Financing Energy Efficiency in Developing Countries – Lessons Learned and Remaining Challenges

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October 2009

Abstract: Although energy efficiency implementation is increasingly being recognized by policymakers worldwide as one of the most effective means to mitigating rising energy prices, tackling potential environmental risks, and enhancing energy security, mainstreaming its financing in developing country markets continues to be a challenge. Experience shows that converting cost-effective energy savings potential, particularly the demand-side improvement opportunities across sectors, into investments face many barriers and unforeseen transaction costs. This paper draws upon selected experiences with financing energy efficiency in developing countries to explore the key factors of various programmatic approaches and financing instruments that have been applied successfully for delivering energy efficiency solutions. Through case studies, a diverse range of institutional issues are examined related to the identification, packaging, designing, and monitoring approaches that have been used to catalyze traditional and innovative financing of energy efficiency projects. With adequate liquidity in major developing country markets and availability of modern energy savings technologies, it is often the institutional issues that become a key challenge to address in order to finance and implement robust energy efficiency programs. As further operational experience is gained, increased knowledge sharing can lead to scaling-up of such energy efficiency investments. The paper concludes with some options for accelerating implementation.

Introduction

Based on recent estimates by the International Energy Agency (IEA), the world's primary energy needs will grow by about 45 percent from 2006 to 2030, requiring some US$26 trillion investment in enhanced system capacities. About 87 percent of this growth is expected to occur in developing countries. Unfortunately, fossil fuels are expected to remain the dominant source of primary energy, accounting for about 80 percent of this projected increase. China and India, which together account for about half of this increased demand, will continue to rely heavily on coal to fuel their growth (IEA 2008a).

There is a critical need to help developing countries meet their growing energy needs in order to maintain robust socioeconomic development. The recent volatility of oil prices and current projections show an increased reliance on oil and gas, and have collectively heightened concerns over energy security issues. Furthermore, increasing concerns over climate change will necessitate the need for low-carbon options to be more actively pursued, with IEA's Reference Scenario showing increases in CO_2 emissions, from 28 Gigatons (Gt) in 2006 to 41 Gt in 2030, an increase of 45 percent.

Unfortunately, while traditional development trajectories and models have been shown to be unsustainable, they continue to serve as ideals for developing countries, leading to increased urbanization, urban sprawl, high levels of consumption and car ownership, numerous energy-using appliances, disposable goods, etc. all of which represent affluent yet inefficient lifestyles.

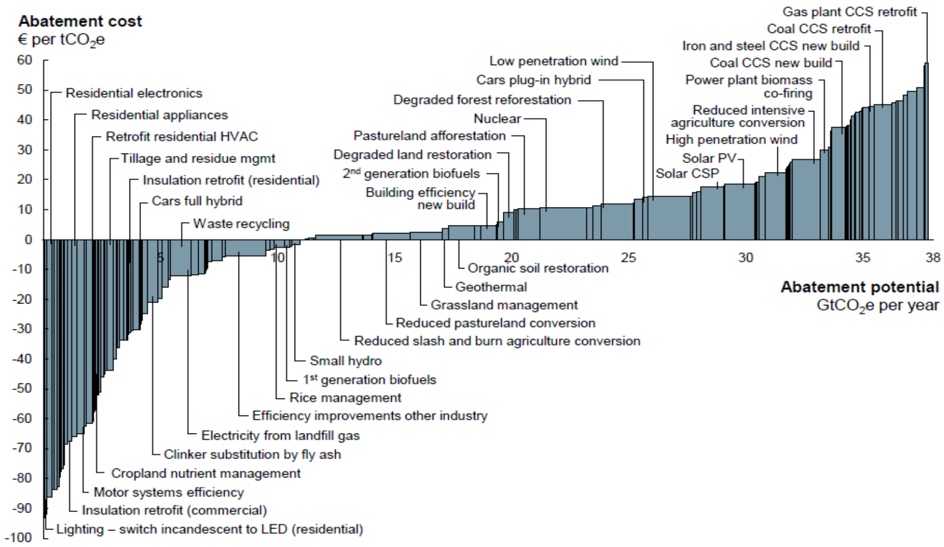
[1] The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of, and should not be attributed in any manner to, the World Bank, to its affiliated organizations, or to members of its Board of Executive Directors or the countries they represent.

Potential Gains from Energy Efficiency

Energy efficiency (EE)[2] is rapidly becoming one of the most critical policy tools around the world to help meet this substantial growth in energy demand. By all accounts, EE programs have always represented a win-win-win option by providing positive returns to the government, energy consumers and the environment.[3] Such programs can: conserve natural resources; reduce the environmental pollution and carbon footprint of the energy sector; reduce a country's dependence on fossil fuels thus enhancing its energy security; ease infrastructure bottlenecks and impacts of temporary power shortfalls; and improve industrial and commercial competitiveness through reduced operating costs. In terms of project economics, EE options are seen as "no regrets" policies, since their net financial cost can be negative, i.e., the measures are justified purely based on high financial returns. EE comes out to be a win-win option even in a pricing regime where tariffs do not reflect costs, because it saves utilities buy or build megawatt capacities that are much more expensive than it takes to save through a "negawatt" measure.

Amongst a limited menu of feasible technical options currently available to help reduce the rate of growth of greenhouse gas (GHG) emissions produced by the energy sector, EE technologies stand apart as the most cost-effective ones, as shown in numerous analysis by various stakeholders, ranging from scientific communities such as the IPCC to the private sector practitioners such as the analyses done by McKinsey (see Figure 1, below). According to the IEA, the implementation of EE policies could result in nearly 36% of avoided GHG emissions by 2050.[4] And, more than two-thirds of these GHG reductions could come from demand-side (end use) EE interventions across different sectors in developing countries.

Figure 1. Global GHG Abatement Cost Curve - 2030



Source: McKinsey & Company (2009)

The business case for EE is clear and includes positive returns on investment, reduction of energy costs and energy dependency, as well as significant co-benefits, which include economic growth and job creation. However, EE technologies, particularly those on the demand side (shown as negative

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[2] EE refers to the adoption of improved technologies and practices in order to reduce the energy required to provide the same output or level of service.

[3] Without EE measures adopted from 1973 onwards, energy use in 11 of the major OECD countries (36 of global primary energy use) would already have been 56% higher in 2004. This represents fuel costs savings of over US$500 billion. Yet, there is more happening as the world's energy use continues to grow and there is huge EE improvement potential across many sectors that remains to be tapped.

