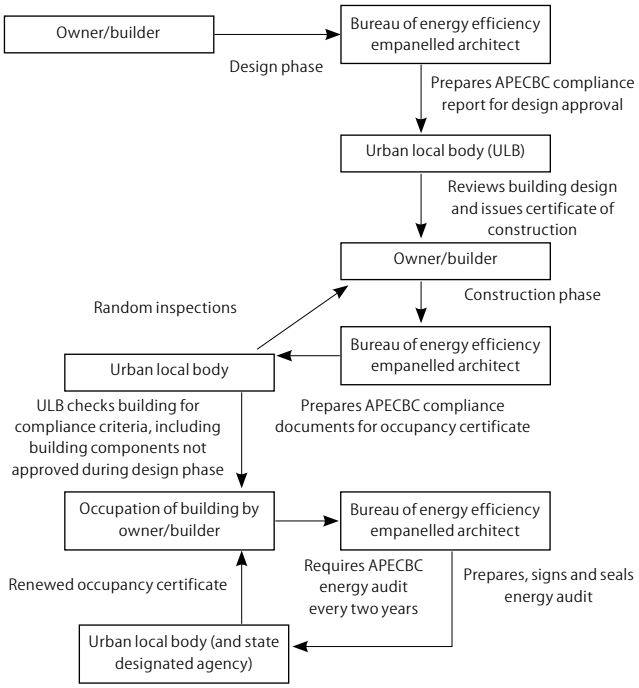
Source: Adapted from the Technical Committee Report, AP 2013.

Compliance and Capacity Building Design: The committee proactively emphasised the need to address capacity and compliance issues during the policy adoption process. In an unusual and far-sighted decision, it agreed to notify the code only once a proposed compliance framework and capacity building programme was designed.

The lack of compliance with a notified code is among the biggest challenge across states, and was repeatedly highlighted during the AP consultations. Two sets of reasons are responsible. The first is the lacuna of skilled professionals who are conversant with the code and can serve as its implementers and evaluators. The second is the absence of an established framework for ECBC compliance design, which can serve as a blueprint for states. The committee and knowledge partners paid close attention to these issues and developed a compliance framework based on the state's existing capacities and needs. Simultaneously, to address needs from future real estate growth, a programme for systematic capacity building was developed.

The committee's compliance framework, reviewed by experts and stakeholders, is designed with built-in checks, pre-construction and pre-occupancy. A schematic of the framework is illustrated in Figure 1. The first check is during building design approval, when a BEE-empanelled architect submits an APECBC compliance report to the urban local body and obtains a certificate to start construction. During construction, urban local body officials make random site inspections. The next check is post construction, when the empanelled architect submits compliance documents to the urban local body, whose representatives inspect the building for modifications from

Figure 1: APECBC Compliance Framework



Source: Technical Committee Report, AP 2013.

original design. Empanelled architects are to report an APECBC energy audit every two years for renewal of the occupancy certificate. The framework attempts to prevent loopholes for incomplete enforcement, and can serve as a template for other states as well.

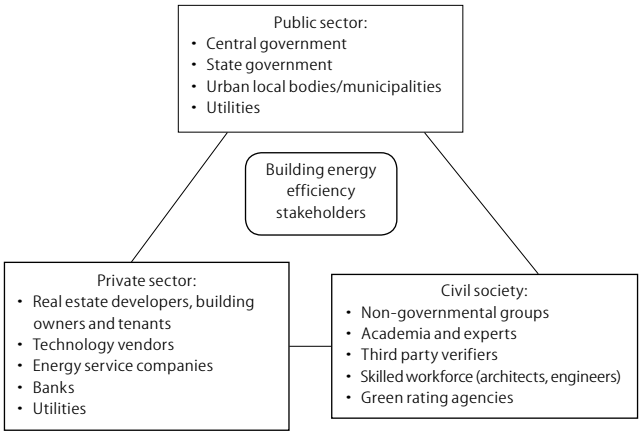
The success of any policy is ultimately linked to the available capacity of officials who will implement it. To ensure sufficient time for stakeholder familiarisation with code technicalities, a time lag of one year was maintained between notifying the APECBC and its date of coming into effect. The hub for organising the capacity building programme was the local knowledge partner, ASCI, in conjunction with the BEE's state designated agency. The programme to train building professionals consists of establishing an empanelment committee; and certification programmes for architects, engineers, government officials and real estate developers. Twelve training workshops for developers, municipal engineers and architects are planned with the target to reach 800 government officials. An evaluation of the programme's success will be possible in the near future. If successful, the institutionalisation of capacity building could have long-term benefits of levelling the different disciplinary grounds within government departments.

