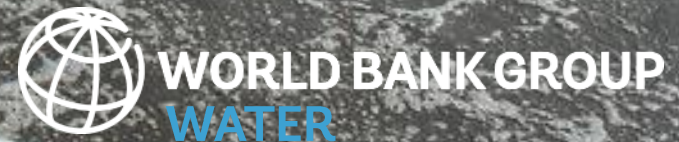


Mainstreaming Energy Efficiency Investments in Urban Water and Wastewater Utilities

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Outline of presentation

- 1 Importance of energy efficiency improvement in urban water and wastewater utilities
- 2 Energy efficiency and load management measures
- 3 Implementation and financing of energy efficiency investments
- 4 Suggested actions for promoting energy efficiency



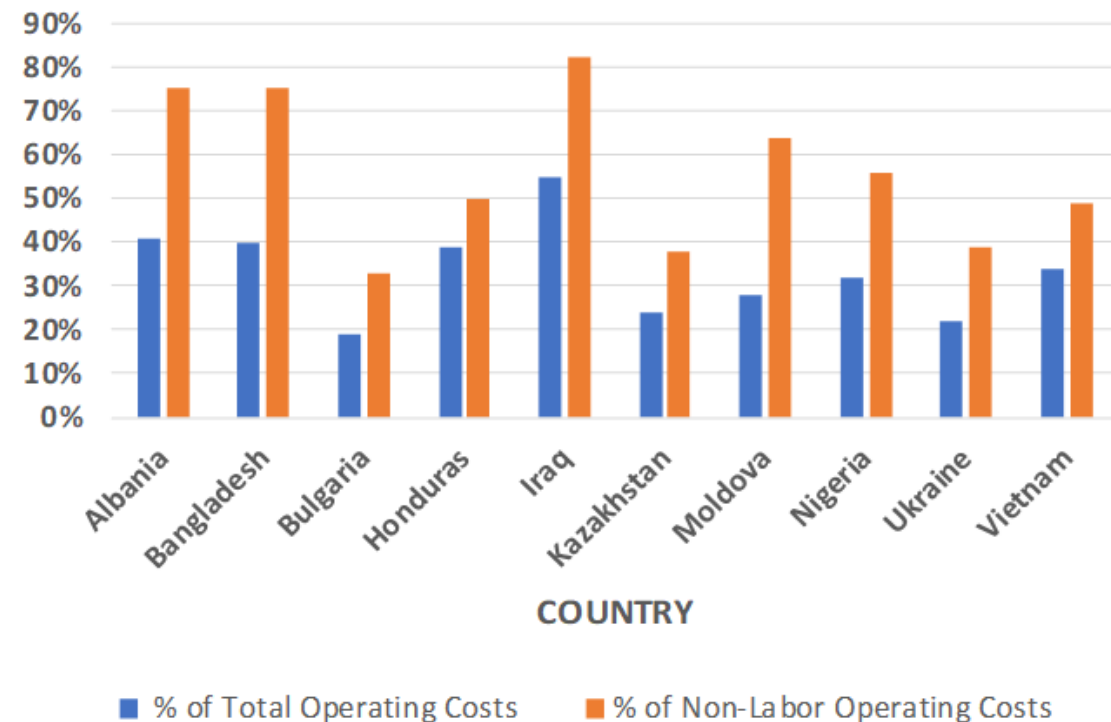


Importance of energy efficiency (EE) improvement in urban water and wastewater utilities (WWUs)

Energy Use in WWUs

- Rapid urbanization likely to increase demand for WWU services by 40% over the next 20 years
- WWUs face increasing pressures to provide reliable safe drinking water and wastewater treatment services
- Water supply and treatment facilities are energy-intensive.
- Electricity consumption of the water sector worldwide was 4% of total global electricity consumption
- Electricity costs for water production, distribution, and treatment in many WWUs range from 33 to 82% percent of nonlabor operating costs
- These costs are the largest "controllable" operating costs
- Savings of 20 to 40% are feasible from improved efficiency

