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China's Urban Energy Challenge

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Initiatives

China's Urban Energy Challenge

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Abstract

China's urbanization trends will exacerbate existing energy challenges across the country. To help manage this situation, the 11th Five Year Plan seeks to reduce the country's energy intensity by 20% by 2010. Responsibility for achieving this goal falls on the shoulders of both public and private sector officials, with the mayors of Chinese cities holding key energy policy planning and implementation powers. Although cities across China have already done a great deal to improve local energy efficiency, these actions tended to be siloed, focusing narrowly on one specific policy area, such as transport, buildings, power, or water. Recently, international NGOs and private consulting and technology firms have begun to work with local authorities across China on more comprehensive energy strategies. Another program seeks to teach energy efficiency strategies to Chinese mayors at a special 7-day school in Beijing. Shifting course from the current policy approach will be challenging for a variety of institutional reasons and could benefit from improved coordination between central government and local government officials.

Keywords: China, urban, planning, energy policy.

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China's shift towards urbanization is well documented. By almost any metric, superlatives are inadequate, because rarely in human history have we seen migration, development, and consumption patterns change so swiftly on such massive scale and with such synergistic effects.

The McKinsey Global Institute's report, *Preparing for China's Urban Billion* (McKinsey, 2009), offers the most comprehensive — and, some say, scary — vision of China's urban future. It projects that:

- Over the next sixteen years, more than three hundred million people will migrate from rural to urban China and, by 2030, the country's urban population will exceed one billion.
- 40 billion square meters of floor space will be constructed in five million new buildings.
- Five billion square meters of new road surface will be paved, the equivalent of nearly 100,000 miles of new US interstate highway system-quality roads.

Growth on this scale will require massive quantities of energy. The same McKinsey report estimates that, by 2025, *urban* energy demand in China will constitute roughly 85-90% of total *national* energy demand, with coal maintaining its position as the fuel of choice for most cities. According to the International Energy Agency, urban energy demand constituted roughly 75% of China's total national energy demand in 2006 (IEA, 2008).

Given the frequently-cited statistic that China already builds one new coal power plant each week — with potentially dire long-term consequences for the country's greenhouse gas emission levels — getting urban energy demand under control is an imperative, both for China and the rest of the world. There have been some important efforts undertaken by the central government to contain energy use. The results have been impressive and have led to the closure of thousands of inefficient power plants and manufacturing facilities across the country (Associated Press Financial Wire, 2009).

Less attention has been given to how local authorities are engaged in these matters, and what results their efforts are achieving. Because cities are acknowledged to constitute an important tier of government in China — local authorities hold key land use planning powers and account for roughly 70% of all government spending (Landry, 2008) — understanding how cities view energy planning responsibilities may illuminate how well urban energy demand can be controlled.

1. ENERGY PLANNING IN CHINA: SOLID PROGRESS, BUT STILL FAR TO GO

Although several highly important energy policies have been issued by China's central government in recent years — on renewables, vehicle fuel economy standards, transmission grid upgrades, and green building standards (WRI, 2009) — the energy intensity mandate is unquestionably the most important policy driving local level actions on energy throughout the country.¹ Recognizing that inefficient industrial production practices were forcing China to grow its energy infrastructure larger and faster than necessary (Andrews-Speed, 2009), the 11th Five Year Plan (the key planning document produced by the People's Congress) included a goal of reducing energy consumption per unit of gross domestic product (GDP) by 20% between 2006 and 2010.

The decision to slow the rate of energy demand growth — rather than absolute energy consumption levels — was strategic, given China's overarching need to sustain the economic engine that powers the country. Four years into the plan, China is running behind schedule in its effort to reach its target, having reduced energy intensity across the country by 14.38% (Li, 2010). On the whole, however, China appears to have made dramatic strides in this area, reducing its energy intensity by more than half since 1980, as Figure 1 makes clear.

