POWER MORE WITH LESS: SCALING UP ENERGY EFFICIENCY FOR GROWTH AND ENERGY SECURITY

World Bank Group Approach Paper

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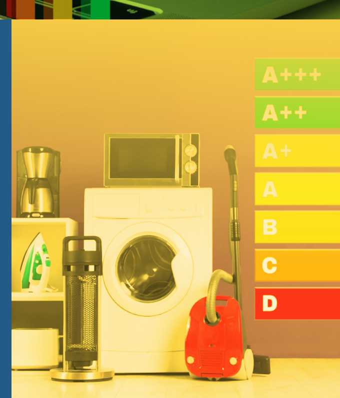

WORLD BANK GROUP

ESMAP
Energy Sector Management Assistance Program

World Bank Group
Approach Paper

POWER MORE WITH LESS:
SCALING UP ENERGY EFFICIENCY FOR GROWTH AND ENERGY SECURITY

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ESMAP
Energy Sector Management Assistance Program

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This report was prepared with financial and technical support from the World Bank's Energy Sector Management Assistance Program (ESMAP). ESMAP is a partnership between the World Bank and over 20 partners to help low- and middle-income countries reduce poverty and boost growth through sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the World Bank (WB), ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal 7 (SDG 7) to ensure access to affordable, reliable, sustainable, and modern energy for all. It helps to shape WB strategies and programs to achieve the WB Climate Change Action Plan targets.

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Abbreviations

AFE	Africa East
AFW	Africa West
AI	artificial intelligence
BAU	business as usual
CAPEX	capital expenditure
CCUS	carbon capture, utilization and storage
DEC	decarbonization scenario
DR	demand response
DSM	demand-side management
E3	Scaling Up Energy Efficiency in Europe and Central Asia (MPA)
EAP	East Asia and Pacific
ECA	Europe and Central Asia
EDGE	Excellence in Design for Greater Efficiencies (IFC)
EE	energy efficiency
EEX	Energy and Extractives (World Bank department)
EJ	exajoule (=1 quadrillion or 10^{18} J)
ESA	energy service agreement
ESCO	energy service company
ESMAP	Energy Sector Management Assistance Program
ESS3	Environmental and Social Standards 3 (ESS3): Resource Efficiency and Pollution Prevention and Management (under World Bank's Environmental and Social Framework)
EU	European Union
EV	electric vehicle
FI	financial intermediary
GCP-E	Global Challenge Program for Energy Access and Transition (World Bank)
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GWh	gigawatt-hours (=1 million kWh)
HIC	high-income country
HVAC	heating, ventilation and air conditioning
ICR	Implementation Completion and Results Report (World Bank completion report)
IEA	International Energy Agency
IFI	international financial organization
NFOŚiGW	National Fund for Environmental Protection and Water Management (Poland)
kWh	kilowatt-hour
LAC	Latin America and Caribbean
LED	light-emitting diode
LIC	low-income country
M&E	monitoring and evaluation
M&V	measurement and verification

MNA	Middle East and North Africa
MIC	middle-income country
MDB	multilateral development bank
MPA	multiphase programmatic approach
MW	megawatt
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
NEEAP	National Energy Efficiency Action Plan
NPV	net present value
NZEB	near-zero-energy building
O&M	operations and maintenance
PIU	project implementation unit
PM	particulate matter
PWh	petawatt-hours (=1 trillion kWh)
RE	renewable energy
RISE	Regulatory Indicators for Sustainable Energy
SAR	South Asia Region
SMEs	small and medium enterprises
SOE	state-owned enterprise
TOU	time of use
TWh	terawatt-hours (=1 billion kWh)
UN	United Nations
URL	Urban, Resilience and Land (World Bank department)
WACC	weighted average cost of capital
WBG	World Bank Group

Acknowledgments

This paper presents the World Bank Group's new approach to supporting and helping scale up energy efficiency in its client countries. It builds on more than two decades of World Bank Group experience in this area. The financial and technical support by the Energy Sector Management Assistance Program (ESMAP) is gratefully acknowledged.

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Foreword

Affordable and reliable energy is critical for developing countries to lift themselves out of poverty and grow their economies. Achieving this ambition requires scaling up energy efficiency, a low-cost, largely untapped energy solution that offers multiple socioeconomic benefits. For every dollar invested, energy efficiency can yield $3 to $5 in returns.

Despite global commitments and broad recognition of its potential, energy efficiency policies and programs have not been adopted and implemented at the scale needed. As a result, countries are overspending on new energy supplies, importing more fuels, and taking on more debt for their energy sectors. The burden of these higher costs eventually falls on households and businesses, negatively impacting economic growth, energy security, affordability, and the environment. This report seeks to change that.

The World Bank Group is committed to supporting its clients to achieve universal access to reliable and affordable electricity, the foundation of our Mission 300 initiative, which aims to provide electricity to 300 million people across Africa by 2030, unlocking opportunities for prosperity. Domestic, low-cost energy resources, such as energy efficiency, are crucial pathways to fulfill this mission by boosting productivity and creating jobs. Energy efficiency can be a critical enabler of structural reforms in the power sector, promoting integrated energy planning and more efficient pricing while protecting consumers and businesses from increased energy costs. Unfortunately, consumers face persistent barriers in investing in energy efficiency measures, primarily due to a lack of incentives and knowledge.

This timely report makes a compelling case for placing energy efficiency at the center of energy policies, planning, and programs. It aims to guide our client countries, international financial institutions, the broader donor community, and the private sector in designing effective programs to transition from small demonstration projects to scaled-up, national energy efficiency programs.

The World Bank Group is ramping up efforts through programmatic approaches and innovative financing mechanisms to maximize impact and boost private sector investments for energy projects. We are also expanding our knowledge-sharing platforms, including the World Bank Group Academy, to build institutional capacity and improve project implementation. Our collective actions can help spur vital policy and institutional reforms that can unlock the full potential of energy efficiency.

Countries that have embraced energy efficiency have seen strong results. The challenge now is to replicate and expand these successes across more developing economies. We hope this report inspires bold national programs and partnerships to achieve this goal—and the World Bank Group stands ready to assist in making it happen.

Guangzhe Chen
Vice President for Infrastructure
World Bank

Executive summary

This approach paper advocates for energy efficiency (EE) to be prioritized and scaled up—necessitating its elevation in energy sector policies, targets and programs, for both low- and middle-income countries (LICs and MICs). It draws on the lessons learned through the World Bank Group's (WBG's) EE engagements since 2010 and offers guiding parameters for policymakers, development partners, and the private sector to use in scaling up demand-side EE globally in end-use sectors—including public facilities, households, and industry—and the role the WBG can play to enable this.

Global context

Despite huge improvements in EE globally, almost two-thirds of primary energy is not used productively. These inefficiencies, combined with the projected 30% increase in energy demand over the next decade (driven largely by industrialized MICs), will require an urgent scale-up of EE to be able to support continued economic development. EE must help curb energy demand in key sectors such as space cooling, energy-intensive industries such as iron and steel, and in the energy-hungry data centers needed to power artificial intelligence and other digital needs. EE would need to make up about 40% of the global energy investments by 2050 to meet net-zero goals. But we need to start now. EE improvements must double by 2030, which means tripling the annual investments to US$1.8-1.9 trillion.

FIGURE ES-1. Drivers for energy efficiency

The good news is that EE is a low-cost resource that offers many opportunities to achieve energy security, economic growth, and other development goals. EE can contribute to a variety of benefits (Figure ES-1). Every dollar invested in EE offers 3-5 dollars in return, along with multiple socioeconomic benefits. EE can result in substantial fiscal savings since it can help lower energy subsidies, facilitate tariff reforms, and lower public energy costs. It can boost competitiveness leading to job growth, enhance energy security while easing energy supply bottlenecks, and provide a range of co-benefits—from reduced local and global pollution to improved health and enhanced resilience.

Market failures

Despite its low costs and substantial benefits, EE has failed to deliver at scale. It is well known that EE has lagged due to a range of policy, institutional, financial, and informational market failures or barriers. Because EE projects are generally small compared with other infrastructure investments, these barriers can lead to high transaction costs to identify, prepare, finance, and implement. This is exacerbated in many LICs and MICs, where low energy prices, poor enforcement of regulations, weak institutions, and limited access to financing and/or data further constrain EE markets. EE also faces a perception problem as it consistently receives less attention in public policy documents and company business plans. However, since EE has the characteristics of a public good given its society-wide benefits, governments must play an important role to overcome these challenges. Global experience shows these barriers can be overcome—and EE can be delivered at scale.

World Bank portfolio

Energy efficiency within the World Bank's portfolio has been very cost-effective, at 0.63 US¢ per kWh saved, compared to 3-8 US¢ per kWh for typical clean energy supply options.

The WBG has been investing in EE for more than three decades and has accumulated a wealth of policy and operational experience. Over the past decade (FY15-24), the World Bank's EE lending portfolio has reached US$6.71 billion, including investments in buildings, industry, public lighting, water pumping, and other sectors. Within this portfolio, EE has been delivered extremely cost-effectively, with an investment cost of only 0.63 US¢/kWh saved, compared to 3-8 US¢/kWh for typical clean energy supply investments. This translates into about US$10.46 investment per ton of CO_2 emissions reduced. The portfolio has also yielded substantial lessons, including the need for government commitment, strong policies and regulations, innovative financing and delivery models customized to local markets, robust institutional and market development, and effective information sharing. In some cases, especially when payback periods are longer, an extra government push is needed through a combination of regulations and incentives. EE investments can and should be taken up by the private sector, once such prevailing barriers are addressed. More recently, the WBG has supported some more ambitious programs that show greater potential for further scale and replication. These programs—which were national, regional, or global in scope; relied on well-resourced institutions; offered a mix of leveraged financing and incentive schemes; mobilized strong partnerships; and included extensive outreach—can offer inspiration to others.

Creating an EE ecosystem

More than three decades of WBG experience has led to a playbook of tested interventions that, when combined with technical innovations, create new opportunities for achieving impact at a larger scale. The WBG's global EE portfolio has employed models that have successfully overcome typical barriers and, together with development partners and governments, generated a wealth of good practices. These lessons, combined with important technological and digital innovations (such as heat pumps, near-zero energy buildings, and AI-enabled building automation), have created new opportunities for countries to leapfrog to high-efficiency systems and practices. These trends provide opportunities to scale up EE while boosting market demand—which can bring in new suppliers, help lower costs, and channel the massive inflow of private capital needed to realize EE's vast potential at scale.

A programmatic approach can allow for a longer-term engagement underpinned by a range of structured interventions. It can provide a flexible menu of activities that addresses high-impact barriers and private sector investment constraints in the public, residential, and industrial sectors (Figure ES-2) to achieve national-level goals. In less developed markets, as in many LICs and some MICs, it will be important to introduce the policy and institutional reforms needed to facilitate EE investments. Public financing through mechanisms such as EE revolving funds may be needed until commercial financiers can be engaged. In some LICs and most MICs, as markets evolve, subsequent phases of projects, combined with key policy and institutional reforms, can help countries move from demonstration projects to scaled-up national programs that leverage commercial financing while addressing reform measures and risk mitigation mechanisms to achieve the required scale of investments. Increased coordination with donor partners will allow collaboration on joint national programs where possible.

> ***The WBG will pursue a more programmatic approach aspiring to national-scale programs, while transitioning to more commercial financing mechanisms, and stronger policies, institutions and knowledge.***

FIGURE ES-2. Programmatic framework to scale up energy efficiency by sector

	PUBLIC	RESIDENTIAL	INDUSTRY
STAGE 1 *Pilots with technical assistance*	• Pilot investments with government units to demonstrate EE and develop institutional capacities	• Pilot investments with grants to demonstrate EE and catalyze supply chain markets	• Public support for audits, financing for energy intensive facilities and SMEs • Pilots to develop case studies • Energy management systems help build databases
STAGE 2 *Sustainable financing mechanisms*	• Sustainable financing mechanisms to demonstrate financial viability • New business models (e.g., ESCOs)	• Sustainable financing mechanisms with phased down grants • Public financing to focus on low-income households	• Scale up commercial financing for industrial EE, introduce benchmarking • Expand to include industrial decarbonization
STAGE 3 *National programs with commercial financing*	• National-level programs with commercial financing • Mainstreamed business models to expand markets	• Scale up local financing and market capacities • Strengthened regulations and processes to lower transaction costs	• Mainstream commercial financing • Strengthen regulatory enforcement and market-based mechanisms

EE at scale can save a typical MIC over US$11 billion in reduced power system costs, while reducing potential stranded assets of new energy supply, if concessional financing can be mobilized to help overcome the high cost of capital and address other market barriers. Modeling of a typical MIC power system showed that investing in all commercially available EE measures could save up to US$11.6 billion in power system investments by 2050. Many of the investments are cost-effective today but require enabling activities—from energy audits to appliance testing. In addition, the higher costs of capital and constraints on borrowing mean that many MICs and LICs cannot afford some of the EE investments that have longer payback periods but offer deeper energy savings. This means LICs and MICs will have to invest more for their energy systems through 2050; a typical LIC would incur US$157 billion more than a typical high-income country while achieving only about half the level of energy savings. Concessional financing is thus needed to facilitate viable EE investments, both for enabling activities and to lower the cost of capital—up to US$6.6-7.1 billion for a typical MIC and over US$10 billion for a typical LIC.

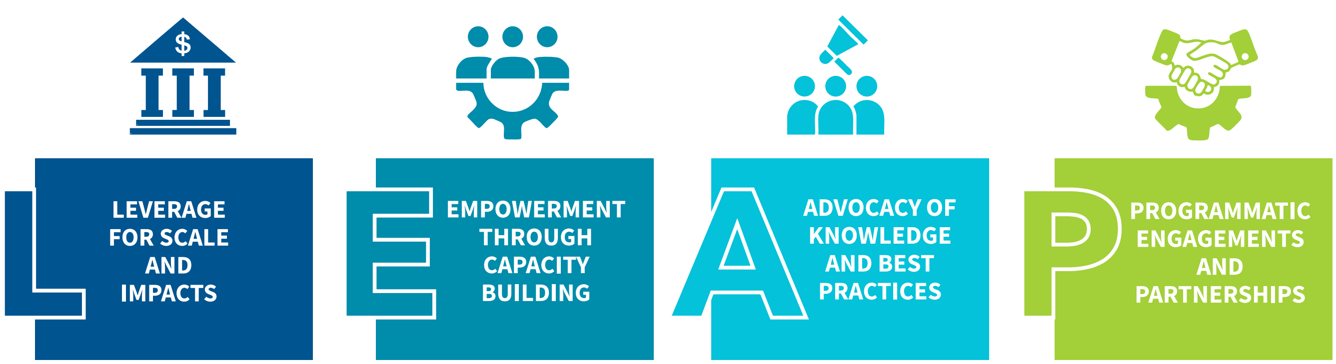
Driving actions for scale

In the short term, increasing EE in buildings should be a priority for all LICs and MICs. Additionally, targeted support should be provided to industrial EE in highly industrialized, reforming MICs. Since most buildings that will be in operation in 2050 have yet to be built, it will be critical to ensure that stringent building codes are in place and the buildings are as close to net zero as practical, with very efficient design techniques, envelopes, equipment, and on-site renewable energy. Aggressive national renovation and retrofit programs are also needed to improve the existing building stock and appliances. The harmonization of policies, technical standards, documents, and templates is also important to help create more predictability for equipment suppliers, commercial banks, service providers and others to build stronger supply chains and lower costs. Finally, better urban planning is needed to ensure cities are more compact, opportunities for district-level heating/cooling are explored and greater opportunities for public transport are realized. EE in industry will also be important but targeted in industrialized MICs committed to reforms in the near term, with greater scale up to all LICs and MICs in the medium- to long-term.

