WATER GUIDANCE NOTE

Mainstreaming Energy Efficiency Investments in Urban Water and Wastewater Utilities

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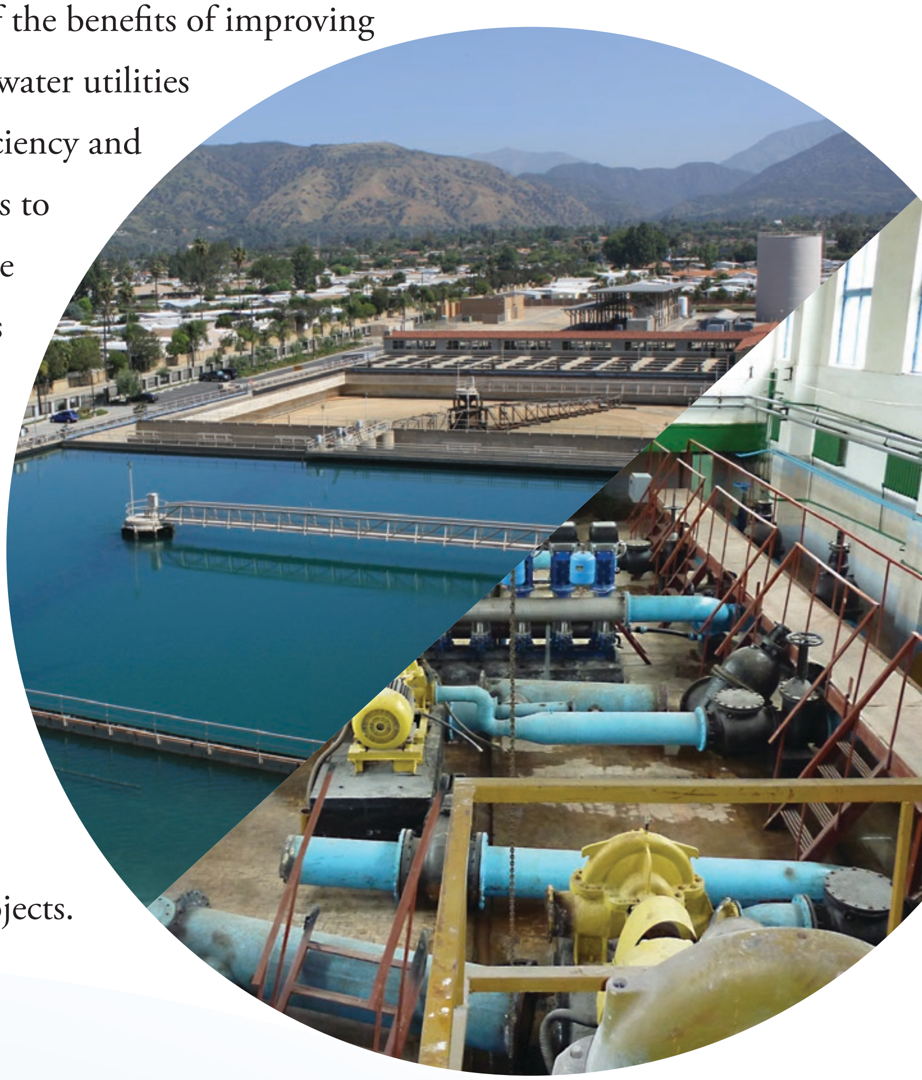
This guidance note presents an overview of the benefits of improving energy efficiency in urban water and wastewater utilities (WWUs). It defines the typical energy efficiency and load management measures and the process to identify and assess these measures. The note addresses some of the major considerations related to implementation and financing of investments in energy efficiency, and highlights past activities and lessons learned. Included are suggested actions by national and local governments, international financial institutions, and senior management of WWUs for promoting energy efficiency in WWUs, and a road map for mainstreaming energy efficiency in water sector infrastructure projects.



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ESMAP Energy Sector Management Assistance Program

GWSP GLOBAL WATER SECURITY & SANITATION PARTNERSHIP

Why Energy Efficiency Matters

For most WWUs, investments in energy efficiency will generate the highest return on investment. With rapid urbanization throughout the developing world, WWUs are facing increasing pressures to provide reliable safe drinking water and wastewater treatment services. These are highly energy-intensive activities. A recent report by the International Energy Agency (IEA 2016) estimates that in 2014 the electricity consumption of the water sector worldwide was 4 percent of total global electricity consumption. Based on projections of urban population growth, the demand for municipal water supply and wastewater treatment services is expected to increase by 40 percent in the next 20 years. Electricity costs for water production, distribution, and treatment contribute significantly to operating costs, ranging in many countries from 33 percent to 82 percent of nonlabor operating costs of WWUs.