**Electricity Costs in WWUs
as % of Operating Costs**



Improving Energy Efficiency



Low energy efficiency in WWUs

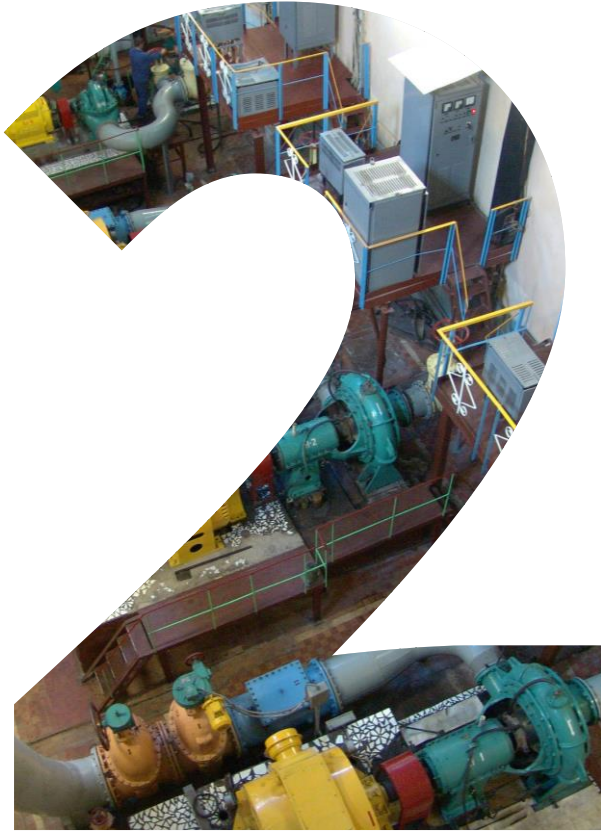
- Old inefficient pumping equipment
- Inadequate equipment maintenance
- Limited knowledge and expertise of WWU staff re efficient equipment and operating practices
- Large amount of non-revenue water (NRW)
- Lack of institutional and technical capacity
- Lack of motivation and incentives for staff.



Benefits of improved energy efficiency

- Reduced operating costs; better operational and financial performance
- Improved creditworthiness - better access to commercial financing
- Reduced water losses
- Lower vulnerability to future electricity price increases
- Reduced needs for new investment in power supply
- Improved electricity supply efficiency and reduced costs
- Reduced local and global environmental impacts.





Energy efficiency and load management measures

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Key steps to identify and assess
these measures

Typical Energy Efficiency Measures



Demand-side efficiency measures to reduce water consumption



Water loss management technologies

- Leak reduction
- Pressure management.



New technologies

- Implement supervisory control and data acquisition (SCADA) systems
- Install smart pumps



Wastewater treatment

- Improve efficiency of anaerobic digestion and aeration equipment
- Use efficient activated sludge processes
- Reduce wastewater with reuse and recycling.



Pumps and pumping system operations

- Replace inefficient pumps
- Install variable frequency drives
- Utilize gravity-fed systems instead of pumping
- Optimize pumping system operation
- Improve maintenance.

Investments in energy efficiency typically have a **simple payback between 2 months and 5 years.**

Load Management

- Electricity tariffs may vary based on the costs of power generation during peak and off-peak operations. **The peak electricity tariff can be 2 times higher than the off-peak tariff.**
- Substantial cost savings can be achieved by shifting pumping operations, and contract demand and power factor optimization
- Shifting your pumping operations from peak to off-peak periods is a quick way to save money.

Figure 1 - Typical Time-of-Use Electricity Tariff



Renewable Energy Options

RENEWABLE ENERGY OPTIONS

01

Solar photovoltaic (PV) generation

02

Generation of electricity from small hydropower

03

Use of combined heat and power (cogeneration)

04

Generation of electricity from biogas in wastewater treatment facilities.



Barriers to Energy Efficiency Improvement

Main barriers

- Barriers faced by WWU management and staff
- Legal, regulatory, and institutional barriers
- Challenges faced by equipment and energy service providers
- Financing barriers
- Limited implementation capacity

Overcoming the barriers

- Requires concerted and coordinated efforts among national governments, local or municipal governments, international financial institutions (IFIs), and WWU management.
- Specific actions identified in the Guidance Note.



