BRIC'd Up Energy Efficiency: Energy and Climate Policies in Brazil, Russia, India, and China

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ABSTRACT

The BRIC countries (Brazil, Russia, India, and China) are vitally important to the global economy and to global efforts to combat climate change effects. Individually, they face different challenges and opportunities. India and China have very large populations and extremely fast growing economies. Both countries have made significant improvements in energy intensity in recent years. India has established a national agency focused on energy efficiency and is relying on market-based mechanisms, whereas China has adopted a more command and control approach. Brazil has been very effective in promoting energy efficiency and has benefited from a largely hydro-based electric sector, indigenous production of oil and natural gas, and a strong agricultural program to address deforestation and promote ethanol feedstock from sugarcane. Russia begins its quest toward greater energy efficiency at a comparative disadvantage. Under the Soviet Union, the country industrialized heavily and the legacy industrial base and building stock is for the most part aged and inefficient. Russia's energy intensity is significantly higher than Western Europe and thus it has adopted a 40% energy intensity improvement goal by 2020 over 2007 and established a National Agency to address energy efficiency.

While each of the BRIC countries face unique challenges, all have recognized the importance of improving energy efficiency and have taken concrete steps forward. Perhaps even more significantly, given similarities in the size of these economies to the US, energy efficiency innovations in these countries will begin to offer US policymakers new policy and program models to consider. Sharing these innovations across the US and BRIC countries will become increasingly critical. By examining each country's current national energy efficiency initiatives and unique challenges to energy affordability and security, focus areas can be identified for evolving efforts.

Introduction

Brazil, Russia, India, and China (the BRIC countries) are vital actors in the global climate debate, and their energy efficiency and climate policies and programs have massive influence on the world's energy markets and climate policies. China and India are among the world's fastest growing economies and China has surpassed the U.S. as the largest emitter of greenhouse gases. Brazil is a fast growing developing country with innovative alternative fuels and energy efficiency policies.

All of the BRIC countries have recently initiated energy efficiency policies and programs. Brazil, in addition to a well developed flex-fuel program for its transport sector, has passed legislation mandating investment in energy efficiency by the country's distribution utilities.

Russia is piloting several initiatives, while India has recently established a government agency focused on energy efficiency and has developed a new regulatory structure governing efficiency improvements in several key sectors of the economy. China has announced efficiency goals and is taking several steps to improve the energy efficiency of its building stock and fast growing industrial sector.

Based on experience in designing and implementing energy efficiency initiatives in each of the BRIC countries, the co-authors' of this paper will examine the recent policy developments and programs being implemented in each nation. The paper will also examine each country's policy position on climate change, and the linkage of its energy efficiency initiatives to the climate change issue as well as the related issues of economic development, energy affordability, and energy security. In conclusion, some critical but missing aspects of an effective national energy efficiency infrastructure will be identified as an indication of where future efforts in these countries might be directed.

Brazil: Innovation in Alternative Fuels and Energy Efficiency Policies

Brazil has targeted energy efficiency programs and policies that curb its emissions and continue to support economic growth. Brazil ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and the Kyoto Protocol in 2002, which allows Brazil to participate in the Clean Development Mechanism (CDM). The CDM allows certification of emission reduction projects in developing countries and the subsequent sale of the certified emission reductions to be used by developed countries to meet their targets. Currently, Brazil is the third most active country, with 438 projects (8%), while China ranks first, with 2136 projects (37%) and India second, with 1,524 projects (27%). There are good opportunities for CDM project development in Brazil's electricity sector, especially those related to power generation by using byproducts and residues from the industrial sector, such as sugar and ethanol, chemical, metallurgical, paper & pulp and steel industries. Currently, almost half of the registered CDM projects in Brazil belong to the renewable energies category.

In April 2009, the Ministry of the Environment's enforcement agency, the Institute of Environment and Renewable Natural Resources (IBAMA), enacted the Normative Instruction 7 that requires companies to promote a mitigation program for carbon dioxide (CO2) emissions to obtain the environmental operation license for thermal power plants. The program allots a third of the budget to forest recovery and two thirds to the generation of renewable energy and measures to promote energy efficiency. After the rule was published, the companies and organizations affected by it entered with an ordinary action against IBAMA at the Court. In December 2009, this Instruction was temporally annulled by the Brazilian Judiciary Instance during evaluation.

