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The international implications of national and local coordination on building energy codes: Case studies in six cities

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ABSTRACT

Building energy efficiency is an important strategy for reducing greenhouse gas emissions globally. In fact, 55 countries have included building energy efficiency in their Nationally Determined Contributions (NDCs) under the Paris Agreement. This research uses building energy code implementation in six cities across different continents as case studies to assess what it may take for countries to implement the ambitions of their energy efficiency goals. Specifically, we look at the cases of Bogota, Colombia; Da Nang, Vietnam; Eskisehir, Turkey; Mexico City, Mexico; Rajkot, India; and Tshwane, South Africa, all of which are "deep dive" cities under the Sustainable Energy for All's Building Efficiency Accelerator. The research focuses on understanding the baseline with existing gaps in implementation and coordination. The methodology used a combination of surveys on code status and interviews with stakeholders at the local and national level, as well as review of published documents. We looked at code development, implementation, and evaluation. The cities are all working to improve implementation, however, the challenges they currently face include gaps in resources, capacity, tools, and institutions to check for compliance. Better coordination between national and local governments could help improve implementation, but that coordination is not yet well established. For example, all six of the cities reported that there was little to no involvement of local stakeholders in development of the national code; only one city reported that it had access to national funding to support code implementation. More robust coordination could better link cities with capacity building and funding for compliance, and ensure that the code reflects local priorities. Understanding gaps in implementation can also help in designing more targeted interventions to scale up energy savings.

1. Introduction

Building energy efficiency plays a central role in national strategies to achieve emissions reductions (Evans, 2017). In fact, 55 countries have included building energy efficiency in their Nationally Determined Contributions (NDCs), i.e., national pledges, under the Paris Agreement, and more are likely to join as countries flesh out the details on how they will achieve their emissions targets.[1] Buildings currently represent about 1/3 of total global energy demand, and this share is growing (IEA, 2013b). Buildings also have many opportunities to save energy while simultaneously saving money (IEA, 2014a). Yet this low-hanging fruit in the buildings sector also indicates the challenges with achieving energy efficiency in the built environment.

This article focuses on building energy codes, which have significant potential to save energy. Building energy codes also represent a particularly cost-effective approach to achieving savings because they integrate efficiency measures during initial construction. Codes also play an important role because they help lock in an energy efficient footprint for the life of a building. Depending on the region of the world, buildings typically last between 30 and 100 years (Johansson et al., 2012).

The Intergovernmental Panel on Climate Change has found that building energy codes are one of the most effective mechanisms to reduce carbon emissions from the building sector in the coming decades (Lucon et al., 2014). Studies in Europe have found that codes have achieved reductions in average residential energy use

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[1] Since the research was completed, the United States has submitted notification to the UN that it intends to withdraw from the Agreement as soon as it is eligible to do so. The U.S. President has indicated that the U.S. will not implement the NDC submitted by the previous administration.

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of 6–22%, depending on the country and code stringency (IEA, 2013a). Codes can also be very cost effective. A study in the United States found, for example, that current codes can save $126 billion between 2010 and 2040, at relatively modest compliance costs (Athalye et al., 2016; Williams et al., 2014). Codes have a payback period in U.S. homes on average of 3.45 years (Paquette et al., 2010). It can be quite costly after a building is built to change windows, walls, insulation, and even heating and cooling systems, which means that more often than not, these core elements of a building tend to remain fixed for long periods. Building energy codes, when implemented, mainstream energy efficiency by requiring it in all new buildings. This in turn can help lower costs and build capacity, which can make retrofits, above-code buildings, and improvements to the code over time more achievable.

However, achieving the potential of building energy codes (and other energy efficiency policies) requires effective implementation systems. Countries like the United States and China have found that robust implementation systems can lead to compliance rates of 80–100% (DOE, 2015; Shui and Nadel, 2012). However, in many countries implementation remains one of the major challenges of reducing emissions through buildings. Most codes are implemented at the local level, while national governments typically develop the codes and NDCs.