Table 1 provides illustrative data, extracted from the World Bank International Benchmarking Network for Water and Sanitation Utilities database (Limaye and Jaywant 2019). Increasing electricity costs will lead to increasing pressures on high and unsustainable operating costs that are likely to directly impact the levels of service.

Electricity costs are the largest "controllable" operating costs for most WWUs, and international experience indicates cost reductions of as much as 20 percent to 40 percent are feasible through improved efficiency of energy use (Barry 2007; Liu et al. 2012).

Benefits of Improved Energy Efficiency

Improving energy efficiency in WWUs leads to lower energy costs and reduced vulnerability to future tariff increases. The resulting operating cost reductions help WWUs improve cost recovery, which leads to better operational performance. See case studies in box 1. Other financial and environmental benefits include the following:

- **Better financial performance.** Reduced operating costs lead to higher net margins.
- **Better creditworthiness.** Improved financial performance provides WWUs with better credit and may allow them to have better access to commercial financing for infrastructure improvements.
- **Reduced water losses.** Some energy efficiency technologies contribute to reduced water losses (e.g., through optimized pipe pressure).
- **Reduced needs for new investment in power supply.** By reducing the electricity demands, the electric utility can reduce its capital investment needs for new power generation.
- **Improved electricity supply efficiency and reduced costs.** Measures to shift pumping operations to off-peak periods help reduce peak demand for electric utilities and can reduce WWUs' electricity tariffs.
- **Reduced local and global environmental impacts.** Reduced energy use leads to lower greenhouse gas (GHG) emissions, thereby contributing to mitigation of climate change impacts, and to meeting the objectives of the Paris Agreement.

TABLE 1. Electricity Costs for Water and Wastewater Utilities in Selected Countries

Country	No. of utilities	Electricity costs			
		Per m^3 produced (US$)	Per m^3 sold (US$)	As % of total operating costs	As % of nonlabor operating costs
Albania	39	0.12	0.28	41	75
Bangladesh	26	0.04	0.04	40	75
Bulgaria	30	0.07	0.20	19	33
Honduras	7	0.07	0.10	39	50
Iraq	10	0.49	0.65	55	82
Kazakhstan	14	0.09	0.11	24	38
Moldova	16	0.22	0.40	28	64
Nigeria	8	0.12	0.21	32	56
Ukraine	12	0.07	0.09	22	39
Vietnam	38	0.04	0.06	34	49

Source: Limaye and Jaywant 2019.

BOX 1. Energy Efficiency Case Studies

Mexico. The city of Monclova installed variable speed drives, improved pumping efficiency, replaced old pumping equipment with more energy efficient pumps, and optimized pumping operational schedules. Results include reducing the energy intensity by 23 percent, improved operational efficiency, and increased revenues with a simple payback of 1.9 years.

Bosnia and Herzegovina. The town of Mostar implemented pump upgrades and replacements, greater use of gravity-fed water, and water leakage detection and repairs to reduce energy use by 40 percent, declining from 9.4 megawatt-hours in 2001 to 5.6 megawatt-hours in 2004. These energy savings have translated into an estimated annual electricity cost savings of US$128,400 for the town.

Armenia. The city of Yerevan engaged a competitively selected management contractor to undertake a performance-based contract that includes rehabilitating pumping stations, increasing gravity-fed water supply, trimming pump impellors, and upgrading pumps. The US$16.8 million investments have provided an annual cost savings of US$4.8 million, yielding a payback of 3.5 years.

Brazil. The city of Campinas established an energy management program, including specific energy efficiency improvements, as part of operational management to improve the overall operational efficiency and enhance financial performance. In the Capivari water treatment plant, energy efficiency measures have resulted in annual energy savings of US$200,000 (1.8 gigawatt-hours) with an investment of US$1.3 million, for a simple payback of about 6.5 years.

Source: ESMAP database, www.esmap.org/node/231.

Typical Energy Efficiency and Load Management Measures

There are many measures available for WWUs to reduce energy consumption and costs (EPA 2013; Liu et al. 2012; WRF 2017).