[4] IEA developed a set of 25 policy recommendations that, if implemented, could reduce the global CO_2 emissions by 20% per year by 2020 (IEA 2009a).

costs in Figure 1) are relatively more complex and difficult from an implementation standpoint. Due to the fact that the delivery of energy savings from these apparently straightforward EE technologies is not easy, the rate of implementation of EE policies and measures as well as the adoption of energy efficient technologies and best practices lag well behind the opportunities that exist for energy savings in industry and other economic sectors.

Despite the promising benefits of EE, achieving significant and sustained efficiency gains has proved a daunting challenge in all countries (see Box 1). The major constraints to increased EE financing and implementation are inherently institutional in nature (Taylor et al. 2008). When institutions cannot enforce or govern EE regulations, the impact is often detrimental. If financial institutions are not geared towards lending for EE, which are not traditional asset-based deals and pose higher risk perceptions as they are driven by estimated energy savings, credit for EE is hampered. Many sectors have principal-agent or "split-incentive" barriers, where one entity, such as a builder, installs equipment while another one, such as a owner or tenant, pays the electric bills. Further, lack of information about EE and awareness amongst various stakeholders leads to market failure in EE sector. While some mechanisms, such as utility demand-side management (DSM) and energy service companies (ESCOs) were developed to address these institutional challenges and have worked well in the OECD countries, experience has shown that the institutional mechanisms must be designed very carefully and adapted to fit local needs and situations.

Box 1: From EE Technology to Delivering Energy Savings- The Missing Link

Even with currently available technologies, estimates show 30-40% efficiency potential across many sectors and countries, which have yet to be converted to investments. For instance, 70% of the global public and buildings lighting (which consumes 20% total global electricity consumption), including in industrialized world, can save 50% energy even using current technologies. Over 90% of street lights around the world (including the industrialized world) use technologies which consume 40% more energy than efficient high pressure sodium vapor lamps, a technology that has been around for over two decades, and is now being take over by even newer third generation technologies based on efficient LED and other high efficiency fluorescent technologies for street lighting. On the appliances front, IEA estimates indicate that switching to best available household appliances would save 40% of residential energy consumption, globally $130 billion per year in costs.

Source: Authors; IEA (2008b).

As a result, many feasible EE projects remain unimplemented and EE results continue to lag expectations. The high potential of EE improvements thus have yet to be realized globally to have truly transformative changes. This has also been the case with some Organization for Economic Cooperation and Development (OECD) countries where they have failed to implement the policies effectively as they face similar pervasive barriers (IEA, 2009b).

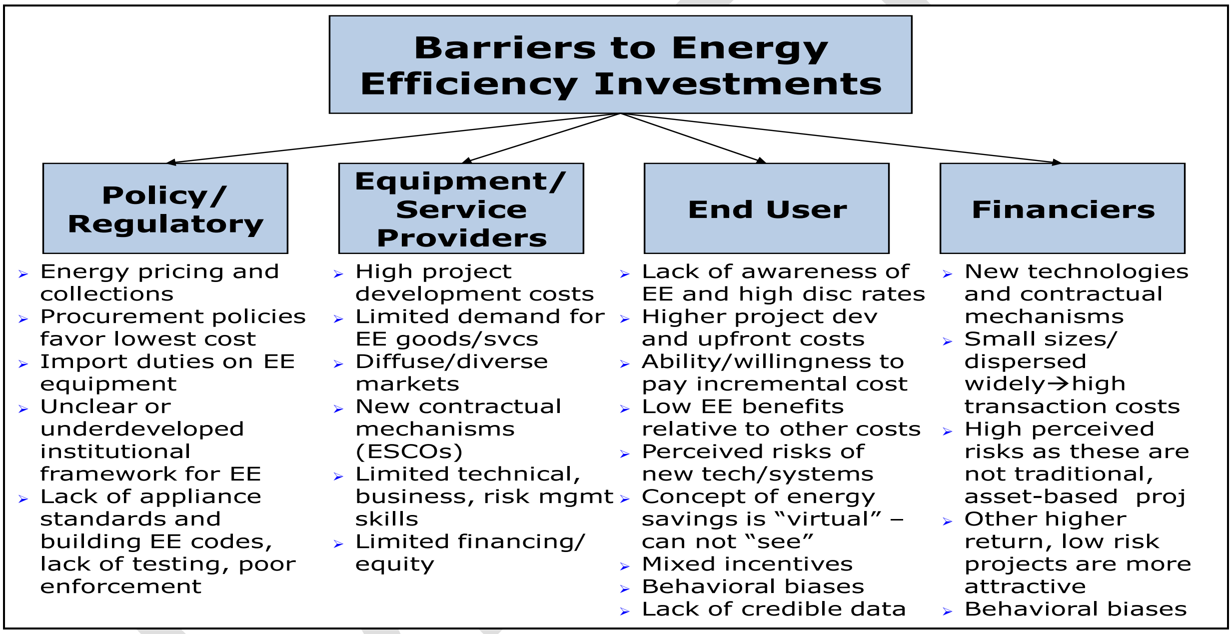
Implementation Challenges

As policy makers and practitioners well know, there are numerous informational, technical, financial, institutional and behavioral barriers for EE across a wide range of stakeholders (see Figure 2). This represents the nature of the problem; many small market failures and gaps in information and perception that can be very difficult to overcome. In addition to these project level barriers, there are other more systemic ones that affect the developing countries, in particular:

- ✓ ***Lack of consensus*** on best practices to promote EE, i.e., regulation vs. incentives/subsidies vs. market-based schemes vs. awareness/informational issues, the right balance between these mechanisms, and the appropriate role of government;
- ✓ ***Project-by-project solutions*** to address what are inherently larger and more systemic challenges, requiring a more ambitious and concerted engagement at all levels of government and in all sectors;

- ✓ ***Overreliance on Western EE program models (e.g., DSM and ESCOs)***, which can help guide developing countries but need to be significantly adapted to suit local markets and conditions;
- ✓ ***Lack of EE data***, which is compounded by the lack of internationally recognized indicators to adequately compare countries relative EE levels to take into account their economic structure, climate, geography, population, and other factors, and to effectively determine the real potential for improvements;
- ✓ ***Poor EE governance*** among EE and related institutions which can undermine government policy frameworks and initiatives, including inability to enforce or govern EE regulations and coordinate different level of government, the international community, the private sector and civil society***;***
- ✓ ***Energy subsidies*** which continue to diminish the returns from EE improvements; and
- ✓ ***Lack of institutions and capacities*** for public agencies to organize, transform and develop new and nascent markets for EE goods and services, and for local private sectors to adopt state-of-the-art EE technologies and practices.

Figure 2. Barriers to Energy Efficiency Investments



Source: Authors.