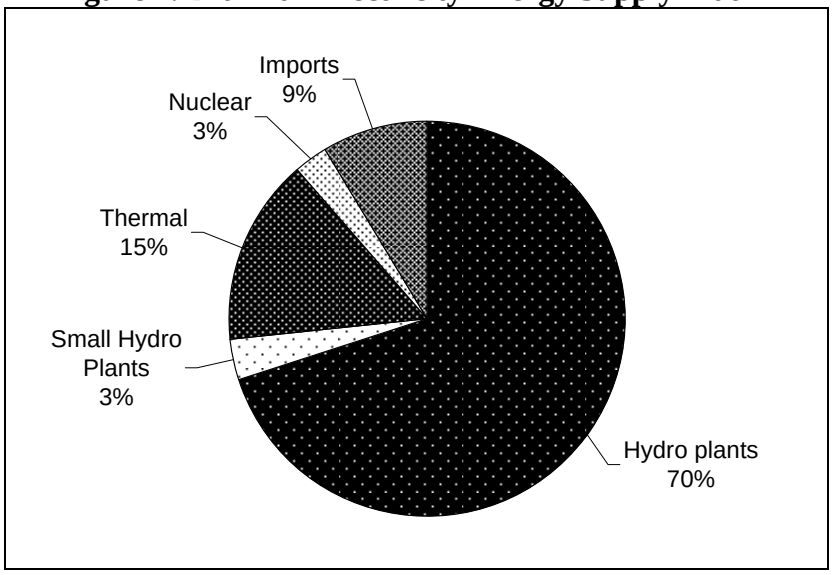
Brazil's Law # 12,187 (passed Dec. 29th, 2009) instituted the National Policy on Climate Change (PNMC). The law requires a reduction in the national greenhouse gas emissions of 39% by 2020. This goal is estimated to save approximately 1.06 billion tCO2e by 2020, and reducing deforestation is the most significant aspect of the law. The law also specifies that a decree from the Executive Instance shall establish the Sector Plans of mitigation and adaptation to climate change for the following sectors: energy generation and distribution; urban public transport and modal interstate cargo and passenger transportation systems; manufacturing industry and durable

consumer goods industry; fine chemicals industry and basic chemicals industry; paper and cellulose industry; mining; civil construction industry; healthcare services; and agriculture and ranching.

Brazil has used policy and program initiatives to leverage its renewable energy resources. In order to foster private participation in generation from renewable sources, the Brazilian government implemented the Program of Incentives for Alternative Electricity Sources (PROINFA) through the Law 10,438/02 in April 2002. This program provides incentives to private companies that generate electricity from small hydro power plants (SHPs), biomass, cogeneration, and wind resources by guaranteeing power sale contracts of 3,300 MW of energy (1,100 MW of each renewable source).

Brazil has a relatively clean energy matrix thanks to its extensive hydro generation, which represents 73% of the Brazilian electricity supply (including small hydro plants) as shown in Figure 1.

Figure 1. Brazilian Electricity Energy Supply Matrix



Source: Brazilian Energy Research Office 2008

Brazil's energy supply has several important distinguishing aspects: its electricity supply is dominated by hydroelectric generation, a renewable source; coal consumption is small compared with many other countries; domestic crude oil (and natural gas) production is in balance with consumption; and there is substantial industrial transformation and consumption of bio-fuels. Although the electricity supply is dominated by hydroelectric generation, thermal generation is increasing rapidly – rising 63.2% in 2008 (against 2007), primarily using natural gas (116.6%) and nuclear (13.1%) fuels. The 2008 average production of natural gas was 59.0 million cubic meters per day. Natural gas imports were 31.0 million m³/day during the first quarter of 2008, representing a full use of the Bolivia – Brazil pipeline. Additionally, Petrobras built and made operational natural gas liquids (NGL) facilities in the Northeast region. Brazil's biodiesel production increased 188.7% in 2008, from 404.329 m³ in 2007 to 1,167,128 m³ in 2008 (B100 - fuel originated 100% from renewable sources). Such explosive growth is due to the mandatory biodiesel addition to mineral fuel, as defined in Federal Law 11.097/05. Until 2007,

the addition was voluntary, but since Jan 1st 2008, a 2% mixture is mandatory. On July 1st 2008 the percentage was raised to 3%, and will increase to 5% this year.