The scaling up of EE will require a concerted effort by governments, the WBG, donor partners, and the private sector in all areas in order to LEAP forward (Figure ES-3). This call to action will necessitate:

- better *Leverage for scale and impacts*
- greater *Empowerment through capacity building*
- global *Advocacy of knowledge and best practices*, in terms of successful policies and approaches for scale
- more systematic *Programmatic engagements and partnerships*

FIGURE ES-3. L-E-A-P to achieve scale for energy efficiency



Leverage for scale and impacts

- Foster market-friendly environment through policy and regulatory reforms
- Strategize the use of public and concessional financing to maximize private capital
- Lead by example: promote innovative pilots for scale up

Empowerment through capacity building

- Develop practical guidance to enable replications and scale up of bankable projects
- Reinforce capacity building training to government agencies, financiers, and technical practitioners

Advocacy of knowledge and best practices

- Raise public awareness and general knowledge to create demand
- Mobilize regional and global knowledge platforms to discuss the common challenges and opportunities

Programmatic engagements and partnerships

- Plan a clear national strategy that enables structured and sequenced interventions from public, private and international stakeholders to achieve scale
- Enable a dedicated and well-resourced agency for programs and partner coordination

Moving forward, governments would need to:

- Embed EE into national development plans and strategies, such as power development plans, and strengthen policy frameworks, such as enacting building codes and equipment standards with suitable enforcement and periodic updating, reforming energy pricing, and strengthening rulebooks for systematic measurement, reporting, and verification.
- Strengthen institutional governance and provide the resources necessary to access and analyze data for benchmarking, assess and leverage markets, and deliver EE programs at scale.
- In LICs and MICs with underdeveloped markets, invest in public facilities to help spur markets for energy efficient services and equipment and lead by example. Governments can also undertake lower-cost measures such as raising awareness and influencing behaviors, recognizing high performers, and optimizing heating and cooling settings.
- In MICs with more developed markets, begin scaling up EE programs by launching more sustainable financing schemes, such as EE revolving funds for the public sector, or guarantees to local banks for industry and households—and transitioning to national-scale programs (e.g., programs that serve all eligible public buildings, factories, or homes).

Multilateral Development Banks and donor partners would need to:

- Work together to advocate and provide technical support for EE to be prioritized within national government strategies, plans, policies, and programming.
- Provide technical assistance and financing to support the design and development of pilot programs—with a clear line of sight to get to scale—in coordination with governments, donor partners, and the private sector.
- Use public financing, concessional funds, and risk mitigation measures (such as guarantees) judiciously to address key market failures and barriers to unlock commercial financing.
- Share models and approaches, results, and lessons—even failures—to help inform future efforts and support global communities of practice.

The private sector would need to:

- Engage with governments and donor partners to identify key market constraints to investments in EE and advocate for supportive EE policies and actions.
- Identify and replicate successful or promising business models.
- Develop bankable financing and business models that can be replicated and scaled up, where markets are ready.
- Share experiences and lessons through participation in suitable fora.

The WBG is ready to assist governments to intensify impacts, with its programmatic engagements under the Global Challenge Program on Energy Access and Transition, WBG Academies to share knowledge and build capacity, a more cohesive WBG approach to help unlock access to more commercial financing, and partnerships to address global challenges. The ingredients to develop the foundations and to foster scaled-up programing for EE are now largely known; the biggest obstacles are the lack of political will and resource mobilization.

While developing EE policies and programs at scale will require time and effort, the rewards far outweigh the challenges. Countries that have made the bold and concerted efforts to do so have seen huge returns accrue. The urgency now is to turn plans into action—unlocking EE's full potential through strong collaboration with governments, donor partners, and the private sector. Together, we can unlock energy efficiency at scale—and power more with less.

1. Why is energy efficiency important to meet today's development challenges?

Energy efficiency is a low-cost energy resource that can help low- and middle-income countries drive economic growth, enhance energy security, and address rising energy demand with many socioeconomic benefits.

This approach paper seeks to provide a high-level case for prioritizing the scaling up of energy efficiency (EE) and ensuring EE is included in energy sector policies, targets and programs in both low- and middle-income countries (LICs and MICs). The paper was prepared in consultation with staff of the World Bank's Energy and Extractives (EEX) Department, other relevant sector departments—such as Urban, Resilience and Land (URL) and Water—as well as IFC and MIGA staff (collectively the World Bank Group or WBG) at the global and regional levels. The paper also benefited from external consultations with other multilateral development banks (MDBs) and the private sector (see Annex A). Drawing on lessons learned through the World Bank's EE engagements in over 66 countries since 2010 (178 operations) and IFC engagements, it offers guiding parameters and actions for governments, donor partners, and the private sector working to scale up demand-side EE globally, and suggests how the WBG can help.

Setting the scene

Energy is the driver of global economic growth and development. Energy serves as a fundamental input for nearly all production and consumption activities in a modern economy—powering industries, transportation, and basic services and enabling the creation of goods and services that drive economic development and improve living standards. However, the trillions of dollars needed to fuel continued economic growth in the developing world and provide universal access to energy may be out of reach for most countries. Continued geopolitical uncertainties have heightened concerns about energy security and the need to ensure reliable and affordable energy supply. It is against this backdrop that EE has re-emerged as an increasingly important resource that countries can no longer afford to ignore. The term *energy efficiency* refers to the improvement of technologies and practices to provide the same—or improved—levels of production and/or service quality with lower energy inputs.[1] For the purposes of this paper, unless otherwise noted, EE refers to *demand-side* EE[2], which entails improvements in end-use sectors, including public facilities, households, and industry.

Despite improvements in EE, today's global energy system remains inefficient, with around two-thirds of primary energy not used productively. The primary driver of this energy loss is the widespread reliance on fossil fuels, which are inherently inefficient across the supply chain—from production and transmission to use—resulting in a significant portion of primary energy being wasted throughout the process. In 2019, nearly 400 exajoules (EJ) of energy—equivalent to two-thirds of the world's total primary energy supply—were wasted, amounting to an economic loss of over $4.5 trillion, or nearly 5% of global GDP.[3] Of the wasted energy, roughly half was on supply side in terms of energy production (47%) and transportation losses (5%); the remaining loss was on the demand side for turning final energy, such as gasoline and electricity, into functional uses like vehicular motion, heating, and cooling. The world needs to do better.

Based on current trends, energy demand for LICs and MICs, excluding China, could rise by almost 30% over the next decade, three-quarters of which would likely be met by fossil fuels.[4] In the last

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1 In technical terms, it is the ratio of useful energy output to total energy input (in physical units) in a system, regardless of fuel.

2 Demand-side EE is sometimes also referred to as demand-side management (DSM). However, for the purposes of this paper, demand-side EE or EE is used; DSM is only used in the context of utility-led EE programs for consumers (see Section 5).

3 RMI (2024). The incredible inefficiency of the fossil fuel energy system.

4 IEA (2021). Financing Clean Energy Transitions in Emerging and Developing Economies. World Energy Investment 2021 Specialist Report. Paris, 2021.

decade, the overall energy demand declined on average by 0.5% per year for high-income countries but rose by 2.6% annually in LICs and MICs. Today, LICs and MICs account for about 60% of global energy demand and will continue to be key drivers of demand growth in the coming decades due to population growth, economic development, urbanization, and rising living standards. In 2024, global energy demand grew by 2.2%, notably faster than the annual average of 1.3% in 2013-2023. This increase was driven primarily by a 4.3% surge in electricity demand, fueled in part by the rapid adoption of electricity-dependent technologies like heat pumps and electric vehicles (EVs) (Box 1).[5] LICs and MICs drove 80% of the increase in energy demand in 2024, of which 60% was in Asia. From a sectoral standpoint, energy demand from industry is expected to surge, alongside cooling, which is projected to triple by 2050. Data centers, which are needed to support artificial intelligence (AI) and other growing digital needs, are also becoming a significant driver of electricity growth—they consumed an estimated 460 terawatt-hours (TWh) in 2022, and this could rise to over 1,000 TWh by 2026, which is equivalent to the electricity consumption of Japan.[6] Because LICs and MICs will be the main driver for future demand growth, they have the greatest need and potential for EE gains.

BOX 1. ENERGY EFFICIENCY AND ELECTRIFICATION

Primary energy use can be reduced through both technical energy efficiency (defined as changes in technologies to reduce overall energy use for the same output) and electrification (switching from fossil fuels to electricity). Electrification, primarily through heat pumps and EVs, saves significant amounts of energy: heat pumps are typically 3-5 times more efficient than traditional, fossil-fuel-based heating systems, and EVs are 2-5 times more efficient than internal combustion engines. Both also reduce primary energy use and thus greenhouse gas (GHG) emissions and local air pollution. However, electrification is often viewed as a decarbonization measure since it is generally motivated by reducing fossil fuel use.

So, while both reduce energy consumption, the literature generally treats them differently. Heat pumps are often a replacement for gas boilers/furnaces or fossil-fuel-based district heating, and EVs require broader shifts in car manufacturing and charging infrastructure, each with their own sets of policies and programs to support them. While it is recognized that there are synergies between them—for example, EE policies and programs can help offset the additional electricity demand from electrification—this paper focuses on technical energy efficiency.

Achieving the required pace and scale of the needed energy supply is unattainable without a significant and urgent scaling up of EE to restrain the growth in energy demand. The reduced energy demand from accumulated EE improvements over the last two decades saved advanced economies around US$680 billion in 2022, equivalent to 15% of the total annual energy bill. EE is also a core pillar of the Sustainable Development Goal (SDG) 7, which aims to ensure universal access to affordable, reliable, sustainable and modern energy. And the International Energy Agency's (IEA) Net Zero Emissions by 2050 Scenario (NZE) shows that EE measures represent about 40% of the investments required through 2050[7] (a reduction of around 35 EJ, or about India's annual energy consumption), with roughly 85% of this investment in LICs and MICs, predominantly energy-intensive MICs.[8] Under the NZE, the annual EE improvements

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5 IEA (2025). Global Energy Review 2025.

6 IEA (2025). Electricity 2024.

7 IEA (2021). Net Zero by 2050.

8 Calculated based on International Energy Agency (IEA) (2023). Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach.

double—from below 2% today to 4%—by 2030 to achieve global targets and enable 50% of the emission reductions.[9] This is why more than 130 countries at the COP 28 meetings in Dubai in 2023 pledged to do so.[10]

The global energy crisis in 2022 showed global vulnerabilities in energy supply chains, particularly natural gas, impacting energy security and affordability. Western Europe, Europe and Central Asia (ECA), and other regions were severely impacted by the successive waves of the COVID-19 pandemic and the Russian invasion of Ukraine, which contributed to an unprecedented energy crisis, placing energy security and affordability in jeopardy. The supply shock in the natural gas markets consequently led to a significant hike in regional prices. Even before 2022, the strong post-COVID-19 recovery had driven energy demand up globally, resulting in exceptionally high natural gas prices. A spike of wholesale electricity prices across Europe ensued, along with steep rises in heating costs. These price hikes exposed consumers to price volatility, negatively affected energy-dependent sectors of the economy, pushed inflation to multi-decade highs, and affected vulnerable households in ECA where energy poverty remains high. The urgency of the crisis led many governments to boost EE programs, given EE's ability to reduce demand quickly and improve affordability while reducing future vulnerability of the systems to both physical and price shocks.

Globally, the poor are stuck in a vicious cycle of high energy costs and constraints to invest in EE. While the consumption of poorer households is modest, they typically spend a larger share of their income on energy. The poor are more likely to live in uninsulated, leaky buildings with older appliances and more polluting fuels for cooking and space heating. They often lack the means to access credit markets to invest in energy-efficient homes and appliances with higher upfront costs, resulting in chronic inefficiencies which then lead to higher energy bills and lower quality of energy services (e.g., undercooling, underheating).

While retrofits can save substantial energy, it is also important to acknowledge the role that urban planning and designs can play to significantly reduce energy use. Cities are amongst the largest consumers of energy (buildings, district energy systems, transport, water/waste, etc.) and overall account for about 75% of global primary energy and 50-60% of global GHG emissions.[11] The global urban population is expected to increase by between 2.5 and 3 billion by 2050, when it will include 64-69% of the world's population. Sprawling cities with low-density development are inherently less energy efficient—they require more heating and cooling, incur more energy losses in utility transmission, feature longer travel and commute times, and have fewer viable options for public transportation.[12] Therefore, improved city planning, densification and better urban designs must consider energy use to avoid lock-in of inefficient practices. The World Bank estimates that US$7.9 to 26.3 trillion will be required for cities in LICs and MICs to 2050 to make key low-carbon and resilience investments, including EE.[13] However, since urban planning is extensively covered in existing literature, it is not covered further in this paper.[14]

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[9] Under the IEA's Announced Pledges Scenario (APS), introduced in 2021, the extent to which announced ambitions and targets can deliver the emissions reductions needed to achieve net zero emissions by 2050 are presented. Under the APS, the EE annual improvement rate is only 3% which would fall short of global targets. Sources: IEA (2023). Energy Efficiency 2023; IEA (2024). World Energy Outlook 2024.

[10] IEA (2023). IEA Assessment of the evolving pledges at COP 28.

[11] UN Habitat, see https://unhabitat.org/topic/urban-energy

[12] The comparison of Barcelona, Spain, and Atlanta (Georgia, U.S.) is a common one, with Barcelona being a model city that incorporated EE into its city planning, while Atlanta shows the downsides of very energy-intensive urban sprawl. As a result, the population density of Barcelona is about 29 times higher than that of Atlanta, and energy use per capital for vehicles is about 9 times lower. Source: ESMAP Energy Efficient Cities (2014), *Planning Energy Efficient and Livable Cities*, Mayoral Guidance Note #6.

[13] World Bank (forthcoming). *Banking on Cities: Investing in Resilient and Low-Carbon Urbanization*. Washington, D.C., 2025.

[14] For more information on urban form and planning, please see, for example, World Bank, 2023. *The Power of Cities: Harnessing Low-carbon Urbanization for Climate Action*. Washington, D.C., 2023.

Drivers of energy efficiency

Every dollar invested in EE offers a 3-5-dollar return, along with multiple development benefits.[15] The primary benefits of EE are linked to enabling economic growth and competitiveness, jobs, and energy security while providing broader socioeconomic benefits, which is why investing in EE is so important for LICs and MICs. Some demonstrative drivers of EE—from energy security and consumer affordability to competitiveness and the environment—are included in Figure 1. Different countries often have different drivers, so it is important to tailor the messaging, policies, and programs to address each country's needs. There are also regional differences—such as ECA, which has a strong focus on reducing air pollution by supporting a transition to sustainable heating; South and East Asia, which prioritize industrial EE to spur growth and competitiveness; and Africa for energy access and affordability under the Mission 300 initiative (Box 2).

FIGURE 1. Energy efficiency drivers aligned with the World Bank's focus areas, with examples

PEOPLE

CONSUMER AFFORDABILITY: Adoption of efficient appliances and building renovations can lower energy bills. The levelized cost of an LED bulb is about 1/10 the cost of an incandescent lamp.

ENHANCED ENERGY SECURITY: Reducing energy use reduces exposure to volatile energy price shocks that disproportionately affect the most vulnerable populations. EE mitigated energy rationing in Brazil after reduced hydropower availability in 2001 and in Japan after the tsunami in 2011.

PROSPERITY

FISCAL SAVINGS: Implementing all global EE measures by 2030 could reduce energy costs by 20–25% and achieve ~US$2 trillion in annual economy-wide savings. In 2022, energy savings from past EE actions saved advanced economies ~$680 billion, equivalent to 15% of the total energy bill.

COMPETITIVENESS AND JOBS: EE is central to industrial productivity and allows companies to stay competitive in an increasingly carbon-constraint environment. Highly labor-intensive, EE can create nearly 3x the jobs per investment dollar compared to fossil fuels and 2x for solar power.

INFRASTRUCTURE

INCREASED RESILIENCE: EE can help enhance critical infrastructure's resilience to growing climate and natural hazards, such as heatwaves. Advanced cool roof materials alone could reduce indoor air temperatures by 5-10° C.

REDUCED ENERGY SUPPLY BOTTLENECKS: EE, coupled with demand response (DR), can ease bottlenecks in generation, transmission and distribution supply and optimize grid performance, leading to more reliable and cost-effective energy systems. The US saved over 62 GW in peak load reduction in 2022 (~6.5% of demand) due to wholesale DR programs.

PLANET

MITIGATED LOCAL AIR POLLUTION: EE in heavily polluting sectors, such as heating and heavy industry, still largely reliant on fossil fuels, can significantly enhance air quality and strengthen public health, leading to reduced mortality rates associated with toxic air pollution (~ 3 million deaths per year globally) - a pressing issue in countries like Bangladesh, China, India and Poland.

ABATED CLIMATE CHANGE: Unused energy is the cleanest energy. EE is a cost-effective measure that can deliver 50% of the emissions reductions needed by 2030 and 40% of reductions by 2050.

DIGITAL

SUSTAINABLE USE OF DIGITAL TECHNOLOGIES: The rapid expansion of digital technologies, such as artificial intelligence and growing data centers, is driving up global energy demand. EE investment can reduce the energy demand, costs and environmental impacts of digitalization.