A Consultative Approach to Code Adoption

The collaborative nature of decision-making was a defining feature of AP's code adoption story. Led by a combination of state and non-state actors, the consultations emphasised the institutional structures underlying implementation. As a result, key constraints, such as coordination and technical limitations, and conflicting stakeholder interests as with real estate developers, were addressed during the policy design itself.

Examining the roles and interests of stakeholders is the first step to deliberative decision-making. Three broad groups form the country's building energy efficiency landscape: the public sector; private sector; and civil society/expert groups. The groups have different agendas and timescales when advancing efficiency. While the public sector is motivated by policy mandates usually as a result of national energy or climate planning or as a response to state energy needs, the private sector is driven by monetary benefits. Civil society and experts on the other hand are interested in creating the knowledge and facilitative base to advance regulatory goals. Figure 2 lists the actors that comprise each group.

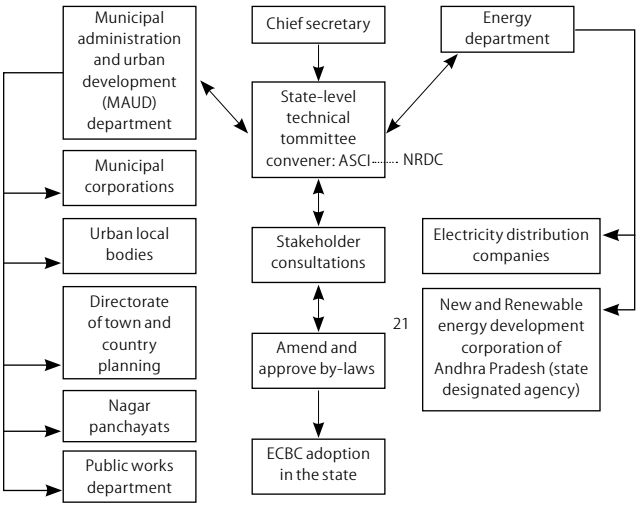
Figure 2: Building Energy Efficiency Stakeholder Map



Source: Compiled by the author.

As the three groups are motivated differently, a driving force is required to nudge them towards a successful policy outcome. In AP, this role was fulfilled by the complementary leadership of state and non-state actors. From the state, it was the office of the highest bureaucrat, the chief secretary. At the non-state level, two agencies served as hubs of technical and facilitative expertise: the locally based research and semi-governmental institute, the ASCI, and the international environmental organisation, Natural Resources Defense Council (NRDC). The partnership between ASCI and NRDC was based on a shared interest to promote energy efficiency, with ASCI bringing trusted knowledge-sharing relationships with the state, and the NRDC providing international best practices on codes and conducting consultations. The role of these two knowledge partners was fundamental to the state's efforts and enabled linkages between the state, national and international levels. AP's progress was showcased at national discussions and at co-convened workshops with the Ministry of Urban Development and Ministry of Power. Figure 3 shows the formal organisation of the process.

Figure 3: Organisation of the ECBC Adoption Process in Andhra Pradesh



Source: Adapted from the Technical Committee Report, AP 2013.

Stakeholder conflicts were an important outcome of the process. Real estate developers formed the chief opposition against code adoption for reasons of higher upfront costs and split incentives when their properties are leased or sold. To alleviate these concerns, the knowledge partners led engagement with developers and their associations through individual meetings and workshops. The conversations, remarkably, enabled a forum for alignment and a compromised solution was arrived at: fast clearances for APECBC star-rated buildings, as opposed to concessions such as property tax reductions which benefit the enduser and not the developer. The discussions brought out that while costs are indeed constraints, developers' opposition to a mandatory building energy policy was in fact rooted in administrative concerns about project delays.

The state and non-state actors worked jointly across stakeholder groups for the two years during which AP adapted and mandated the code. The process was fundamental to identifying and overcoming underlying structural constraints and led to the creation of the technical committee and initiatives to increase capacity and compliance. Importantly, the deliberations enabled buy-in by the groups that would be most affected by the policy change, paving the way for smoother compliance. At a macro-level, AP's experience with consultations suggests a way to navigate the complex landscape of different actors, institutions, capacities and agendas that make up India's built environment.