Energy Efficiency Measures

- **Pumps and pumping systems operations:** (a) replace inefficient pumps; (b) install variable frequency drives; (c) utilize gravity-fed systems instead of pumping; (d) optimize pumping system operation; and (e) improve maintenance.
- **Water loss management technologies:** (a) leak reduction and (b) pressure management.
- **Wastewater treatment:** (a) improve efficiency of anaerobic digestion and aeration equipment; (b) use efficient activated sludge processes; and (c) reduce wastewater with reuse and recycling.
- **Demand-side efficiency measures:** implement to reduce water consumption.
- **New technologies:** (a) implement supervisory control and data acquisition (SCADA) software; and (b) install smart pumps.

Table 2 shows the results from the energy audit for the Shimla, India, water utility (DESL 2017b). Another example is the energy efficiency measures identified in the detailed energy audit of the Namangan Suvokova in Uzbekistan (TERI 2019), presented in table 3.

TABLE 2. Energy Efficiency Opportunities in the Shimla Water Utility, India

Energy efficiency measures	Annual savings: Energy (kWh, millions)	Annual savings: Costs (US$, millions)	Investment needed (US$, millions)	Simple payback (years)
Pumps and pumping systems	8.91	1.32	6.60	5.0
Load management	17.55	1.51	0.63	0.4
O&M measures	0.54	0.07	0.40	5.7
Totals	27.00	2.90	7.63	2.6

Source: DESL 2017b.
Note: O&M: operations and maintenance.

TABLE 3. Energy Efficiency Options, Namangan Suvokova, Uzbekistan

	Energy efficiency measures	Annual savings		Investment needed (US$, thousands)	Simple payback (years)
		Energy (kWh, millions)	Costs (US$, thousands)		
Short-term	Optimize distribution-side voltage Optimize pump operation Operate pumps in off-peak hours Avoid throttling of pumps Replace delivery pipe Operate lower capacity pump	2.7	100.5	23.8	0.2
Medium-term	Pump replacement Energy-efficient lighting Install lower head pump Shift pumping operations	6.4	183.1	269.2	1.5
Long-term	Reduce transformer losses Install capacitor banks Install variable speed drives Motor replacement	1.4	7.9	32.8	4.1
	Totals	10.5	291.5	325.8	1.1

Source: TERI 2019.

Load Management Measures

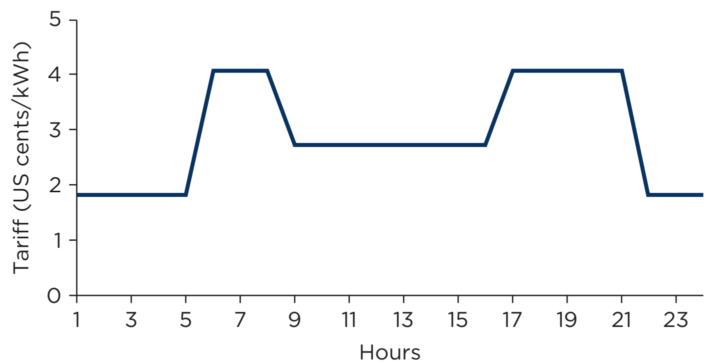
In many countries, the electricity tariff varies during the day based on the costs of power generation during peak and off-peak operations. Load management involves shifting of pumping hours from peak to off-peak periods. Pumps and pumping systems consume a large proportion (generally 70 to 80 percent) of the total electricity use by WWUs. If these operations can be shifted or limited to off-peak operations, substantial cost savings can be achieved. Figure 1 shows a typical time-of-use electricity tariff, in which the peak tariff is 225 percent of the off-peak tariff.

Savings can be achieved by improving the power factor such as by installing capacitors and by optimizing contract demand. The Shimla (India) energy audit estimated that an annual savings of US$670,000 can be achieved through power factor correction, contract demand management, and shifting pumping loads from peak to off-peak periods by pumping water to storage reservoirs during off-peak periods (DESL 2017b).

Renewable Energy and Other Technology Measures

WWUs may also reduce energy costs by deploying renewable energy resources (DESL 2017a; EPA 2018; Lisk, Greenberg, and Bloetscher 2012); suggestions include the following:

FIGURE 1. Typical Time-of-Use Electricity Tariff



Source: TERI 2019.

