

## THE BOTTOM LINE

Energy efficiency is among the cheapest and cleanest energy resources available. The World Bank, together with its development partners and client governments, is making a commitment to ensure that energy efficiency becomes the “first fuel” of energy policy makers and governments around the world. This brief highlights lessons learned from two decades of energy efficiency programs in many countries. Five recommendations are offered at the end of the brief. They are to focus on delivering energy efficiency at scale, to engage the private sector early, to scale up energy efficiency in the public sector, to include the residential sector, and to plan.

# Why Energy Efficiency Matters and How to Scale It Up

## What is the problem?

**Growing energy demands and continued economic growth in developing countries will create major fiscal, environmental, and social pressures**

Global energy demand is increasing at a steady pace. To meet that demand and sustain economic development, trillions of dollars will be invested over the coming decades. The International Energy Agency (IEA) projects that demand for energy will increase from about 13,400 million tons of oil equivalent (Mtoe) in 2012 to 18,300 Mtoe in 2040—a 37 percent increase (IEA 2014a),<sup>1</sup> with most of the growth coming from developing countries.

As demand grows, energy subsidies, government transfers, guarantees to state-owned utilities, and energy imports will also increase, placing enormous fiscal burdens on governments. But phasing out energy subsidies and introducing new energy and environmental taxes to curb demand will provoke social tensions and adversely affect the poor and most vulnerable.

Concerns over energy security have led to a growth in domestic resource exploitation, including fossil fuels. New coal power plants are already planned or ready to start production. These developments will have substantial adverse impacts—locally and globally.

## Can energy efficiency help meet the challenges?

**Energy efficiency offers the cleanest and most economical way to meet growing energy demands**

Energy efficiency should be the “first fuel” of energy policy makers and governments around the globe. It can help meet growing energy demands cleanly and cheaply, increase competitiveness, generate employment, secure energy, reduce poverty, and benefit development (figure 1). The IEA notes that among single supply-side resources, energy efficiency made the greatest contribution to meeting energy demands between 1974 and 2010 (figure 2) (IEA 2014b). Harnessing energy efficiency can facilitate more efficient allocation of resources across the global economy, potentially boosting economic output by US\$18 trillion through 2035.

Energy efficiency contributes to a number of prevailing development challenges (table 1), included the World Bank’s twin goals of poverty reduction and shared prosperity. Improved energy efficiency in industry modernizes factories, increasing productivity and competitiveness. This fosters economic growth and creates and protects long-term employment opportunities. In the urban and public infrastructure sectors, energy efficiency can help local governments provide more reliable public services, such as heating, power, public lighting, and water, while reducing costs. Freed up fiscal resources can then be used for socioeconomic development and for programs benefitting people living in poverty. Energy efficiency mitigates the impact of ongoing tariff reforms, which adversely affect poorer households, and it is a relatively inexpensive method for reducing global and local pollution. McKinsey Global Institute (Beinhocker and others 2008) ranks energy efficiency as the top priority among measures to mitigate climate change.



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1. Data are from the IEA New Policies Scenario, which assumes that all existing and planned energy policies are fully implemented. If only existing policies are considered, demand would be about 10 percent higher.

“Increased global commitments are already beginning to pay off. In 2011, energy savings in 11 OECD countries reduced demand by an amount that exceeded the total energy consumption of the European Union.”

Energy efficiency could curb demand by almost 10 percent (1,750 Mtoe, under the IEA New Policies Scenario) by 2040, decreasing energy intensity by about 1.8 percent per year, still short of the 2.4 percent required to contain long-term increases in the global temperature to 2°C or less.

The challenge is daunting. According to the World Bank and IEA (2015), the rate of improvement in energy intensity from 2010–12 is almost a full percentage point slower than the objective of the international Sustainable Energy for All initiative, which calls for a 2.6 percent average annual improvement for the period 2010–30. However, increased global commitments are already beginning to pay off. In 2011, energy savings in 11 OECD countries reduced demand by 1,337 Mtoe—more than the total energy consumption of the European Union (IEA 2014c).