World Bank Support for EE

Despite these hurdles, the World Bank Group (WBG) has been able to steadily increase EE lending, especially in recent years. From FY2003 through FY2009 (July 2003-June 2009), the WBG has invested over US$4.4 billion to support EE programs.[5] In FY2009 alone, US$1.7 billion investments were committed by the WBG, of which over 80% represented commitments in projects. These projects have included a variety of mechanisms and sectors, ranging from International Development Agency (IDA)-funded energy efficient lighting interventions in Mali to International Bank for Reconstruction and Development (IBRD)-funded buildings EE project in Belarus to Clean Technology Fund (CTF)-funded EE financial intermediation for private sector projects in Turkey to

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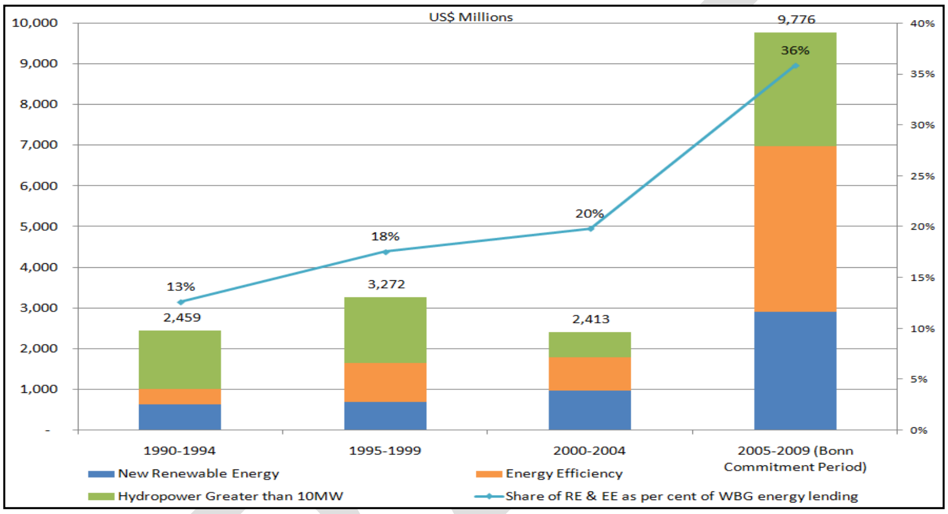
[5] In a broader context, the definition of EE in the WBG context includes load management and energy saving measures on both demand and supply side. Demand side interventions include activities such as those that generate energy (electricity or thermal) savings without reducing the output (in physical or economic terms) across various sectors (industry, municipalities, residential, agricultural, transport, etc.). Supply side interventions include efficiency improvements through district heating systems, combined heat and power plants, rehabilitation of power generation systems and, upgrading of transmission and distribution lines, etc.

Global Environment Facility (GEF) and carbon finance-blended innovative financing program for replacing old chillers (for air-conditioning units) with energy efficient/CFC-free chillers in commercial buildings and industrial establishments in India.

In addition to contributing to GHG mitigation, application of clean energy technologies have helped advance the development goals of WBG client countries by reducing oil imports and total energy costs and by improving economic competitiveness. The WBG has also been able to respond quickly to the uptake in demand by its clients, partly driven by the volatility of oil and other conventional energy prices, concerns about reliable access to adequate energy supplies, greater concerns about climate change, and the cost reductions and technology maturation in both EE and renewable energy. As Figure 3 shows, the WBG financing of these projects and programs rose 24% in the last fiscal year to reach US$3.3 billion, the highest ever.

Figure 3. World Bank Group Financing for Energy Efficiency



Source: World Bank (2009c)

Over the past two years, the WBG launched several initiatives that have a strong bearing on its continued and expanded support for EE. The WBG's Development and Climate Change: A Strategic Framework (SFDCC) serves to guide and support the operational response of the WBG to new development challenges posed by global climate change. Some of the major initiatives have been embedded within the SFDCC, to grow the clean energy portfolio more proactively, with emphasis on attaining more ambitious goals. Under the SFDCC, the WBG will increase financing for EE and renewable energy projects by an average 30% a year, from a baseline of US$600 million in average annual commitments during FY2005-07, and expand lending to hydropower, with the share of low-carbon projects to 50% by FY2011. This commitment comes on the heels of, and as a logical extension of, the WBG meeting its EE and renewable energy commitments from the Bonn Conference in 2004.

EE Financial Approaches and Program Models

There have been a number of program modalities tested in developing countries, most with roots from developed country experiences. The WBG has worked with all of these approaches in various forms. Key models, along with some of their relative strengths and shortcomings, based on WBG operational experiences, are discussed below.

Utility DSM. Utility demand-side management, or DSM, is generally defined as programs implemented by a utility to change the consumption patterns of their customers. This can include efforts to reduce peak loads to increasing consumption during low load hours. In the developing country context, housing EE programs with local utilities has been a common approach, since the utilities often have the strongest technical and implementation capacity and many donors already provide direct assistance to them (e.g., Argentina, Bangladesh – see Box 2, Brazil, India, Mexico, Pakistan, Philippines, South Africa, Sri Lanka, Thailand, Uruguay, Vietnam). This institutional set up has a number of benefits since utilities have: strong institutional capacities with financial means; qualified technical and administrative staff; an in-depth understanding of their customer load profiles and consumption patterns; incentives for targeted peak load reduction programs and easing demand when supplies are limited or supply costs exceed tariffs; ability to bundle many small EE projects within its customer service territory for bulk financing and an existing recovery mechanism (utility bills); core planning functions which can take into account EE as a resource option; and, interests to develop new lines of business and relationships with existing customers through DSM advisory services. In smaller countries with limited institutional capacities and alternatives, utility DSM may be the only viable option for implementing and financing EE programs. Between 1993 and 2009, the World Bank supported about two dozen utility DSM programs globally (World Bank 2005a; Heffner et al. 2009, World Bank data).

Box 2. DSM in Bangladesh

Due to peak load deficits of over 2,000 MW, load shedding during peak hours is a regular occurrence in Bangladesh. Poor electricity service has also been identified as a major constraint to the country's sustained economic growth and, hence, its ability to alleviate poverty. At the same time, the demand for electricity continues to grow at the rate of over 500 MW/year due to population growth, increased industrialization, additional connections and rise in modern, electrical appliances.