- **Solar photovoltaic (PV) generation.** The costs of solar PV have decreased substantially (to US$1 to US$2 per watt), and solar generation is becoming competitive in many areas. WWUs could install solar PV to reduce their purchased electricity needs.
- **Generation of electricity from small hydropower.** To the extent that WWUs are discharging water to a lower level, small hydro turbines could be used to generate electricity.
- **Use of combined heat and power** (cogeneration) when both heat and electricity are required.
- **Generation of electricity from biogas** in wastewater treatment facilities.

Barriers to Energy Efficiency

Despite the recognition of the potential benefits of improving energy efficiency, many barriers have limited the implementation of energy efficiency projects in WWUs.

Barriers Faced by Water and Wastewater Utility Management and Staff

- Limited knowledge of management and staff of energy efficiency project opportunities and benefits.
- Limited budgets for capital investment.
- Poor creditworthiness, which limits access to commercial financing.
- Limited experience with new technologies and service providers.
- Greater emphasis on new connections rather than cost reduction.
- Limited data on equipment characteristics.
- General lack of high incentives to save electricity costs.

Legal, Regulatory, and Institutional Barriers

- Restrictions on the amount of debt financing by WWUs.
- Budgetary rules and procedures that may not allow WWUs to retain the cost savings from investments in energy efficiency.
- Public procurement rules and procedures, particularly those requiring the selection of low bids, that discourage the procurement of the most efficient equipment.
- Low regulated electricity tariffs that provide little incentive for efficiency improvement.

Challenges Faced by Equipment and Energy Service Providers

- Weak and fragmented markets for providing energy services to WWUs due to lack of demand for such services.
- High costs faced by energy service providers for developing energy efficiency projects for WWUs.
- Limited access to equity and debt financing for such projects.

Financing Barriers

- Terms and conditions of commercial lenders are generally not very attractive to WWUs.
- Difficulty in providing required collateral for commercial loans.
- Perception of commercial lenders that energy efficiency projects for WWUs are associated with high risk.

Limited Implementation Capacity

- Limited capacity of WWU management and staff, energy service providers, and financial lenders.
- Lack of standard templates for energy audits and service contracts, which limits implementation.
- Limited experience and capacity with measurement and verification of energy and cost savings.

Overcoming the Barriers

Addressing and overcoming the barriers may require concerted and coordinated efforts among national governments, local or municipal governments, international financial institutions (IFIs), and WWU management. Governments can address the legal and regulatory barriers by establishing appropriate legislation and regulations to allow WWUs to retain energy cost savings; removing any barriers to debt financing; and modifying public procurement rules and regulations to facilitate the procurement of energy efficient equipment. Electricity regulators can develop cost-based tariffs and incentives for peak load reduction that will make energy efficiency investments financially attractive. National governments may also enact legislation facilitating public-private partnerships (PPPs) that can be effective in leveraging private financing for implementation of energy efficiency options.

IFIs could include a component for energy efficiency implementation in water sector infrastructure projects and specify results indicators related to energy efficiency improvement. IFIs can cooperate with governments to develop sustainable financing mechanisms and provide seed capital for such mechanisms. IFIs can provide expert technical assistance for capacity building of stakeholders, developing the energy services markets, and facilitating the formation of energy service companies (ESCOs) and performance contracting (Limaye, Singh, and Hofer 2014a). Another important aspect is the capacity building of commercial lenders by informing them of the benefits of energy efficiency projects and the potential business opportunities in debt financing of such projects for WWUs.

WWU management needs to recognize the importance of energy efficiency, commit to energy efficiency improvement, and develop an internal culture that promotes operational efficiency. Part of this is to encourage facility managers and engineers to increase their knowledge of energy efficiency options, and if possible, provide incentives to staff members who achieve cost reductions through increased efficiency.

Three Key Steps to Improved Energy Efficiency

Step 1: Identifying Energy Efficiency Opportunities

The first step is to: (a) determine how much electricity the WWU consumes and how much it costs; (b) identify equipment and processes that consume the most energy; (c) document the equipment characteristics; and (d) identify cost-effective energy efficiency options. This step can be accomplished internally (if capacity exists) or through an energy audit of the facility conducted by external technical experts. While the term *energy audit* is somewhat subjective, with many variations and several levels of energy audits for WWUs in different countries, energy audits can generally be classified into two major types:

- A "walk-through survey" or preliminary energy audit, which entails a reconnaissance of the facility and an initial assessment to identify potential energy efficiency opportunities. This defines whether there is a need for the more detailed audit.
- An investment grade audit, which includes a detailed definition of the baseline, a technical and economic analysis, a prefeasibility study of individual energy efficiency and load management options, and identification of preferred investments options for WWU management.