The Brazilian National Program of Ethanol (ProAlcool) started in the 1970s in response to the first oil crisis and the fluctuation of sugar prices in the international market. Since then, Brazil has produced alcohol-fueled automobiles. The regulatory percentage of ethanol in gasoline sold in the Brazilian market is between 20% and 25%.

According to the Brazilian Ministry of Agriculture, sugarcane production in 2008 reached 552.9 million tons, an 11.57% increase over 2007, when harvest was estimated at 495.5 million tons. Ethanol production from sugarcane increased 20.3% in 2008 compared with 2007, reaching 27.1 billion litres. Nearly 65% of 2008 production was hydrated ethanol due to the effective penetration of flex-fuel vehicles.

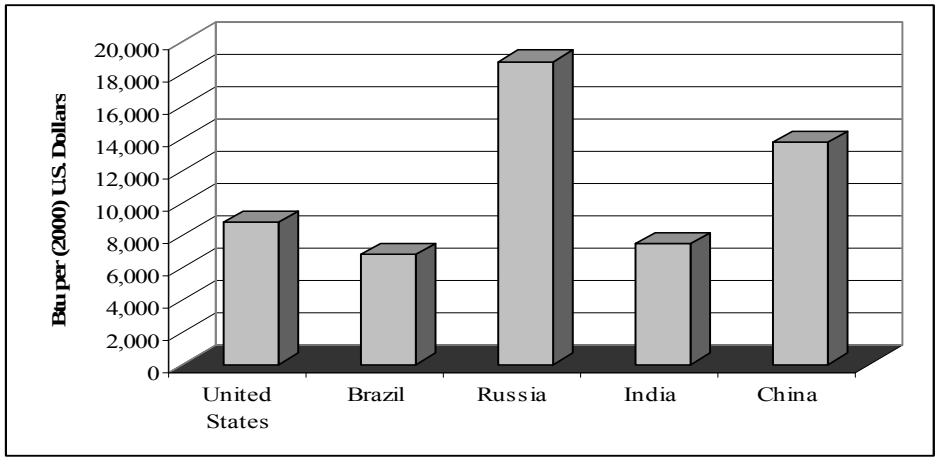
Brazil has initiated a national energy efficiency labeling program for appliances. Brazil's National Program of Electric Energy Conservation started in 1985 and the voluntary labeling program "PROCEL" started in 1993. The label has been offered to distinguish the efficiency of products such as refrigerators, freezers, washing machines, air conditioners, computer monitors, DVDs, and TVs. The PROCEL label program is shifting towards a more mandatory participation, particularly from the Energy Efficiency Law # 10.295 (Oct 17th, 2001). For example, since July 2008, all televisions sold in Brazil must have the PROCEL standby efficiency label. It is estimated that PROCEL has saved 22 billion kWh as of mid-2008.

In Brazil, the National Institute of Metrology, Standardization and Industrial Quality (INMETRO) runs the Brazilian Labeling Program (PBE) for commercial buildings, whose main product is the National Energy Conservation Label (ENCE), developed in partnership with ELETROBRAS in 2009. It is currently a voluntary program for new and existing public services and commercial buildings, but will become mandatory in the future. The PBE considers three requirements for buildings: lighting system, air conditioning system, and the building exterior. A general classification can also be given to the building based on pre-defined weights taking into account the cited requirements. Currently Brazil has five building projects with the PBE, four of them in the South of Brazil, and one in Northern part of the country.

Russia: National Policy Action for Substantial Efficiency Opportunities

In recent years, there have been significant developments in Russian legislation and regulation to encourage energy efficiency. The opportunities are substantial, since Russia has energy consumption per unit GDP many times greater than both US levels and its fellow BRIC countries (see Figure 2).