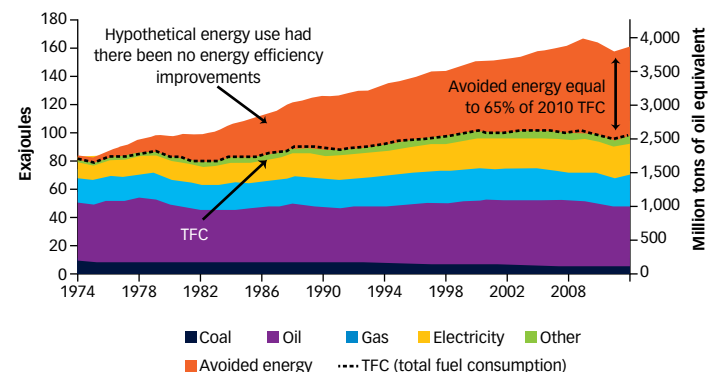
**Figure 1.** The multiple benefits of energy efficiency



Source: IEA 2014b.

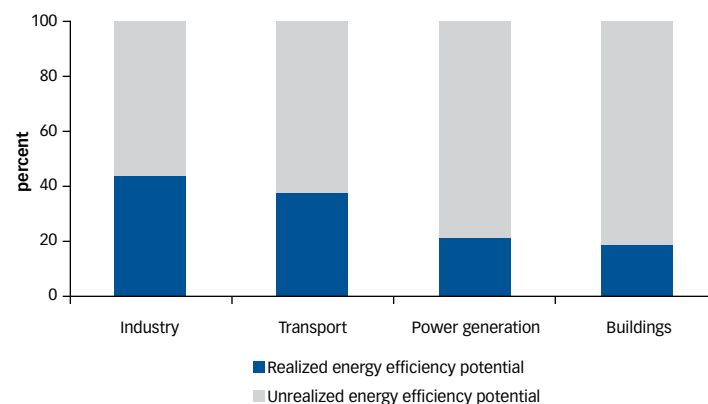
Energy efficiency continues to be a mostly untapped resource (figure 3). Although industrial productivity has improved dramatically over the past few decades, substantial gains remain available through the adoption of cost-effective measures, global best

**Figure 2.** “Avoided energy use” resulting from energy efficiency in 11 IEA countries



Source: IEA 2013.

**Figure 3.** Long-term energy-efficiency potential by sector



Note: These energy efficiency potentials are based on the IEA New Policies Scenario outlined in the World Energy Outlook 2012. Investments are classified as “economically viable” if the payback period for the up-front investment is equal to or less than the amount of time an investor might be reasonably willing to wait to recover the cost, using the value of undiscounted fuel savings as a metric. The payback periods used were in some cases longer than current averages, but they were always shorter than the technical lifetime of individual assets.

Source: IEA 2012.

**Table 1.** How can energy efficiency help tackle today's global challenges?

Development challenge	Energy efficiency can ...	Costs and opportunities—examples
Infrastructure bottlenecks and shortfalls	... mitigate impacts of supply constraints by better managing system peak loads and easing demand during shortages, minimizing productivity losses.	In Turkey, a seven-hour blackout in March 2015 resulted in an estimated US\$700 million loss in production.  The United States has saved 150 GW in peak demand over the past 30 years through refrigerator efficiency standards alone.
Fiscal constraints	... ease fiscal limits through reduced energy and fuel subsidies, fiscal transfers to distressed public utilities, and energy costs for publicly owned assets (e.g., buildings and street lighting).	Energy accounts for 8 percent of Serbia's fiscal deficit due to energy subsidies, direct transfers to state-owned energy utilities, and guarantees for utility borrowing.  An initial evaluation of the European Union's advanced buildings directive expects €30–40 billion in direct benefits to the public budget. The addition of tax revenues and reduction of unemployment benefits increases the estimate to €67–128 billion.
Energy security	... enhance energy security by easing the need for energy imports, making local energy resources last longer, and reducing volatility in energy supply and prices.	Vietnam's energy consumption has tripled over the past decade, making it one of the most energy-intensive economies in East Asia. It has, as a result, become increasingly reliant on imported coal after having been virtually energy independent (1997–2007).  Japan has replaced half of its missing nuclear power capacity since the March 2011 earthquake, tsunami, and subsequent nuclear disaster at Fukushima, solely with energy efficiency measures.
Economic growth, competitiveness, and jobs	... develop new industries from the reduction of energy waste (e.g., energy service companies), improving industrial productivity and creating employment opportunities.	Small and medium-sized enterprises, which constitute over 80 percent of industrial firms in India, face high and rising electricity costs coupled with supply shortages (about 10 percent overall; 17 percent at peak times), undermining their global competitiveness.  A study on the impacts of energy efficiency programs in Canada shows a net increase of Can\$234–580 billion in GDP, with 1 dollar of spending yielding 5 to 8 dollars in GDP and the creation of 30–52 jobs.
Poverty reduction	... lower overall energy bills and the percent of household income devoted to energy, thereby decreasing energy poverty.	The lack of cost-reflective tariffs cost countries in Europe and Central Asia 0.5–1 percent of GDP. Effective social assistance programs and energy efficiency could alleviate these losses.  An electricity connection regularization program in the slums of Sao Paulo, Brazil, promoted energy efficiency measures and formal connections. Nonpayment was reduced by 67 percent and customer energy use by 40 percent.
Environmental stewardship	... reduce local and global pollution in a most cost-effective manner.	Russia is the third largest energy-consuming country, but it is more energy-intensive than the top 10 energy-consuming countries. Through energy efficiency, it could eliminate almost 800 million tons of CO <sub>2</sub> per year—equal to the total energy consumption of France.  China has embarked on one of its most ambitious energy efficiency programs. From 1980–2010, energy intensity declined by 70 percent, resulting in CO <sub>2</sub> emission reductions of 24.4 billion tons.
Energy access	... support reductions in energy losses that increase energy access or lower upfront costs for off-grid energy services.	Under a national grid extension initiative, Rwanda is distributing more than 900,000 compact fluorescent lamps to new household connections, enabling it to reduce the load on the grid and connect to more homes.