Implementing building energy codes with a high level of compliance usually requires resources, capacity, and institutions to check for compliance. Local building permitting offices are often short-staffed, and, in developing countries, they may have limited resources to check for basic safety and health issues. Local officials may also have limited technical knowledge of energy issues in buildings. Improving compliance typically requires resources to pay for staff to review building plans and inspect construction sites (whether these are government or private third parties). It may also require investment in training and software tools to help with compliance. In addition, having a clear set of rules and reporting structures can help streamline compliance.

This paper uses building efficiency, and building energy codes in particular, as a case study on what it may take for countries to reach their targets. Our central research questions are to identify the gaps that countries and cities are experiencing in implementing building energy codes and whether coordination with national governments is helping to fill these gaps.

2. Literature review

A small but growing body of literature has been published on development, implementation, and enforcement of building energy codes, and their role in improving energy efficiency in new and existing buildings. Implementation and robust compliance are key to capturing the full advantages of building energy codes (Yu et al., 2014). The literature examining building energy codes primarily looks either at national level trends, or at specific local case studies. Few studies to date have considered the interactions between national and local governments in developing and implementing building energy codes and other building energy policies.

One group of studies reviewed the status of building energy codes and key elements to promote code implementation in countries. Evans et al. (2017b) examined building energy codes in 22 countries at the national level, looking at key elements of implementation systems across these countries. IEA (2013a), Laustsen (2008), and Liu et al. (2010) also examine the experience with building energy codes at the national and specific case studies to assess best practices. Levine et al. (2012) reviewed building energy efficiency policies including energy codes in the United States, European Union, China, and India. Concluding that building energy codes are the most effective policy option to reduce buildings energy use, Levine et al. (2012) listed trainings for stakeholders, regular updates to the standards, and early announcement of codes revisions as key factors in making building energy codes effective. Guo et al. (2016) and Evans et al. (2010) analyzed the building energy codes framework in China and identified the supervision and inspection systems as the key factors in the successful enforcement of mandatory building energy codes. Huang et al. (2016) analyzed and compared national and regional building energy efficiency policies in China and Japan using stakeholder interviews, literature review, and a typology from the United Nations Environment Programme on policy actions.

Another group of studies examined building energy efficiency at the local level. A report from the World Bank (ESMAP, 2011) provided a comprehensive analysis of implementation and enforcement of building energy codes in Tianjin, China. In an analysis of performance-based building codes in Hong Kong, Hui (2002) argued that this type of code requires advanced skills from building designers and code users as implementation and validation of these codes is more complicated. Evans et al. (2014) explored trends in rural building energy use in China and found that implementation of building energy codes in rural China faces a number of challenges. In a broader perspective, Fudge et al. (2016), used a “Multi-Level Perspective” framework, drawing on qualitative data gathered through interviews with local authorities in the United Kingdom. The article explored the interactions and challenges associated with the role of local government in the sustainable energy transition, concluding that there is a need to build the energy-related capacity of local authorities.

However, neither set of literature explored how the national government works with state and local governments to roll out these policies and how local players interacted with national government in policy implementation.

National-subnational coordination is critical to fulfilling clean energy goals as well as climate targets (Busche, 2010; Cox, 2016). Li and Shui (2015) and Khosla et al. (2017), taking China and India as examples, investigated how multi-level governance is used to implement building energy policies. Li and Shui (2015) conducted a comprehensive review of building energy efficiency policies in China. Khosla et al. (2017) explored multilevel connections in India's building energy sector and found that interactions between different government levels can both promote as well as impede low-carbon technology deployment. These studies only used secondary information by reviewing existing literature and data in China and India. However, first-hand information can improve the understanding of real-world challenges and opportunities in implementing building energy policies. In addition, as countries have their own circumstances, compared to the study of a single country, cross-country analysis can help address building energy efficiency issues to a broader audience.

We believe this paper fills some important gaps in the literature. First, there is limited research to date examining the real-world capacity for and coordination on implementing specific, sectoral commitments, in other words, for implementation of the core plans to reduce greenhouse gas emissions. Second, this study involves interviews and analysis of stakeholders on the ground in specific cities that have made strong commitments in their own right. And third, we take a cross-cutting look using a standard methodology examining cities in six emerging economies spanning four continents. In summary, the existing literature examines discrete elements related to building energy sector policies, but not the importance of the linkages between local, national and international actors drawing on real-world information.