In 2009, the World Bank approved a project to finance a utility DSM program to help alleviate these issues through large scale replacement of customer incandescent bulbs with high efficiency compact fluorescent lamps (CFLs). Over 10 million CFLs, will be distributed free of charge to residential consumers in 10 cities in early 2010, to replace incandescent lamps. As lighting coincides with the peak load hours and contributes over 20% of the demand, this initiative is expected to reduce peak power demand by about 360 MW and help reduce load shedding significantly while improving power supply reliability, particularly in the rural areas. The investment of only US$15 million compares very favorably to the alternative of installing a comparable amount of new peak generation capacity estimated at US$235 million. In addition, the project is expected to bring an additional $5-10 million in carbon revenues through the implementation of associated CDM using a programmatic approach.

Having realized the importance of EE improvements and the need to utilize the large energy savings potential across various sectors, in 2008, the Government also drafted the Energy Conservation Act, which is expected to be endorsed by the Parliament in the near future, and has introduced some other electricity load management measures, such as time-of-use pricing and mandatory shop closures.

Source: Authors; World Bank 2009b.

Given major electricity shortages in many countries across Sub-Saharan Africa and South Asia, load reduction programs using compact fluorescent lamps (CFLs) have been on the rise. The World Bank supported only about half a dozen programs in the 1990s and early 2000s (most with GEF support) but, since 2005, has consulted with over 15 countries on implementing such programs, many with IBRD loans, IDA credits, and carbon financing. While these are generally viewed as an emergency response, the economics are quite attractive. One million CFLs can reduce the peak by about 38 MW at a cost of less than $40 per kW, compared with supply costs of $500-2,000 per kW. From the customer perspective, a CFL often has a payback of less than six months.[6] The "carbon economics" are even more favorable, with carbon emission reduction purchases paying up to $2.00 per CFL[7].

[6] Assumptions include: 38 W savings per lamp @*pf*=0.7, CFL cost of $1.50, 4 hours use per day, 4-year (5,840 hour) CFL life, average tariff of US$0.07/kWh.

[7] Assumptions for carbon economic example: 38 W/CFL @*pf*=0.7, 5 hours use per day, CFL cost of $1.50, 20% T&D losses, 4-year (~7,000 hours) CFL life, grid emissions factor 0.6kgCO_2e/kWh, $12/t$CO_2$e.

The approaches have varied substantially from direct utility bulk purchase and giveaways to branding with utility bill financing.

Despite some of the promising attributes, WBG experience with utility DSM programs has been mixed. A number of these programs were able to meet short-term objectives and successfully launch several DSM programs and reduce peak demands and save energy. Unfortunately, in most cases, DSM functions within the utility (and their funding) have not generally been sustained over time. This has been due to a variety of factors, including wavering utility management commitment to DSM programming (from a perceived lack of institutional incentives), limited regulatory mechanisms/incentives to allow utilities to recover DSM program costs and lost revenues, difficulties sustaining DSM functions through utility/sector restructuring, and concerns over equity (if all end users pay the DSM surcharge but only some sectors benefit from DSM programs). Where the short-term programs have been identified, the program coincides with utility interests and an external source of funding is identified, the projects have generally performed well. However, where the objectives required longer-term commitments, or where external funding mechanisms were needed, utility commitment has waivered.

Experience to date suggests that continued short-term programs may still be viable especially with an external source of funding, particularly where end-uses coincide with peak loads. Careful documentation of economic and financial analyses of all DSM programs (considering direct costs and more indirect costs/benefits such as lost revenues, environmental gains, deferred investment, economic losses from load shedding, etc.) is important to identify various stakeholder costs and benefits so that participation costs and incentives can be appropriately applied. Experience has been better where the utility acts as a service provider (where revenues are present) or as a market facilitator (where revenues are not); in the latter case a clear exist strategy should be developed. From an institutional perspective, different options should be considered, such as: DSM units with complete in-house capability to design, implement and evaluate programs; core DSM units with many functions outsourced to contractors; or DSM bidding/standard offers, where the utility identifies one or more DSM programs and then bids out program implementation to the private sector, typically with payments based on actual energy savings/load reduction (see Box 3). Regulatory mechanisms may also be needed to create mandates or incentives for utilities to participate, including identifying funding mechanisms. Where this is not feasible, the government may consider periodically contracting with select distribution utilities for specific DSM program implementation functions.

Box 3. ESKOM's Proposed Standard Offer

South Africa is currently experiencing power shortages and load shedding, as generation capacity has not increased for more than 10 years despite a steady growth in electricity demand. Increasing power shortages could pose a serious threat to sustained economic growth and economic competitiveness.

ESKOM, the national utility, has indicated its goal of saving 3,000 MW by 2012 through DSM measures to help mitigate this crisis. ESKOM has implemented DSM programs to help curb demand for over ten years, but recently sought options to dramatically scale-up program implementation. In 2007, they reduced peak demand by 152 MW at a cost of US$75 million. They have now developed some of the most ambitious programs ever – a 30 million CFL program, a one million solar water heating campaign and have considered a standard offer. The standard offer is a mechanism to acquire demand-side resources (energy efficiency/load reduction) under which a utility purchases resources based on a pre-determined rate (e.g., R/kWh or R/kW). Purchase rates can be determined by the long-run marginal cost of supply or estimated subsidies necessary to attract commercial bids. ESCOs, equipment suppliers or other organizations that can deliver energy/demand savings at the agreed rate are eligible to submit projects and are paid once the projects have been implemented and savings certified by an authorized monitoring and verification organization.

Source: World Bank data; Xiaodong Wong and Grayson Heffner (World Bank), pers. comm.., 2008.

ESCO Development. Energy service companies, or ESCOs, are commercially-operated companies that help end users identify, package, finance, implement and monitor energy savings projects. Typically, this is done through energy performance contracting (EPC), where the ESCO (and financier, if not the ESCO) is paid over time from the energy savings. ESCOs have been a very attractive model for implementing EE projects, precisely because they are designed to address a number of the inherent barriers to EE investments and overcome the critical institutional barriers associated with packing, financing and implementing such projects while taking on project performance risks. It is also a way to facilitate access to commercial financing, since financing can be collateralized based on the guaranteed savings benefit stream. Further, these ESCOs can serve as market aggregators, by allowing financiers to support a portfolio of EE projects. The World Bank has developed over three dozen projects to support the development of local ESCO industries, including Brazil, Bulgaria, China (see Box 4), Croatia, India, Poland, Thailand, Tunisia, Turkey, Uruguay, and Vietnam.

Box 4. Chinese Energy Management Companies

In the mid-1990s, China sought out new, market-based models to promote EE. The Government piloted the use of a commercial company model, which they refer to as energy management companies (EMCs), to offer full-service ESCO contracts for public, commercial and industrial energy consumers. Three pilot EMCs were established in the Beijing municipality, and Liaoning and Shandong provinces to test and demonstrate the EMC model and work with the Government to address policy and market issues that arose. Because the model was carefully adapted to meet the Chinese context and the pilot EMCs enjoyed strong government support, the program has been one of the most successful adaptations of the EPC mechanism in the developing world. By 2006, their combined annual EPC investments reached about US$30 million. More importantly, during this same period, the EMC industry has grown to over 400 companies, with a combined investment of more than US$1 billion in 2007 alone.