Source: International Energy Agency (IEA) (2019), Multiple Benefits of Energy Efficiency; IEA (2022), Energy Efficiency 2022; RMI (2024), Why Efficiency Matters: Unlocking Benefits Beyond Climate for All; World Research Institute (2021), The Green Jobs Advantage: How Climate-friendly Investments Are Better Job Creators; World Bank (2016), Why energy efficiency matters and how to scale it up, Live Wire 2016/53; World Bank (2022), Energy Crisis – Protecting Economies and Enhancing Energy Security in Europe and Central Asia; World Bank (2024), Selecting and Implementing Demand Response Programs to Support Grid Flexibility: A Guidance Note for Practitioners.

15 An ACEEE study (2014) found that each dollar invested by utilities and participants in EE measures yielded US$1.24 to US$4.00 in benefits. Similarly, a KfW study (2013) found that €1 invested in EE resulted in €4-5 in benefits.

BOX 2. EE FOR WBG'S NEW MISSION ON ENERGY ACCESS: MISSION 300

In 2024, the WBG, in partnership with the African Development Bank and other organizations, launched an ambitious plan called "Mission 300" to connect more than 300 million people across Sub-Sahan Africa by 2030. In support of Mission 300 and their own energy access targets, African countries are developing National Energy Compacts to address constraints across the energy sector, which include EE on both the supply and demand sides. Malawi, for example, has prioritized improving supply-side EE (to reduce system losses and strengthen utility finances) while also investing in demand-side EE (such as switching to more efficient lighting and cooling appliances). These efforts are accompanied by policy and regulatory support, including establishing minimum energy performance standards in the residential, commercial, and industrial sectors—all to help ensure these new connections are financially sustainable and affordable to households while ensuring more efficiency from the outset.

Source: WBG (2024). Connecting Millions to Electricity in Africa with "Mission 300".

These EE drivers have proven relevant for LICs and MICs to address a variety of challenges:

- In terms of *energy security*, EE is a pillar of Türkiye's energy security plans given that the country imports about 74% of its energy supply (including 100% of its gas and 91% of its oil).[16]
- On *fiscal savings*, implementing essential reforms to transition to cost-reflective electricity, district heating, and fuel pricing with targeted, energy-related social assistance and residential EE investments could generate fiscal savings of 0.5–1.0% of GDP on average for ECA countries.[17]
- EE is a *jobs* machine. Job creation varies by program type, but in 2022 the end-use efficiency sector was the largest employer, with over 11 million jobs globally; estimates are that 8-27 job years were created for each €1 million invested in EE.[18] In Poland, a program to support sustainable heating in ~3 million single family homes is projected to create more than 100,000 jobs in heating product manufacturing and supply, construction material supply, installation, and related services.[19]
- *Competitiveness* is also enhanced through EE. A recent firm survey (almost 20,000 firms in 12 countries, half in Asia) found that EE is positively correlated with productivity; managerial human capacity is the most significant factor in differences in EE across firms.[20]
- Energy *supply reliability* is also important. In South Africa, for example, aging coal-based power generation has resulted in frequent power cuts, which have disrupted economic activity, increased operating costs for businesses (many of which rely on costly diesel generators), and cost the country 0.7-3.2% of GDP. Reforms supported by the Bank include EE improvements in electricity supply and in businesses and households.[21] Ghana introduced a demand response (DR) mechanism—through a

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[16] World Bank, 2024. *Phase 1 of the Multiphase Programmatic Approach of the Scaling-Up Energy Efficiency in ECA (E3) Program Appraisal Document*. Report No. PAD00193, May 29, 2024.

[17] World Bank, 2012. *Europe and Central Asia balancing act: cutting subsidies, protecting affordability, and investing in the energy sector in Eastern Europe and Central Asia region*. Washington, DC: World Bank.

[18] IEA (2023). World Energy Employment.

[19] World Bank, 2021. *Clean Air Through Greening Residential Heating Program Appraisal Document*. Report No. PAD4081, November 12, 2021.; Program Implementation Status Report, June 30, 2024.

[20] World Bank, 2025 (forthcoming). *Adoption of Green Technologies and Practices in Developing Countries. Evidence from the Firm Adoption of Technologies Surveys.* World Bank presentation, April 10, 2025.

[21] World Bank, 2023. Sustainable and Low-Carbon Energy Transition Development Policy Loan Program Document. Report No. PGD444, September 28, 2023.

voluntary industrial time-of-use (TOU) rate structure—to reduce forced load shedding[22] and improve revenue collections. The TOU rate helped reduce the industrial peak demand by 5.5% (56 MW) and net benefits to the utility of US$36.6 million.[23]

- Enhancing consumer *affordability and utility revenues* through EE can not only help households get more from the energy they use, but also improve the utility's finances. In Sao Paolo, Brazil, a slum electricity regularization program promoted energy-efficient appliances that reduced nonpayment by 67% and energy use by 40% for poor households.[24]
- For *energy access sustainability*, EE schemes can help make electricity services more affordable, and DR programs[25] can help lower the cost of new supply in Sub-Saharan Africa and South Asia. Mozambique is providing LEDs to new household connections and public facilities, and promoting energy-efficient cookstoves, to reduce energy expenditures and ensure energy services are more affordable for poorer homes.[26]
- Across ECA and parts of East Asia, *air pollution* from space heating can be stifling during the winter months. Programs in Bosnia & Herzegovina, China, Kyrgyz Republic, Mongolia and Poland are all promoting the transition from coal and wood stoves to cleaner, energy-efficient technologies such as heat pumps and biomass pellet boilers to reduce fine particulate matter ($PM_{2.5}$) emissions, a leading cause of many respiratory illnesses.

Given the role of EE in advancing energy security, economic growth, affordability, and the energy transition, it has been prominently featured in key global and national flagship documents. Most recently, the flagship *World Bank Development Report 2024: The Middle-Income Trap* identified EE as the key to MICs escaping the middle-income trap and achieving prosperity. The report encourages MICs to prioritize EE to help them achieve multiple goals, including: (i) disciplining incumbents such as inefficient state-owned enterprises (SOEs) through competition and creative destruction; (ii) fostering innovation through enhanced resource allocation and efficiency; and (iii) pursuing sustainable growth by decoupling economic growth from energy and carbon intensities. Recent World Bank research has also found that adopting EE measures is a crucial strategy for firms to safeguard employment and mitigate the impacts of electricity prices volatility; a 1% increase in electricity prices reduces employment by approximately 1.5% in energy-intensive firms that have not implemented EE measures, compared to similar firms in less energy-intensive sectors.[27] The importance of EE is also central to the World Bank's flagship 2023 paper *Scaling Up to Phase Down: Financing Energy Transitions in the Power Sector*, which notes that the energy transition hinges on the advancement of EE as a first step, to support the rising energy needs associated with expanded access to energy and inclusive economic development, while also maintaining low GHG emission levels.

[22] *Load shedding* involves a controlled, temporary shutdown of the electricity supply in specific areas.

[23] ICF International, 2015. *Partnership for Growth, Ghana: TOU Tariff Analysis and Program Development: Final Report*. Prepared for USAID.

[24] USAID, 2009. *Transforming Electricity Consumers into Customers: Case Study of a Slum Electrification and Loss Reduction Project in São Paulo, Brazil*. Prepared by Nexant, Inc.

[25] Demand response programs provide an opportunity for consumers to be compensated to voluntarily modify their consumption temporarily to optimize the electricity system. For more information, see World Bank (2024). *Selecting and Implementing Demand Response Programs to Support Grid Flexibility: A Guidance Note for Practitioners.*" Washington, DC: World Bank.

[26] World Bank, 2021. *Sustainable Energy and Broadband Access in Rural Mozambique Project Appraisal Document.* Report No. PAD4550. November 19, 2021.

[27] Aterido, Reyes; Iootty, Mariana; Melecky, Martin. 2025. "Energy Prices, Energy Intensity, and Firm Performance." Policy Research Working Paper 11069 (Washington, DC: World Bank).

2. Why have energy efficiency gains fallen short of their potential?

Despite the huge potential and many benefits, energy efficiency has struggled to gain recognition among financiers, policymakers, and energy planners.

Over the past decade, many MICs and LICs—particularly in ECA, East Asia and Pacific (EAP), and Latin America and Caribbean (LAC)—have strengthened their national policy landscapes for EE. This includes developing and adopting national EE action plans and strategies with clear EE targets and reporting, long-term decarbonization strategies and plans, and retrofit plans, as well as incorporating EE into climate plans such as Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs). Collectively, these documents provide useful roadmaps and detailed approaches for governments to significantly scale up the pace of building renovations, industrial modernization, and other EE programs. However, while many MICs have strengthened their national legislation and plans, substantial gaps remain in terms of regulatory enforcement and institutional capacity (as well as financing and incentives) that underpin concrete action. In LICs, many of the foundations remain to be developed, contributing to a significant lag in EE investment and implementation.

Global energy efficiency performance and investment trends

Today, high-income countries (HICs) continue to rank the highest in various EE scorecards, while some MICs have made significant progress. The nature of EE makes it difficult to track economy-wide. Energy intensity is often used as a proxy, but it can vary significantly due to non-EE factors, such as changes to the structure of the economy or climate conditions. This has led to the development of various EE scorecards (Annex B), such as the World Bank's Regulatory Indicators for Sustainable Energy (RISE),[28] which assess 120 countries using composite scoring based on nine key EE indicators ranging from governance to financing and regulatory mechanisms at sectoral levels. RISE shows several MICs, such as Brazil, India, Kenya, and Romania, as having advanced EE regulatory frameworks. Other EE scorecards are available, such as the International Energy Efficiency Scorecard,[29] which evaluates 25 of the world's largest energy users across 36 efficiency metrics. As this scorecard shows, HICs, notably those in Europe, remained the dominant players in the global EE landscape in 2022, but several MICs—notably China, Mexico, Poland, and Türkiye—ranked in the upper set of countries.

However, despite increased efforts to develop policy frameworks, the current global annual EE improvement rate of 1% is far short of the 4% needed each year between now and 2030 to be on track for net-zero emissions by mid-century. Globally, the average annual improvement in EE over the last decade remained around 2%, but it fell to 1% in 2023 and was anticipated to remain the same in 2024.[30] This rate has been even lower in LICs and MICs (except for China). Even if the countries achieve all their announced EE pledges and targets, as noted in the IEA APS, the annual EE improvement rate would still be 3%,[31] indicating the urgency of further reinforcing both the enabling policies and implementation. Translated into absolute terms, this requires tripling the annual investment amount to US$1.8-1.9 trillion through 2030 globally, and more than doubling it to an annual average of US$711 billion for LICs and MICs.[32] Based on the announced ambitions and targets, the annual global investment for EE reaches around US$1.4 trillion through 2035.[33]

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28 WBG Energy Sector Management Assistance Program (ESMAP) (2024). Regulatory Indicators for Sustainable Energy (RISE).
29 American Council for an Energy-Efficient Economy (ACEEE) (2024). International Energy Efficiency Scorecard.
30 IEA (2024). Energy Efficiency 2024.
31 EA (2024). World Energy Outlook 2024.
32 IFC & IEA (2023). Scaling up Private Finance for Clean Energy in Emerging and Developing Economies.
33 IEA (2024). World Energy Outlook 2024.

While global investments in clean energy have reached a record high, investments in EE have lagged considerably. In 2024, only about one-fifth of global energy investment is expected to be for EE and end-use decarbonization—and of this, a large share is for EVs, leaving only a fraction for investments in EE.[34] In the case of LICs and MICs, the share of EE and end-use decarbonization in total energy investment was even smaller at only about 8%. Between 2019 and 2023, investment for EE and end-use decarbonization remained stagnant at around US$10 billion per year in LICs and MICs, while renewable energy (RE) generation surged by 145%, highlighting a stark disparity in investment and policy focus. Given the massive energy demand expected in MICs and LICs, accessing the required financing for new energy supply will be difficult and costly, necessitating a substantial step-up in EE investments alongside RE investments, particularly for energy-intensive MICs.

Inherent challenges with energy efficiency implementation and scale-up

EE represents a market failure and has characteristics of a public good, both of which justify interventions by governments. The lack of investment in EE is a *market failure*, as the free market fails to allocate resources efficiently, leading to underinvestment in EE, especially in developed countries. This is due to several factors, such as information asymmetry, externalities, behavioral biases, and other market imperfections (e.g., imperfect competition due to low energy prices and credit constraints). EE is also sometimes categorized as a *public good*, since EE reduces negative externalities like environmental pollution and energy security risks (which are not fully captured in the market price of energy). Also, energy savings achieved by one end user can lead to more and cheaper energy for others.

These market failures manifest themselves as a range of policy, technical, financial, institutional, and informational barriers that prevent EE projects from being realized. These barriers are well documented in the EE literature, and a summary of barriers and solutions to address them is presented in Annex C. Because EE projects are generally small compared with other infrastructure investments, such barriers can become difficult to overcome because the relative "transaction costs" are substantial. EE investments incur various administrative, financial, and logistical costs, including things like conducting energy audits, navigating complex regulations, preparing designs, accessing financing, and managing project implementation (designs, procurement, construction/ installation, measurement and verification [M&V]). These can often be significant barriers, particularly in developing countries.

EE also faces a perception problem as it consistently receives less attention in government cabinets, corporate boardrooms, and the public domain. Only about one-half of the NDCs mention EE, whereas 90% mention RE. The gap is even more pronounced in the private sector, where just over 100 corporate commitments include EE compared to more than 440 focused on RE (Box 3). In daily Google searches, a broad measure of public interest, the frequency ratio of EE to RE is 1 to 5.[35] Given that EE requires broad participation and coordinated action from diverse stakeholders—including governments, industry, banks, and energy consumers—this attention gap must be overcome.

The weak public infrastructure and services in LICs and MICs also create unique challenges for EE. Many existing buildings are old and undermaintained, so while EE potential is high, such investments do not make sense without parallel investments in structural improvements and safety enhancements (to address seismic and fire safety, lack of ventilation, poor indoor air quality, accessibility, resilience, etc.).

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[34] IEA (2024). World Energy Investment 2024.

[35] RMI (2024). Why Efficiency Matters: Unlocking Benefits Beyond Climate for All.

BOX 3. PRIVATE SECTOR PERSPECTIVES ON ENERGY EFFICIENCY CHALLENGES

IFC has been working with the private sector on EE and decarbonation for more than two decades. Based on several supply chain surveys conducted by global firms including Walmart and IKEA, the main challenges with investing in EE may be summarized as follows:

- ***Energy is often seen as part of overhead (fixed costs), rather than a variable operating costs that can be actively managed.*** Energy may be a relatively small share of the operating cost and bundled with other utility costs, so it is not always visible to factory owners. This creates less interest to develop internal expertise and change behaviors to manage it.
- ***Factories often cannot get independent, objective advice due to vendor and consultant practices.*** Equipment suppliers and consulting firms often promote specific technologies that align with their expertise or prefer selling individual components rather than a comprehensive solution, which can lead to skepticism among factory owners.
- ***Credible comparative and evaluation data are hard to find.*** Business owners struggle to find trusted and reliable benchmark and product performance data which would enable them to assess energy savings, returns on investment and risks.
- ***Competition over company budgets and financing.*** EE projects have to compete for funding against many other investment opportunities, including production capacity expansion, new product lines, and other investments which are seen as closer to their core business interests.
- ***Institutional biases against EE.*** Companies tend to prioritize revenue growth over cost savings and see EE investments as less attractive and risker. EE investments can also face internal bureaucracies such as multiple department or managerial approvals. Financiers also see smaller investments, uncertain returns and higher perceived risks.

Sources: Personal communication, Martin Dasek, IFC.

Economically attractive investments in developed countries, such as rooftop chillers, HVAC air-handling units, or solar water heating, are not feasible in developing countries without reinforcements to roofs and walls. Many public buildings and households also exhibit suppressed demand such as underheating or undercooling, which limits potential EE cost gains. There is also a need to modernize and update the functionality of older facilities—such as connection and wiring upgrades to accommodate more appliances, improved plumbing, better automation, and so forth—or to expand service (e.g., extending streetlighting to unserved areas).

These barriers are further exacerbated when trying to get to scale. There are hundreds of examples of small-scale pilots and demonstration projects that have successfully overcome barriers to save energy and showcase the potential impacts of EE. However, it remains challenging to identify instances where such programs have been scaled to national-level programs.[36] This is due to a host of specific scaling challenges (see Table 1) that often exist alongside the generic EE barriers.