Local authorities are playing a key role in implementation and enforcement efforts, working with the central government to monitor and supervise energy efficiency projects at the 1,000 largest energy-consuming enterprises in the country. Local authorities have also been tasked with closing down small,

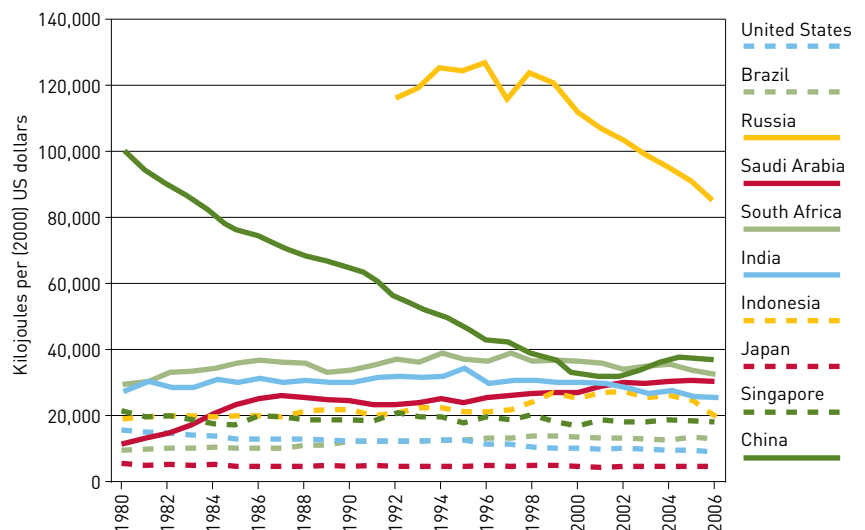


Figure 1. Energy Intensity of Selected Countries (1980-2006). The original figure was in Btu/\$US. A Btu, British thermal unit, is approximately the amount of energy needed to heat one pound of water by one degree Fahrenheit. One Btu is equal to about 1.06 kilojoules. Source: Table E. 1g World Energy Intensity—Total Primary Energy Consumption per dollar of gross domestic product using market exchange rates, 1980-2006. Energy Information Administration, US Department of Energy (2008).

¹ China's 12th 5-year plan — currently under development — will apparently establish a fixed carbon intensity reduction target for the period 2010-2015, operationalizing the commitment made by China's President Hu Jintao in late 2009 in the run-up to the Copenhagen climate summit (Finamore, 2010). For the purposes of this historical review, however, the energy intensity reduction target is the most relevant policy affecting local energy policymaking in recent years.

inefficient, power plants and industrial facilities and delivering energy use reductions across other sectors, including their own government operations. Figure 2 compares the changes in energy intensity in four of China's largest cities between 1997 and 2007, during which time three of the four reduced their energy intensity by approximately 50%.

Part of the challenge that local authorities face is that there is no one-size-fits-all energy plan suitable for China's cities, and over time there is less and less low-hanging fruit to target. What makes sense varies significantly based on the economic makeup, climatic conditions, geographic location, and infrastructure of each city. Heavily industrialized cities demand different action plans than cities that have a more diversified economic base; cities in the north have vastly different energy systems than cities in the south. Thus, the energy initiatives undertaken by cities across China vary widely, covering issues as diverse as transportation, waste management, renewables deployment, and upgrades to local power and thermal energy systems. Specific examples include:

- Planned upgrades to the district energy systems of five small- and medium-sized cities (100,000-500,000 population) in Liaoning province (World Bank, 2008).
- 99% of residences in Rizhao (almost one million residences in total) have solar hot water heaters, thanks to an aggressive push by the local government, which mandated their installation on new buildings in 2003 and provided R&D funding that drove the cost of a standard 32-gallon heater down to \$230, making it affordable for existing buildings (Hvistendahl, 2009).
- Beijing, Ji'nan, Hangzhou, Kuming, Chengdu, Xi'an, and Shenzhen have all invested in Bus Rapid Transit programs to reduce traffic congestion and local pollution levels.
- In Beijing, heavily polluting private vehicles were first banned from the center city. Now, Beijing's municipal government has set aside \$140 million (US) in a local 'cash for clunkers' program to reward owners who take their cars to the scrap yard. It has been estimated that, if these

350,000 "Huangbiaoche" — which account for just 11% of the vehicles registered in Beijing — were taken off the road, local transport-related pollution emissions would decline by more than 50% (Wang, 2009).