Source: Taylor 2008.

Despite the promising attributes of the model, development of sustainable ESCO business models in developing countries has proved challenging. Many countries often lack the legal and financial policies and systems to accept and enforce such complex contractual models. International ESCOs, while initially very eager to operate in the developing world, quickly realized that many prospective customers took a lot of time and capacity building to adequately understand and accept such contracts and customer creditworthiness was not assured. The creation of new ESCOs, on the other hand, has been slow and ineffective when these new entities lacked the proper skills (corporate/financial management, credit assessment, risk management, sales), had no track record in the local market and had weak balance sheets which undermined the credibility of their performance guarantees. Many customers have simply been unwilling to accept ESCO contracts because they did not understand how to fully assess the relative technical merits, costs and benefits associated with ESCO proposals.

World Bank experiences have generally concluded that ESCO promotion and development is a long-term undertaking and must have significant government support in order to succeed. Considerations for target markets, long-term financing requirements and potential sources, substantial market organization and development, massive dissemination of early successes, proactive resolution of common legal, financial, accounting/tax and other issues associated with EPCs, etc. are all necessary. Such a perspective is reinforced when viewing the number of years it took for ESCOs to be considered mainstreamed in North America and elsewhere and the substantial support, particularly in the public sector market. Also, the portfolio of ESCO projects around the developing world has uncovered a greater variety of contractual models for EPCs that requires further study (World Bank 2005a). While the "full service ESCO" model has been more common in North America, simpler models may be more appropriate in developing countries, at least until the market as a chance to evolve to more sophisticated contractual arrangements over time.

Special Funds, Credit Lines, and Loan Guarantee Programs. Over the past decade, the development of dedicated financing programs has become a major aspect of many government and donor EE programs. These were deemed necessary when end users, ESCOs and other actors experienced difficulties accessing appropriate and affordable financing sources. There has been a wide range of mechanisms under this category, including credit lines, revolving funds, special purpose funds (including equity, mezzanine), partial credit guarantees and loss reserves, special purpose vehicles, etc. In most cases, access to local capital was not an issue, so some designed their interventions to mobilize local commercial capital for EE programs. Others saw little prospects in the near-term to influence local banks, so developed parallel mechanisms to provide financing until the local banks were able and wiling to pick up the business line. Since 1997, the WBG has supported more than three dozen projects dealing with EE financing, including Bulgaria (see Box 5), China, Hungary, India, Lithuania, Philippines, Romania, Russia, Thailand, Tunisia, Turkey, and Uruguay.

Box 5. Energy Efficiency Financing in Bulgaria

Commercial banks in Bulgaria were failing to meet the demand for capital from the many financially viable energy efficiency projects because of a lack of liquidity in the capital market and the perceived high risks of energy efficiency investments. Many small and medium-sized enterprises, housing cooperatives, municipalities, hospitals, and other entities thus had very limited access to project financing.

In 2006, the Bulgarian Energy Efficiency Fund (BEEF) was established as a dedicated, PPP-based finance facility to support energy efficiency improvements in the country. Its initial capitalization was US$15 million, including a US$10 million GEF grant through the World Bank, contributions from the Bulgarian and Austrian governments, and cofinancing from private Bulgarian firms. BEEF is a commercially oriented fund, and it achieved financial self-sufficiency in 2009. BEEF offers three financing products for energy efficiency projects dealing with building rehabilitation, street lighting modernization, small co-generation systems, and other projects:

- Loans to small, bankable energy efficiency projects (up to US$1 million)
- Partial credit guarantees, with up to 80 percent coverage
- Low-cost portfolio guarantees to ESCOs and housing cooperatives, with coverage up to the first 5 percent of delinquent payments in the portfolio

In its first three years of operation, BEEF approved more than 75 energy efficiency projects valued at US$21.9 million, with BEEF financing of US$11.5 million, with about 60% of the projects approved in the public sector.

Source: World Bank 2005b; Istvan Dobozi (World Bank), pers. comm. 2009.

Performance of these programs has been mixed; while some were quite successful in stimulating local bank lending and investment, many suffered from chronically low deal flow – due to a variety of reasons. In some cases, the markets may not have been sufficiently developed with strong institutions capable of packing and delivering high quality projects for financing, while other cases the program was not properly designed or sufficiently adapted to meet local circumstances. In other cases, the banking sectors in these countries were still under development or in transition, which made designing appropriate appraisal methods and financing products more difficult. More experiences are needed, as well as substantially better sharing of implementation experiences across countries. Full market analyses are critical to identify early pipelines and expected market challenges; programs should be designed based on solid commercial principles, be flexible and have a fair sharing of incentives commensurate with risks; financial partners should be selected competitively and with care; programs should be developed to meet the financing partner's core business objectives to ensure their full and sustained participation; multiple channels for identifying and preparing projects should be employed; and, the program should be intensively and continually marketed.

Experience in WBG projects demonstrate that it takes substantial effort in terms of time and money to set the right institutional framework and enabling environment to convert the EE potential into real investments, through innovative structuring and financial engineering of the deals which help address the risks and barriers in EE investments. In many situations, the small scale of the EE project investment makes the transaction cost highly prohibitive. Banks must understand the nature of the EE businesses, the opportunities and risks, in order to develop suitable financing products, marketing strategies, develop suitable appraisal methods, determine reasonable default projections, and the like. (See Box 6 for an example from China.)

Box 6. Fostering EE Technologies in China through Financial Intermediation

The iron and steel industry is the second largest industrial user of energy (over 23 Exajoules, EJ, in 2005. It is the largest industrial source of GHG emissions (around 3% of global GHGs). China accounts for 45% of this potential, partly due to its 34% share in the total world steel production. IEA estimates that if best available steel making technologies were applied worldwide, the total energy savings potential is almost 4.5 EJ (that is, almost 20%), with annual GHG emissions reduction potential of 340 million tons of CO_2. The Electric Arc Furnace (EAF) method is much less energy intensive (4-6 GJ of energy/ ton of steel output) compared to Basic Oxygen Furnace (BOF) technology (13-14 GJ of energy/ton of steel output). Significant energy savings and, therefore, GHG emissions reductions, can be made by switching from BOF to EAF, and also blast furnace improvements, waste heat recovery, coke dry quenching (instead of coke wet quenching), etc. The World Bank's China Energy Efficiency Financing Project (IBRD-$200 million, GEF- $13.5 million) provides financing to two financing intermediaries in China – China Exim Bank and Huaxia Bank – which will on-lend funds for energy efficiency improvements in industry sector in China, including the iron and steel industry. In addition, the $12.9 million World Bank Carbon Finance project approved in FY2008 is aimed to help switchover to more energy efficient coke dry quenching process in Baotou Iron and Steel Industry in China.