As a result of these challenges, many policymakers have reinforced their views that EE is a small-scale endeavor that lacks the potential to deliver at scale, drive markets, and attract large-scale commercial financing in developing countries. Many previous implementation models used in developed countries, from utility demand-side management (DSM) programs to donor-funded credit

[36] Here, national-level programs refer to broad programs that target all eligible facilities within a market segment such as a program that targets all public buildings, all residential building or all SMEs.

lines to commercial energy service companies (ESCOs), have been unable to operate successfully and at scale in developing countries. Developed-country cases, which have largely relied on strong regulations (such as the EE-related directives in the European Union (EU), utility regulations in the U.S. and Canada, or incentives in EU and Japan), do not always offer practical models for developing countries where regulatory noncompliance can be high and constrained public budgets are unable to fund large-scale incentive schemes. Many countries lack clear institutional champions for EE, since EE can span several ministries but be a core function of none. There are also concerns about incentives for EE, which are not politically viable in many cases since they tend to disproportionately benefit larger, wealthier end users. Finally, there are many myths about EE that need to be overcome (Annex D). This has left many LICs and MICs in search of new program models, without which they are often reluctant or unwilling to devote substantial resources to EE.

TABLE 1. Challenges with scaling up energy efficiency programs

Challenge	Description
Low energy prices	When energy prices do not reflect their true costs, it depresses EE markets. This includes low electricity tariffs, heating or fuel prices, collections, metering, peak pricing, etc., all of which discourage market development and keep private financiers and suppliers away.
Non-scalable program models and designs	Most pilot institutional setups, financing, information, etc. were never designed to be scalable and/or replicable. The number of international models that have successfully delivered at scale without access to substantial financial resources for incentives is extremely limited.
Under-resourced agencies and public sector	Local energy agencies responsible for EE programming often lack the staff and resources needed to launch large-scale programs. The financing and incentives available within public budgets are often insufficient to launch large-scale programs, particularly for sub-national governments. This is exacerbated by needed parallel investments in structural and functional improvements to infrastructure, climate and disaster resilience, etc.
Lack of national data	There is a lack of national-level data (building inventories, databases of large energy users, appliance data, benchmarking, etc.) needed to design major programs and track performance.
Lack of accessible financing	Many of the targeted end users (e.g., households, SMEs, municipalities) have limited access to affordable financing or are not considered creditworthy, limiting the market size. High transaction costs to prepare smaller investments also make financing inaccessible at scale.
Low capacity and level of market development	Service providers have limited technical capacities to design, implement, maintain, and repair new or renovated infrastructure at a high scale and pace. Underdeveloped markets also imply weak supply chains, inadequate competition, lack of spare parts, etc.

Source: Authors.

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3. What has the World Bank Group done?

The WBG's portfolio shows energy efficiency is least-cost and there are growing opportunities for scale-up.

Cost competitiveness of demand reduction versus new energy supply

EE within the World Bank's global EE project portfolio has been delivered extremely cost-effectively, with an investment cost of only 0.63 US¢/kWh saved, compared to 3-8 US¢/kWh generated for typical clean energy supply options. Within the World Bank's portfolio (projects approved after FY15 and closed before FY24) across the energy, water, and urban sectors, EE projects have delivered energy savings at an investment cost of less than 1 US¢/kWh saved (US$10.46 per ton of CO_2 emissions reduced),[37] a fraction of the investment cost for new clean energy supply. For ongoing EE operations (projects approved after FY20 and still ongoing), the cost of energy savings is still projected to remain cost-competitive at about 2.0 US¢/kWh.[38] These findings are in line with experience from other countries and regions (Table 2).

TABLE 2. Comparing the cost-effectiveness of various demand-side energy efficiency implementations

Global EE Program Portfolios	Cost of EE (US¢/kWh saved)
World Bank demand-side EE portfolio—achieved (FY15-24)	0.63
World Bank demand-side EE portfolio—ongoing	2.0
U.S. Utility DSM programs	2.4
EU Energy Efficiency Obligation scheme	0.36–1.0
Canada-Ontario Electricity Savings program	1.17

Source: World Bank Operations; The Regulatory Assistance Project (RAP) (2016). *Costs and Benefits of Energy Efficiency Obligation Schemes.*; Cohn, C. 2021. *The Cost of Saving Electricity for the Largest U.S. Utilities: Ratepayer-Funded Efficiency Programs in 2018*. Washington, DC: ACEEE.; Clean Air Alliance, 2024. Ontario's Electricity Options: A Cost Comparison.

World Bank EE portfolio trends

The World Bank's support for EE has been strong but uneven. Over the last decade, cumulative IBRD/IDA financing for EE, including both supply-side EE (e.g., grid upgrades, rehabilitation, loss reduction) and demand-side EE (i.e., EE in in end-use sectors such as buildings, appliances, industry, public lighting, etc.) reached US$15.8 billion (FY15-24), delivering 226 projects[39] (Figure 2, left), with over US$28.5 billion in total project costs (including government cofinancing, other donors, and private capital), representing an almost 1:1 leverage ratio. The demand-side EE financing represents about 43% of the total EE portfolio (US$6.71 billion), or an annual average of US$670 million over the past 10 years, with total project costs of

37 Source: World Bank EE project database. This figure was calculated using the actual energy savings (MWh) and total project disbursements (in US dollars) for EE projects (or project components) from relevant Implementation Completion and Results Reports (ICRs). World Bank's fiscal year is July 1-June 30, so FY15 is July 1, 2014-June 30, 2015.

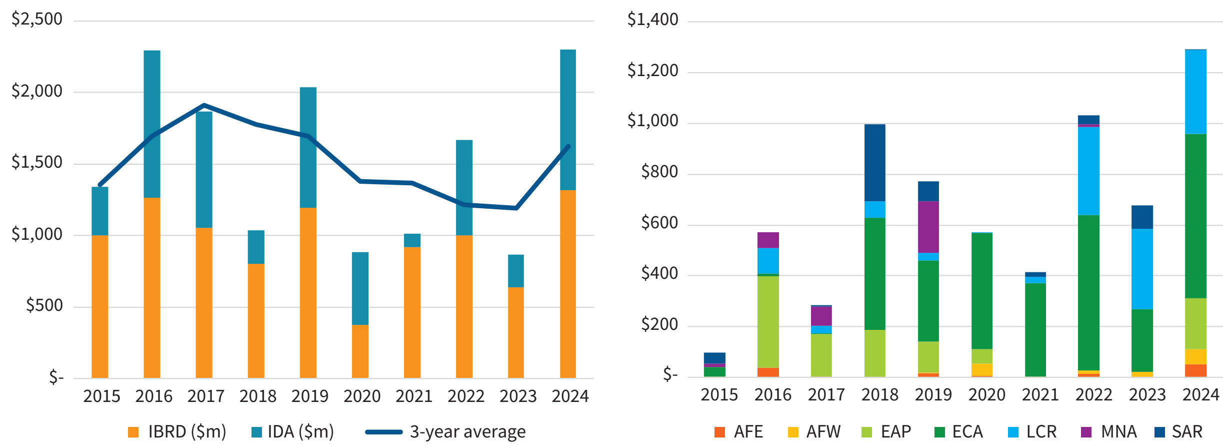
38 World Bank EE project database. This figure was calculated using the anticipated energy savings (MWh) and total project cost (USD) of EE projects (or project components) from Project Appraisal Document (PADs). Development Policy Financing (DPF) projects with EE components and other energy supply operations (involving district heating) were excluded from this analysis.

39 The portfolio review includes all World Bank operations including IPFs, PforRs, DPLs, guarantees and sources of funds (IBRD, IDA, GEF, CTF, GCF and trust funds).

US$15.62 billion or a leverage ratio of 1:1.3. While substantial, this amounts to only 0.1% of the annual EE investment required for LIC and MICs on average in 2026-30 under the IEA NZE.[40]

ECA leads the regions, with almost half the demand-side EE investments. ECA accounts for 46.9% of the total (US$3.15 billion), followed by 18.6% in LAC (US$1.25 billion) and 16.3% in EAP (US$1.1 billion). EE lending in ECA has been steady in the last five years, lending in EAP dropped significantly after FY19, and LAC has seen a surge over the past three fiscal years. The remaining regions—South Asia Region (SAR), the Middle East and North Africa (MNA), and Africa East and West (AFE, AFW)—have experienced some sporadic EE lending over the last decade (Figure 2, right).

FIGURE 2. World Bank financing for energy efficiency (FY15-24)

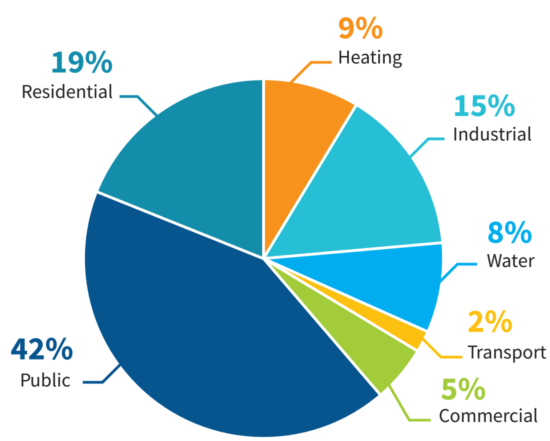


Supply- and demand-side EE by financing type ***Demand-side EE by region***

Source: World Bank Operations.

Investments in the public sector have remained dominant, followed by the residential and industrial sectors. The public sector, which includes new and renovated public buildings (schools, hospitals, offices), public lighting, and water systems, accounted for about 42.3% (US$2.8 billion); the residential sector (housing and appliance retrofits, new low-income housing) for 19% (US$1.3 billion); and industry for 15% (US$1.0 billion) (Figure 3). While EE financing in the industrial and district heating[41] sectors has been declining since 2019, the residential and water sectors have grown. URL-led urban engagements have risen to US$1.1 billion (16%), and water sector engagements to US$580 million (8%). Development policy operations with EE policy and regulatory actions have grown and now make up 26% (US$1.75 billion) of the portfolio.

FIGURE 3. Demand-side EE lending by sector (FY15-24)



[40] IFC & IEA (2023). Scaling up Private Finance for Clean Energy in Emerging and Developing Economies.
[41] Heating has significantly decreased since FY20 due in part to stalled reforms and concerns over fossil fuel-dominated systems.

The World Bank's EE portfolio demonstrates that overcoming barriers and delivering EE effectively requires a mix of innovative financing, strong policies, robust institutional and market development, and effective information sharing. Many EE investments are cost-effective and can be adopted by the private sector once barriers are removed. However, investments with longer payback periods may need government regulations, incentives, or dedicated financing. It is crucial to adapt international models to local market conditions, incorporate EE into policy dialogue and energy planning, ensure implementing agencies are well-resourced, and develop tools to standardize EE projects and reduce transaction costs. Annex E summarizes lessons learned from over two decades of the World Bank's EE programs.

IFC EE portfolio

IFC has seen steadier growth with its EE portfolio. Over the last five years, IFC's EE business has more than doubled, from about US$837 million in FY20 to over $2 billion in FY25. Commitments reached more than US$9 billion in EE investments across the infrastructure, manufacturing, and financial institutions business units covering green buildings (housing and commercial buildings), industry (mostly SMEs), and banking sectors.[42] IFC's EDGE[43] green buildings program has also grown in the past 10 years from about US$668 million in FY15 to over US$4.2 billion in FY24. (See Annex F for more information on EDGE.)

MIGA EE portfolio

MIGA has also seen growth in its EE and climate financing. Since FY21, MIGA has grown its climate finance volume from about US$1.4 billion (26% of its portfolio, excluding trade finance) to over US$2.5 billion (38% of its guaranteed investments) in FY24. Green buildings and the EE portfolio constitute 21% of the climate finance issuances over the FY21-24 period, or about US$1.38 billion. Its guarantees have supported green buildings and green investments across the SME, building, and public lighting sectors.[44]

Case studies to scale up impacts

Recent operations within the WBG's EE portfolio have shown the ability to achieve scale. Several projects implemented over the past decade have been able to achieve greater scale, be sustainable, and leverage private capital. These projects can offer models and inspiration for what can be done under supportive policies and well-designed programs. A summary of selected WBG case studies from China, India, Poland, and elsewhere is included in Annex F.

These operations had several common elements that allowed them to achieve greater scale than typical EE operations, including the following:

- All programs were national or regional in scope, with ambitious objectives and a supportive policy environment, and used WBG financing to leverage other resources to increase impacts.
- These operations relied on well-developed and resourced institutions and partners, with good track records in delivering EE programs and financing and a good reputation in the market.

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42 IFC Climate Business Department project data.

43 The EDGE (Excellence in Design for Greater Efficiencies) Green Building Certification System was developed in 2015.

44 MIGA, 2024. *MIGA Sustainability Report 2024. WBG*, Washington, D.C.

- All made use of strategic partnerships (e.g., with ESCOs, utilities, municipalities, banks, developers) to build project pipelines and leverage their customer bases.
- Each program used a mix of financing and incentives designed for local markets. These programs were able to serve all major markets—industry (China), commercial facilities (China, Kasada Hospitality Fund), the public sector (China, India), and households (India, Poland, IFC's EDGE).
- All programs had extensive outreach and marketing components designed to raise awareness, identify and recruit new program participants, and build their investment pipelines.
- Each program had a substantial impact on its respective market—leading to new suppliers and products (such as heat pump suppliers in Poland and green financing in China) and cost reductions from high volumes and competition (e.g., lighting in India).

4. Is there a case for concessional financing?

The hidden costs and high cost of capital in LICs and MICs necessitate concessional financing to harness the vast energy efficiency potential at scale.

The substantial socioeconomic benefits and public-good aspects of EE, combined with underlying market failures, justify interventions by governments. Policies and programs adopted by countries to reduce energy demand through EE will result in a variety of development benefits but face barriers. Such investments also require higher upfront costs, with savings accruing over time, making them more sensitive to the costs of financing. For both the barrier removal and financing costs, concessional financing can accelerate and amplify the adoption of EE measures.

Investing in commercially-viable demand-side EE measures can lower power sector investment costs—for a typical MIC, investing in all commercially available EE measures could save up to US$11.7 billion (2.2%) in power sector costs by 2050. The least-cost electricity transition pathway for a typical MIC was modeled using data from its National Energy Efficiency Action Plan (NEEAP). Table 3 illustrates the cost savings potential from two groups of demand-side EE investments: *Type 1*, "Low-cost EE investments" (US$10-40/MWh saved), which include technologies such as LED lighting; and *Type 2*, "Medium-cost EE investments" (~US$130/MWh saved) in electrical appliances that have higher upfront costs and longer payback periods but deeper savings. For both types:

- A weighted average cost of capital (WACC) of 10% was assumed.
- In the Business as Usual (BAU) scenario, investing in EE first can reduce demand by about 1.8%, lowering the cumulative investments by US$4.3 billion by mid-century. All low-cost EE investments (Type 1) are fully deployed since their costs are less than new energy supply.
- In the Power System Decarbonization (DEC) scenario, all low-cost EE investments (Type 1) and 25% of medium-cost EE investment (Type 2) are deployed. This results in a reduction in electricity demand by 2.2%, leading to a cumulative US$11.7 billion cost savings in system decarbonization by 2050.

TABLE 3. Cost savings potential from EE investments for a typical middle-income country by 2050

Scenario	Present value of system costs (USD, billions)	Reduction in electricity investment (%, USD)	Reduction in electricity demand (%)	Type 1* EE deployed by 2050 (%)	Type 2** EE deployed by 2050 (%)
BAU without EE	369.6				
BAU with EE	365.3	1.2% [$4.3 billion]	1.8%	~100%	0%
DEC without EE	491.9				
DEC with EE	480.2	2.4% [$11.7 billion]	2.2%	~100%	25%

Source: Authors.
Note: BAU = Business as usual through 2050; DEC = Power system decarbonization scenario through 2050.
* Type 1 EE investments (US$10-40/MWh saved) have been modeled into the World Bank's Energy Planning Model (EPM) as (negative) generation asset with a CAPEX of ~US$1.5 million/MW. Type 2 EE investments (~ US$130/MWh saved) have been modeled as (negative) generation asset with a CAPEX of ~ US$8.0 million/MW. Both Type 1 and 2 used a typical 15-year lifetime with 100% availability for a system of 2 GW. It was assumed that the total investments needed for all Type 1 and Type 2 measures were equal. The EPM is limited to power system only; thus, EE measures that save/replace fossil fuels, such as district heating and heat pumps, are not included.
** The modeling takes into account environmental and climate externalities by adding a carbon constraint.