The energy audits explore options to unlock the energy efficiency and load management potential of the WWU by analyzing its energy performance indicators and identifying energy savings and load shifting options. The energy audit and prefeasibility assessments should: (a) document in detail the characteristics of the equipment and facilities and identify cost-effective operations and maintenance (O&M) adjustments, low-cost, short-term, as well as medium- and long-term, energy efficiency recommendations; (b) develop estimates of needed investments to improve energy efficiency; and (c) provide recommendations to enhance the capacity of the WWU for data collection, analysis, and O&M. The energy audit may also include specifications for equipment and implementation services that could be used for development of bidding documents. A summary of the requirements of the terms of reference (TOR) for the energy audit and prefeasibility study for the Namangan Suvokova is provided in box 2.

Step 2: Implementation Strategy

Once the audit and prefeasibility study have identified the energy efficiency and load management options, the next steps (for options that are not purely operational changes) are to develop the detailed engineering design, equipment procurement, installation and commissioning, and measurement and verification of the energy and cost savings. Most WWUs have limited capacity to undertake these tasks internally and are likely to engage external service providers. Procurement of equipment and services can be a challenge, particularly if existing public procurement rules and procedures require the low bidder to be selected, which may limit the selection of the most efficient equipment or service provider.

One option for WWUs is to engage energy service providers (ESPs), such as ESCOs, to undertake some or all of the implementation activities. An ESP can provide services spanning the entire energy services value chain, including auditing, design and engineering, equipment procurement, installation and commissioning, financing, O&M, and facility management (Limaye, Singh, and Hofer 2014a). ESPs offer a number of advantages to WWUs, such as the following:

- Mobilizing private sector innovation, entrepreneurship, and financing.
- Providing access to the latest energy efficient products, technologies, and equipment.
- Providing high-quality installation and O&M.
- Implementing projects more efficiently and generally at a higher benefit-cost ratio.
- Providing training to facility engineers and managers on O&M, thereby improving staff skills.
- Providing performance guarantees, thereby reducing the project risk to the WWUs.

ESPs offer a wide range of business models. Figure 2 illustrates four main business models to offer the services and products identified previously (Limaye, Singh, and Hofer 2014a). Energy saving performance contracts (ESPCs) can be quite attractive to WWUs. The major characteristics of ESPCs are: (a) the ESP provides a full range of energy services related to financing and implementation of energy efficiency projects designed to reduce energy use and costs; (b) payments for ESP services are made by the WWU from the cost savings resulting from the projects; (c) payments are generally contingent upon satisfying certain performance guarantees; and (d) the ESP assumes most of the technical, financial, and performance risks (Limaye 2005). Figure 3 illustrates the basic ESPC model.

BOX 2. Terms of Reference for Energy Audit and Prefeasibility Study of Namangan Suvokova, Uzbekistan

Task 1: Energy Eficiency Audit. To carry out the energy efficiency audit, the Consultant shall collect and analyze both technical and financial data such as historical energy consumption and equipment inventory (including technical characteristics of pumps used, energy use by each facility (kilowatt-hours), electrical, mechanical and process systems, electricity costs, electricity bills, and O&M costs). The analysis will identify the most energy intensive equipment/processes and their impact on total costs, and highlight potential areas of energy savings. A breakdown of energy consumption and costs shall be determined, based on a thorough assessment of the existing systems. This assessment is intended to inform the identification and prioritization of interventions (both physical and institutional) to improve energy efficiency and reduce costs of utility operations. The assignment will include data collection (document and data reviews, field measurements, and other on-site assessments), information analysis, and identification and evaluation of energy saving options. The Consultant shall also assess the power supply system of the water intake facilities and pumping stations and recommend measures on how to improve the reliability of the system operation and maintain optimal pressure at control points.

Task 2: Analysis of Electricity Time of Use. This task shall include assessment of electricity bills paid by the water utility, specifically from the point of view of assessing the demand or capacity charges paid and any penalties incurred during the peak-demand timings coincident with high electricity demand on the electricity distribution system. It will include assessment of the potential to shift the pumping hours from on-peak to off-peak periods to understand the benefits the water utilities would be able to harness during the periods when they are able to shift the water pumping timings. The Consultant shall suggest demand management protocols to promote a permanent load shift through simple heuristics or rules drawn out for management of pumping hours, optimized use of holding capacities, etc.