Figure 2. Total Primary Energy Consumption in BTU per Dollar of Gross Domestic Product



Source: U.S. Energy Information Administration 2006

As energy costs rise, this creates considerable competitiveness challenges for Russian industry, which over time will make industrial energy efficiency investments a priority for Russian companies competing in global markets. Similarly opportunities exist for energy-related cost savings in the residential and the municipal heating sectors, where around a third of Russia's energy savings can be made through a combination of upgrades to building energy control systems and lighting, the replacement of centralized district heating boilers with distributed boilers in tenement blocks and the deployment of better insulation and glazing. Energy metering at apartment level and separation of energy bills from apartment rental would create far better awareness of energy consumption and assist changes in energy consumption behavior.

In 2003, the Russian government published the Russia Energy Strategy to 2020 to support energy efficiency improvements. (Approved by Government Decree № 1234-h of August 28, 2003). This decree required the development of policy instruments to stimulate investment in energy-efficiency measures by energy consumers. The strategy set out to support specialized energy efficiency businesses that could attract private financing and reduce public energy budgets. The decree required energy efficiency measures to become a mandatory part of regional energy programs.

In May 2008, the Russian government ordered the Ministry of Economic Development and other ministries to prepare a program concept to stimulate energy conservation in Russia, including mandatory minimum energy-efficiency standards, introduction of energy-efficiency markets and public-private partnerships for developing and introducing new energy savings technologies. This was followed quickly in June 2008 by the Russian President, Mr. D. Medvediev, signing Decree № 889, entitled "*About some measures to increase energy and the environmental efficiency of the Russian economy*." This Decree stipulates that Russia will aim to reduce energy intensity of the Russian GDP by 40% compared to 2007. The proposed measures included technical regulation and dedicated budgetary funds to stimulate renewable energy and environmentally safe energy sources.

In September 2008, the Ministry of Energy of RF signed an order "*About creation of Coordination Soviet in order to solve problems with respect to energy saving and energy efficiency issues*" № 75 for coordination of federal and regional authorities and businesses to increase the energy-efficiency of the Russian economy. This included the development of

regulatory framework, target-programs, and implementation of energy-efficiency projects. The main objects of this proposed Coordination Soviet body (which is in effect a national energy efficiency agency) are 1) preparation of proposals for regional and federal energy efficiency programs, and 2) preparation of recommendations for regulatory support for energy efficiency.

In January 2009, Order № 1-r was signed "*The main direction of state politics in the sphere of increasing energy-efficiency of electric power on the base of renewable sources of energy for period till 2020*." This document requires an increase in the proportion of energy from renewable energy resources to 4.5% by 2020.

In late November 2009, Federal Law No. 261-FZ "*On saving energy and increasing energy efficiency and on amendments to certain legislative acts of the RF*" was signed. This new law replaces the existing Federal law "*About energy efficiency*" (№ 28 –FZ from 03 April 1996). This new law established basic principles for the regulation of energy consumption to increase energy efficiency and to stimulate more effective use of non-renewable energy resources. It also covers increased use of renewable energy resources and alternative sources of fuel to produce thermal and electrical energy. The new law obligates manufacturers of certain goods, such as household appliances, to determine energy efficiency of their products and disclose the information on labels. Labeling will be required on household appliances starting January 2011 and on office equipment beginning 2012. Starting in January 2011, public purchasing of incandescent bulbs over 100W will no longer be permitted. The law introduces energy efficiency regulations for buildings, categorization of apartment buildings by energy performance, introduction of building energy metering and incentives for energy saving in apartment buildings. It establishes requirements for energy audits, which are mandatory for certain energy-intensive organizations. It also introduces energy service contracts, mandatory energy efficiency programs for state and municipal regulated organizations, favorable tax treatment for energy saving technologies and an improved system of energy efficiency information provision. To support this increasingly favorable commercial and regulatory framework for energy efficiency, the European Bank for Reconstruction and Development (EBRD) and the International Financing Corporation (IFC) have established financing schemes to support investment in industrial and municipal energy efficiency.