Enabling activities that are pre-requisites for realizing EE savings from Type 1 investments can involve "hidden costs". These enabling activities can include measures such as conducting energy audits; setting up databases to assess, monitor, and verify the energy savings; establishing standards and testing facilities; introducing labeling schemes; raising awareness; providing training; introducing financing schemes; and coordinating across sectors (e.g. buildings, industry, transport). Thus, while the Type 1 investments are very cost-effective (1-4 US¢/kWh saved), the "hidden costs" of facilitating them need to be accounted for, and funding to address them, secured.

The hidden costs required to facilitate these EE investments make a strong case for concessional financing. In the representative NEEAP, these hidden costs constitute about 24% of the total EE investment in the BAU scenario but are reduced to 7% in the DEC scenario. In absolute terms, these costs amount to approximately US$720 million in the BAU scenario and US$210 million in the DEC scenario.[45] Thus, to remove these hidden costs to fully implement the Type 1 EE investments, US$210-720 million in concessional (grant) financing would be necessary. These estimates are conservative, as some hidden costs for the representative MIC may have already been addressed through earlier policy and regulatory improvements. For lower-income MICs and LICs, these hidden costs are likely to be significantly higher.

The inherent barriers for EE noted earlier, combined with high transaction costs and the relatively smaller, dispersed nature of such investments, results in high hidden costs for EE. The analysis above is consistent with a literature review, which shows that hidden costs for EE measures can range from 9% to 40% of the total investment, varying by country, market, sector, and technology.[46] In the case of private companies in the EU, the share of transaction costs in EE investments ranged from 10% to 20%[47]; and within the residential sector, for a case involving single-family household renovations, the transaction costs were 24% for wall/roof insulation and 50% for efficient windows.[48] Hence, concessional financing can be critically important to overcoming these hidden costs and enabling these EE investments to take place.

Because of their higher costs of capital and constraints on borrowing, most MICs and LICs cannot afford many of the Type 2 EE investments that have higher upfront costs but yield deeper energy savings. Table 4 compares the impacts of different costs of capital, expressed in WACC, on the overall power sector transition as well as the uptake and impacts of demand-side EE investments. Because demand-side EE investments have higher upfront costs, their viability is more strongly tied to the cost of financing. As shown, Type 1 demand-side EE investments are fully deployed under all WACCs, while the deployment of Type 2 is sensitive to the WACC, showing zero uptake for LICs (with a WACC of 15%) and 90% for HICs (with a lower WACC), which would lock LICs into less-efficient technology choices and thus higher cost systems. The higher cost of capital significantly drives up the total cost of the power systems in both scenarios; a typical LIC would incur US$157 billion more than a typical HIC while achieving only about half the level of energy savings. The potential reduction in total power system investment costs from EE is thus lowest for LICs and highest for HICs, with reductions of 1.98% (LIC), 2.40% (MIC), and 2.93% (HIC). Overcoming this barrier will necessitate concessional financing resources to ensure these investments are realized.

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45 The concessional finance (grant) required to cover the hidden cost was calculated as follows: CAPEX of Type 1 EE investment * percentage of hidden costs. These costs are cumulative through 2050.

46 Ekins, P. et al. (2011), *Marginal Abatement Cost Curves: A Call for Caution* (UCL Energy Institute, University College London); World Bank (2012), Energy Efficiency Programs and Barrier Removal Costs: Analytical Framework and Empirical Analysis of Energy-Efficient Lighting Programs Featuring Compact Fluorescent Lamps (Washington, DC: World Bank).

47 Hünecke, Katja et al. (2019). What role do transaction costs play in energy efficiency improvements and how can they be reduced? ECEEE Summer Study Proceedings. pp. 675-684.

48 Lundmark, Robert (2022). Time-adjusted transaction costs for energy renovations for single-family house-owners. Energy Economics, Volume 114, October 2022, 106327.

TABLE 4. Power system costs and viability of EE investments in HICs, MICs, and LICs

Scenario	High-income country [WACC = 6%]	Middle-income country [WACC = 10%]	Low-income country [WACC = 15%]
BAU without EE (PV of system costs) (US$ billions)	$331.4	$369.6	$417.1
BAU with EE (PV of system costs) (US$ billions)	$327.2	$365.3	$412.6
BAU—reduction in investment without vs. with EE (% and US$ billions)	*-1.27% -$4.2*	*-1.20% -$4.3*	*-1.06% -$4.5*
DEC without EE (PV of system costs) (US$ billions)	$424.5	$491.9	$580.8
DEC with EE (PV of system costs) (US$ billions)	$412.1	$480.2	$569.3
DEC—reduction in investment without vs. with EE (% and US$ billions)	*-2.93% -$12.4*	*-2.20% -$11.7*	*-1.98% -$11.5*
Deployment of Type 1 by 2050 in DEC-EE scenario (%)	~100%	~100%	~100%
Deployment of Type 2 by 2050 in DEC-EE scenario (%)	90%	25%	0%

Source: Authors.
Note: BAU = Business as usual through 2050; DEC = Power system decarbonization scenario through 2050, PV = preset value

Lowering the cost of capital for LICs and MICs may require up to US$6.4 billion for a typical MIC and US$9.6 billion for a typical LIC in concessional financing to help realize the full EE potential. To allow for a 90% uptake of Type 2 investments in MICs and LICs, concessional financing would be necessary to reduce the capital costs. The modeling estimated that the concessional financing needs to 2050 amounted to around US$6.4 billion for a typical MIC and US$9.6 billion for a typical LIC.[49] These figures account only for the high cost of capital and not the additional US$210–720 million in concessional financing needs to cover the hidden costs discussed previously.

These analyses are conservative but illustrate the importance of concessional financing in enabling such EE investments to happen. The conclusions are consistent with the recently issued roadmap for increasing investment in clean energy in developing countries[50]—an initiative of the G20 Brazil Presidency in 2024—which highlighted that while the share of concessional funding by technology varies with market maturity and the technologies required for the energy transition. The largest amounts of concessional funding across LICs and MICs annually through 2035 are required for grids and storage (US$37 billion) and for buildings (US$29 billion), with EE requiring particular attention given the significant investment gap today.

Scaling up EE investments to curb demand can reduce the massive investment needed to ensure access to reliable and sustainable energy. The modeling reveals the potential for a ~2.2% demand reduction from the demand-side EE investments, leading to US$11.7 billion less investment needed in new, clean energy supply through 2050. Accounting for these EE investments in the energy sector plans today will ensure that this additional energy supply will not have to be financed and constructed, thus avoiding potential future underutilized or even stranded assets.

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49 The concessional finance (grant) to lower the cost of capital of MICs and LICs to that of HICs was calculated as follows: CAPEX of Type 2 EE investment * percentage point to lower the cost of capital to that of HICs (6%).

50 IEA (2024). Roadmap to Increase Investment in Clean Energy in Developing Countries – an initiative by the G20 Brazil Presidency.

5. How can we create the right ecosystem for energy efficiency?

New programmatic engagements offer an opportunity to harness various initiatives to renew approaches in the promotion of energy efficiency at scale.

After more than three decades of WBG experience, a standard playbook of interventions has emerged which, when coupled with higher levels of country ambition and technical innovations, has created opportunities for scaled-up regional and global approaches. The WBG's global EE portfolio has employed models that have successfully overcome typical barriers through a combination of strong policy and regulatory frameworks, financing and incentives, institutional and market development, and information. In addition, important technological and digital innovations, such as heat pumps, near-zero-energy buildings (NZEBs), geospatial planning, and AI-enabled building automation, have created new opportunities for countries to leapfrog to high-efficiency systems and practices. These developments provide opportunities to scale up EE while boosting market demand for EE services, products and financing—which can bring in new suppliers, help lower costs, and channel the massive inflow of private capital needed to realize the vast EE potential. In addition, the further harmonization of policies, technical standards, documents, and templates will help create more predictability for equipment suppliers, commercial banks, service providers and others—leading to more-resilient supply chains, greater interregional trade, and further economies of scale.

The World Bank Group is committed to scaling up impacts

The WBG's Global Challenge Program for Energy Access and Transition (GCP-E) seeks to respond to the urgency of scaling up EE through an enhanced programmatic engagement approach. This new approach, underpinned by replicable EE project designs and implementation models, will allow the WBG to deliver solutions and impact at scale through national-level programs—leveraging the concerted efforts of the WBG, development partners, and governments to improve the enabling conditions necessary for private capital mobilization at scale. Governments play a critical role in improving their enabling environments by facilitating investments and strengthening their policies and institutions to deliver national-scale programs. Because the EE investment needs are massive and largely cost-effective, and public funds are limited, the scaling-up of EE necessitates private sector participation.

While EE programming will vary by country circumstances and local markets, the WBG's Country Climate and Development Reports and Country Partnership Frameworks will identify ways to help countries access a range of public and private solutions for domestic, regional, and global challenges. These approaches will focus on engaging countries to support their development challenge with greater impact, while enhancing efficiency, an outcome focus, partnerships, and tapping into private sector solutions wherever possible. A well-coordinated sector reform effort driven by government leadership, including critical energy price reforms, setting of EE targets and mandates, capable institutions, and ambitious programs, etc. will collectively boost the bankability of EE investments. Governments should make EE an upstream consideration in all relevant sectors (urban, water, education, health, etc.) and work to incorporate EE standards and lifecycle costing into all new infrastructure.[51] LICs and MICs also need (i) to address project bankability by mitigating country-, sector-, and project-specific risks (using public and concessional resources with financial and de-risking solutions) and (ii) to maximize socioeconomic impacts.

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51 This is consistent with the WBG's Environmental and Social Framework, Environmental and Social Standard 3 (ESS3), "Resource Efficiency and Pollution Prevention and Management", which specifically calls for clients to implement all technically and financially feasible measures to reduce energy, water and raw materials.

An example of this new approach is the WBG's Scaling Up Energy Efficiency in ECA ("E3") Multiphase Programmatic Approach (MPA),[52] which provides US$1.46 billion in financing while seeking to leverage US$2.4 billion from program partners. The MPA, approved in June 2024, is structured along four pillars reflecting ECA priorities in the public, residential, industry, and district heating sectors. The E3 MPA provides a medium-term program objective alongside a range of structured interventions and a flexible menu of activities that address high-impact barriers that are known to constrain private investment in EE (Figure 4). Under the E3 MPA, multi-phase projects are eligible to help countries move from demonstration projects to scaled-up national programs that leverage commercial financing while addressing reform measures and risk mitigation mechanisms to achieve the required scale of investments. Increased coordination with donor partners will allow the E3 MPA to collaborate on joint national programs where possible (such as through pooling of funding) or to coordinate parallel programs in other cases.

FIGURE 4. E3 MPA framework for investment and scale-up

- Financing would support countries at different stages and efforts to transition to national scale EE programs to meet national targets.
- Selection of suitable stage based on the level of individual country's market readiness in coordination with other IFIs and partners.
- Full leverage of WBG to accelerate countries' transition to advanced stages and achieve scale.

Increasing market maturity and decreasing risks

	PUBLIC	RESIDENTIAL	INDUSTRY	DISTRICT HEATING (DH)
STAGE 1 Technical assistance with pilot investments	• Pilot investments through government PIU to demonstrate EE and develop institutional capacities	• Pilot investments in residential buildings and appliances with grants to demonstrate EE, assess demand, and catalyze supply chain markets	• Energy audits, credit lines for energy intensive facilities (SOEs, SMEs, factories) • Pilot case studies • Deploy Energy Management Systems to build database	• DH utility diagnostics, develop and implement performance improvement plans with pricing reforms to reduce losses
STAGE 2 Sustainable financing & strengthened implementation	• Introduce sustainable financing mechanisms to capture cost savings and replicate to demonstrate financial viability • New/advanced business models (e.g. ESCOs)	• Phase down grants to introduce sustainable financing schemes and business models, including for low-income households	• Scale up financing for industrial EE, expand clean production, electrification, decarbonization, industrial benchmarking	• Build utility capacities, strengthen regulatory measures to reduce losses • Further utility and pricing reforms to mobilize commercial financing for loss reduction
STAGE 3 Mainstreamed national programs with commercial financing	• Scale-up up pace and implementation • Leverage commercial financing • Expand markets, including private ESCOs	• Scale up local financing and market capacities (e.g. auditors and construction firms) • Strengthen regulations and processes	• Mainstream financing for industrial decarbonization; • Strengthen regulatory enforcement and market mechanisms (e.g. emissions trading scheme)	• Mainstream utility financing (e.g. guarantees) • Reinforce regulations and utility capacities to adopt advanced technologies and further reforms
	Public Financing $$$ Private Financing $	**Public Financing $$ Private Financing $$**	**Public Financing $ Private Financing $$$**	**Public Financing $$$ Private Financing $**

Note: PIU = Project Implementation Unit.
Source: World Bank, 2024. Scaling Up Energy Efficiency in Europe and Central Asia (E3) Program Appraisal Document. Report No. PAD00193.

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[52] An MPA allows countries to structure a long, large, or complex engagement as a set of smaller linked operations (or phases) under one program. As a result, governments can match borrowing more closely with financing needs, permitting more efficient use of financial resources for both the World Bank and clients. This "adaptive approach" also strengthens the potential for crowd-ing in other sources of capital to support development objectives.

Under the E3 MPA, WBG financing is provided to support EE investments in the public sector, residential buildings, industrial facilities, and heating utilities to contribute to national-level energy savings targets. Specific investment programs would be based on each participating country's target market(s) and conditions. In the early stages, private capital will be sought to demonstrate the viability for commercial lenders and other financiers (such as ESCOs and leasing companies). In less developed markets, it will be important to introduce the policy and institutional reforms necessary to provide the right conditions for scaled-up, private-sector-led markets and domestic commercial financing in later stages. Public financing (through mechanisms such as EE revolving funds) may be needed for less creditworthy segments of the market until repayments and default rates can be documented, so that potential commercial financiers can accurately price-in risks. Over time, as countries' markets evolve, programs can transition to commercial financing (e.g., partial risk-guarantees,[53] ESCOs[54]). Upstream engagement with partners can inform strategies for successive program stages and joint or coordinated programs.[55]

The WBG has also recognized the importance of knowledge, which has led to its renewed focus as a "Knowledge Bank". The GCP-E and recently-launched World Bank Group Energy Academy[56] also aim to enable participating countries to be beneficiaries of, as well as contributors to, the knowledge generated among countries that seek to accelerate the energy transition. The goal of the Academy is to empower "coalitions for reform" through knowledge sharing and capacity building to further the WBG's mission.

Countries must do more to scale up energy efficiency

Addressing energy efficiency in the public sector[57]

Government facilities are, collectively, the largest energy user in most countries. Available data suggest that the public sector, which includes central and municipal administrative buildings, universities and schools, hospitals and clinics, and other publicly owned facilities, typically accounts for 2-5% of a country's total energy consumption. As a large and visible consumer, the government can set an example for EE improvements in other sectors, use its purchasing powers to drive markets and pool procurements to lower costs, demonstrate good energy-management practices and high-performance technologies, and develop tools and templates (e.g., standard contracts, energy audit templates, EE calculators) that can be utilized by businesses and households. Public services and utilities (which can provide electricity,

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[53] MIGA houses a new guarantee platform which serves as a one-stop shop for the WBG's guarantee business to leverage commercial capital. The platform includes credit guarantees (for loans to the public or private sectors), political risk insurance (for private sector projects or PPPs), and trade finance guarantees for public sector risk. The World Bank has deployed guarantees in a few markets to support EE (e.g., Colombia, India, Vietnam), but in most cases the instrument was unable to overcome perceived market risks. The exception was the India Partial Risk Sharing Facility in Energy Efficiency, which supported 81 sub-projects with a guaranteed amount of US$88.9 million, mobilizing a total of US$ 135.7 million (as of February 2025).

[54] It should be noted that markets can evolve more quickly, potentially skipping some stages or financing instruments.

[55] This approach has been demonstrated in several ECA countries: launching EE programs for central government buildings followed by establishing programs for municipal facilities, setting up systems (e.g., energy audits, designs, commissioning, M&V) and program procedures, building market capabilities (of energy auditors, construction firms, ESCOs), stimulating demand for EE equipment and materials, and subsequently launching programs for private facilities (e.g., residential buildings).