Other projects have been highlighted in a Climate Group report that profiled benchmark programs in cities across the country (The Climate Group, 2009). Although such initiatives are noteworthy on their own, and hundreds of similar examples could potentially be profiled for their energy efficiency benefits, what is most relevant for our purposes is that these initiatives have largely been developed in isolation. They have been pursued as part of a policy silo-specific strategy that focuses narrowly on transportation, district energy system development, waste management, water supply and treatment, and so on. This is the result of China's top-down bureaucratic structure, under which information, resources, and responsibilities flow from central government ministries to similarly named bureaus in provincial and local governments (Lieberthal and Oksenberg, 1988). Gan similarly notes that communication among different local authority bureaus is lacking, making implementation of cross-agency initiatives more challenging (Gan, 1999). Inter-bureau or ministerial rivalries may exacerbate the problem, as local officials jockey for attention or resources.

In the west, openness to different perspectives is considered de rigeur when preparing sustainability or climate plans.² These efforts typically involve key industry players, the general public, and relevant governmental agencies in an attempt to ensure solid local acceptance and, ideally, financial support for the final plan.

China has shown that it can break down these policy walls when it wishes, particularly in the area of sustainability. During the 1990s, the central government established an Agenda 21 plan³, as did two-thirds of all provinces around the country and several cities (Administrative Center for China's Agenda 21, 1997). Agenda 21 planning efforts were broad in their orientation and more inclusive in their approach, integrating the perspectives

of a range of different line agencies. Many of the initiatives that local authorities are now pursuing throughout China in the name of energy efficiency were undoubtedly first identified or nurtured by these Agenda 21 plans.

The central government has also been credited with employing a more open process in its recent efforts to craft a new national energy law. Public comments were solicited in assessing the draft law and concerns raised by respondents were discussed at public meetings. This is quite a change in a country where opacity was once the hallmark of government (Zhu, 2008).

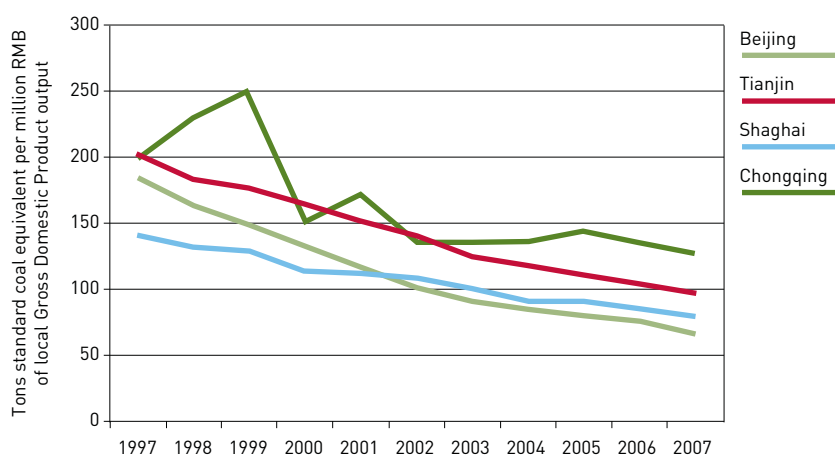


Figure 2. Energy intensity of four large cities in China (CEIC Data Manager, 2009)

² For example, see New York City's *PlaNYC 2030* report, the *London Climate Change Action Plan*, Paris' *PlanClimat*, and Toronto's *Climate Change, Clean Air and Sustainable Energy Action Plan*.

³ Agenda 21 is an outgrowth of the Rio earth summit in 1992. It is predicated on the development of growth and sustainability plans that incorporate environmental, social, and economic concerns. One section of Agenda 21 called for similar activities to be undertaken by local authorities, thus earning the moniker of Local Agenda 21 plans. A key precept of the Agenda 21 movement is the involvement of a wide range of stakeholders, both in and out of government, to ensure that issues and solutions are considered from non-siloed vantage points.

Can China move beyond its traditional government-centric, top-down planning model in its pursuit of more energy efficient cities? Does broader stakeholder involvement actually deliver better results? There is considerable urban activity that is just getting underway that may help us to answer both questions.