India: Crafting a New Regulatory Structure

Driven by its rising population, expanding economy, and a drive towards improved quality of life, India's energy usage is expected to grow at an exponential rate. With a GDP of USD 1.23 trillion, India is currently the world's fourth largest economy[1] and the fifth largest energy consumer in the world. Due to its large population (approximately 1.1 billion), the per-capita energy consumption is comparatively low, less than one-third the global average.[2]

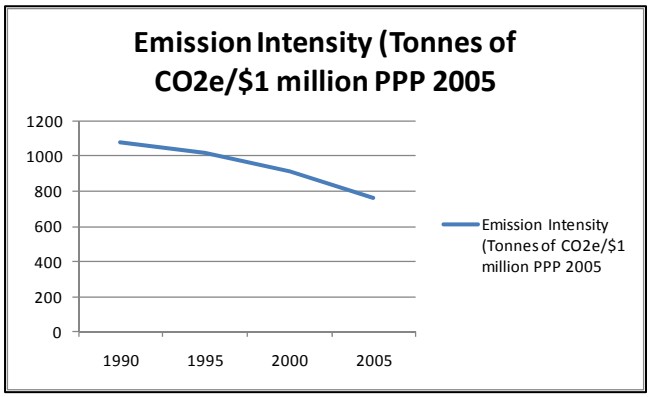
India is currently planning to create an energy efficiency market modeled on carbon emission cap-and-trade schemes, which is estimated to be worth INR 740 billion (US$16 billion) a year by 2015. The plan was proposed in summer 2009. Energy-intensive firms set efficiency targets and those that exceed their targets are awarded credits that can be sold on power exchanges to companies that fail to meet their targets. The Indian government believes the

[1] In terms of Purchasing Power Parity (PPP) terms (the GDP in PPP terms is estimated at approximately USD 3.2 trillion)

[2] The per capita consumption in India ~ 400 KWH per annum. 530 Kg of Oil Equivalent (kgoe) while the world average is more than triple that (approximately 1800 kgoe).

scheme would provide incentive for investment in energy efficiency measures while helping meet its national target of cutting the carbon intensity by 20 -25% by 2020.

Figure 3. Reduction in India Emission Intensity



Source: Ministry of Environment and Forests 2005

Prior to the Copenhagen Summit, India clarified its stance on climate change. A *Five-Point Action Plan* to help the country reduce its emission intensity (emissions per unit of GDP) by 20-25% by 2020 was presented in the parliament. As shown in Figure 3, India has successfully reduced its emission intensity by 17.6% between 1990 and 2005[3] and on the basis of this historical experience, the Indian Planning Commission has estimated that India's emissions will increase, but emission intensity could potentially decrease by 20-25%. Thus, emissions will increase at a slower rate. This would involve converting some nationally appropriate mitigation actions (NAMA) into nationally accountable mitigation outcomes (NAMO). These steps will fall under domestic jurisdiction and not be monitored internationally. India has been aggressively reducing the energy intensity of its GDP and is comparable to Germany. Only Japan, UK, Brazil, and Denmark have lower energy intensities.

India is an active participant in the Clean Development Mechanism (CDM) under the Kyoto Protocol with the second highest number of projects registered for any country and estimated to offset almost 10% of India's total emissions per year by 2012. India has been assessed as the "Best CDM Country" in a recent independent study. India has also recently approved its National Solar Mission, which sets ambitious solar energy generation targets for the medium-term.

India's building and construction sector has seen unprecedented growth since the early 1990s. The influence of western media in the 90s led to a spurt in western-style commercial and residential construction with a total disregard to context and climatic conditions of India. This trend led to a steady increase in building energy consumption from the use of high embodied energy materials such as aluminum and steel and extensive external glazing systems. These methods led to increased heat gains and consequently required the use of extensive refrigeration-based conditioning systems and electrical appliances. The first stand-alone national building energy standard/code in the name of Energy Conservation Building Codes (ECBC) was developed after the implementation of the Energy Conservation Act, 2001. Under the Act, the formation of the Bureau of Energy Efficiency (BEE) covered most aspects of energy efficiency dealing with new and existing buildings. As per the Energy Conservation Act 2001, ECBC is

[3] According to the data presented by the Minister of Environment and Forests.

applicable to all the buildings with a connected load of 500kW or contract demand of 600kVA and intended to be used for commercial purposes. The code is also applicable to all buildings with a conditioned floor area of 1,000 m2 (10,000 ft2) or greater.