[56] The WBG Academy, launched in 2024, is a knowledge platform that unites the expertise of global and local partners alongside the WBG to tackle pressing development challenges. The first "EEX Academy for Energy Access and Transition: Scaling Up Energy Efficiency" was held in Rabat, Morocco, in January 2025, and brought leaders and professionals together from nine MNA countries to discuss the importance of EE, barriers and global solutions, EE statistics and data, the EE project cycle, program design and implementation, and successful financing and business models.

[57] For more information, see: World Bank, 2018. *Energy Efficiency in the Public Sector*. World Bank/ESMAP Live Wire 2018/94.

heating and cooling, water, public lighting, etc.) can also invest in EE to lower their costs, thereby reducing costs to their consumers and leading by example.

Despite attractive payback periods and the potential for energy savings, the public sector, particularly in developing countries, often lags the rest of the economy in terms of efficient energy use. This is traceable to several inherent market failures and characteristics of the public sector, which include both general barriers to EE (low energy prices, high upfront and transaction costs, limited access to data) and barriers specific to the government sector, including restrictive policies and a lack of incentives.

It is critical that pilots be used to inform more ambitious, national-level programs—and that prevailing barriers be removed so that markets and impacts continue to grow. Because of the inherent disincentives for public agencies to lower their costs, strong policies and regulations obligating public agencies to report energy use, conduct energy audits, benchmark energy use, and invest in EE are needed. National and sectoral EE targets, international and government rewards and recognition, enforcement, and cost-reflective energy prices can all improve incentives. A strong EE ecosystem—e.g., data and information, technical know-how (in fields such as auditing, financing, service providers, and equipment suppliers), M&V, operations and maintenance (O&M),[58] and energy management systems—is also needed. As shown earlier in Figure 4, governments often start with smaller-scale initiatives, such as establishing a small project implementation unit (PIU) to renovate or retrofit a batch of public buildings to establish the necessary procedures and templates before transitioning their PIUs into capable, sustainable institutions which can offer financing (such as public ESCOs or EE revolving funds[59]) and be repaid through energy cost savings.[60] As payment discipline improves and the market develops, governments can design broader, national programs with blended financing or credit guarantees with commercial banks. Scale can also bring significant cost reductions and increased competition. This gradual shift in institutional and financing mechanisms needs to be accompanied by policy reforms, such as budgeting (e.g., to allow public entities to retain their energy cost savings across budget years),[61] procurement (e.g., to allow for ESCO contracting, NPV selection or lifecycle costing), and other aspects (e.g., ESCO legal framework). But some public financing may be required to address legacy issues with buildings (such as structural issues), facilities in poorer municipalities, or institutions that serve the poor.

Promoting energy-efficient homes and appliances

The residential sector—housing—makes up about 70% of building energy demand, and accounts for nearly 30% of global energy use and 27% of global GHG emissions. Much of this demand is for cooling and heating—in the form of space heating, water heating and cooking. Over the next decade, energy consumption in residential buildings is expected to grow faster than in the rest of the building sector due to expected increases in both the number of households and per capita energy use as incomes

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58 While estimates vary, Energy Star in the U.S. estimates that effective O&M can save 5-20% on energy use. Therefore, a portion of the energy savings should ideally be directed to ensure that O&M is carried out regularly and professionally.

59 For more information on financing for the public sector, see: World Bank, 2025. *Mobilizing Commercial Financing to Scale Up Energy Efficiency in the Public Sector*. World Bank/ESMAP Live Wire 2025/137.

60 Such transitions from PIUs to EE funds have been successfully achieved in World Bank programs in Armenia, Bosnia & Herzegovina, Bulgaria, Croatia, Kosovo, Montenegro and Uzbekistan.

61 One mechanism used to address budgetary constraints is the energy service agreement, or ESA. Under an ESA, the financier (typically an EE revolving fund or super ESCO) offers a package of services to prepare, finance and implement EE projects. The client is asked only to continue to pay its average baseline energy costs. From this payment, the financier is able to pay the new (lower) energy bill and apply the balance to recover its investment cost and associated fees until the contract period ends. ESAs have been used in Armenia, Kosovo, Mexico, and Uzbekistan.

rise. Cooling, in particular, is expected to rise, more than tripling in the next 25 years. Such growth will place a strain on energy infrastructure and resources.

While most EE improvements remain cost-effective, more than 80% of the global economic EE potential in buildings remains untapped. The residential sector is challenging because homeownership is disaggregated, developers/owners and owners/tenants have split incentives, homeowners do not always have access to credible information on EE products, joint ownership of multifamily apartment buildings requires collective decision-making, and individual investments are often small—all of which leads to high transaction costs. Low levels of service, such as underheating or undercooling, lower the potential energy savings, and many lower-income residents in LICs and MICs cannot afford higher upfront costs, lack access to affordable financing, and have competing priorities for household expenses.

Because the residential sector contains so many small, heterogeneous homeowners and investments, selecting the most effective and efficient institutional setup and delivery mechanism is a key challenge. Utilities often emerge as leading implementing candidates given their existing customer relationships, access to energy use data, and active billing systems. Utilities can also benefit from reducing energy demand during peak times through DR programs, and from reduced sales to subsidized, low-tariff consumers. Utilities in LICs may also see value in financing efficient appliances for new household connections as part of energy access programs, to ensure customer affordability. In such cases, governments need to explore regulatory options to incentivize or oblige utilities to offer EE programs to their customers, as in many utility DSM[62] or Energy Efficiency Obligation schemes.[63] Once incentives are in place, utilities can implement bulk purchase and distribution programs (e.g. for efficient lighting products) and offer rebates, on-bill financing for efficient appliances, low-cost energy audits, and many other services. Where utility incentives are not possible or preferred, governments can appoint other public institutions (e.g., EE agencies, EE funds, public ESCOs) to carry out bulk purchase schemes, rebates or coupons, single or multifamily home renovations, etc. (Table 5). These programs should be

TABLE 5. Implementation options for residential energy efficiency

Financing and implementation mechanism	Description	Examples
Bulk purchase and distribution	Large quantities of energy-efficient products (e.g., LEDs) are procured and distributed to consumers, often by a utility or other government agency.	Bangladesh, Ethiopia, India, Mexico, Mozambique, Philippines, Vietnam
Utility demand-side management (DSM)	Regulatory mandate for utilities to finance and implement EE programs for their customers. Utilities can also outsource program implementation to ESCOs, program agents, or other external entities.	Belgium, Brazil, Canada, Thailand, Vietnam, United States
EE obligation	Regulatory mandate for energy suppliers to achieve savings targets by financing and implementing EE programs for their customers.	Australia, Denmark, France, Ireland, Italy, United Kingdom
Manufacturer or supplier partnerships	Manufacturers, in cooperation with the government or utility, offer incentives (e.g., coupons) and cooperate on marketing and distribution.	Brazil, Canada, India, EU, Republic of Korea, United States

Source: World Bank, 2025. "Scaling Up Energy Efficiency in the MENA Region". Presentation under the EEX Academy delivered in Rabat, Morocco, January 27-29, 2025.

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62 For utilities that earn revenues from selling electricity, EE can be contrary to their business model, despite economy-wide benefits. Some regulators in the U.S. thus require utilities to meet prescribed EE targets, allowing them to recover their program costs, lost revenues and profit from the tariff or DSM/EE surcharge (25 U.S. states). In other cases, regulators have sought to decouple electricity sales from profits (e.g., California, Colorado, Washington), allowing them to promote EE without financial repercussions. Other regulations have allowed utilities to earn a higher regulated profit on EE investments than other typical transmission and distribution assets.

63 World Bank, 2014. *Exploiting Market-Based Mechanisms to Meet Utilities' Energy Efficiency Obligations*. Live Wire 2014/18.

complemented with parallel financing schemes, such as revolving funds, credit lines (e.g., green loans/ mortgages, PACE loans,[64] retailer credit) or guarantees. Early pilots can test these financing and delivery systems, develop case studies, develop technical standards, etc.—but then plans must be put in place to transition to national-level programs with robust and scalable institutional and financing arrangements.

Governments would also need to (i) assess the potential for incentives as a way for households to adopt more-efficient homes and appliances and (ii) analyze potential funding sources (including concessional financing). Incentives can help overcome the higher incremental cost for more efficient construction, building materials, and appliances, especially for the poor. Such mechanisms can also help improve program participation rates and stimulate demand for efficient products, which helps bring new suppliers into the market. Incentives can come in many forms: fiscal incentives (e.g., tax credits or rebates, import tariff waivers), grants/subsidies or rebates, coupons, or even nonfinancial incentives (e.g., lottery tickets, awards, public recognition). Governments would need to ensure that incentives are easy to access (with clear, transparent rules and eligibility criteria), temporary, targeted (e.g., based on investments with the highest energy-saving potential, aimed at the lowest-income consumers), and ideally bundled with financing options to simplify transactions. Over time, as competition increases and costs decline, these incentives can be scaled down or phased out. While the World Bank and other donors may provide the initial capital for such schemes through grants and concessional financing, any sustained need for incentives must be secured through local sources such as EE or environmental taxes (on electricity or petroleum sales), general tax revenues, revenues from fees or penalties (e.g., license fees, privatization proceeds, environmental fees) or carbon market revenues.

Addressing energy efficiency in industry[65]

The vast EE potential in industry also remains largely untapped, impairing competitiveness and global efforts to mitigate climate change. In 2022, industry accounted for 37% of global energy consumption (166 EJ) and 25% of CO_2 emissions (9 gigatons).[66] While industrial energy productivity has improved over the past two decades, energy use continues to rise due to the increased production of energy-intensive industries (e.g., iron and steel, cement, chemicals, and pulp and paper). By 2050 population growth and economic growth in LICs and MICs is likely to increase demand for raw materials, which will continue to drive energy demand in industry. Some countries have large industrial bases (e.g., China, India, Indonesia, Mexico, Türkiye), some have a legacy of outmoded and inefficient plants (e.g., Russia, Kazakhstan), while others have ambitions for new or substantial growth in industrialization (e.g., Uzbekistan, Vietnam).

Although most analyses of the potential of industrial EE have focused on upgrading energy-intensive industrial processes, most countries have the bulk of their manufacturing employment and GDP productivity in SMEs. Heavy industry has substantial EE potential, but many of the larger factories in LICs and MICs are state-owned, foreign-owned, or large conglomerates, so motivating them to invest in EE can be difficult. If governments can influence their more energy-intensive SOEs, and these firms are creditworthy and subject to market forces, options for supporting policies and facilitating

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64 Green mortgages can offer preferential mortgage terms to support the purchase of new, energy-efficient homes (or renovation of existing ones) and the purchase of energy-efficient appliances (e.g., in Australia, Germany, Mexico, the Netherlands, United States). Property-assessed clean energy (PACE) loans are another tool that allows homeowners to finance renovations and procure new energy-efficient appliances, rooftop solar, etc., while applying repayments to their property tax bills. If the homeowner sells the home, the repayment obligations transfer (along with the future cost savings) to the new owner.

65 For more information, please see: World Bank, 2018, *Energy Efficiency in Industry*, Live Wire 2018/96; and World Bank, 2016, *Designing Effective National Programs to Improve Industrial Energy Efficiency*, Live Wire 2016/55.

66 IEA statistics. https://www.iea.org/energy-system/industry.

access to financing should be explored. Because SMEs make up the bulk of factories and local employment, they have often been a higher priority for governments for the purpose of driving economic development. SMEs offer potential for significant EE improvements across subsectors through simple, replicable measures such as production process improvements and optimization, equipment renewal and modernization, waste heat recovery, and fuel switching.[67] Where possible, EE investments should be combined with other investments needed to decarbonize industry, such as electrification with RE; switching with other fuels (e.g., biofuels, hydrogen); and carbon capture, utilization, and storage (CCUS).

Most challenges for the adoption of EE equipment and practices in industry are in two areas: financing and knowledge. In terms of financing, many EE investments have high upfront costs, which become more difficult to implement if financing is not accessible (due to short loan durations or creditworthiness) or affordable. Low energy prices, particularly for fossil fuels such as coal and oil, result in longer periods for recovering investments, making them less attractive. Transaction costs also tend to represent a higher proportion of smaller investments, especially for SMEs. In terms of technical capacity and information, factories may be unaware of various energy-efficient technologies and opportunities, their current costs and expected savings, O&M needs, access to spare parts, and performance risks. Ultimately, factory owners' priority is production volume and quality, so perceived minor cost-cutting improvements that could require downtime to install, impact production in the short term, or use limited debt ability for noncore investments, etc. are not always welcome. (See Box 3 in Section 2 on specific company challenges.)

Countries that have been able to achieve progress on industrial EE have accelerated various policy and market reforms while working to facilitate and sometimes even mandate EE improvements. Those MICs that have achieved significant and consistent improvements in industrial EE over the past two decades have made deliberate efforts to pursue market reforms and to pilot, demonstrate, and scale up policy interventions. HICs, such as Japan and the Netherlands, have made efforts to encourage, facilitate, and at times mandate larger industries to achieve significant long-run improvements in EE. For LICs and MICs, national EE programs and plans should be underpinned by relevant legislation, institutions, and broad-based market principles (such as energy pricing and SOE reforms). The governments can select from a broad set of policy instruments and implementation support systems, such as minimum energy performance standards for common industrial equipment (e.g., boilers, electric motors); voluntary or mandatory energy savings agreements; requirements for annual energy use reporting, periodic energy audits, and appointment of energy managers; tax and grant incentives based on exceeding subsector benchmarks; funding for energy audits; assistance in establishing energy-management systems; information and training programs; development of ESCOs; and facilitation of commercial financing for industrial EE (through credit lines, guarantees, etc.) based on local market conditions and barriers

Governments must continue to push needed policy reforms

Governments need to (i) complement scaled-up investments with activities designed to support the critical reforms and enabling environment necessary for the design, implementation, monitoring, and reporting of EE programs and (ii) put in place the necessary conditions to advance to subsequent stages of programming. These include national EE policies and regulations, national EE strategies and targets, and support for energy pricing reforms, as follows:

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[67] This approach (replicable technical product lines) has been used in World Bank operations in China, India, Türkiye and Vietnam.

- *Strengthening and updating of national-level policies and regulations.* Governments need to formulate and adopt broad EE policies to anchor EE within the policy landscape, authorize the creation of new institutions or institutional mandates, introduce equitable incentives, enable secondary legislation, etc. This should be backed up with *new and improved regulatory regimes and secondary legislation* that can provide for EE building codes, equipment and appliance standards, rulebooks, and obligations for larger energy consumers (e.g., energy reporting), along with enforcement mechanisms. Such regulations can also enable or even require *supporting mechanisms* such as complementary certification schemes, amendments to public budgeting rules, adjustments to procurement regulations, and authorization to set up new public entities or enable existing ones to provide EE financing (such as through public/super ESCOs or EE revolving funds).
- *Formulation of national strategies and planning documents.* Governments should formulate and adopt national energy strategies and plans with EE included (noting the complementarity of EE with RE and other supply options), parallel EE action plans and targets, building renovation and industrial decarbonization plans, sustainable heating and cooling strategies, EE components of NDCs/NAPs, etc., and data collections and analysis to support their development.
- *Energy pricing.* Government regulators should review electricity, gas, and heating tariff methodologies and implement tariff reform roadmaps. These include assessments of the social and fiscal impacts, strengthening of social safety nets, incorporation of EE to mitigate impacts of reforms, rollout of metering, design and adoption of time-of-use tariffs, tariff-based incentives for load management and other DR mechanisms, carbon pricing, DSM/EE surcharges, etc.

Establish strong institutional frameworks

A strong institutional setup is critical for the effectiveness of EE policies and programs. Institutional frameworks represent the organizational structures and related instruments that governments establish to facilitate the development of enabling mechanisms (such as laws or decrees), the formulation of government strategies and policies, the design and implementation of supporting programs, and monitoring and evaluation (M&E). Table 6 includes the main functions that a country's institutional framework should have in each of the target sectors (e.g., public, residential, industrial). There should be clear responsible and accountable agencies for each function, along with coordination mechanisms across line ministries and agencies.[68] Information and data must be shared freely across agencies for the public benefit, and periodic evaluations are needed to document lessons.