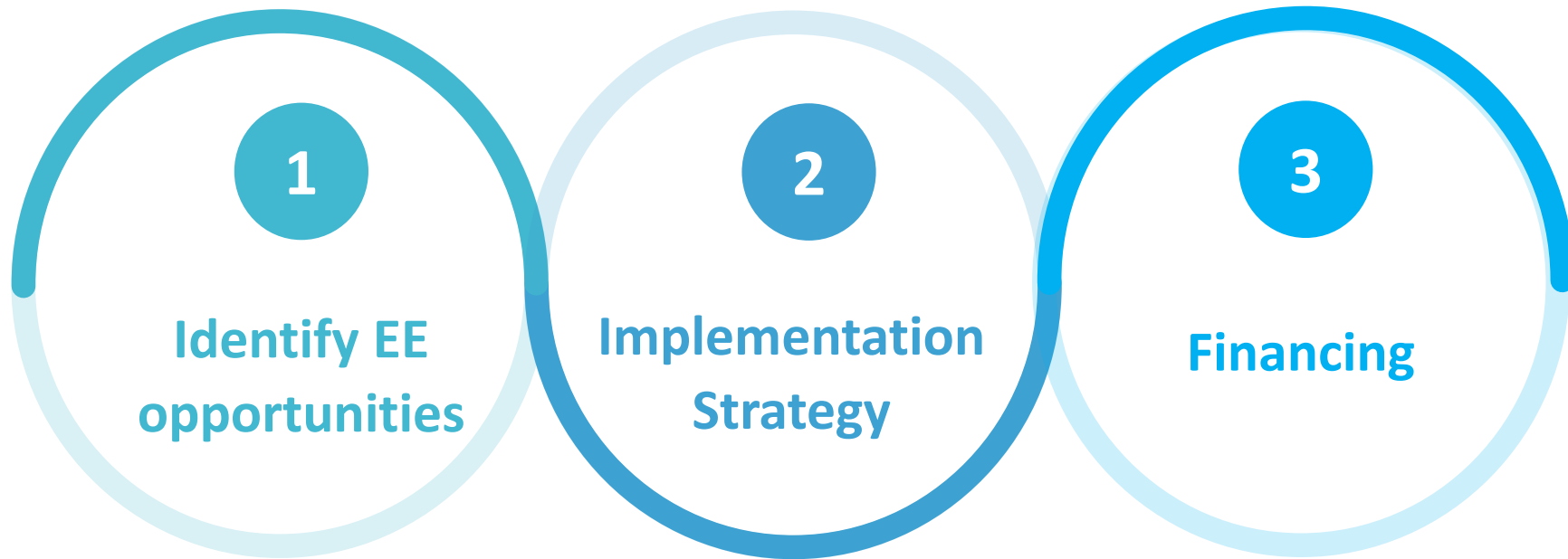
Implementation and financing of energy efficiency investments

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**Relevant World Bank projects and
lessons learned**



Key Steps to Improved Energy Efficiency



Identifying EE Opportunities – The Energy Audit

The energy audit:

- Assesses energy performance indicators and identifies energy savings, load management, and renewable energy options
- Documents characteristics of the equipment and facilities
- Determine electricity consumption and costs
- Identify equipment and processes that consume the most energy

Can be accomplished internally (if capacity exists) or through an energy audit of the facility conducted by external experts.



Key results:

- Identifies low-cost, short-term, as well as medium- and long-term, cost-effective options.
- Develops estimates of needed investments to improve energy efficiency
- Provides recommendations to enhance the capacity of the WWU for data collection and analysis.



Implementation Strategy

Key Elements

- Detailed engineering design, equipment procurement, installation and commissioning, and measurement & verification
- Procurement of equipment and services must consider existing public procurement rules and procedures that may limit the selection of the most efficient equipment or service provider
- Most WWUs may have limited capacity to undertake these tasks internally and may need to engage external service providers.

Implementation Strategy

Engaging an energy service provider or energy service company (ESCO)

- Mobilizes private sector innovation, entrepreneurship, and financing
- Provides access to the latest energy efficient products, technologies, and equipment
- Provides high-quality installation, operation and maintenance
- Implements projects more efficiently and generally at a higher benefit-cost ratio.



Energy Services Business Models

There is a wide range of energy services business models and the performance contracting model can be attractive to WWUs.