Sources: Media reports and technical studies available from the author upon request.

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practices, and available technologies. The building sector, which represents almost 40 percent of global energy demand, can still meet more than 80 percent of its potential through improved building codes and deep retrofits. Tapping into these cost-effective measures will require an additional investment of US\$3.8 trillion by 2035, with simple payback periods of two to eight years.

### Why has energy efficiency been difficult to achieve?

#### Market failures and implementation barriers have so far prevented energy efficiency from reaching its potential

Energy efficiency investments are generally profitable and cost-effective, with energy savings repaying investment costs over time. However, many energy efficiency improvements have not been made owing to market failures—systemic barriers that prevent the realization of energy efficiency’s potential. Those barriers include:

- Poor market incentives, including low energy pricing that makes investments in energy efficiency less attractive and encourages overconsumption.
- Weak capacity and governance of energy efficiency agencies, which inhibits their ability to influence changes in policies and markets, deliver effective programs, and be accountable for results.
- Lack of data on energy use, baselines, and systematic evaluations of programs, costs, and impacts.
- Absence of international consensus on the most-effective policies and approaches for scaling up energy efficiency (e.g., regulations, incentives, or market-based mechanisms), the appropriate role of government and public financing, and how cultures and behaviors can be changed.

Thus, on-the-ground results and expanding policy targets have substantially lagged behind the tremendous potential for energy efficiency. But circumstances are beginning to change.

### What have we learned?

#### The past two decades have yielded valuable lessons to countries at all levels of development—but more systematic evaluations are needed

Despite challenges, governments have continued to promote energy efficiency with varying degrees of success. These initiatives have yielded valuable lessons, some of which are being incorporated into new policy and program designs or have already been operationalized and promise improved performance.

The lessons learned are first summarized in bullet form, followed by details on each point.

- Policies must be accompanied by enforcement and implementation.
- National targets and reporting improve accountability.
- Programs should be designed for implementation at scale.
- Simpler program and business models are needed.
- Incentives must drive markets.

**Paper policies are insufficient.** An expanding list of countries have developed commendable policy frameworks backed by sound secondary regulations. Governments must urgently shift to policy implementation and enforcement to realize the gains these policies represent. For example, since 2007, China has substantially stepped up its enforcement of energy-saving building codes through: (i) strong regulatory support, including the deployment of “acceptance codes” at a building’s commissioning phase; (ii) stable government budgets for implementation and enforcement agencies; (iii) transparent management of the certification of third-party companies; (iv) clear rules and responsibilities for noncompliance; and (v) an effective national program for inspections (Bin 2012).