2. LOCAL ENERGY INITIATIVES AND PARTNERSHIPS

In the city of Urumqi (population 2.5 million) in western China, municipal officials are working with foreign consultants to develop a 20-year energy master plan that considers all forms of energy supply and use across the city. The consultants (US-based Garforth International, Owens-Corning, and the German energy firm, MWV) had previously partnered to help the municipality of Guelph (Ontario, Canada) develop a comprehensive energy strategy and are employing a similar stakeholder-driven initiative in Urumqi. Initiated by the municipal government's Construction Committee, the project seeks to build on the extensive work that Urumqi has done during the past decade to track local energy use, construct green buildings, expand the use of cogeneration systems, and run 'train the trainer' programs (Heidelberg University, 2009). Key partners in the new energy master plan development effort include the mayor's office, a local technical institute that specializes in district heating, the local and regional power system operators, and large property management companies from around the city (Peter Garforth, Personal Communication).

In Guangdong province, the Vermont-based Institute for Sustainable Communities (ISC) has partnered with three local townships⁴ on community-based energy efficiency projects. The initiative brings together citizens, government, and local officials to identify, prioritize, and implement energy efficiency projects in local factories, schools, municipal buildings, hospitals, and residences (Institute for Sustainable Communities, 2009). The stakeholder process that ISC has successfully employed in other countries is designed to build local capacity and create support for locally managed revolving loan funds that support energy efficiency projects in the region. In 2010, ISC is launching a similarly styled Climate Leadership Academy in Jiangsu and Guangdong provinces, seeking to train local officials from around each province on strategies that will reduce carbon emissions in their cities (Institute for Sustainable Communities, 2010).

In 2008, the World Wildlife Fund launched a Low Carbon City Initiative, partnering with the cities of Shanghai and Baoding to explore ways to marry economic development and energy efficiency. In Shanghai, the primary focus will be on improving energy efficiency in buildings, whereas the emphasis in Baoding is on expanding the renewable energy technology-manufacturing sector (WWF, 2009).

In Tianjin, local officials have partnered with the government of Singapore to build a 30-km² eco-city that will eventually be home to 350,000 people. Key energy goals for the project include ultra-high rates of public transport use for trips within

the eco-city and provision of 15% of the city's energy supply from renewable resources. Construction of the project commenced in September, 2009.

There are other projects where less progress has been made or less information is available, but the emphasis is the same, placing cities at the heart of efforts to reduce energy use across China. For example, in early 2009, the Climate Group announced plans to partner with 15-20 Chinese cities (of varying sizes and types of economic activity) in a Low Carbon Cities program to transform and reorient the local economy towards energy efficiency and climate concerns. To date, Guiyang and Dezhou have signed on to the program. Another set of initiatives has been launched by ENN Energy Services, a large China-based clean energy and energy-efficiency services provider. ENN reports that it has signed up the city of Gaoyou (one million inhabitants) in Jiangsu Province in its Urban Energy Services Program. As part of this program, ENN analyzed the city's energy use patterns, and has developed a 15-year plan that is designed to reduce consumption and increase the use of renewable and cleaner forms of energy. A press release issued by the firm claims that ENN has assisted more than ten other cities in China, each of which are now working to implement a custom-tailored energy master plan (Xinaogas, 2009). In 2010, General Electric also intends to launch a sustainable cities initiative, collaborating with leading international planning, architecture and engineering, and technology companies to provide integrated climate and energy planning and technology deployment services to local authorities in China (China Daily, 2010).

3. PROMOTING MAYORAL LEADERSHIP: THE JUCCCE ENERGY SMART CITIES TRAINING PROGRAM

The initiatives cited above have largely been city- and NGO-led, but there is also active support within China's central government to promote such endeavors. One of the most noteworthy examples is a training program that targets mayors from across China. Structured as collaboration between the Joint US-China Collaboration on Clean Energy (JUCCCE)⁵ and the National Training Center for Mayors of China (NTCMC)⁶, the Energy Smart Cities program seeks to train 300 mayors and vice mayors on energy efficiency issues during the period of 2009-2011. Three training sessions were held in 2009, while one training session has been held thus far in 2010.⁸

Under the terms of JUCCCE's agreement with NTCMC, two different length training modules are to be provided, with the curriculum content developed by JUCCCE in consultation with the Training Center.

