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THE BOTTOM LINE

As a collectively large energy user, the public sector can set an example for efficiency improvements in other sectors. It can also stimulate EE markets, bring down costs for other energy users, lower emissions, and free up funds for investments for other development priorities. For years, barriers specific to public sector budgeting and financing discouraged the investments and other changes necessary to realize the vast potential of energy efficiency, but a range of smart policies, programs, and approaches has now been developed to overcome them.

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Energy Efficiency in the Public Sector

Why is energy efficiency in the public sector important?

Publicly owned facilities are major energy users and ready targets for energy efficiency measures

Government facilities—which can include central and municipal administrative buildings, universities and schools, hospitals and clinics, orphanages, museums and other publicly owned facilities—are, collectively, the largest energy user in most countries. Available data suggest that the public sector typically accounts for 2–5 percent of a country's total energy consumption, although this figure is much higher (up to 30 percent) in countries with large heating loads (such as China and the countries of the World Bank's Europe and Central Asia Region) or low energy access (as in many Sub-Saharan African countries, where only major cities are electrified).

The public sector also represents a strategically important market segment for energy efficiency (EE). As a large and visible consumer, the sector can set an example for EE improvements in other sectors. Because EE measures in public facilities are highly visible, they can demonstrate good energy-management practices and high-performance technologies. The inclusion of energy-efficient criteria for products purchased for public offices, for example, can stimulate manufacturers to seek the necessary certifications for their products to compete in public tenders. The public sector can also use its purchasing power to stimulate EE markets; by purchasing in large volumes, it can also bring down costs for all energy users. Moreover, the development of practices that promote public sector EE (for example, standard contracts, tools, and so forth) can also be utilized by businesses and institutions, while public campaigns can showcase the benefits of and build confidence in EE among citizens. Reductions in the government's energy costs can open up fiscal space for investments in other socioeconomic priorities, such as improving quality and access to basic services (such as health, education, and infrastructure). Finally, public sector EE makes for a more resilient energy supply and lowers local and global emissions.

What are the main challenges to achieving EE in the public sector?

Barriers specific to public sector budgeting and financing discourage the necessary investments

Despite attractive payback periods and the potential for energy savings, the public sector, particularly in developing countries, lags the rest of the economy on efficient energy. This is traceable to a number of inherent market failures and characteristics. Although the market barriers to EE in general are relevant here—low energy prices, high upfront and transaction costs, and limited access to data and information—other barriers are specific to the public sector, including:

- **Restrictive government policies and procedures.** From budgeting to procurement, government policies and procedures make it difficult to justify higher upfront costs and upgrades even when costs over the lifecycle may be much lower.
- **Limited financial resources for capital upgrades.** Public agencies rely on annual budget allocations that primarily cover operating costs. Restrictions on public borrowing, low creditworthiness, and existing debt levels may also prevent these costs from being amortized.
- **A lack of incentives.** Government agencies are often unable to retain cost savings from one budget year to the next. A principal-agent or split-incentive issue may also arise, whereby a parent budgeting agency determines capital budget needs while a subordinate agency pays the monthly energy bills.

Public employees have behavior inertia. They have no incentives to lower their agency's costs, as assessments of their performance are rarely tied to energy efficiency or cost savings.

- **Public employees have behavioral inertia.** They have incentives to do things the same way. They may also lack the awareness and expertise to identify potential EE improvements, estimate cost savings, implement and finance upgrades, assess risks, and maintain and operate new equipment. Staff have no incentives to lower their agency's costs, as assessments of their performance are rarely tied to EE or cost savings.

How have countries addressed these challenges?

Governments have developed a range of policies, programs, and approaches to help overcome barriers

Although some government interventions are specific to a particular barrier, most address several simultaneously. For example, many governments have so-called nodal agencies, such as EE agencies or departments, to provide an overall framework for government programs, advise on policies and provide information, develop model tender documents, and assist public agencies in reducing their energy use. But there are no simple measures or universally applicable approaches. Consequently, solutions need to be tailored to each country's (or local government's) context and circumstances. Differences might stem from policy and regulatory frameworks, institutional setups, available resources, income levels, cultural norms, or other factors. A summary of tested approaches can be found in table 1.