**National targets focus attention.** Broad energy efficiency legislation and frameworks are useful when establishing institutional mandates, a legal infrastructure, funding mechanisms, and initial obligations. However, national targets are better at holding policies, institutions, and programs accountable for results because they usually require evaluations of policies and programs. The ensuing assessments make it possible to adjust those that are

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not performing. In 2008, India launched the National Mission on Enhanced Energy Efficiency, which called for annual savings of at least 23 Mtoe by 2015. Turkey’s 2012 National Energy Efficiency Strategy calls for a 20 percent reduction in energy intensity by 2023 (compared with 2011 levels). Both countries are now improving their monitoring and evaluation systems to better assess impacts and enhance policy implementation and program designs.

**One-off pilots are not helpful.** Pilot projects are usually seen as a way to test implementation mechanisms on a small scale. However, most pilots are done without any commitments or means for scaling up successful schemes, and the experiences are lost soon after the program ends. Emphasis should be placed on national-level programs that can create economies of scale. This would allow for the pooling of government and donor resources into country-led initiatives that are ultimately sustainable. For example, the World Bank is helping the Mexican government launch a national municipal energy efficiency program with a pilot in 32 municipalities covering street lighting, municipal buildings, and water pumping. The pilot will test the design and financing scheme. After savings and repayments are verified, the program—designed to be scalable—will expand to the national level, covering all 2,438 municipalities as well as all municipal sectors.

**Delivery models used in developed countries must be simplified and adapted.** When public financing is deemed necessary to develop or scale up a target market, models from Europe, Japan, and North America can offer valuable suggestions, but usually they must be adapted to suit the local context. Feedback mechanisms that enable learning from program lessons and improvements during implementation are also important. For example, in 2010, with World Bank assistance, South Africa’s power utility, Eskom, launched the Standard Offer Program,<sup>2</sup> a successor to its demand-side management program. The program was based on a North American model. It was then revised based on experience and customized to meet the energy needs of South Africans (ESMAP 2011).

**Energy service companies (ESCOs) can serve as a mechanism for financing and delivery of energy efficiency, but**

2. A standard offer is a mechanism for acquiring demand-side resources. The utility, regulator, or other government agency agrees to purchase energy savings or load reduction for a predetermined rate based on verified energy savings. Any end user, energy service company, equipment supplier, or other entity can propose ideas to reduce energy use, but it will be compensated only after completion of the plan and verification of savings.

this approach is often too complex for use in emerging markets. ESCOs cannot succeed if they are undercapitalized, if clients are only marginally creditworthy, if accounting and legal systems are underdeveloped, and if data are insufficient or unreliable. Until the market can develop organically, ESCOs should have simple business models and modest requirements for performance guarantees and verification of energy savings. In 2011, the World Bank developed an energy efficiency program for public facilities in Armenia using simplified ESCO contracts under which the service company is paid for an approved design, delivery of the project, and commissioning.<sup>3</sup> Only the last payment is tied to a performance test. To date, the Armenian R2E2 fund has signed more than 58 ESCO contracts. According to World Bank project documents and progress reports, all are performing well.

**Incentives, incentives, incentives!** Incentive gaps related to energy efficiency are numerous. Public agencies investing in energy efficiency fear budget reductions. Utility companies fear a decrease in sales if they help customers cut energy use. When bills are based on heated floor area, customers that are more efficient may not realize any cost savings. And although landlords own buildings and equipment, tenants often pay the energy bills, so neither party has a sufficient incentive to invest in energy efficiency. Careful resolution of misaligned incentives is critical to ensure good implementation and high participation. In the United States, the Property Assessed Clean Energy (PACE) mechanism was developed to overcome energy efficiency challenges in commercial buildings. PACE allows for long-term financing of energy efficiency measures, often for as long as 20 years, enabling more-ambitious retrofits. If a building is sold, the PACE payments are transferred to the new owner.

Markets are responding to these lessons and informed policies. Global estimates indicate that in 2012, the energy efficiency market rose to an estimated US\$310–360 billion, more than supply-side investments in renewable energy or coal, oil, and gas (IEA 2014c). Energy efficiency financing is becoming more mainstreamed and has

3. Under an energy service agreement, the financier (typically an energy efficiency fund or public ESCO) provides financing for an energy efficiency project, usually to a public or municipal client. The client agrees to continue paying current energy bills (or baseline energy costs). The new (lower) energy bills are paid from an escrow account, and the remainder goes toward repayment to the financier. This kind of scheme offers clients a significant advantage by relieving them of operational risks, enabling them to maintain a positive cash flow. Energy service agreements are typically viewed as long-term contract obligations. They are therefore not generally counted against public debt. Such agreements are being used or considered in Armenia, Belarus, Macedonia, Mexico, Turkey, and Ukraine, among other countries.