Source: World Bank 2008a & 2008b; IEA 2008b.

Market Transformation. Another common approach is to promote the adoption of more efficient products in market, such as refrigerators, CFLs, or chillers. This is done by targeting one or more products (or end uses), rather than by consumer (or end user), and developing strategies and incentives to increase market penetration rates of the efficient models. Unlike some of the recent CFL programs, which have been largely designed to achieve short-term load reduction benefits, market transformation programs seek longer-term goals to shift the market on a sustained basis. Strategic interventions can vary widely and include utility DSM, standards and labeling, bulk purchase/market aggregation, marketing/promotion, technology transfer, financing (including carbon finance), subsidies/rebates, manufacturer negotiations or a combination of these. The biggest issue has generally been how best to overcome the incremental costs for the efficient models and thus incentivize end users to change their purchasing behaviors. However, over the past decade, this has been made easier as costs for many energy-efficient appliances have declined, partially due to increased demand and partly because more products are being manufactured in developing countries. The GEF has financed much of these efforts in developing countries, mostly through the United Nations Development Programme (UNDP), but the WBG has also implemented about a dozen programs in India (see Box 7), Mexico, Philippines, Poland, South Africa, Thailand, and Vietnam.

Bulk purchases, utility financing, and negotiated bulk discounts have all been fairly successful at bringing down incremental costs. Where incremental costs were negligible, labeling and marketing campaigns have generally been adequate. Strong upfront market research and an in-depth understanding of consumer purchasing patterns and influences can have a great impact on the quality of program designs. Use of market-based mechanisms has the best prospects for sustainability, however, where barriers exist, strategic government intervention can be very helpful. Introduction of voluntary mechanisms (e.g., labels, voluntary standards, financing) first before mandatory ones (e.g., standards, import bans) has also worked better in many markets. Judicious use of subsidies can help stimulate markets but such tools are best restricted to early promotional periods and target markets segments and explicit sunset provisions included. Enforcement, where necessary, should be effective and efficient. Programs must maintain a high degree of credibility, by ensuring technical product quality and credibility of labels, and develop competitive and sustainable delivery mechanisms that support local/international participation and flexibility as market conditions change over time. And, well-designed marketing efforts can be critical to bridge the gap between supply and demand.

Box 7. Energy Efficient Chillers in India

In order to meet India's commitment under the Montreal Protocol to phase-out the new demand for ozone-depleting chlorofluorocarbons (CFCs) by 2010, the World Bank and Government of India launched the Chiller Energy Efficiency Project (CEEP)'s, designed to accelerate the replacement of centrifugal chillers with efficient non-chlorofluorocarbons-based centrifugal chillers.

With GEF and Multilateral Fund for the Implementation of the Montreal Protocol (MLF) assistance of US$6.3 million and 1 million respectively, effectively leveraged with estimated carbon finance of US$5.85 million, this innovative project will replace 370 CFC-based inefficient chillers used in commercial buildings and industrial establishments. Under this scheme, carbon credits generated by about initial group of 215 chiller replacements which are funded through grant-based incentives of around 20% (of the total replacement cost) from GEF and MLF, would be used to provide further grant subsidies for another 155 chiller replacements. The main financial intermediary, the Industrial Development Bank of India (IDBI), along with other domestic banks will provide the financing to chiller owners, manufacturers, ESCOs, etc. CEEP is estimated to reduce energy consumption of targeted chillers by 30 percent, thereby helping Government of India meet its goal of increasing the overall EE by 20% by 2016-2017. It is estimated that about 158 metric tons of CFCs from 370 chillers will be phased out over a 20-year period. This pioneering model of integrating GEF and MLF assistance with carbon revenues obtained through a programmatic CDM approach is now being replicated in the Philippines.

Source: World Bank 2009a

Subsidy/Grant Mechanisms. While direct subsidies and grants do not directly address market barriers on a sustainable basis, they can be used effectively in the short-term to demonstrate new technologies or delivery mechanisms, overcome initial high costs and reduce perceived risks. Such options may be more appropriate to support commercial transactions where the credit barrier is too high or the banking sector is still underdeveloped, although some developed countries do use these instruments as a means of dealing with the prevailing low priority placed on EE considerations in the marketplace. It can also be developed in concert with other approaches, provided the subsidies do not undermine the other market-based approaches. Programs employing such mechanisms should be efficiently and effectively administered in order to prevent creating new bureaucratic barriers to the market, include sunset provisions for when the grant objectives have been achieved (and indicators to monitor achievement of these objectives), and support intensive dissemination of early results. The World Bank has only supported a limited number of such programs (see Box 8 for an example from Vietnam).

Box 8. Small Grants in Vietnam

Vietnam has experienced unprecedented growth, with resulting electricity demand increasing by 15-18 % per year for more than a decade. A small number of commercial energy efficiency service providers have emerged but have experienced difficulties growing their businesses given the lack of lending culture and perceived risks associated with energy saving projects. The World Bank, with GEF support, initiated a US$1.1 million small grants program where up to $8,000 would be provided for each audit and up to $30,000 as an investment bonus for each project implemented. Part of the audit grant was held back to incentivize the service providers to encourage the customers to implement the projects. The amount of the grants was reduced during the project period as customers began sharing a greater part of the costs. The project is expected to leverage about $7.5 million in private investment and, to date, about 111 projects have been registered with a total estimated investment of $4.8 million, with 59 under construction and 17 completed.

Source: World Bank 2003 and data.