Financing is one of the most difficult issues for public sector EE. The financing ladder in figure 1 identifies options that policymakers can adapt to provide products suited to their country's needs. In the case of *"MOF financing with budget capture,"* the main budgeting agency provides financing for EE upgrades through the budgetary process and then scales back future budgetary outlays, thus "capturing" the energy savings. *"Energy efficiency revolving funds"* are independent, publicly owned entities that provide EE financing to public clients, which are then obliged to repay the investment from the energy cost savings. "*Utility on-bill financing*" refers to schemes where a public or private utility borrows and finances EE investments in public clients and then recovers its investments through its customers' utility bills. *"Public ESCOs"* (energy service companies)

Table 1. Improving public sector energy efficiency: Dismantling barriers

Barrier	Indicative action
Lack of information/ awareness, including opportunities, costs, benefits, and risks	Initiate awareness campaigns and demonstrations; publish and disseminate information such as case studies, procurement guidelines, product catalogs, specifications, etc.
Lack of technical capacity for audits, project design, procurement, implementation, monitoring; trust in EE potential	Create nodal agency to provide technical assistance for EE projects; appoint energy managers; develop training programs for facility operators and energy managers; encourage the formation and prequalification of ESCOs; develop EE analytical tools, audit and procurement guidelines, and measurement and verification protocols
Limited incentives to implement EE (potential loss of budget), try new approaches, and take risks	Revise budgeting to allow retention of energy savings; issue awards for agencies/staff; include EE in management performance reviews; develop risk sharing/ financing programs; set EE targets
Lack of agency accountability for energy savings	Create public sector/agency targets with monitoring; set penalties for nonperformance; establish program to label energy performance of buildings
Restrictive procurement, contracting, and financing rules	Revise public policies on purchase of EE products (e.g., to mandate the purchase of products with energy efficient labels or to make purchasing decisions based on life-cycle costing) and services; develop local ESCO models; create public EE funds
Lack of funding for upfront energy audits and project funding	Earmark public EE budgets; create dedicated grant/subsidy programs, public revolving funds; levy a demand-side management surcharge or "electricity surcharge" to mobilize funds for free energy audits
Small size and high transaction costs	Bundle public EE projects; generate model documents/templates to streamline projects; develop ESCO umbrella contracts; practice bulk procurement of EE products through cooperative purchasing agreements

Source: Adapted from ESMAP (2012).

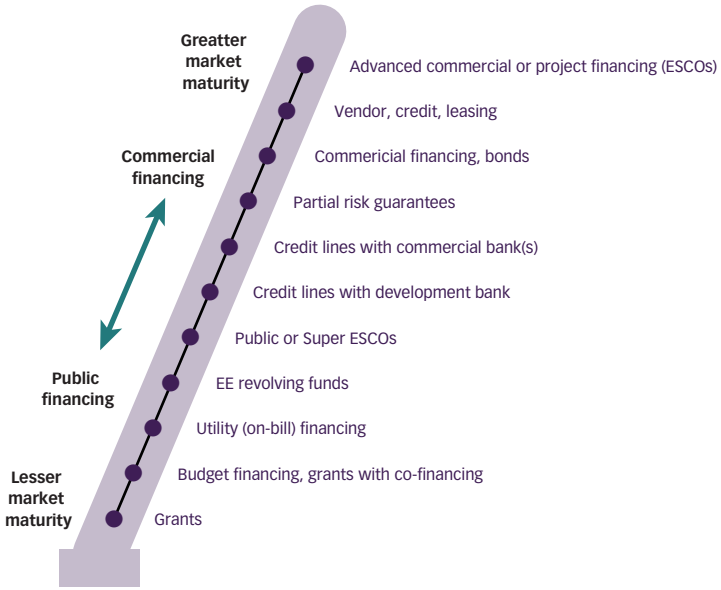
Note: EE = energy efficiency; ESCO = energy service company.