Task 3: Energy Efficiency and Load Management Prefeasibility Study. The Consultant shall conduct prefeasibility analysis to translate key findings into prioritized investment plans, considering both institutional and infrastructure or equipment requirements, to improve efficiency of utility operations. During this process the Consultant is expected to further develop the analysis of the current state of infrastructure and utility operations by updating existing data as necessary. This may include development of energy and water balance models, and hydraulic modeling of the water supply system with different scenarios of water consumption and operation of pumping stations. It will also include identification of investment needs, considering key infrastructure and equipment for improved efficiency (e.g., leakage and pressure control, pump replacements, and other modifications), along with utility operational aspects. Based on the technical, economic, and financial analysis, along with other institutional, environmental, and social considerations, the Consultant shall develop a prioritized investment program including development of prefeasibility level designs and specifications and cost estimates for priority investments.

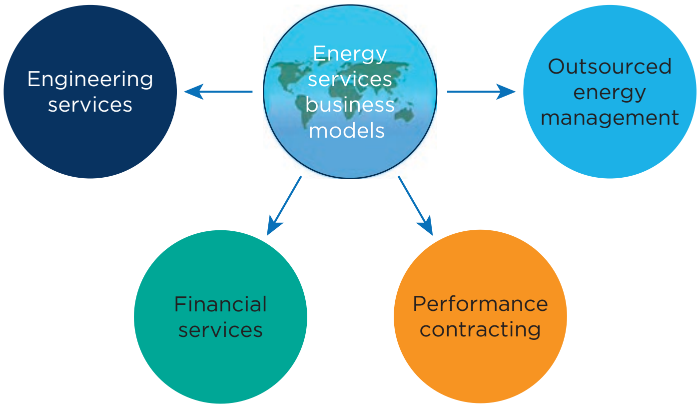
Source: TERI 2019.

Step 3: Financing

Many of the initial government and IFI programs for financing energy efficiency projects in developing countries have involved grant financing. However, governments and IFI have concluded that while grant financing can be an important and useful first step for implementing energy efficiency projects, the availability of such financing is limited, and grants may not be a sustainable option. Many countries, with the assistance and participation of donors, have developed and implemented financing and delivery mechanisms either to enhance the financial leverage of public funds or to gain access to commercial funding for public sector energy efficiency projects.

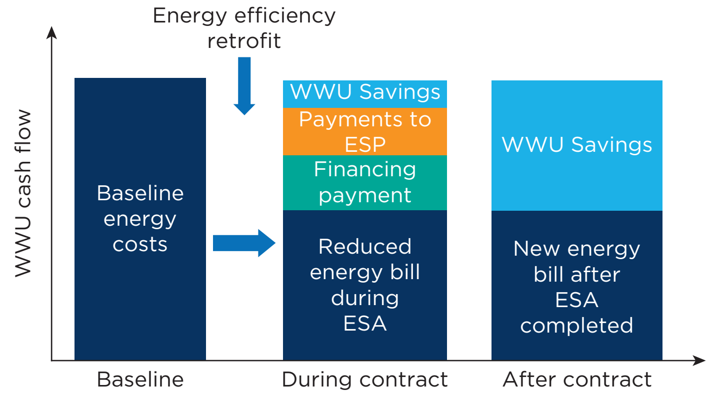
The World Bank has developed the concept of a financing ladder for water sector energy efficiency projects.

FIGURE 2. Energy Services Business Models



Source: Limaye, Singh, and Hofer, 2014a.

FIGURE 3. Energy Saving Performance Contract Model



Note: ESA = energy services agreement; ESP = energy service provider; WWU = water and wastewater utility.

FIGURE 4. Financing Ladder

Market maturity ↑ | Commerical financing ↕ Public financing | Public EE financing ladder

Financing mechanism	Description
ESCOs	Third-party finances and implements measures under an energy performance contract
Corporate bonds	Utility issues bonds to access capital markets
Vendor credit/leasing	Equipment supplier finances equipment replacement and installation
Credit guarantee	Guarantee to enable commercial financing of investments to improve operational or energy efficiency
Credit lines	Finances a portfolio of energy efficiency subprojects
Public or super ESCO	A company established by the government to implement EE projects in WWUs
Management contract	Third-party manages and invests in operations, including energy efficiency projects
Energy efficiency revolving fund	Capitalization of funds to support a portfolio of municipal/energy efficiency subprojects
Energy savings capture	Cost savings resulting from energy efficiency projects are placed in a special account for financing future projects
Results financing	Disbursement linked indicators based on improvements in operational and energy efficiency
Public financing	Public lending for water infrastructure and service improvements/expansion, including energy efficiency

Source: Adapted from Bakalian, Singh, and Jacques 2019.
Note: ESCO = energy service company.