Lessons Learned from Implementation Experiences

Based on the World Bank's experiences, as well as those documented from other development partners, EE implementation is difficult and requires a long-term, dedicated focus. A successful institutional framework for EE must take into account the country context; technical and management capacity; new legislation and rules to enable EE investment; level of integration between EE and other clean energy and clean development goals; requirements for organizational autonomy, flexibility and agility; funding mechanisms; and importance of stimulating private sector participation. Some other emerging lessons have been identified, including:

- Conduct ***holistic market assessments***, to determine realizable EE potential, public and private capabilities, critical policy and market barriers, misaligned institutional incentives, etc. in order to develop a clear operational strategy to impact the market.
- Look to international experiences for common program strategies and approaches, but ***adapt and tailor models to suit local conditions***, including prevailing policy environment, market realities, and capacities of institutions to ensure better program effectiveness and local buy-in.
- Design programs to be ***commercially-oriented***, ***demand-driven***, and ***flexible*** in order to help create sustained shifts in the market and adjust based on changing market conditions and implementation realities.
- Achieve a ***strong balance*** between policy frameworks, institutional arrangements, training, and implementation - policy without program implementation or vice versa has had limited effectiveness. A similar balance is needed between the technical information and assessments and the financial and transaction intermediation.
- Focus programs to ***deliver real energy savings within 1-2 years*** to build program credibility and learn from early implementation. Programs that have been overly focused on outputs (energy audits, market studies, training, action plans) have generally had minimal impacts.
- Provide participating institutions (banks, service providers, end users) with ***clear incentives to actively participate***; stakeholders should share in rewards commensurate with risks borne.
- Develop ***well-designed parallel marketing efforts***. Such channels can include conventional approaches, such as case studies and workshops as well as more innovative ones that may involve nongovernmental organizations, local schools, etc. In some cases, use of performance-based contracts for marketing contractors (i.e., payments based on positive leads or sales) can help create more focused and effective strategies.
- Provide ***intensive and sustained technical support*** to address unforeseen and emerging barriers, ongoing skills enhancement, behavioral biases, institutional inertia, etc. and create feedback loops so that early implementation experiences can be incorporated into future training efforts.

EE Scale-Up Challenges

Despite numerous attempts, including significant efforts on part of the development community in accelerating EE scale up, the results has been very difficult to accomplish. Without large clusters of viable projects, serviced providers and financiers are reluctant to enter the market. Determining how dispersed EE projects can be organized, packaged, financed and implemented in the most effective and efficient manner has proved very difficult. Viable projects, in turn, are difficult to identify and develop without the supporting market actors to realize a project's implementation. The result is end users continuing to purchase the same products as before and suppliers to interpret this behavior as a clear lack of demand for more efficient products, creating a self-fulfilling prophecy. Three other key major areas in the scale-up dilemma are:

- ***EE Retrofits vs. New Systems*** - While retrofits have been slow to implement, much of the future EE potential can be derived from infrastructure that has yet to be built. How can retrofits of existing systems be significantly accelerated? How can the design of new systems (e.g., new urban areas, factories, buildings, energy and transport systems) be most appropriately influenced?

- ***Regulations vs. Incentives*** – Regulatory mechanisms[8] can be the least-cost way to transform markets, particularly for new products and systems. However these require strong and effective local institutions and good governance, which can take years to cultivate. How can improved regulatory and enforcement regimes be fostered? How can regulatory measures be best complemented with voluntary programs, perhaps with incentive schemes?
- ***Global Trade*** – A majority of the more energy-efficient equipment has been designed and developed in OECD countries, which creates a major disincentive for developing countries to adopt stringent EE standards. Middle income countries are under pressure to support their local manufacturing base, which can include a diverse mix of firms including small and medium enterprises; least developed countries often do not have domestic supply but worry about affordability of efficient, imported equipment. How can the international community help address these developing country disincentives? What types of different approaches need to be developed for importers vs. exporters? How can the private sector be engaged to help address these issues?

Accelerating Energy Efficiency Implementation

The greatest EE contributions to a low-carbon development path lie in systematic efforts to reduce the energy intensity of specific end-use sectors, through efficiency (technological) improvements, rational energy pricing, and market liberalization, and an optimal, and often phased mix of the key approaches to scale up EE -- (i) Enabling **Regulations** and Institutional Governance Structures, (ii) Targeted Financial **Incentives**, and (iii) Knowledge Sharing and **Information** Dissemination Mechanisms -- have to be tailored to meet each of these very different areas. At the same time, the actions have to be practical and have large-scale replicable potential, high world-wide scalability and impacts.

In an effort to reduce the financing resource gap in addressing the challenge for scaling up EE, the World Bank's own funds continue to be complemented by new concessional resources, in addition to the GEF and carbon market finance. The main one among these new incentive mechanisms is the Climate Investment Funds (CIF) under the SFDCC. CIF is a new source of financing to pilot projects to initiate transformational change towards low-carbon and climate-resilient development. The CIF funds, to be disbursed as grants, highly concessional loans, and/or risk mitigation instruments, are being administered through the multilateral development banks and the WBG for quick and flexible implementation of country-led programs and investments. CIFs consist of the Clean Technology Fund (CTF) with donor commitments of US$5.2 billion, and the Strategic Climate Fund (SCF). The CTF is designed to promote scaled up demonstration, deployment and transfer of low-carbon technologies in power sector, transportation, and EE in buildings, industry and agriculture. Explicit provision has been made for private sector participation as part of an overall emphasis on market transformation (see Box 9).

There is also a strong need for improving the share of EE in carbon markets. Carbon finance, as an incentive mechanism, has not helped the EE agenda as much as it was anticipated when flexible mechanisms such as CDM were conceived under the Kyoto Protocol. A very small share of global carbon market trade through CDM has been for demand-side EE projects so far, due to the barriers that EE traditionally faces which are further exacerbated by complex and demanding CDM rules and procedures. The barriers are in terms of complex monitoring and verification of savings associated with EE projects and the fact that carbon revenues are earned after the project is implemented and

[8] These could include appliance standards, building codes, vehicle inspection and maintenance, automobile fuel efficiency standards, industrial benchmarks, sectoral regulations on utility losses, etc.

does not address the issue of incremental finance required to cover the higher upfront costs of EE measures.

Box 9: Mobilizing Incentives through the Clean Technology Fund

- Investment plans endorsed with a total funding envelope of US$1.85 billion
- Average leverage US$ 1 to 10 billion
- US$5.2 billion pledged

Mexico	Turkey	Egypt
EE Program - replace inefficient lighting and appliances expected emissions reductions of 4 million tons of CO2 per year Urban Transport - 20 bus rapid transit corridors with low-carbon bus technologies Renewable Energy (Wind) **Proposed CTF $500 million *leverages* $6.2 billion**	RE Program - Implementing "intelligent" grid management and control systems to support large-scale integration of wind power RE and EE - Promoting private sector development through credit lines to local development banks **Proposed CTF $250 million *leverages* $2.1 billion**	Wind Power – From <1,000-2,500 MW of electricity from wind Urban Transport - Six bus rapid transit corridors and five light rail route **Proposed CTF $300 million *leverages* $1.9 billion**

Source: World Bank, 2009d

Experience in promoting the use of carbon funds to enhance the EE markets reveals that the objective is possible to be attained if actions are taken by the CDM market, along several approaches. First, EE initiatives in the carbon market have to gradually transition away from project-based CDM to programmatic and sectoral crediting approaches which would help overcome some of the barriers such as high transaction costs and complex measurement and verification of energy savings (and GHG emissions savings) that project-based CDM approaches currently suffer from. The new emerging concept of programmatic CDM can help implement policy-based EE programs (for example, raising energy prices or reducing import taxes on EE equipment) that have difficulty demonstrating direct causality and have fallen through the cracks in the present CDM market. Second, innovative financial engineering has to be applied in a manner that the future CDM revenue streams, including those in the post-2012 period, could be securitized and paid upfront. While CDM will essentially remain a source of additional ex post revenue in EE projects, other existing incentive mechanisms like GEF can be effectively applied upfront, to strategically integrate with the mainstream EE project finance.