Financing is one of the most difficult issues for public sector EE. As local markets evolve, the goal should be to move up the ladder to more commercial financing mechanisms. Once a mechanism is selected, the design should ideally include elements to facilitate the transition to schemes that are higher on the ladder. The mechanisms are not mutually exclusive, and governments need not climb every step.

are publicly owned companies that provide financing and implementation support for public EE projects, with repayments based on energy cost savings.

Over time, as local markets evolve, the goal should be to move up the ladder to more commercial financing mechanisms. Thus, once a mechanism is selected, the design should ideally include elements to facilitate the transition to schemes that are higher on the ladder. Of course, the ladder is only meant as a guide. In reality, the mechanisms are not mutually exclusive, and governments need not climb every step of the ladder. The selection of appropriate mechanisms and their subsequent design will depend on a number of factors, including: (i) legislative and regulatory conditions; (ii) the maturity of financial and public credit markets; (iii) the state of the local EE service markets, including ESCOs and energy auditors; and (iv) the technical and financial capabilities of public entities for EE. Once the mechanisms are selected, they must be designed to suit the local market.

Figure 1. Financing energy efficiency in public buildings: A ladder of options



Source: World Bank (2014).

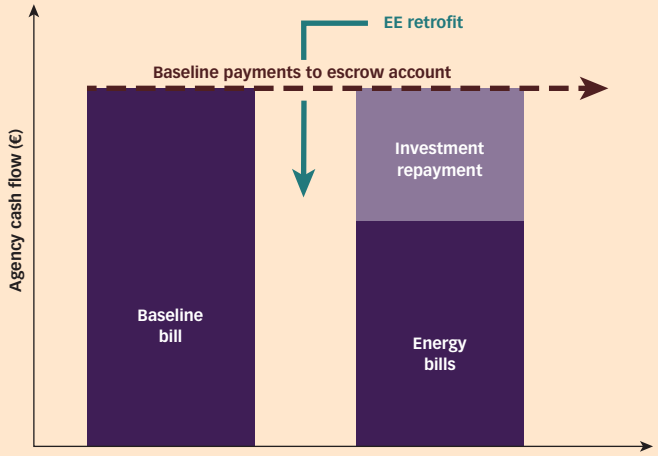
A new financing scheme called the energy service agreement (ESA) was recently developed by the World Bank to help municipalities that had reached their debt limits or were deemed not creditworthy. This mechanism is explained in box 1.

Box 1. Energy service agreements (ESAs)

Under an ESA, the financier (usually an energy efficiency revolving fund or public/super energy service company) offers a package of services to identify, finance, procure, implement, and monitor EE projects for clients. The client is asked to pay only what it is currently paying for energy; that is, to pay its baseline energy costs, from which the financier draws to make the new, lower energy payments, thereby recovering its investment cost and associated fees until the contract period ends.

The figure illustrates the basic idea of clients' cash flow under the ESA, with payments equal to their baseline energy bill. This allows them to maintain a constant cash flow while retaining their energy cost savings for the duration of the ESA. In some cases, the contract duration is fixed; in others, the contract can be terminated after an agreed amount has been paid, which can encourage the client to save more energy.

For public clients, ESAs are viewed not as debt, but as long-term service contracts. For central government entities that are not allowed to borrow, and for municipalities that have reached their debt limits, ESAs provide the twin advantage of being relatively simple and carrying little risk.



Source: World Bank (2014; 2018).

Public and municipal entities often place EE below service expansion and other revenue-generation schemes.