Of the various institutional setups that have been used globally, none has proven to be consistently more effective than the other; the key is *good governance*. Regardless of the selected institutional structure (as summarized in Annex G), governments should ensure the key EE institutional functions are assigned and adhere to key good-governance attributes, including that the EE institution (i) be visible, independent, autonomous, and flexible; (ii) have sufficient resources and staff to carry out designated functions, including incentives for performance; (iii) have strong skills in program design, financing, implementation, and evaluation; (iv) have the capacity to engage, collaborate with, and influence a range of stakeholders; and (v) require periodic reporting to monitor performance.

[68] EE can span many ministries, such as ministries of construction (for building codes), energy (for energy policies and development plans), environment (for NDCs), and science and technology (for standards and testing). Thus, many countries set up EE Coordination Committees to help harmonize policies, public resources, programming, etc., often chaired by a minister.

TABLE 6. Illustrative framework of energy efficiency institutional functions

	Policy				Data and information			Program design, incentives and implementation support					Monitoring and Evaluation		
	Formulate	Implement	Coordinate	Enforce	Collect	Report and publish	Disseminate	Financing and incentives	Program design	Train	Tools and guides	Stakeholder consultations	Targets	M&V	M&E
INDUSTRY	✓		✓		✓						✓		✓		
RESIDENTIAL		✓					✓					✓			✓
PUBLIC									✓			✓			

Source: Adapted from World Bank, 2015. *Republic of Turkey: Institutional Review of Energy Efficiency*. Washington, DC: World Bank, Report No. ACS12738.

Support the knowledge agenda

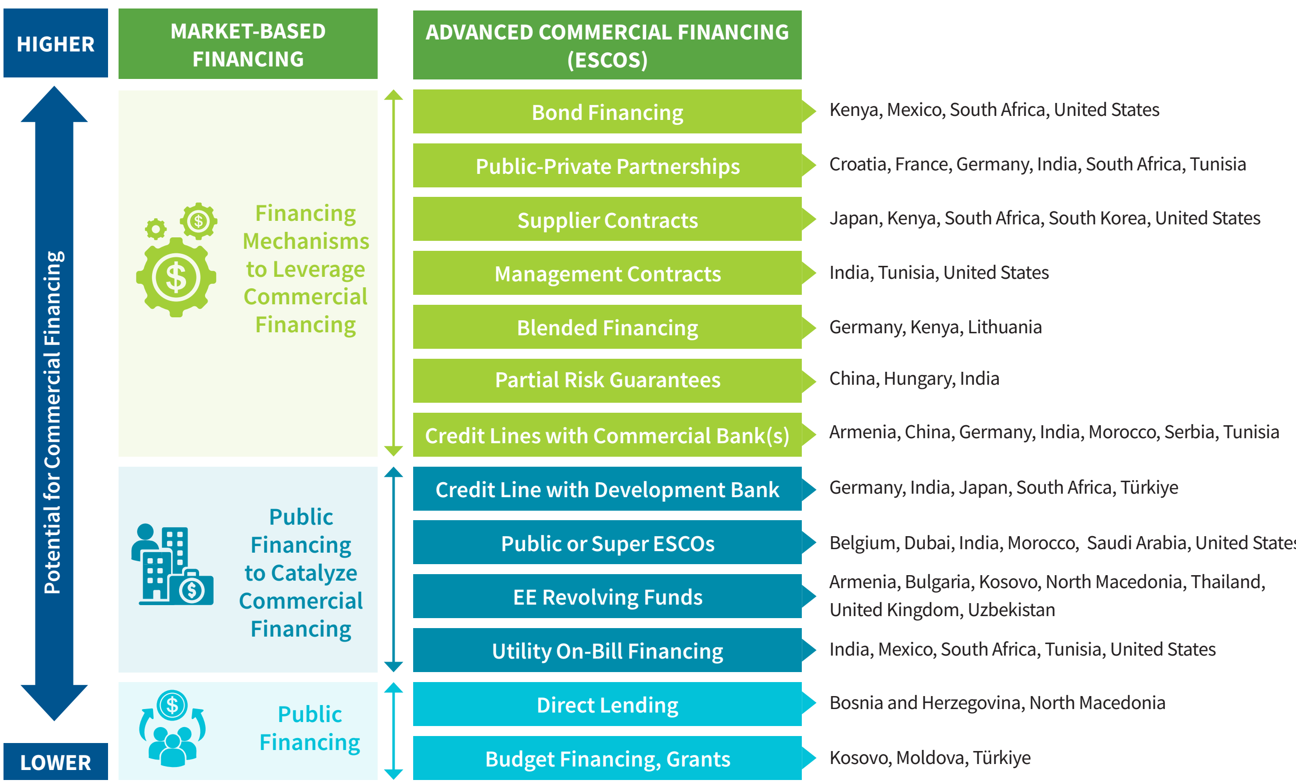
A broad knowledge agenda allows countries to benefit from global best practices and policies, financing and implementation models, and institutional development and capacity building—while developing sustainable tools for accessing local infrastructure and market data, sharing information, raising awareness, and strengthening the capabilities of local market actors. Although many countries face similar challenges, there is often limited information on how countries addressed these barriers, or advocated for changes in policies, regulations, and government procedures. Without such information, other countries are often left to "reinvent the wheel"—which slows progress. Governments need to provide critical technical assistance (TA) to support specific knowledge activities, including: (i) institutional strengthening on a range of project design and implementation skills, from conducting market assessments to M&E; (ii) technical capacity building and training for government agencies, municipalities, and market actors with supporting guides/tools; (iii) access to data and information, which can involve national databases, surveys,[69] case studies, outreach campaigns (designed to reach target end users, including women, and poor and vulnerable consumers), and results; and (iv) sharing of lessons based on program evaluations.

[69] This includes (i) household expenditure surveys and associated distributional analytics, which are essential in understanding the poverty and equity implications of potential EE investments, and (ii) firm surveys to better understand how to integrate EE into the broader firm efficiency agenda. For household surveys, see for example: World Bank, 2018. *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*; for firm surveys, see for example: World Bank, 2023. *Greening Firms in Georgia*.

Crowding-in commercial financing

The scaling-up of EE necessitates mobilizing the needed financing, in addition to building the necessary implementation capacity and service and supply infrastructure. Underdeveloped markets in MICs and most markets in LICs will likely need more public financing initially to stimulate markets and demonstrate results. As markets evolve, governments can develop more sophisticated financing mechanisms as they move up the "financing ladder" (Figure 5).[70] This evolution is critical as public financing alone will be insufficient to finance the massive investments needed. In Türkiye, for example, it was estimated that to renovate just the total public buildings stock (about 500,000 buildings) by 2050 will require about US$8.8 billion—far more than public financing alone can provide.[71] Given these huge investment needs, leveraging commercial financing must be a priority, and the public financing available must be used more strategically to maximize the amount of commercial capital it can mobilize.

FIGURE 5. Financing ladder for energy efficiency



Source: World Bank, 2025. "Scaling Up Energy Efficiency in the MENA Region". Presentation under the EEX Academy delivered in Rabat, Morocco, January 27-29, 2025.

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70 Once a mechanism is selected, programs should include the policy and institutional reforms needed to transition to financing mechanisms that are higher on the ladder. Of course, the ladder is only a guide; mechanisms are not always mutually exclusive, and governments need not climb every step of the ladder. The selection of appropriate mechanisms depends on several factors, including (i) legislative and regulatory conditions; (ii) the maturity of financial and credit markets; (iii) the state of the local EE service markets, including ESCOs and energy auditors; and (iv) the technical and financial capabilities of the target market.

71 Stantec, 2023. *National Program Plan for Energy Efficiency in Public Buildings*. Commissioned by the Turkish Ministry of Energy and Natural Resources.

The use of public financing must be judicious and designed to bring in commercial financiers, provide targeted subsidies alongside commercial financing (where needed), test new business and financing models, and de-risk investments. Public and concessional financing from the World Bank and other MDBs should focus public investments and enabling activities to unlock opportunities to attract commercial financing, especially for industrial and residential buildings. Public support for investment subsidies or grants can be justified but should be done carefully to address legacy structural and functional infrastructure deficiencies, promote deeper renovations and high-efficiency equipment or newer technologies, phase out fossil fuels, and support poorer end users. Public financing can also cover non-EE related costs, such as structural improvements, improved heating/cooling, and other functionalities (e.g., new energy access, ventilation, etc.). Accessing carbon markets can provide the additional revenues needed to incentivize greater levels of ambition and help offset potentially higher upfront investment costs.

The WBG is well positioned to assist governments scale up EE. The WBG can help in developing programmatic approaches to EE in target sectors, helping to identify and develop institutional frameworks, designing EE programs, supporting the selection and design of financing mechanisms, conducting policy gap analyses and formulating reforms to address them, providing global knowledge, and encouraging donor partners and the private sector to work together to help meet governments' development objectives and program goals. An action plan to scale up EE is included in Annex H.

6. LEAP: Driving actions for scaling up energy efficiency

The scaling up of energy efficiency is a call to action to Leverage for scale and impacts, Empowerment through capacity building, Advocacy of knowledge and best practices, and Programmatic engagements and partnerships to LEAP forward.

In the near term, intensifying promoting EE in buildings—including heating, cooling, and other appliances—should be a priority for all LICs and MICs. In addition, targeted support should be provided for industrial EE in highly industrialized, reforming MICs. Prioritizing EE in buildings[72] is universal to all LICs and MICs and helps address to major end uses—cooling and heating (Box 4). Since most buildings that will be in operation in 2050 have yet to be built, it will be critical to ensure that stringent building codes are in place[73] and the buildings are as close to NZEBs as practical, with very efficient design techniques (orientation, natural lighting/shading), building envelopes (e.g., roof/wall insulation, windows),

BOX 4. SUSTAINABLE COOLING AND HEATING

With energy demand for space cooling expected to triple by 2050, sustainable cooling will be critical. Technologies and strategies exist that can deliver today's space cooling needs with less than half the energy use while delivering a lower lifecycle cost to users and consumers—however, these remain largely unexploited. A recommended approach to sustainable cooling involves: (i) reducing cooling loads through passive building designs (e.g., insulation); (ii) ensuring efficient cooling from high-efficiency fans, air conditioners, and chillers; and (iii) optimizing cooling systems and user behaviors to minimize loads. Supportive policies and regulations (e.g., building codes, equipment standards), accessible and innovative financing (such as cooling as a service), consumer awareness, and enhanced professional capabilities can all help drive this important transition.

In many parts of ECA and EAP, space heating is not sustainable. Air pollution, particularly in urban areas, is a serious threat that causes 302,000 deaths and incurs a welfare cost of 7% of GDP annually. Fossil fuels and unsustainable biomass (mostly firewood) have overwhelmingly met this energy need. Governments are advised to develop sustainable heating strategies to include: (i) reducing heating demand through EE in buildings and changing user behaviors; (ii) bolstering and decarbonizing centralized district heating where viable; and (iii) promoting clean building-level heating systems, such as heat pumps or biomass pellet boilers, where centralized heating is not economic. Public sector planning and regulations, the development of programs including incentives and financing (including for poorer households), inclusive communications and outreach, and training are all important elements of a holistic government response to enable the sustainable heating transition.

Source: IWorld Bank, 2020. Primer for Space Cooling. ESMAP Knowledge Series 030/20; World Bank, 2023. ECA: Toward a Framework for the Sustainable Heating Transition. Report No: AUS0003480, World Bank.

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72 IEA's NZE (Investment section) shows that global investment in EE for buildings more than doubles, from US$342 billion (2024) to US$853 billion (2030), with the bulk of this investment in LICs and MICs due to rapid urbanization—significantly outpacing industrial investment, which rises from US$52 billion to US$126 billion by 2030. However, beyond 2030, industrial investment must accelerate exponentially, driven by the adoption of more capital-intensive measures and not-yet-commercial technologies, such as the deployment of hydrogen and CCUS for deep decarbonization.

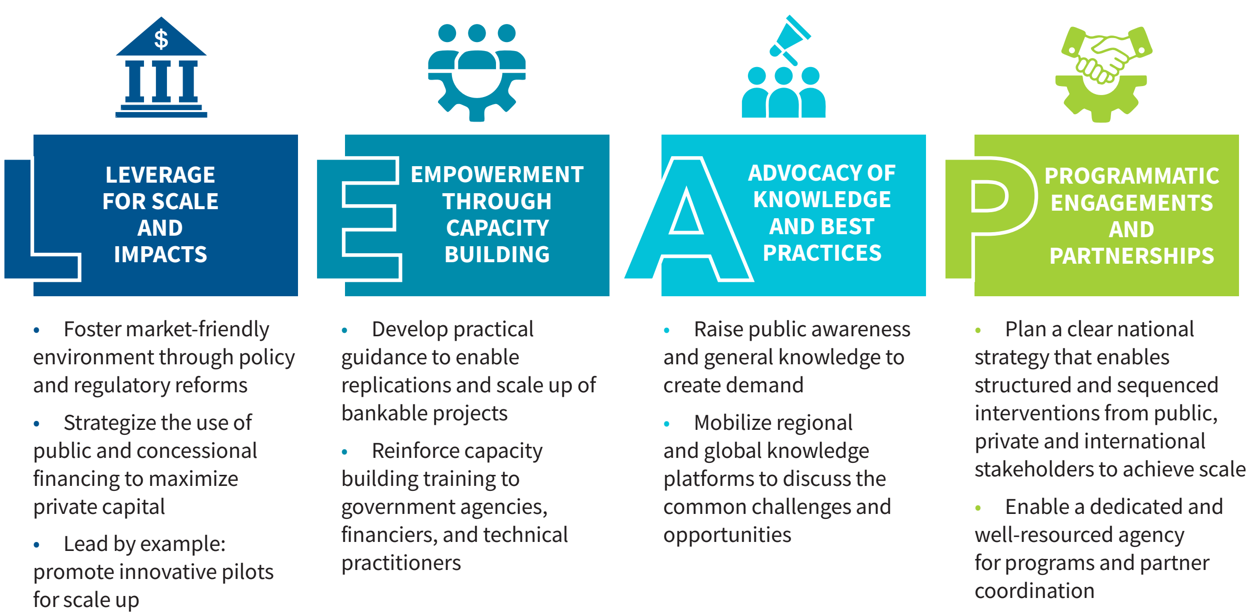
73 Only about one-third of countries (88) have building energy codes and less than one-quarter (52) demonstrate consistent enforcement. For more information, see World Bank, 2025. *Unlocking Efficiency: The Global Landscape of Building Energy Regulations and Their Enforcement*. Washington, D.C.: World Bank Group.

equipment, and on-site RE such as rooftop solar. Aggressive national renovation and retrofit programs are also needed to improve the existing building stock and appliances. And better urban planning is needed to ensure cities and infrastructure systems are more compact, opportunities for district-level heating/cooling are explored, and greater opportunities for public transport are realized. EE in industry will still be important, but targeted in industrialized MICs committed to reforms in the near term. In the medium-term, these programs are likely to become embedded in broader industrial decarbonization programs, which would include electrification and RE, and eventually incorporate new technologies such as energy storage, hydrogen, and CCUS.

What should we do?

The complex set of policy, institutional, financial, and technical barriers cannot be overcome at scale without strong political will and a sustained and concerted effort. There is a growing set of examples of successful models and programs globally that can serve as inspiration. But while international models can provide options for MICs and LICs, they need to be carefully adapted to local regulatory and market contexts. The WBG, together with its donor partners, will collate these experiences and distill models with the ability to scale. The WBG will also use its convening power to bring together a wide range of stakeholders and forge partnerships with the donor and financier communities to coordinate approaches and develop joint programs. These required actions are multifaceted and interconnected, but they can be distilled into four key building blocks for MDBs and donor partners, governments, and the private sector: ***Leverage*** for scale and impacts, ***Empowerment*** through capacity building, ***Advocacy*** of knowledge and best practices, and ***Programmatic*** engagements and partnerships—or LEAP (Figure 6). The WBG is already moving in this direction with its programmatic engagements, its academies to share knowledge and build capacity, a more cohesive WBG approach to leveraging financing, its continuing

FIGURE 6. LEAP to achieve scale for energy efficiency



Source: Authors.

emphasis on partnerships, and its new Framework for Financial Incentives to support Global Challenges.[74] There is now a need to raise awareness of these important initiatives to EE and to increase the advocacy for EE and global good practices.