“Within the World Bank, lending for energy efficiency has become a mainstreamed business line, with more than US\$5.2 billion lent over the five fiscal years ending June 30, 2015.”

greater specialized products, from on-bill utility financing to ESCOs to green bonds. International financial institutions provided more than US\$4.23 billion for energy efficiency in 2013.

### What has the World Bank done?

#### The Bank has mainstreamed lending for energy efficiency

Within the World Bank, lending for energy efficiency has become a mainstreamed business line, with more than US\$5.2 billion lent over the five fiscal years ending June 30, 2015. However, the business remains volatile: Lending has ranged from a high of US\$2.1 billion in fiscal 2011 to a low of US\$218 million in fiscal 2015. Three-year

averages indicate that lending is declining—from US\$857 million per year in 2008–10 to US\$530 million in 2013–15—but several extensive programs are in the pipeline in Bulgaria, China, Egypt, Mexico, Russia, and Vietnam. The recent restructuring of the World Bank and the formation of Global Solution Groups and Global Leads offer an opportunity to scale up energy efficiency lending.

The Bank’s current energy efficiency portfolio covers the major sectors: industry, public, and residential (table 2). The lending figures include supply-side investments in generation, transmission, and distribution of electricity and heat, but these are not included in the table because their modalities are more typical, with commercial and regulatory incentives to drive utilities to reduce their losses, reinforced by World Bank lending toward the same end. However,

**Table 2.** World Bank program models for energy efficiency

Sectors	Industrial and commercial	Public and municipal	Residential
Program models	Credit lines, loan guarantees, mezzanine funds	Public financing, energy efficiency/urban development funds, super ESCOs, credit lines, loan guarantees	Utility DSM/rebates, bulk purchase, credit lines, loan guarantees, manufacturer incentives
Description	Lending to one or more local banks to support portfolio of smaller energy efficiency investments in public/private enterprises	Lending to government or financial intermediary to support portfolio of energy efficiency investments in public entities	Lending through utility/intermediary to support efficient appliances and home renovations
Implementing agencies	Commercial banks, guarantee companies	Ministry PIUs, energy efficiency funds, public ESCOs, commercial/development banks	Utilities, commercial/development banks, equipment manufacturers
Success factors	<p>Market analysis to identify target market(s)</p> <p>Strong, stable demand built through multiple channels and technical intermediation</p> <p>Appropriate financial products, standardized to lower transaction costs</p> <p>Committed banking partners with internal capacity raised as needed through technical assistance</p>	<p>Strong, committed implementing partners</p> <p>Target sectors with a strong stake in energy efficiency and credible borrowing profile</p> <p>Repayments and periodic recapitalization to ensure sustainability</p> <p>National program framework with regulatory obligations to drive demand</p> <p>Project bundling to lower transaction costs</p>	<p>Simple delivery mechanism to avoid disrupting typical supply chains</p> <p>Strong management commitment within utility and appropriate financing/ regulatory incentives for DSM</p> <p>Incentives targeting poorer consumers</p> <p>Effective outreach and social marketing</p>
World Bank examples	<p>Ongoing: China, India, Jamaica, Tunisia, Turkey, Ukraine, Uzbekistan</p> <p>In pipeline: Egypt, Russia, Vietnam</p>	<p>Ongoing: Armenia, Bosnia &amp; Herzegovina, India, Kosovo, Montenegro</p> <p>In pipeline: Belarus, Macedonia, Mexico, Turkey</p>	<p>Ongoing: Bangladesh, Benin, Mexico, Rwanda</p> <p>In pipeline: Bulgaria</p>

Source: World Bank reports and data.

DSM = demand-side management; ESCO = energy service company

“Unlike supply-side energy efficiency, which focuses on a few large investments, demand-side energy efficiency programs require intermediaries or bundling agents to bring many heterogeneous investments under one program.”