Table 2. World Bank program models for public EE

Program models	Public/budget financing, EE/urban development funds, super ESCOs, credit lines, loan guarantees, single municipal loans, municipal district heating
Implementing agency or agencies	Ministry or municipal implementation units, EE funds, public ESCOs, commercial/development/municipal banks, utilities
Success factors	• Strong, committed implementing partners • Target sectors that want EE and have credible borrowers • Required repayments and periodic recapitalization to ensure sustainability • A national program framework with regulatory obligations to drive demand • Project bundling to lower transaction costs

Source: Adapted from ESMAP (2012).

Note: EE = energy efficiency; ESCO = energy service company.

What has the World Bank done?

The Bank has developed a robust portfolio of public sector EE over the past ten years

More than half of that portfolio is in the Bank's Europe and Central Asia Region[1] because of the region's old, inefficient stock of public buildings and inefficient, Soviet-era heating systems. More recently, municipal energy efficiency programs, from China to Mexico, have bolstered the pipeline, as green and sustainable cities have become an emerging product line. A number of projects fall outside the energy sector, such as urban and water projects that contribute to the overall public EE portfolio.

Investment projects fall into three categories: (i) credit lines through development banks or specialized funds, (ii) direct loans to municipalities or municipal utilities, and (iii) public or super ESCOs (table 2). Although such projects are still usually limited to a single sector, such as buildings, they increasingly cover multiple sectors, such as water pumping, street lighting, and district heating. The total current portfolio is estimated to be about $3.4 billion (World Bank financing), with total investments of about $5.1 billion (when counterpart and partner financing are included). But because a number of programs support both public and private facilities or are part of larger urban, water, and supply-side EE projects, some figures are estimates. Table 3 includes a selection of these projects to show the range of models and project types.

The main challenges to increasing the portfolio include the limited credit capacity of many public and municipal entities and their vast investment needs. Those able to borrow often place EE, whether for new or renovated facilities, below service expansion and other revenue-generation schemes. As energy costs continue to rise, however, and climate change becomes part of national strategies, demand for EE is expected to grow. Innovative financing mechanisms, such as ESAs, can overcome some of these challenges.

Table 4 includes results from several recently closed operations. Although results vary and are difficult to aggregate, reporting shows cost-effective energy savings in public sector infrastructure.

[1] The ECA region comprises 23 countries: Albania, Armenia, Azerbaijan, Belarus, Bosnia & Herzegovina, Bulgaria, Croatia, Georgia, Kazakhstan, Kosovo, Kyrgyz Republic, Macedonia FYR, Moldova, Montenegro, Poland, Romania, Russian Federation, Serbia, Tajikistan. Turkey, Turkmenistan, Ukraine, Uzbekistan.