The first, a 1-day module that emphasizes energy-related economic development and energy project finance, is designed to fit into the NTCMC's twice-a-year, 30-day mayoral training program on planning and construction-related topics. Mayors and vice mayors are required to participate in this program at least once every five or six years.

The second training program is a more intensive 7-day module that involves a different set of mayors and touches on the full range of energy policy-related topics relevant to local authorities in China. This includes energy-related economic development, energy project finance, green buildings, land use and transportation planning, waste and water management practices, energy master planning, and the use of 'clean' power generation technologies. Climate change is implicitly addressed in the training with emission reductions treated as a co-benefit of efforts to promote energy efficiency and clean energy system deployment. However, climate change is not intended to be an explicit topic of conversation at the training.

The content will likely vary each year, based on feedback from the participants, the preferences of the NTCMC, and changing local circumstances and trends in the urban energy field.

In structuring these sessions, the JUCCCE team has three key goals. First, in a country where central planning dominates, JUCCCE hopes to encourage mayors to become more actively engaged on energy planning matters. By inviting former London Deputy Mayor Nicky Gavron, former Salt Lake City Mayor Rocky Anderson, and New York City Sustainability Director Dr. Rohit Aggarwala to speak, JUCCCE tries to reinforce the message that large cities around the world are independently embracing energy efficiency as an issue central to their future. Progress can be challenging, of course, but mayors of leading cities are taking concrete actions to change the trajectory of their energy use. JUCCCE wants China's mayors to join the ranks of those standing up to provide local, national, and even international leadership on these issues.

Second, JUCCCE seeks to promote a comprehensive systems-based approach to energy planning. JUCCCE recognizes that mayors in China already know a great deal about energy-related topics because they've been living with the energy intensity reduction mandate for the past 4 years. But because efforts have frequently been managed in a silo-specific context, JUCCCE emphasizes the interconnected nature of these issues. Land use planning, for example, can influence mobility patterns, the types of energy technologies deployed in the city, the level of energy consumed in buildings, and the amount of energy required to construct new buildings. Most energy modeling programs that are used to calculate urban scale demand require a full range of data inputs on different types of energy use, looking far beyond individual silos. JUCCCE argues that energy planning efforts in China should similarly involve a wide array of stakeholder inputs.

Lastly, JUCCCE seeks to introduce mayors to a new set of energy experts through its extensive international knowledge network. This network includes finance, engineering and energy consultants (McKinsey & Co., Philips, Dow, DT Shaw, Arup, Broad Air Conditioning, and ICF Consulting), waste-to-energy experts (Covanta, HDR Engineering), non-governmental organizations (Alliance to Save Energy, World Bank), and leading academic institutions (Columbia University, Tsinghua University, and China

Academy of Urban Planning and Design). The goal of the network is to provide mayors with the latest information on energy topics, energy planning consulting support, and turn-key technology and financing solutions. Although JUCCCE's name implies a singular focus on US-based expertise, the knowledge network is global in focus, and includes experts already on the ground in China. JUCCCE is also developing a customized library of 'best practice' energy efficiency case studies that are drawn from cities around the world. These case studies will be used in future training, and made available to local officials from around China through the JUCCCE website.

4. INSTITUTIONAL IMPEDIMENTS TO CHANGE

Although the training program has the potential to heighten interest in energy issues in large and small cities across China, significant challenges remain that even the best training program will have difficulty surmounting.

First, during the opening plenary session of the 7-day training in May 2009 MOHURD Vice Minister Qiu Baoxing made a powerful observation when he told the mayors, "If you do not have knowledge of sustainability issues, you should not be a mayor."¹⁰ To the extent this portends a new scheme to 'grade' potential mayoral appointees on their environmental commitment and credentials, this could represent meaningful change.