The Prime Minister's Council on Climate Change has recently approved a National Mission for Enhanced Energy Efficiency (NMEEE), which sets ambitious goals for improving building energy efficiency, among other focus areas. The NMEEE places a major emphasis on the development and promotion of energy service companies (ESCO), framing them as important intermediaries between energy users and the energy efficiency market. Although ESCO business models have been in use in India for over a decade, they have had limited success because of their difficulty in finding clear monitoring standards and verifiable parameters on which to peg their performance contracts. This limits their ability to secure financing and to scale up. Through the creation of energy efficiency certificates, the NMEEE will have addressed the single biggest constraints to ESCOs by providing clear reporting and monitoring and verification standards.

The ESCO explosion that is about to unfold and represents the best entry strategy for firms wanting to position in this market. The Indian Bureau of Energy Efficiency (BEE) has already instituted a program of accrediting and rating existing companies that meet a set of basic qualifying criteria. So far, approximately thirty ESCOs with market capitalization of $20 million have been considered. This list should provide investors with a ready reference for potential acquisitions, investments or partnership targets.

BEE is also facilitating the market development process through creation of a "super ESCO," the Energy Efficiency Limited (EESL) that could potentially lead the market and address the barriers that impede investments in energy efficiency projects. EESL has already outlined ESCO activities in several key programs including the Bachat Lamp Yojana (CFL lighting scheme), implementation of energy conservation building codes, and agricultural and municipal demand side management and industrial energy efficiency. The formation of EESL allows BEE to serve more effectively as the regulator and manager of the energy efficiency market.

In recent years, India has launched successful standards and labeling programs for appliances. No-frost refrigerators are the first product to have a comparative label. The program for refrigerators was launched in May 2006. So far eleven products have been labeled by BEE. A massive communication campaign introducing the labeling program has been launched. India is also in the process of setting up energy efficiency norms for buildings and implementing a standards and labeling system for all appliances, which is expected to lead to savings of 11,689 million kWh annually in the first 5 years of operation. India has announced a roadmap for fuel economy standards for all vehicles that will be fully operational within the next two years.

ICF's work with BEE and the British High Commission has resulted in energy efficiency manuals that promote low and no cost options for saving energy in non-residential buildings.[4]

China: Working to Overcome Implementation Challenges

China is intently focused on pursuing energy efficiency strategies. It has made substantial efforts toward achieving a 20% reduction in energy intensity per unit of GDP over the past five years by working towards aggressive goals outlined in the current 5-year plan. This

[4] Manuals available at the following urls: http://www.bee-india.nic.in/ecbc/guidebook-School.pdf, http://www.bee-india.nic.in/ecbc/guidebook-Hotel.pdf,http://www.bee-india.nic.in/ecbc/guidebook-Healthcare.pdf

achievement has largely been overlooked by western policymakers. Energy efficiency efforts are focused on improving building codes and minimum standards for efficiency, increased product energy efficiency labeling and certification, and launching of successful industrial efficiency programs, such as the "Top 1,000 Program." More recently, moves toward promotion of energy service companies throughout various economic sectors, and formalized demand side management policies have begun to take shape. As China's climate policies continue to evolve, Chinese enterprises will continue to be pressured to deliver on energy efficiency to achieve China's 40-45% carbon emissions intensity reduction target by 2020. China's leaders have made recent comments indicating that a very firm hand will be driving efficiency at China's industrial and commercial enterprises. Delivering on additional energy efficiency results will be challenging, as much of the low-hanging fruit has been captured.

China's key challenge is implementation of energy efficiency activities. Regulation in China is still grounded predominantly in command and control concepts, with a host of regulations and audit-based enforcement and punishment. However, this approach is quickly becoming outdated and outstripped by the pace of development in China and experience that suggests the approach is not the most effective means to ensure policies are implemented and adhered to. These policies discourage poor energy performers but do not encourage exemplary performance. As energy efficiency policy is increasingly delegated to the enterprise/organization level, there are increasing opportunities for Chinese policymakers to more directly influence the market, which to-date has been a challenge. Concepts such as voluntary energy efficiency targets and programs, large-scale DSM, and similar strategies that have been successful in the US and Europe have not been fully investigated or implemented in China. Voluntary approaches could help China achieve more aggressive targets and provide an effective complement to regulation and enforcement. But implementation challenges associated with new approaches, such as voluntary and enterprise-level models, are substantial. Capacity needs to be built among policymakers and organizations responsible for implementation at the national and, most importantly, local levels. Chinese utilities have not been sufficiently engaged in energy efficiency and policymakers at the national and local levels do not have enough experience working collaboratively with the market to effectively support enterprise-focused programs.