Table 3. Selection of World Bank public EE projects

Country	Project	Total project cost [WB financing] (US$ million)	Description/model/target market	Approval date/closing date
Bosnia and Herzegovina	Energy Efficiency	$32.0 [IDA: $32.0]	Finance EE investments in schools, hospitals, and clinics, and develop sustainable EE financing mechanisms in the public sector	March 13, 2014/December 31, 2019
China	Green Energy Schemes for Low-carbon City in Shanghai	$246.0 [IBRD: $100.0; GEF: $4.3]	Finance EE in buildings in commercial and public buildings	March 20, 2013/December 31, 2018
China	Urban Scale Building Energy Efficiency and Renewable Energy	$30.6 [GEF: $12.0]	Develop energy performance benchmarking and disclosure (EPB&D) systems and improve supporting mechanisms for public and commercial buildings	April 26, 2013/December 31, 2018
Georgia	Second Regional Development Project	$37.5 [IDA: $30.0]	Improve infrastructure services, including EE of street lights	September 12, 2012/December 30, 2019
India	Partial Risk Sharing Facility in Energy Efficiency	$133.0 [CTF: $25.0; GEF: $18.0]	Finance EE investments in SMEs and municipal street lighting through partial risk-sharing facility	February 25, 2015/April 1, 2022
India	India Energy Efficiency Scale-Up	$1,348.0 [IBRD: $300.0]	Scale up energy savings in residential and public sectors, including financing public street lighting	May 17, 2018/September 20, 2022
Kazakhstan	Energy Efficiency Project	$23.0 [SDC: $21.8]	Improve EE in public and social facilities through implementation of demonstration EE projects	May 22, 2013/March 31, 2019
Kosovo	Energy Efficiency and Renewable Energy	$32.5 [IDA: $31.0]	Renovate central government buildings for EE and RE-heating measures	June 18, 2014/August 31, 2020
Kyrgyz Republic	Urban Development	$14.4 [IDA: $12.0]	Pilot EE and seismic resilience retrofits in schools.	March 18, 2016/December 31, 2020
Macedonia, FYR	Second Municipal Services Improvement Project	$28 [IBRD: $28.0]	Improve municipal services including EE of municipal buildings.	January 11, 2016/March 31, 2021
Mexico	Municipal Energy Efficiency	$211.8 [IBRD: $150.0; GEF: $5.8]	Finance EE in municipal buildings, schools, hospitals, water and street lighting through fund using ESAs and utility on-bill repayment	March 8, 2016/October 31, 2021
Montenegro	Second Energy Efficiency Project	$9.0 [IBRD: $7.4]	Finance EE investments in state-owned public health sector facilities and enhance local EE capacity	June 4, 2018/May 26, 2023
Serbia	Enhancing Infrastructure Efficiency and Sustainability	$764.0 [IBRD: $118.6]	Finance improvement of EE and safety in public buildings (under energy component of project)	February 11, 2017/December 31, 2021
Tuvalu	Energy Sector Development	$9.1 [IDA: $7.0; SIDS DOCK: $2.1]	Increase EE in selected buildings, including government buildings, through installation of prepayment and smart meters, EE investments, policy and standards development, and awareness raising	January 26, 2015/March 31, 2019
Uruguay	OSE Sustainable and Efficient	$84.0 [IBRD: $42.0]	Reduce energy costs through energy management and investment component of water project	July 5, 2012/February 28, 2018

Source: Author's compilation.

Note: CTF = Clean Technology Fund; EE = energy efficiency; ESA = energy service agreement; GEF = Global Environment Facility; IBRD = International Bank for Reconstruction and Development; IDA = International Development Association; SIDS DOCK = Small Island Developing States sustainable energy transition initiative; SME = small and medium-sized enterprises; WB = World Bank.:

Table 4. Results from recently closed World Bank public EE projects

Project name [Implementation period]	Total project cost [WB financing] (US$ million)	Description	Reported results
Armenia Energy Efficiency Project [Mar 2012–Jun 2016]	$11.3 [GEF: $1.8]	Finance EE in public social facilities using ESAs	• Commissioned 124 public sector projects • Lifetime energy savings of 540,000 MWh (250 percent of target) • Lifetime carbon savings of 145,739 tons CO_2 equivalent (288 percent of target)
Belarus Post-Chernobyl Recovery [Apr 2006–Dec 2013]	$92.1 [IBRD: $80.0]	Renovate buildings and other infrastructure to provide efficient, reliable heat/hot water	• Annual energy savings were more than twice the target, reaching 348,214 MWh (heat and electricity) • CO_2 emission reductions (114,662 tons) were over 2.7 times the target • 741 buildings and 32 boiler houses were renovated • Over 250,760 beneficiaries, including 5,005 households with new gas connections for cooking and heating services
China Urumqi District Heating [May 2011–Dec 2015]	$343.2 [IBRD: $100.0]	Upgrade and extend district heating system, fuel switch (coal to gas)	• Annual reduction in coal consumption for heating exceeded target by 126 percent (final value: 7.8 ktce/km2) • Significant reductions in heating boiler emissions (SO_2, dust, CO_2)— all exceed project targets • 86.3 km of new pipelines installed; two pressure-regulating substations added; 63 new group and 2 building level substations constructed; 65 group substations rehabilitated
Macedonia Sustainable Energy [Dec 2006–Mar 2013]	$9.3 [GEF $5.5]	Finance EE retrofits in public buildings focusing on municipal schools and kindergartens	• Lifetime energy savings of 112,000 MWh • Triggered an initial market for EE measured by increased demand for EE retrofits from municipalities
Montenegro Energy Efficiency [Dec 2008–Mar 2018]	$13.3 [IBRD: $13.3]	Finance EE in public buildings (hospitals and schools)	• 45 public buildings (across 25 facilities) were renovated including hospitals, clinics, and schools • Lifetime energy savings of 109,000 MWh • Lifetime carbon savings of 40,464 tons CO_2 equivalent
Poland Energy Efficiency [Oct 2004–Oct 2012]	$57.8 [GEF: $11.0]	Guarantees and grants for EE projects in buildings, including public buildings	• Number of transaction relating to EE projects/ESCOs increased from 3,195 to 28,115 during the project period Volume of debt financing relating to EE projects/ESCOs increased from $210 million to $3 billion • Number of EE/ESCO projects larger than $250,000 increased from 151 to 1,830
Serbia Energy Efficiency [Mar 2004–April 2013]	$51.4 [IDA/IBRD: $49.2]	Finance EE in public buildings	• 82 public buildings renovated (36 schools, 41 hospitals, 5 social care buildings) • 66 percent energy savings in schools; 53 percent savings in hospitals • Significant reduction in air pollution in target hospital boilers; emission of SO_2, ash, soot were eliminated