TABLE 4. Energy Efficiency Financing Mechanisms in the Public Sector

Financing mechanism	Countries	Sector
Results financing	China Mexico	Industry, SME, Public Water Utilities
Energy savings capture model	Montenegro Uzbekistan	Public Water Utilities
EERF	Bulgaria Armenia Romania	Industry, SME, Public Public Industry, SME, Public
Management contract	Armenia (Yerevan) India (Shimla)	Water Utilities Water Utilities
Public or super ESCO	India Ukraine Croatia	Public Public Public
Partial risk guarantees	Eastern and Central Europe China India	Industry, SMEs Industry, SMEs Industry, SMEs

Note: EERF = Energy Efficiency Revolving Fund; ESCO = energy service company; SME = small and medium enterprise.

The steps in the ladder show the progression from strictly public financing to commercial financing (see figure 4). Moving up the ladder requires increasing participation of commercial financing and improved maturity of the financial markets. Since public financing may not be sustainable in the long term, other steps in the financing ladder need to be considered.

Unfortunately, in most developing countries, commercial financing is generally not available for WWUs. Therefore, options such as credit lines through commercial banks, vendor credit or leasing, and corporate bonds are unlikely to be feasible in the near term. Financing energy efficiency may have to rely on the other financing options listed below. While there are relatively few examples of such mechanisms in the water sector, table 4 provides examples of financing mechanisms for energy efficiency in other public sectors.

- **Results financing.** Financing from an IFI is linked to specific project indicators related to improvements in operational and energy efficiency, and disbursement is made only upon demonstration that the targets for these indicators have been met. An example is the project in Mexico (PROME).
- **Energy savings capture model.** In this mechanism, initial energy efficiency projects are funded using government or IFI funds, and the savings from these energy efficiency projects are placed in a special account for a specified period. This account is then utilized as the source for financing future energy efficiency projects. This mechanism is being proposed for financing energy efficiency projects in the Suvokovas in Uzbekistan.
- **Energy efficiency revolving fund (EERF).** An EERF can scale up energy efficiency financing in the public sector and has been recommended by the World Bank in many countries (Limaye, Singh, and Hofer 2014b). Under a typical EERF, created using public funds and IFI loans, financing is provided to public agencies to cover the initial investment costs of energy efficiency projects. Some of the resulting savings are then used to repay the EERF until the original investment is recovered, plus interest and service charges. The repayments can then be used to finance additional projects, thereby allowing the capital to revolve and creating a sustainable financing mechanism. Examples in the water sector include Mexico (PRESEM) and India (Tamil Nadu).
- **Management contract.** The management or operation of the WWU is contracted out to a private sector organization that makes investments in energy efficiency projects. Examples of this approach in the water sector are Armenia (Yerevan) and India (Shimla, proposed).
- **Public or super ESCO.** Established by the government, a public or super ESCO functions as an ESCO for the public sector market (including WWUs) while also supporting the capacity development and project development activities of existing private sector

ESCOs. The government (possibly with help from IFIs) capitalizes the super ESCO with sufficient funds to undertake public sector ESPC projects and to leverage commercial financing. An example is Energy Efficiency Services Limited in India.

- **Partial risk guarantees.** A risk guarantee facility addresses the commercial lenders' perspective of high risk by providing partial coverage of the risk involved in extending loans for energy efficiency projects. A partial risk guarantee facility, provided by a government, IFI, or other public agency, can assist WWUs by: (a) providing them access to finance; (b) reducing the cost of capital; and (c) expanding the loan tenor or grace periods to match project cash flows (Mostert 2010). An example is the World Bank's Partial Risk Sharing Facility in India.

Related World Bank Projects

The World Bank's 2025 climate targets include strengthening water utility governance, incorporating water into urban land-use planning, and investing in urban water infrastructure and policies that reduce water and energy use. A specific goal is to help WWUs implement programs for energy and water use efficiency. Consistent with this goal, the World Bank has financed water sector infrastructure projects in developing countries in which improvement of energy efficiency is a component (see table 5).