While China has recently established many new building efficiency minimum codes and regulations over the past several years, there is a lack of guidance and support for facilitating existing building efficiency improvements. There is no uniform, accepted metric for determining whether a given building is efficient or inefficient, and little capacity for improving building energy performance is being offered to the marketplace.

Various international partners are now working with Chinese policymakers and researchers to develop more market facing solutions in the buildings sector. ICF is working with Chinese technical building experts and policymakers to address this issue by supporting the development of a building energy use benchmarking system for rating building energy performance. This will enable building managers to gauge the level of improvement required and set efficiency goals. A building benchmark will also provide policy makers with a useful tool on which to base sector-wide programs on either a voluntary or mandatory basis. As part of these efforts, ICF is working with local Chinese partners in the building sector to aggregate Chinese commercial building performance data, an essential first step towards creating a China-specific comparative rating algorithm and benchmarking system. The US building benchmarking tool associated with the ENERGY STAR and LEED programs is now used by

more than 100,000 buildings to manage energy performance. A Chinese benchmarking system could potentially have an even broader reach and would be instrumental in supporting focused efforts to improve building energy efficiency.

Similarly, the Natural Resources Defense Council (NRDC) is also working on a prototype building labeling system which would complement a benchmarking rating system. The association of voluntary labeling with a benchmarking rating system would offer Chinese policymakers a very power new set of market-based tools to drive energy performance improvements across the buildings sector. These efforts have the active support of key Chinese agencies such as the Ministry of Housing and Urban-Rural Development, and the China Academy of Building Research, which will help ensure successful application and sustainability of these new approaches.

China's prototype building energy benchmarking system has been developed by adapting concepts from the US ENERGY STAR buildings program. The US ENERGY STAR Portfolio Manager benchmarking tool compares a given building's energy performance against its peers in the marketplace using complex embedded algorithms that take into account varying climate, location, size, and building type.

Conclusion

In working with BRIC countries, it is challenging to check preconceptions based on US experience or to avoid simply approaching BRIC challenges with Western solutions. At the same time, decades of US experience are often sought by BRIC countries, and some fundamentals of US success are worth considering when setting larger, programmatic direction in any evolving marketplace. And, there is now enough innovation occurring across the BRIC countries that policy and implementation lessons are flowing in both directions. Across these BRIC countries, we can find useful strategies based on experience in both the US and other countries:

- **Energy and carbon tracking tools**. The capacity to inventory and then track GHG emissions and energy performance over time depends on tools in the marketplace that allow utility bills and other data to be entered, organized, and analyzed over time. Utility involvement in energy efficiency in Brazil and Russia may lead to support for these tools, and specific benchmarking tool development in India and China are obvious links to tracking capability.

- **Benchmarking tools.** In the US, the ENERGY STAR Portfolio Manager site is used by over 100,000 sites to facilitate comparative energy performance in the most prevalent US building types. USGBC has adopted this benchmarking approach as part of LEED, and states and municipalities are incorporating the ENERGY STAR benchmark as part of energy and carbon reduction programs. Again, both China and India are moving forward to create in-country tools with the key challenge being the availability of data.

- **Voluntary market transformation programs**. Programs like ENERGY STAR and LEED have significantly shifted both thinking and performance of the US market. These brands are well recognized outside of the US, and the variety of tools and tactics that

have made these voluntary programs a success are increasingly seen in programs promoting green buildings and energy efficiency.

- **DSM and ESCO infrastructure**. In the US, oil overcharge money jump started the DSM movement, culminating in significant market incentives in the mid 1990s, which might be credited, in part, with the beginning of the ESCO industry. Both ESCO and DSM concepts are familiar in BRIC countries, with program design and implementation being the next challenge.

In general, the diversity of activities across the BRIC countries easily rivals that in the US, and, the rate of implementation, based on urgent need, will be unlike what has been seen in the past decades in the US. There are important lessons for us as these major markets move to rapidly address energy issues in all sectors. For companies and programs operating across all of these countries, coordination and the ability to exchange and adapt market transformation concepts is becoming a key advantage.

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