Conclusions

Buildings consume more than a third of India's electricity (Kapoor et al 2011). However, the country has not as yet developed a comprehensive strategy for building energy efficiency that leverages its multiple benefits. This is in spite of a recognition by the government of the sector's energy and greenhouse gas savings potential (IESS 2013) and its emphasis in NAPCC missions. Building energy codes are for the most part voluntary in nature, as opposed to being mandated by states. Three distinct sets of issues constrain the sector, nationwide, from achieving its policy goals. These are: the need for institutional coordination at and between the national and subnational level, the lacuna in technical capacity, and the absence of accountability frameworks.

The case of AP, however, offers an instructive shift in this status quo. By being one of the first to move from a voluntary to a mandatory building energy policy, the case offers an example for other states. Instead of following what are often technocratic orders, the focus in AP was to examine existing narratives and underlying structures and craft local solutions.

The state responded to each set of constraints in the following ways. A technical and administrative lead agency was set up with inter-departmental membership and the specific goal of mandatory code adoption. To boost technical capacity, code changes were used to bridge institutional constraints and make the code accessible to non-specialists. A case in point is rethinking the criteria for code compliance from a building's connected load to its built-up area. This made technical vocabulary accessible to municipality officials who are not energy specialists but are still responsible for monitoring construction. Finally, the lens of implementation and accountability was applied to overcome the salient challenge of poor policy compliance. The state agreed to notify the code only once the compliance and capacity building framework were determined, a farsighted approach resulting from the needs identified during the participatory process.

A distinctive feature of the AP case was to use consultations to identify the gap between policy goals and the underlying structures within which the policy is embedded. These were then explicitly addressed during the regulatory design phase.

It also created collective ownership of the proposed policy, especially among groups that tend to have contradictory motivations, such as real estate developers.

It is important to note that achieving scale by way of a similar deliberative approach requires committed leadership. In AP, this was established by the state's chief secretary and complemented by the two external knowledge partners, who aligned with bureaucratic will to serve as technical and facilitative supports to the state, often co-producing outcomes. Leadership from state or non-state actors will be essential when duplicating the use of consultations for building energy policy adoption in other states. The lessons from AP serve as useful references for such future projects, especially since the same broad set of constraints are prevalent across the country.

The compliance success of AP's adopted code remains to be observed as the policy comes into effect. In large part, it will depend on sustaining capacity building and not comprising on accountability towards compliance. In the interim, this paper analyses how the dynamics of establishing successful efficiency policies can play out locally to bridge the gaps between existing structures and policy goals.

Looking ahead, there is an understanding that the ECBC will be revised and its status will change from voluntary to mandatory for most states over the next few years. Building energy efficiency is also signalled as key to the emerging Smart Cities Mission. Within this context, areas for enhancement of the code can be considered. First is to rethink the strategy towards retrofits, a specification that is not required by the ECBC so far. This is increasingly important given the changing nature of India's buildings sector, for in a couple of decades, the country would have transitioned from a current stock which is made up of largely new buildings to one where existing buildings predominate. Second, the role of residential buildings needs attention. India's total residential floor area will be much larger than its total commercial floor area by 2030, and the residential energy consumption is predicted to rise by more than eight times by 2050 under a business as usual scenario (Rawal and Shukla 2014). Third, an emphasis on enforcement is critical. An option is for building energy codes to include outcome-based compliance pathways, where the bulk of capacity is spent on checking for compliance post occupancy.

Laying the foundation for an effective energy strategy for India's built environment will require an embedding of policy goals within their broader implementation context. Addressing policy in this way can be central to how India responds to its demanding energy scenario. This is particularly important in the context of the next 15 years, when the country will undergo a surge in real estate construction and lock-in the energy-saving measures it does, or does not, put in place. If examined, strategised and implemented, building energy efficiency could be a rightful front runner in helping India achieve its multiple sustainable development goals.

REFERENCES

Ahluwalia, Montek S (2011): "Prospects and Policy Challenges in the Twelfth Plan," *Economic & Political Weekly*, Vol 46, No 21.

AP (Andhra Pradesh) Government (2014): "White Paper on Power Sector in Andhra Pradesh," http://ap.meeseva.gov.in/DeptPortal/Download-lat/White%20Paper%20on%20AP%20Power%20Sector_V10.pdf, viewed on 22 January 2015.