Source: Author's compilation.

Note: CTF = Clean Technology Fund; EE = energy efficiency; ESA = energy service agreement; ESCO = energy service company; GEF = Global Environment Facility; IBRD = International Bank for Reconstruction and Development; IDA = International Development Association; ktce = kilotons of carbon equivalent; WB = World Bank.

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What have we learned?

Implementing EE in the public sector requires focus and commitment, patience, and institution-building

Some lessons from recent projects include:

- **Start with good policies.** Because of the inherent disincentives for public agencies to lower their costs, strong policies and regulations obligating public agencies to invest in EE are critical. Targets, rewards, recognition, enforcement, and the right energy prices can also improve incentives.
- **Borrow and adapt models.** Policy, program, and delivery models from Europe, Japan, and North America can offer valuable approaches and examples, but they must be simplified and adapted to suit the local context. Feedback mechanisms are also important; these allow enhancements to be made and lessons to be learned during implementation.
- **Strengthen the enabling environment.** Public procurement rules, procedures, agency, and staff capabilities all need to be enhanced to enable agencies to meet the obligations noted above. Tools and guidance notes can help standardize and streamline the actions agencies can take.
- **Make financing accessible and affordable.** Financing, whether delivered through budgetary outlays, loans, or other means, needs to be affordable and accessible. Equally critical is the need to reduce transaction costs and risks associated with investments and to develop mechanisms that can bundle investments. ESCOs are one mechanism, but capable ESCOs must exist in the market. Engaging an ESCO must be simple.
- **Operate on a national scale.** Given the homogeneity of most public entities (common ownership, building typology, and energy use patterns), programs should be developed at a national (or sometimes statewide) scale. Small pilots to renovate a few buildings or street-lighting systems should plan for sustainable scaleup to ensure their eventual expansion through scalable delivery mechanisms.
- **Promote cobenefits.** When old systems are renovated, or new systems built to higher standards, the benefits extend well beyond energy cost savings. They can include improvements in service quality (better street lighting), more comfortable indoor temperatures (renovated public buildings), better education and health (improved school/hospital conditions, reduced indoor air pollution), urban renewal (upgrading of old building stock), and service expansion (reduction of energy/water losses in utilities). In many cases, the public client may value these cobenefits more than the EE benefits.
- **Disseminate the benefits to the market.** When the government leads by example, the entire economy can benefit if the results are properly communicated. Proper documentation of costs and benefits, strong monitoring and tracking systems, and sharing of approaches and lessons can ensure that successful measures are widely replicated.

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