Energy Services Business Models

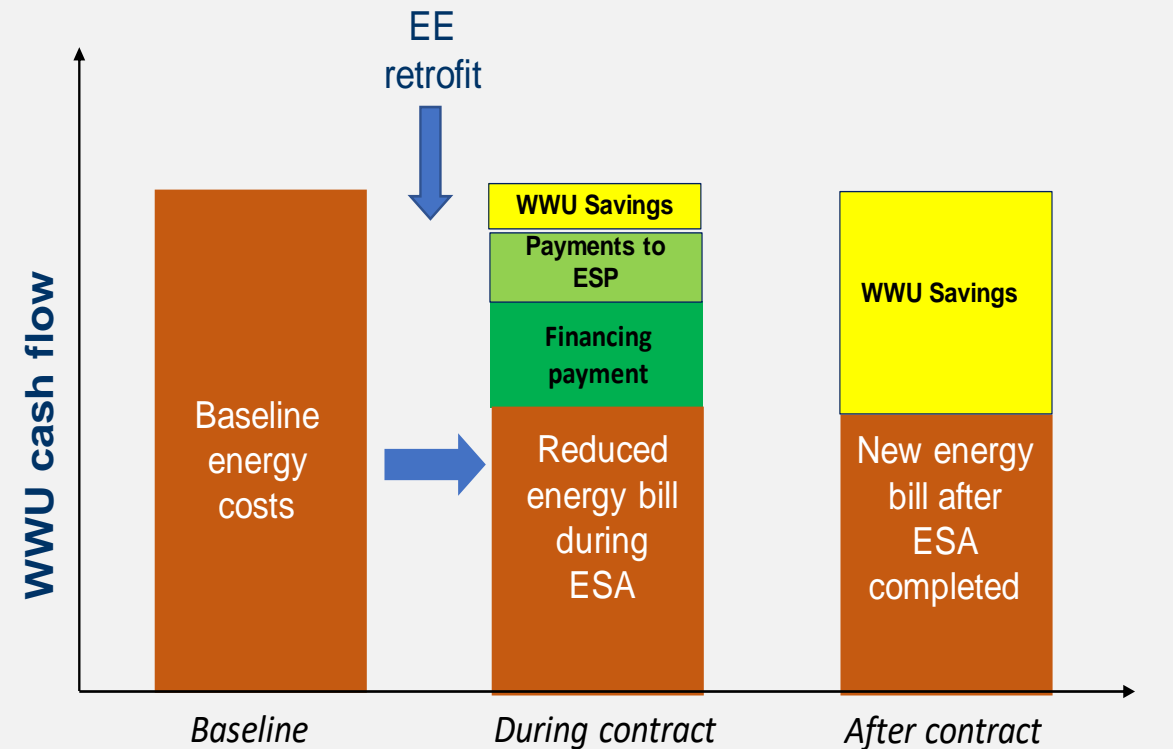
1. Engineering Services

2. Financial Services

3. Performance Contracting

4. Outsourced Energy Management

Performance Contracting Model

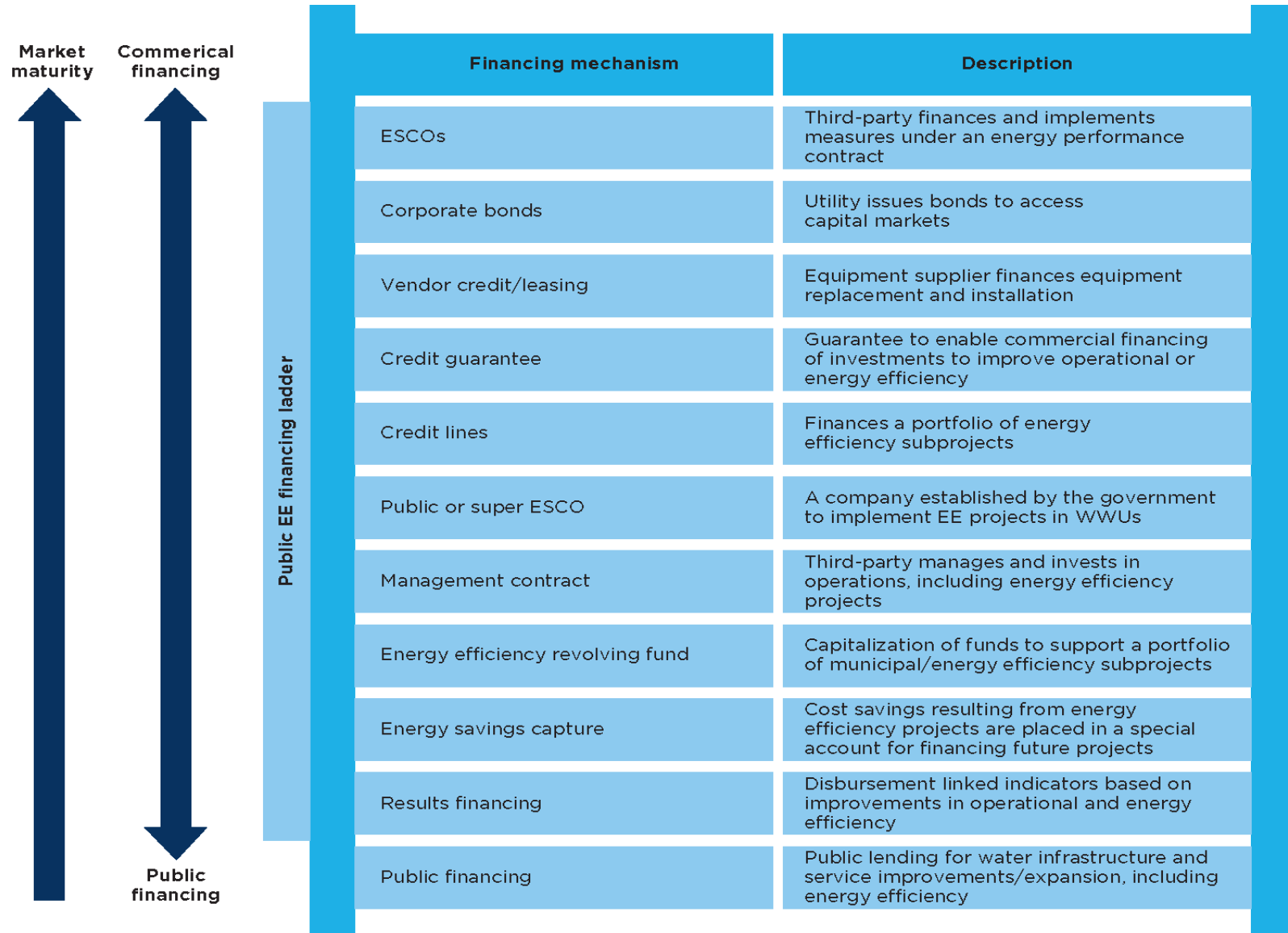


Financing

- **Grant financing is limited** and may not be a sustainable option.
- **Countries must continue to develop and implement financing and delivery mechanisms to:**
 - enhance the financial leverage of public funds or
 - gain access to commercial funding for public sector energy efficiency projects.
- While the **long-term goal should be to leverage commercial financing using performance contracting and ESCOs**, there are many significant barriers to accomplishing this goal in the near-term. The ESCO market in most developing countries is very immature and there is no experience with performance contracting for public agencies.
- The **World Bank has developed the concept of a “Financing Ladder”** showing the progression from strictly public financing to commercial financing.