Balachandra, P, D Ravindranath and N H Ravindranath (2010): "Energy Efficiency in India: Assessing the Policy Regimes and Their Impacts," *Energy Policy,* Vol 38, No 11, pp 6389–7540.

BEE (2007): "Energy Conservation Building Code, 2007," Bureau of Energy Efficiency, New Delhi.

BP (British Petroleum) (2014): "Energy Outlook 2035," http://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2015/bp-energy-outlook-2035-booklet.pdf, viewed on 24 January 2015.

Economic Times (2011): "India's Middle Class Population to Touch 267 Million in 5 Yrs," *Economic Times*, 6 February, http://articles.economictimes.indiatimes.com/2011-02-06/news/28424975_1_middle-class-households-applied-economic-research, viewed on 22 January 2015.

IESS (India Energy Security Scenarios 2047) (2013): "India Energy Security Senarios 2047," http://indiaenergy.gov.in/demand_building.php, viewed on 24 January 2015.

Lucon, O, D Ürge-Vorsatz, A Zain Ahmed and H Akbari et al (2014): "Buildings," *Climate Change 2014: Mitigation of Climate Change Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Edenhofer, O, R Pichs-Madruga, Y Sokona et al (eds), Cambridge: Cambridge University Press, http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter9.pdf, viewed on 22 January 2014.

Kapoor, R, A Deshmukh and S Lal (2011): "Strategy Roadmap for Net Zero Energy Buildings in India," USAID India, http://eco3.org/wp-content/plugins/downloads-manager/upload/NZEB percent20Roadmap-2 percent20Sept percent 202011.pdf, viewed on 22 January 2015.

Kumar, S, R Kapoor, R Rawal, S Seth and A Walia (2010): "Developing an Energy Conservation Building Code Implementation Strategy in India," USAID India, http://eco3.org/wp-content/plugins/downloads-manager/upload/Developing%20an%20ECBC%20Implementation%20Strategy%20in%20India-%20Report%20No.1-028.pdf, viewed on 22 January 2015.

MLJCA (Ministry of Law, Justice And Company Affairs) (2001): "The Energy Conservation Act," New Delhi, India.

NRDC (Natural Resources Defense Council) (2012): "Constructing Change: Accelerating Energy Efficiency in India's Buildings Market," http://www.nrdc.org/international/files/india-constructing-change-report.pdf, viewed on 22 January 2015.

Planning Commission (2014a): "Gross State Domestic Product (GSDP) at Current Prices (as on 31–05–2014)," http://planningcommission.nic.in/data/datatable/0814/comp_databook.pdf, viewed on 22 January 2015.

— (2014b): "Per Capita Net State Domestic Product at Current Prices (as on 31–10–2014)," http://planningcommission.gov.in/data/datatable/data_2312/DatabookDec2014%20156.pdf, viewed on 22 January 2015.

Rawal, R and Y Shukla (2014): "Residential Buildings in India: Energy Use Projections and Savings Potentials," Global Buildings Performance Network (GBPN), http://www.gbpn.org/sites/default/files/08.%20INDIA%20Baseline_TR_low.pdf, viewed on 22 January 2015.

Rawal, R, P Vaidya, V Ghatti, A Ward, S Seth, A Jain and T Parthasarathy (2012): "Energy Code Enforcement for Beginners: A Tiered Approach to Energy Code in India," ACEEE Summer Study on Energy Efficiency in Buildings.

Shnapp, S and J Laustsen (2013): "Mitigation Potential from India's Buildings," September, Global Buildings Performance Network (GBPN), http://www.gbpn.org/sites/default/files/03.India_ExecutiveSummary_0.pdf, viewed on 22 Janauary 2015.

Technical Committee Report, AP (2013): "Technical Committee Report on Energy Conservation Building Code Adoption in Andhra Pradesh," Andhra Pradesh, India.

United Nations (2011): "World Urbanization Prospects," Department of Economic and Social Affairs, Population Division.

Urge-Vorsatz, Diana, Ksenia Petrichenko, Miklos Antal, Maja Staniec, Michael Labelle, Eren Ozden and Elena Labzina (2012): "Best Practice Policies for Low Energy and Carbon Buildings, A Scenario Analysis," Research Report Prepared by the Center for Climate Change and Sustainable Policy (3CSEP) for the Global Buildings Performance Network.