Ideas for Scaling-Up Energy Efficiency

In order to accelerate the trajectory of current efforts, first, EE needs to be promoted through clearer, more relevant message ...."of improved economic prosperity and health", that is, enhanced energy security (fewer power cuts, load shedding, industries getting closed); reduced vulnerability to energy prices; higher industrial and commercial competitiveness (with more and more goods being produced in the developing world); and increased employment which is becoming even more relevant in the current era of financial crisis. Second, there is a need to agree on a broad and ambitious goal. To help remove implementation barriers to meet concrete EE improvement targets on a global scale through broad-based, practical approaches across supply- and demand-side opportunities, collective efforts of various institutions have to be mobilized and their convening force amongst the member countries needs to be utilized effectively to push the EE acceleration agenda further.

To come up with practical actions, however, some key issues need to be addressed. What incentives do countries have to participate in a global goal? Should the initiatives target the largest GHG emitters, only developing countries or all countries? Should any incentives be directed to new systems only or include retrofits? What would such a target link with climate change commitments under any new agreement or the current NAMAs[9]? How can data be developed, collected, analyzed, etc. to track progress in meeting the target without getting caught in some of the same data and methodological traps of the current CDM framework?

Increased international cooperation is the key to tapping the huge EE potential worldwide. Transfer of best implementation practices, policies and technologies from the industrialized world, and also South-South interactions within developing countries will be the cornerstones of cooperation aimed to catalyze EE market transformation at the global level.

A number of initiatives could be launched to help remove implementation barriers to meet concrete EE improvement targets on a global scale through broad-based, practical approaches across supply and demand side opportunities. These ideas could contribute to the stabilization goal of 550/450 ppm of CO_2e by 2030. The success of these actions will rely on cooperation between developing countries, international and bilateral organizations, financial institutions, private sector and NGOs. Alongside these initiatives, there would be specific national level EE improvement targets (of say 20% as in the European Union and China) to be achieved by 2020. It is hoped that such an action would help shift the discussions from what to how, from outputs to results, and from projects to goals. As countries sign on, then the international community can unite their efforts to help countries meet this target in the most practical and cost-effective way. In order to persuade countries to agree to participate in such global level efforts, and to assist countries to meet the targets once they have signed on, the international community has a crucial role to play.

These ideas are proposed for consideration, which could be taken forward by international agencies and MDBs to support developing countries through global level efforts, for achieving their EE goals within their own clean energy sector development frameworks and NAMAs.

a. **International Energy Efficiency Certification Agency:** A dedicated international agency to facilitate access to internationally-certified, high quality EE end-use products (appliances, equipment, lighting, motors, buildings), and to provide information on EE technologies and services.
b. **"International Year of Energy Efficiency" 2010 Public Campaign:** Starting in 2010 as the "Year of Energy Efficiency", organize a global public campaign to galvanize stakeholders and enhance public interest in EE globally through a Global EE Roundtable, Global EE Prize, EE Development Marketplace, etc.
c. **Global Energy Efficiency Public-Private Partnership:** An innovative PPP with high level commitments, such as organizations and donor agencies entering into EPCs; promoting EE within their supply networks (i.e., "green their supply chains"); and phasing out (banning) inefficient energy end-use products.
d. **Global Energy Efficiency Programmatic Fund:** A multilateral dedicated EE fund blending carbon finance and GEF, for targeted grants and financial incentives to help meet EE country targets by 2020 which developing countries will have pledged to do. Priority sectors: urban, buildings, appliances, and transport.
e. **International Industrial Energy Efficiency Technology Financing Facility:** A concessional loan window, to be tapped by MDBs and others, targeting exclusively industry and providing concessional financing to push industries to revamp their processes to be state-of-the-art and based on EE best practice international benchmarks.
f. **Global Standard Offer for Demand Side Energy Efficiency:** A global mechanism to acquire demand-side EE resources from selected projects at a predetermined rate (e.g., $/kWh,

[9] NAMAs, or nationally appropriate mitigation actions, are being developed by non-Annex I countries under the UNFCCC framework.

$/kW, $/toe), based on global average long-run marginal cost of supply or estimated subsidies necessary to attract commercial bids.

g. **Bundle Public Facilities for Scaled-Up Investments:** Due to their relatively homogenous consumption patterns and common ownership, public buildings and other facilities offer huge potential to be bundled and bid out for large-scale retrofits and financing. Bundled facilities of 50-100 or even more can lower transaction costs, bring in economies-of-scale, and attract large suppliers and service providers into developing country markets (Singh et al. 2009).

h. **Improved Urban Planning and Design.** As city build environments are expected to triple within the next 25 years, developing better ways to design cities, us better land-use and integrated planning techniques, promote spatial densification, maximize resource efficiencies through water reuse, waste recycling, methane capture, etc. in order to realize better performing city infrastructure and systems that will last for decades.

These ideas aim to shift the debate from whether or not to pursue EE to how best to meet EE targets, while focusing on broad, common goals rather than the current trends of project-by-project approach. The actions associated with these ideas can work in tandem with each other and will be delivered in partnership with various stakeholders and existing networks. It is important to coordinate policies and transform EE markets in a way that addresses the barriers, across all sectors. The above initiatives could support Governments to stimulate private and public sector investments and accelerate implementation of EE through the introduction and implementation of enabling institutional frameworks, legislations and strategies.

With a strong push from the international community, it is possible to achieve a fundamental shift in global perception about EE and begin taking actions, based on the ideas presented above. These enabling actions during the period 2010-2020 can go a long way in gaining traction amongst all stakeholders. It is hoped that any future climate change agreement could help bring about the funds and other enabling efforts to help convince governments and their constituents to participate and sign on to the EE improvement targets. The proposed actions can be implemented within a short, limited time frame; these are actions that will be replicable, scalable across various energy institutions, and have large scale impact worldwide; they are also innovative, operational, and practically implementable.

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