The Financing Ladder

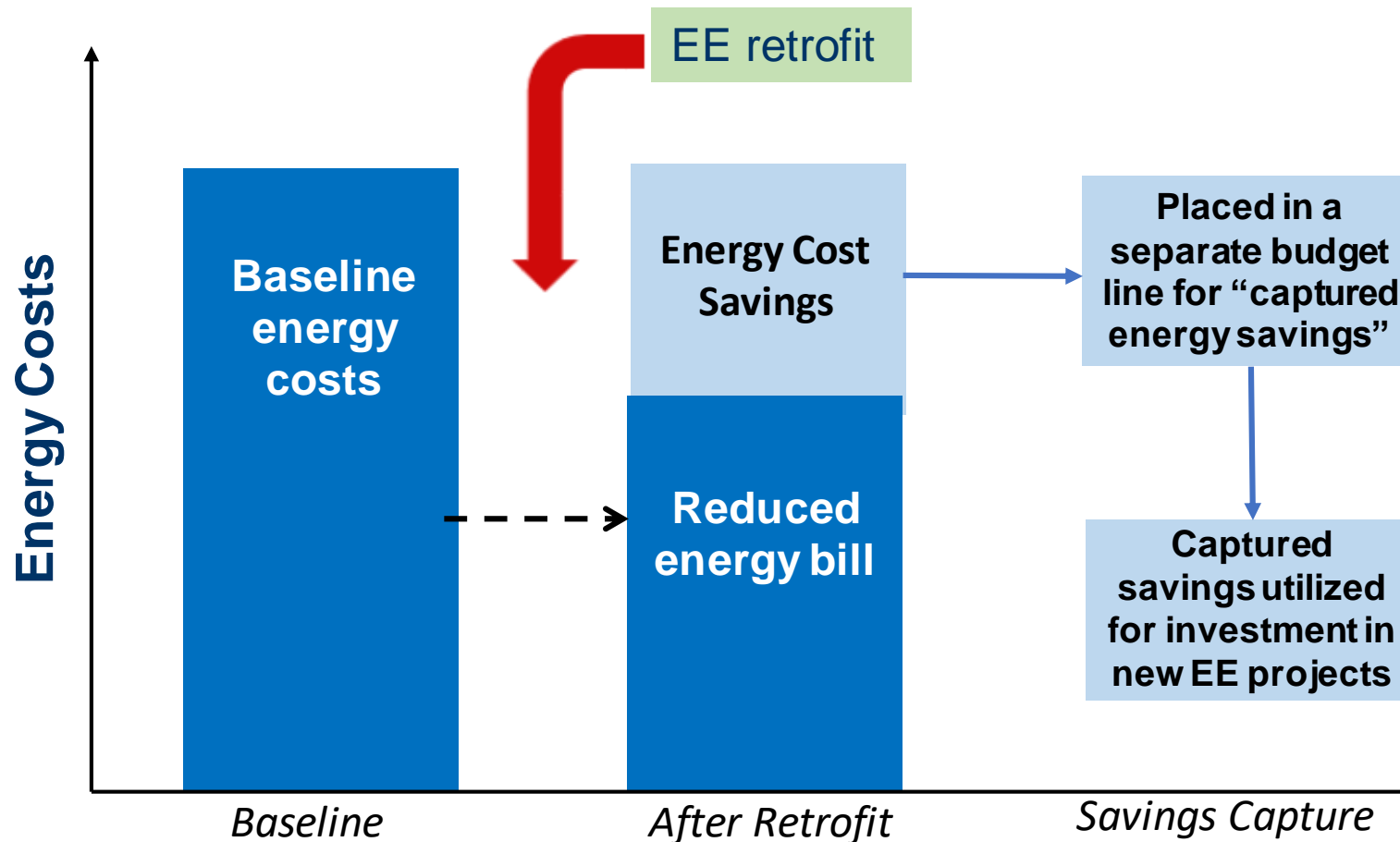


Based on review of international experience and its applicability / suitability



Proposed Energy Savings Capture Model in Uzbekistan

Cost savings from energy efficiency (EE) investments can be recovered or “captured” and utilized for funding additional EE investments.



Proposed Design-Build-Operate Contract – Shimla

- Detailed energy audit of the Shimla conducted under the Greater Shimla Water Supply and Sewerage project
- Identified substantial EE opportunities
- RFP issued for design-build-operate contract

Key contract terms:

- Bidders required to define EE targets
- EE indicators included in bid evaluation criteria
- Performance incentives for exceeding EE targets
- Liquidated damages for failing to meet EE targets



World Bank Projects with EE Components

| Country/City | Project Name | Project Status | EE Component/Activity |
|-----------------------------|---|----------------|---|
| Armenia (Yerevan) | Yerevan Water & Sewerage Management | Completed | Develop energy management plan for 20% cost reduction |
| Bosnia (Mostar) | Water Sector Rehabilitation | Completed | Reduce energy use |
| Jordan | Programmatic Energy & Water Sector Reform | Completed | Increase energy savings in the water sector |
| China | Liaoning Safe & Sustainable Urban Water Project | Ongoing | Development energy management plan |
| India | Water Supply & Sewerage Service DLP for Shimla | Ongoing | Reduction of energy consumption in bulk water production |
| Mexico | Municipal Energy Efficiency Project | Ongoing | Design of energy management systems for WWUs |
| Tanzania | Second Tanzania Water Sector Support Project | Ongoing | Improve energy efficiency |
| Ukraine (various cities) | Second Urban Infrastructure Project | Ongoing | Improve energy use per m ³ of water produced/treated |
| Uruguay | UY OSE Sustainable & Efficient | Ongoing | Energy savings |

Lessons Learned from International Experience

Improved energy efficiency can contribute significantly to better WWU operational performance as well as to GHG 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 (case study summaries provided in guidance note).