The World Bank has documented a series of case studies and information on technologies and tools calculating energy efficiency indicators and potential for cost savings and GHG reduction. *These are available at www.worldbank.org/EEwater.*

The major lessons learned from the World Bank's projects are summarized here:

- Improved energy efficiency can contribute significantly to better WWU operational performance as well as to GHG emission reductions.
- Energy efficiency options use known and proven technologies and methodologies that do not present construction or operational challenges.
- Substantial improvements in energy efficiency are achievable with low paybacks as part of water sector infrastructure projects.
- The commitment of senior WWU management to improving energy efficiency is critical to project success.
- When energy efficiency is included in water sector infrastructure projects, specific results indicators need to be provided to enable measurement of energy savings and resulting GHG emission reductions.

TABLE 5. World Bank Urban Water Sector Projects with Energy Efficiency Components

Country/city	Project name	Project status	Energy efficiency component/activity
Bosnia (Mostar)	Water Sector Rehabilitation	Completed	Reduce energy use
Armenia (Yerevan)	Yerevan Water and Sewerage Management	Completed	Develop energy management plan for 20% cost reduction
Ukraine (various cities)	Second Urban Infrastructure Project	Ongoing	Improve energy use per m^3 of water produced/treated
China	Liaoning Safe and Sustainable Urban Water Supply	Ongoing	Develop energy management plan
Jordan	Programmatic Energy and Water Sector Reform	Completed	Increase energy savings in the water sector
Uruguay	UY OSE Sustainable and Efficient	Ongoing	Energy savings
India	Water Supply and Sewerage Service DPL for Shimla	Ongoing	Reduction of energy consumption in bulk water production
Mexico	Municipal Energy Effciency Project	Ongoing	Design of energy management systems for WWUs
Tanzania	Second Tanzania Water Sector Support Project	Ongoing	Improve energy efficiency

Note: WWU = water and wastewater utility.

Mainstreaming Energy Efficiency in Water and Wastewater Utilities

Based on the experience of the World Bank and other IFIs, the following action items are recommended for mainstreaming energy efficiency projects in WWUs. Figure 5 presents a road map.

Actions for Water and Wastewater Utility Management

- Carry out energy audits.
- Assign responsibilities and targets for energy efficiency and provide sufficient resources to achieve these.
- Develop an internal culture that promotes operational efficiency improvement.
- Increase staff knowledge and awareness of energy efficiency options and technologies.
- Incentivize staff who achieve cost reductions through improved energy efficiency.

Actions for National and Local Governments

- Prioritize energy efficiency improvement in WWU operations in national climate and energy efficiency strategies and goals.
- Facilitate retention of energy cost savings.
- Remove barriers to debt financing of WWUs.
- Develop cost-based electricity tariffs.
- Change procurement regulations to facilitate selection of efficient equipment and services.
- Enable PPPs for project implementation.

Actions for International Financial Institutions

- Include energy efficiency improvement as a component in water sector infrastructure projects and develop appropriate results indicators.
- Develop benchmarks for energy use in water supply and sanitation.
- Develop standard templates for investment grade energy audits and performance-based service contracts.
- Assist in developing and implementing sustainable financing mechanisms and provide initial financing.
- Provide technical assistance to build capacity of all stakeholders.
- Assist in developing energy services markets.

FIGURE 5. Mainstreaming Energy Efficiency in Urban Water and Wastewater Utilities

1. Recommend establishing a high national priority for improving energy efficiency in water and wastewater utilities.
2. Suggest modifications to legislation and regulations to facilitate retention of energy cost savings, procurement of efficient equipment and services, debt financing for utilities, and PPPs.
3. Provide technical assistance for capacity building of WWU management and staff, energy service providers, government officials, project implementation units, and lenders.
4. Develop standardized procedures and templates for preliminary and detailed energy audits and contracts with service providers.
5. Include energy efficiency improvement as a component in water sector infrastructure projects.
6. Develop benchmarks and results indicators for energy efficiency improvement in water supply and wastewater treatment.
7. Develop and document options for implementation of energy efficiency measures.
8. Establish sustainable financing mechanism consistent with existing legislation, regulations, and financial and energy services markets.
9. Develop the monitoring, reporting, and measurement and verification approach.

Note: PPP = public-private partnership; WWU = water and wastewater utility.

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