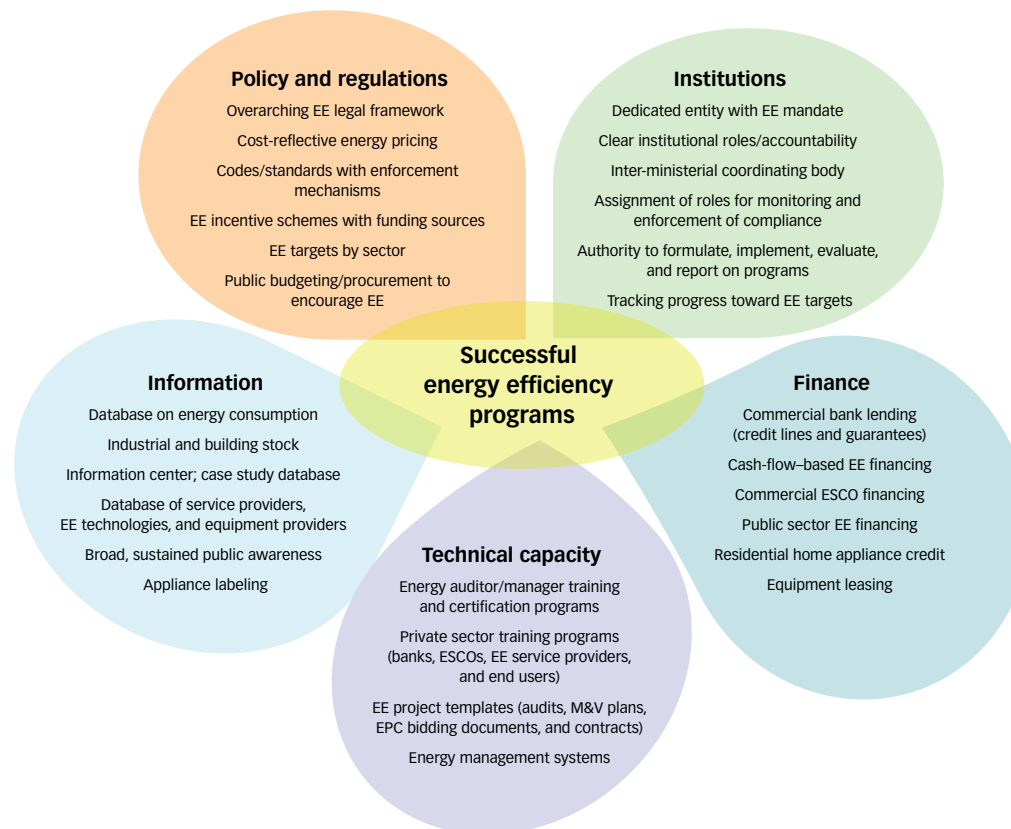
unlike larger infrastructure or supply-side energy efficiency, which is focused on a few large investments, demand-side energy efficiency programs require intermediaries or bundling agents to bring many heterogeneous investments under one program. These bundling agents can be energy utilities, commercial or development banks, special purpose funds, public or super-ESCOs, or equipment manufacturers or suppliers. Program performance is frequently based on the ability of the bundling agent to identify a strong subproject pipeline, to finance and implement subprojects, and to monitor and report results.

What are the priorities for future action?

**Once the prerequisites are met, policy makers should treat energy efficiency as the first fuel of the present century**

National energy efficiency programs should be based on a comprehensive policy and regulatory framework, strong and accountable institutions, dedicated financing mechanisms, detailed and reliable data and information, and measures to enhance technical capacity (figure 4).

**Figure 4.** Framework for successful energy efficiency programs at the national level



Source: World Bank 2015.

EE = energy efficiency; EPC = energy performance contract; ESCO = energy service company; M&V = measurement and verification.

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Once there is a solid framework in place, governments must develop programs to address existing barriers and achieve national energy efficiency goals. Energy efficiency programs can take many forms—for example, providing information, special access to financing, incentives and subsidies, tools and guides, and training—to help end users finance and implement energy efficiency measures. Such programming should be systematic and based on market studies. Plans should have clear objectives, measureable indicators, and defined exit strategies, and they should be subject to broad consultations with potential participants, service providers, financiers, and other stakeholders. Key steps in program design and implementation include:

- Collection of relevant market data to determine energy efficiency potential and prevailing policy and market deficiencies
- Analysis and synthesis of data to determine program goals and expected impacts
- Development of program strategies and designs
- Identification of target markets
- Development of implementation strategies and plans through broad consultations
- Engagement of implementing agents and development of their capacity
- Monitoring and evaluation of program results
- Learning from results to improve program designs and phase out programs that have achieved their goals or have proven to be ineffective.