This is necessary because it is unclear how systematically energy efficiency concerns are being factored into the performance reviews of individual local officials. Landry notes that the 'report card' used to grade local officials has historically emphasized economic development-related metrics above all else (Landry, 2008). Ge *et al* provides documentation on environmental compliance indicators relevant to local performance reviews, but these too lack clear links to energy usage levels (Ge *et al*, 2004). Recognition programs established by different government ministries similarly laud local environmental protection efforts, but to date none emphasize energy efficiency.¹¹ Finally, anecdotes shared with me by NGO and private sector stakeholders during my time in China suggests that local authority energy and climate performance is being scrutinized more closely, and *may* become explicit points of reference during evaluations. However, early efforts in this direction have stalled (China Daily 2004; Newsweek 2008). Whether these initiatives get revived bears watching, as they could provide a powerful means of fostering closer coordination among different local government bureaus.

A closely related second point is the fact that 'green economy' discussions have generated considerable buzz at each of the four mayoral training sessions held as of April 2010. Much as WWF's Low Carbon City Initiative emphasizes how renewables technology manufacturing can be an engine for local economic growth, one session at the JUCCCE training program focuses on how cities can expand their economies by satisfying local, national, and international energy technology needs. The session also emphasizes that different industrial development paths lead to

different local energy demand patterns, possibly stressing the city in ways that are harmful to long-term local economic interests (e. g., pollution, traffic, and vulnerability to energy supply shocks). The high level of interest in this talk appears to highlight the pressure that mayors are under to deliver steady GDP growth in their cities. Whether it has influenced the economic development plans of mayors once they have returned home is less clear, as an evaluation of the impact of the training has yet to occur.

Finally, mayors encounter several specific institutional challenges in China's complex policymaking environment. One example is the relatively rapid turnover of most mayors and top agency heads. Although Mayors are appointed to 5 year terms, many hold their post an average of just 30 months before moving on to their next assignment (Landry, 2008), making it difficult to sustain momentum on complex planning initiatives. It also forces Mayors to focus on short-term victories, emphasizing progress on pressing daily challenges (eg. waste management, water quality, air quality) rather than strategies with a longer time horizon. Although it is certainly true that there is much a Mayor can do to affect local energy usage during a 1-2 year time frame, a comprehensive overhaul of the capital-intensive local energy system can take decades, making it a less appealing target for attention.

5. LOOKING TOWARDS THE FUTURE

It would be wrong to either overstate or understate what has been accomplished to date. China's energy intensity mandate is virtually unmatched anywhere around the world, and the progress achieved thus far has national and global implications. Urban efficiency strategies *are* similarly achieving success, although they remain relatively limited in their policy scope. Given the dramatic growth trajectories of China's cities, local authorities will find themselves playing catch-up for some time to come.

In other words, this next round of project and planning work is critical, offering new insights into whether China can truly get its urban energy demand under control. These initiatives appear to be more expansive in their policy focus, inclusive in their approach, and enjoy heightened access to international expertise and financing. On the other hand, most of the projects discussed above are so new that it will be some time before we can gauge their effectiveness.

China cannot wait until such results are known, so central government's move to develop a mayoral training program targeting more cities is a helpful step. Here again, however, the program's long-term impact may not be clear for some time.

A regular and systematic review of local government energy planning efforts would help track such progress, although no such analysis currently exists. This analysis should seek to identify which types of policy levers (e.g., mandates, financial incentives, and educational programs) are most effective in delivering change. This analysis should also seek to openly examine any failures that occur along the way, such as the collapse of the much-heralded

Dongtan Eco-City project in Shanghai. The post-mortem has yet to fully declare a cause of death, but local government corruption, outsized ambitions (and rhetoric), and difficulties in obtaining project financing were most likely key contributing factors (China Daily 2008; Montlake, 2008). Dongtan has clear lessons for other cities, and central government must be willing to publicize both the good news and bad news to ensure that similar problems do not occur in the future.

Vice Minister Qiu Baoxing's call for mayoral engagement on sustainability issues highlights the key role that mayors assume in society and in addressing China's energy problem. However, China's historic reliance on a top-down approach means that mayors will not solve this problem alone. In the coming years, it will be revealing to see where the nexus forms between local government engagement and central government oversight of this issue. The answer will profoundly influence the trajectory of China's energy future, and perhaps provide new energy governance models from which other countries can benefit.

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