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.





Suggested actions for promoting energy efficiency

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Roadmap for mainstreaming energy efficiency in urban water and wastewater utilities

Suggested Actions for Mainstreaming EE in WWUs

i.

WWU management

- Carry out energy audits
- Assign responsibilities and targets and allocate resources for EE projects
- Develop an internal culture promoting efficiency improvement
- Increase staff knowledge and awareness of EE options
- Incentivize staff who contribute to efficiency improvement.

ii.

National and Local Governments

- Prioritize EE improvement in WWU operations in national climate strategies
- 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
- Enable PPPs for project implementation.



Suggested Actions for Mainstreaming EE in WWUs



iii.

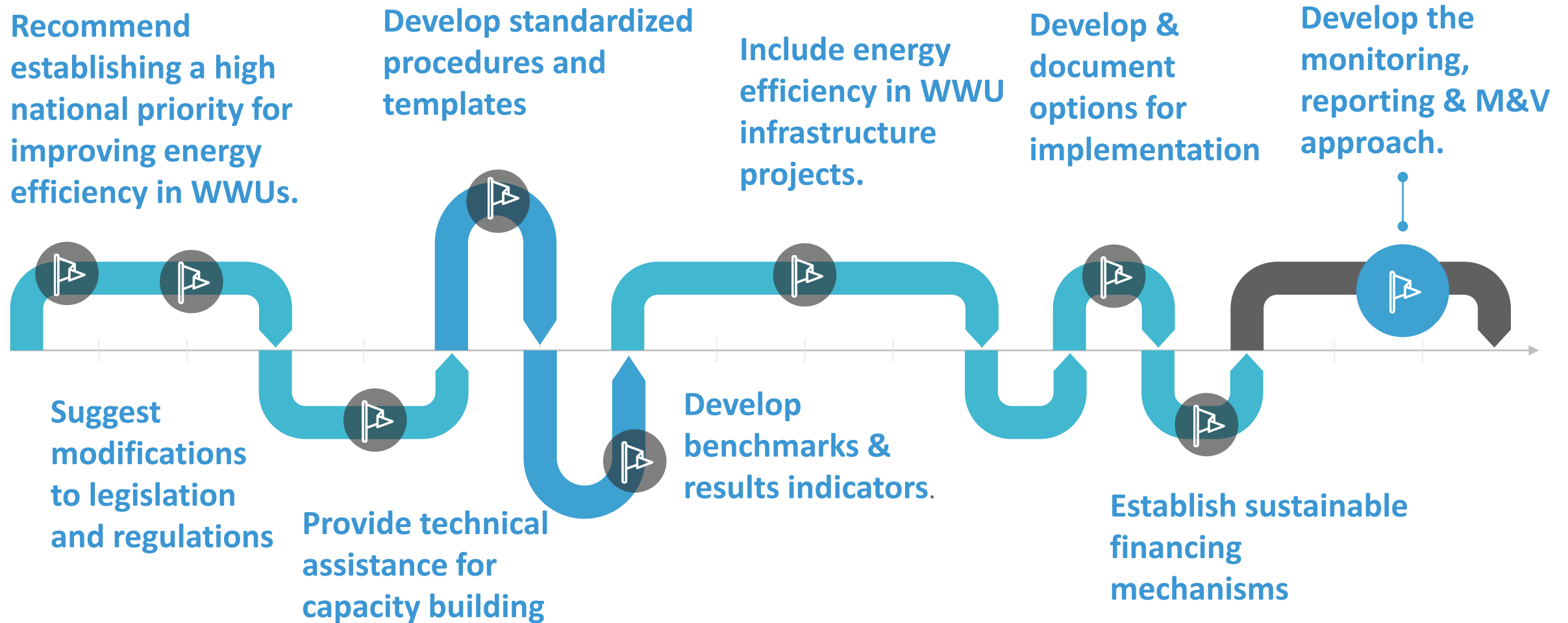
International Financial Institutions

- 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
- Provide technical assistance to build capacity of all stakeholders
- Assist in developing energy services markets.

ROADMAP



Roadmap for Mainstreaming EE in WWUs





Thank you



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