After the foundations are laid, policy makers can begin to treat energy efficiency as *the first fuel for the next century*. Five key recommendations follow:

#### **Focus on delivering energy efficiency at scale.**

Policymakers should develop a range of program models for financing and implementation at the national level. Pilot programs should be accompanied by commitments from the country and potential financiers to expand successful initiatives to national scale. Donors should be encouraged to pool funds in support of national programs to avoid parallel and competing endeavors and to allow donors broader policy engagement, ensuring that policies and regulations,

institutional setups, and enabling environments are in place to sustainably support implementation of a national program.

**Engage the private sector early.** Most energy efficiency potential lies in private factories and buildings, so the private sector should be involved at the start of any initiative, whether as an end user, a potential implementer, or a possible financier. Although early consultations on programming and design can support efforts to ensure that limited public funds will attract commercial financing at a later stage, government support is necessary to develop financing and implementation mechanisms. There must also be buy-in from likely market actors on the approaches and models being tested with public funds so that after government programs are phased out, those actors will be willing to take over financing and expansion. In addition, there must be agreement on the indicators needed by private firms to meet their conditions for investing (e.g., rates of return, default rates, and stable demand). Governments should also seek input and feedback from the private sector on their policies and programming—regulatory and voluntary mechanisms, incentives, information, and technical support (e.g., industrial and building tools, case studies and best-practice guides, recognition for high performers).

**Scale up energy efficiency in the public sector.** Developing countries have pressing needs to rehabilitate old and build new infrastructure, because public buildings, schools, hospitals, street lights, water pumps, and other infrastructure are often outdated and poorly maintained. But credit constraints often limit access to commercial financing. Developing citywide or national programs that target public energy users could have a catalytic effect on local markets, attracting new service providers and equipment suppliers, increasing competition, and driving down prices. Common ownership and similar building types (e.g., schools and hospitals) offer excellent opportunities to bundle projects or equipment purchases, which can provide significant economies of scale. Local governments also have huge investment needs across all sectors: transport, water, waste, buildings, lighting, and energy. Regulations are critical for ensuring that any new infrastructure—e.g., water systems, public buildings, and municipal street or traffic lighting—adhere to national standards that discourage overconsumption of energy.



## MAKE FURTHER CONNECTIONS

Live Wire 2014/11.

“Designing Credit Lines for Energy Efficiency,” by Ashok Sarkar, Jonathan Sinton, and Joeri de Wit.

Live Wire 2014/18.

“Exploiting Market-Based Mechanisms to Meet Utilities’ Energy Efficiency Obligations,” by Jonathan Sinton and Joeri de Wit.

Live Wire 2014/25.

“Doubling the Rate of Improvement of Energy Efficiency,” by Jonathan Sinton, Ivan Jacques, Ashok Sarkar, and Irina Bushueva.

Live Wire 2016/54.

“Fostering the Development of ESCO Markets,” by Kathrin Hofer, Dilip Limaye, and Jas Singh.

Live Wire 2016/55.

“Designing Effective National Industrial Energy Efficiency Programs,” by Feng Liu and Robert Tromp.

**Don’t forget the residential sector.** The residential sector is among the largest (typically comprising 60–70 percent of building energy use) and most challenging for realizing energy efficiency. Having regulations in place and increasing enforcement, particularly of national appliance standards, is an important first step. Many countries have commercial credit programs for residential consumers, but too often these serve only high-income households. Programs with incentive schemes tend to yield more positive results. In terms of programming, bundling agents are more difficult to recruit for the residential sector because investments are smaller and the markets more heterogeneous, but utility DSM programs, credit schemes through banks, and bulk purchases and discounts by manufacturers are viable responses to this problem. Strong communication campaigns and behavior change mechanisms are also critically important owing to the diversity of behaviors, motivations, access to information, financing, and other factors.

**Plan.** In most developing countries, poor planning introduces inefficiencies that can take decades to resolve. Systematic energy sector planning, integrated resource planning, coordinated infrastructure planning, and careful land use and urban planning—all are essential and should be accompanied by stringent codes and standards. Energy sector planning should consider demand-reduction options as well as new supply, allowing the least-cost energy development plans to be formulated. Municipalities should emphasize integrated city planning and urban designs to maximize energy efficiency and improve the quality of life where people work and live. Examples include increasing density in urban areas, developing transit corridors, and incorporating mixed-use space. Infrastructure planning should be integrated to ensure that implications to the energy cost and efficiency of other systems (e.g., roads, water, heating, and cooling) are adequately considered.

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