Leverage for scale and impacts: Mobilizing private capital for multiplied impacts and scale

Given the constraints on public financing and fiscal space, the mobilization of significant commercial financing will be key. The challenge for MICs and LICs now is to be able to implement national-level EE programs. As public budgets cannot cover the substantial investment needed in EE across the sectors, leveraging commercial financing must be a priority. It is therefore important that the WBG, donor partners, and governments utilize the limited public financing to derisk and mobilize the needed commercial capital to urgently accelerate these investments and drive markets. Some public financing may be needed for low-income beneficiaries, buildings that require safety and functional improvements,[75] and beneficiaries unable to access credit markets. The private sector must also engage, entering developed markets and developing suitable financing and business models to deliver EE at scale. To enable this, governments must accelerate improvements in the enabling environment for EE—from policy reforms (including energy pricing) to capacity building to tools and guides for lowering transaction costs. Finally, all stakeholders should seek suitable opportunities to leverage carbon markets to boost returns and de-risk investments.

Empowerment through capacity building: Strengthening the technical and institutional capacity of key actors

The WBG will lead in the development of more ambitious EE programs with a clear line of sight to scalability of impacts—and will share these experiences with development partners. Despite decades of experience, there remains limited practical guidance and information about the models used, impacts, and evaluations needed to enable scale-up. The ability to develop and implement policies and programs at scale requires better sharing of information—such as good case studies documenting scale-up approaches, better accounting of impacts, independent assessments of program results and cost-effectiveness, and documentation of lessons learned. The WBG and donor community should demonstrate the value of more programmatic, ambitious engagements in LICs and MICs by more openly sharing models and approaches, results, and lessons, and by encouraging the private sector to replicate successful models. Expansion of WBG Academy offerings, strategic partnerships with global organizations, and the development of a richer library of case studies, tools, and information are also needed.

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74 The Framework for Financial Incentives, or FFI, approved by the World Bank in April 2024, includes measures to help borrowing countries access more funding and price incentives to reduce costs for eligible projects. It is the first holistic framework among MDBs to provide dedicated financing for projects with cross-border benefits.

75 For more information on frameworks for economic analyses of EE that recognizes the benefits of these additional services, see World Bank (2021), *Energy Efficiency as a Driver of More and Better Goods and Services* (World Bank Live Wire 2021/114). The paper argues that improving the level of service in MICs and LICs can provide additional socioeconomic benefits and quality-of-life improvements which should be encouraged and accounted for. It further proposes a distinction between such activities and the "rebound effect" observed in developed countries, where consumers increase consumption of services as those services become more efficient (and thus less expensive).

Advocacy of knowledge and best practices: Promoting successful policies and programs for scale

An international coalition must be mobilized to work with governments to lead and mainstream EE within energy planning, making it a priority of energy strategies, investment plans, and business operations. The international community must inspire, urge, and incentivize LICs and MICs to incorporate EE policies, plans and investments in their energy development programs with an increased sense of urgency. International agencies, such as the WBG, will elevate EE in their analytics and sector discourse, offer new approaches for better integrating EE into power sector planning, and improve monitoring and quantification of development impacts. Such actions should be reinforced by donor partners and governments to raise awareness[76] and overcome myths that EE is only small-scale, and not achievable or affordable. It will also require more international and local awards and recognition to increase the visibility of successes, incentivize innovation, and foster scaled-up impacts. Strengthening the narrative around EE is also important, with an emphasis on fiscal, employment, and energy security impacts. The WBG is now increasing efforts to be a knowledge broker, with its Academy and database of publications, and to establish external communities of practice with dedicated entities responsible for maintaining a platform for knowledge sharing—with financing and implementation models, tools and templates.

Programmatic engagement and partnerships: Cooperating on national programs can drive synergies

The shift from stand-alone investment operations to programmatic approaches, such as MPAs, can provide a medium-term vision under national country programs that helps establish a blueprint for donor collaboration. The development of national programs, adopted by LICs and MICs, can define a clear strategic direction, a range of structured interventions, and a common medium-term goal—while also providing a flexible menu of activities to which different international organizations, donor partners, the private sector and others can readily contribute. Such approaches can help build a common regional strategy and integrated programs for each participating country. Increased coordination and partnerships through national programs will allow for more collaboration to pool funding and support key policy and institutional reforms to open markets—while demonstrating longer-term commitment to the private sector and commercial financiers, and the development of competitive supply chains.

[76] Raising awareness should not only include general information about EE, but also clear guidelines on how stakeholders can take actions—from engaging an energy auditor to purchasing energy-efficient appliances. The profile of EE can also be raised through organizing high-profile events; integrating EE more regularly into senior management and government official speeches and talking points; promoting relevant ribbon-cutting ceremonies (such as for renovated buildings), which are common for other new infrastructure projects; and holding press events around EE issues.

Conclusions

Over the past decade, many MICs and LICs—particularly in ECA, EAP, and LAC—have worked to develop and strengthen their policy frameworks, institutional capacity, and financing and incentives to support EE. However, in other regions, especially in LICs, many of the foundations remain to be developed, contributing to a significant lag in EE investment and implementation. But the ingredients to develop the foundations and to foster scaled-up programming for EE are now largely known. The biggest obstacles are the lack of political will and resource mobilization.

Although EE policies and programs require time and effort, the potential benefits are substantial. There are well-documented barriers and hidden costs associated with EE that must be identified, and appropriate strategies that must be found to overcome them. But countries that have made the concerted effort to do so have seen huge returns accrue. As discussed in Section 1, given the multiple benefits that EE policies and programs can provide, one dollar invested in EE can often yield 3-5 dollars in benefits. So, countries cannot afford to ignore their EE potential.

Putting in place enabling activities, institutions, and capacity building is necessary to allow the scaled-up programs to be successful. EE needs to be incorporated into planning documents and then converted into actions. Critical building blocks need to be put in place—including well-resourced EE agencies, testing laboratories, and data and informational programs—from which broader programs can be developed. Improving the enabling environments, undertaking key reforms, and designing accessible financing schemes will also be needed to support national programs and help unlock commercial financing.

Concurrently, more efforts are needed to coordinate among international partners to build stronger, national programs. This will require more upstream consultations with MDBs and other donor partners and the private sector, more open sharing about past failures and lessons learned, more flexibility in developing joint programs, and greater innovation in addressing constraints—capacity, institutional, financing—at the local level. Working together, we have a much better chance to scale up EE—and power more with less.

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ANNEXES

A. External consultation take-aways and participants

B. Energy efficiency metrics and scorecards

C. Barriers and global solutions for energy efficiency

D. Debunking myths about energy efficiency in LICs and MICs

E. Lessons learned from two decades of energy efficiency

F. WBG case studies on scaling up energy efficiency

G Institutional set-ups for energy efficiency

H. Action plan to scale up energy efficiency

Annex A. External consultation take-aways and participants

The development of this approach paper was informed by a series of stakeholder consultations, including multilateral development banks (MDBs), international organizations, private sector practitioners, and other relevant entities. (Table A-1 presents a full list of attendees.) These consultations were invaluable, drawing on the extensive expertise within these groups to identify key trends, barriers, mechanisms, and potential solutions for advancing energy efficiency (EE) at scale in developing countries across different regions.

One of the central insights from the consultations was the critical importance of robust regulatory frameworks and policy instruments to promote and scale up EE initiatives. Stakeholders emphasized that EE must be integrated into a country's energy transition plans and decarbonization strategies. The representatives from MDBs shared their experiences financing EE projects, highlighting that a significant barrier to scaling up these initiatives is the insufficient incorporation of EE into national policies and regulatory frameworks, including the enforcement of EE codes and standards.

The MDBs recommended that governments intensify efforts to integrate EE into national energy strategies, establish clear standards and targets, and implement robust monitoring and enforcement mechanisms. Additionally, MDBs identified high transaction costs and lack of technical capacity as obstacles for EE projects, noting a widespread shortage of EE professionals to design and implement effective initiatives. Organizations such as ADB, IDB, CAF, and AfDB underscored the WBG's role in strengthening the institutional and regulatory frameworks, paving the way for successful project implementation. Such efforts contribute to de-risking EE financing by the private sector.

Private sector participants highlighted several opportunities and challenges in executing EE projects. Despite a growing market for energy-efficient technologies, the cost of implementation and lack of access to concessional financing present significant barriers. Stakeholders pointed out that while upfront investments in EE measures can be high, the long-term savings in operational costs often justify these initial expenditures. However, the lack of appropriate financing instruments in emerging and developing economies remains a challenge. To address this, stakeholders emphasized the need for tailored financing solutions that consider the unique requirements of different regions and sectors, especially for small and medium enterprises (SMEs) which struggle to access capital.

Another critical concern raised during the consultations was the need for improved data and monitoring systems. Both private sector and multilateral stakeholders recognized the importance of reliable data in making informed decisions regarding EE investments. This includes the establishment of robust energy audits methodologies, tracking systems, and performance monitoring mechanisms to measure the actual impacts of EE measures, and to adjust policies as needed.

In terms of technological advancements, participants highlighted the rapid progress in energy-efficient technologies, particularly within building construction, transportation, and industrial processes. However, despite the availability of such technologies, adoption remains slow due to a lack of awareness, high initial costs, and perceived complexity of implementation. Stakeholders underscored the necessity for capacity building and awareness-raising activities to foster a culture of EE, particularly at the local level, where stakeholders may be less informed about the benefits and opportunities.

Cross-sectoral collaboration emerged as another key theme during the consultations. Participants stressed the need for enhanced cooperation among the energy, environment, finance, and industry sectors to create synergies and unlock more opportunities for EE. This collaborative approach would position EE not merely as a technical issue but as an integral component of a broader strategy for sustainable development and economic growth.

Finally, stakeholders highlighted the significance of international cooperation in advancing EE. The stakeholders agreed that sharing best practices and lessons learned across countries and regions is essential to overcome challenges and accelerate progress. Initiatives such as knowledge exchange platforms, international funding mechanisms, and partnerships between the public and private sectors could effectively leverage resources and expertise, benefiting countries at all stages of development.

The insights from these consultations suggest that while significant progress has been made in the EE space, a concerted and collaborative effort across sectors and regions is needed to unlock the full potential. There is a pressing need for stronger regulatory frameworks, more accessible financing, improved data collection, and enhanced institutional and technical capacity. Moving forward, it will be essential to foster partnerships, at both the national and international levels, to overcome the barriers and create an enabling environment for EE projects to thrive.

Stakeholders also provided recommendations for the WBG to consider while developing the EE Approach Paper, namely:

1. Goal and Target Specificity: Emphasize specific goals and identify major actions for substantial market impact, while assessing EE technologies or subsectors with the greatest impact potential.

2. Data-Driven Insights: Use the IEA analysis, particularly on net-zero scenarios, to explore energy usage patterns and opportunities for scaling technologies and prioritize accordingly.

3. Tailored Sectoral Approaches: Recognize the various challenges across sectors and regions, requiring tailored approaches for effective EE interventions.

4. Regulatory Frameworks: Highlight the role of regulatory frameworks and policy tools, providing impactful examples.

5. Market Dynamics and Consumer Behavior: Address issues such as consumers prioritizing cost over efficiency, leading to a preference for lower efficiency equipment and the need for improved financial products to support different business models.

6. Private Sector Engagement: Emphasize the importance of profitability and risk management, through improved financial schemes and opportunity mapping to drive private sector investment in EE.

7. Financial and Operational Models: Discuss the need for innovative and standardized financial schemes, addressing high transaction costs, scaling up challenges, and aligning with institutional banking systems.

8. Barriers and Challenges: Identify barriers like lack of data, high transaction costs, risk perception of EE investments, and regulatory gaps. Emphasize the need for legal frameworks, awareness campaigns, and standardized benchmarks.

9. Successful Initiatives and Best Practices: Reference successful mechanisms such as public lighting replacements, demand aggregation, green procurement, and concessional funding to scale up EE investments.

10. Partnerships and Institutional Support: Highlight the importance of strengthening partnerships with MDBs and stakeholders and promoting initiatives like ESCOs for sustained market growth.

11. Innovative Solutions and Future Directions: Encourage innovations such as smart metering, revolving funds for public sectors, result-based financing, and policy support to foster widespread EE adoption.

TABLE A-1. List of stakeholder consultation meeting participants

No.	Name	Affiliation and position
1	Cindy Cisneros Tiangco Call	Director, Energy Sector Office, Asian Development Bank
2	David J. Morgado	Senior Energy Specialist, Asian Development Bank
3	Rhoe O. Polloso	Operations Assistant, Energy Sector Office – Front Office
4	Tamara Babayan	Senior Energy Specialist, ESMAP, World Bank
5	Jas Singh	Lead Energy Specialist, IEEGK, World Bank
6	Israel Biramo	JPA, ESMAP, World Bank
7	Dilip R. Limaye	Consultant, SSAW1, World Bank
8	Selena Jihyun Lee	Energy Specialist, IEEGK, World Bank
9	Alicia Hernández Muñoz	Consultant, World Bank
10	Dimitri Koufos	Head of Sustainable Business, Industry, Agribusiness and Commerce (ICA), European Bank for Reconstruction and Development (EBRD)
11	Solomiia Petryna	Principal, Green Financial Systems, EBRD
12	Konstantinos Dimopoulos	Green Buildings and ICT Specialist, EBRD
13	Ela Yilmaz Akdeniz	Principal Manager (Industrial Decarbonization, Circular Economy), EBRD
14	Emre Oguzoncul	Principal, Sustainable Business and Infrastructure, EBRD
15	Mariné Baghdasaryan	Sustainable Infra & Green Capital Markets, EBRD
16	Monojeet Pal	Manager, Renewable Energy and Energy Efficiency, African Development Bank (AFDB)
17	Jalel Chabchoub	Chief Investment Officer, AFDB
18	Jose Luis Irigoyen	Chief of Operations, Inter-American Development Bank (IDB)
19	Jose Antonio Urteaga Dufour	EE Lead, Senior Energy Specialist, IDB
20	Andres Alcala	Senior Executive, Development Bank of Latin America and Caribbean (CAF)
21	David Germano	Principal Officer, Financing of Productive Sectors, CAF
22	Cesar Vargas	Private sector Specialist, Climate Change and Blended Finance, CAF
23	Cecilia Tam	Head of Energy Investment Unit, OECD, International Energy Agency (IEA)
24	Grace Tam	Head of Consumer Finance, Clean Energy Finance Corporation (CEFC), Australia
25	Daniel Magallon	Managing Director, Base Foundation, Switzerland
26	Noe Afonso Perez	Senior Manager (Public Policy & Regulation), Deloitte, Spain
27	Paula Murcia Pascual	Senior Manager, Deloitte Strategy, Risk & Transactions, Spain
28	William Beloe	Principal Industry Specialist, IFC
29	Lina Sun Kee	Senior Industry Specialist, IFC
30	Ashutosh Tandon	Operations Officer, IFC
31	Qiuping Li	Institutional Communities Lead (Energy transition), World Economic Forum

Annex B. Energy efficiency metrics and scorecards

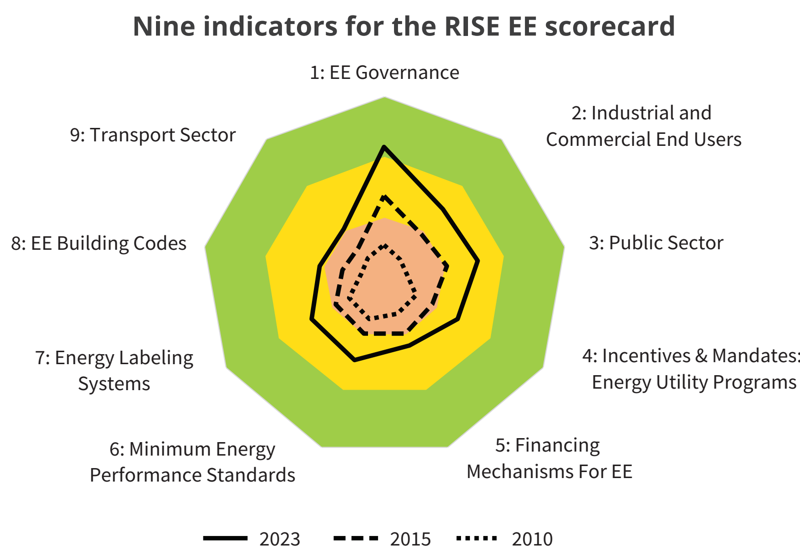
Establishing and applying standardized metrics and benchmarking scorecards for energy efficiency (EE) is challenging due to variations in industry practices, operational conditions, regional regulations, and access to data. A lack of universally accepted standards makes cross-sector and cross-country comparisons difficult, while inconsistent data collection methods and measurement accuracy hinder reliable benchmarking. Additionally, defining appropriate baselines is complex, as energy performance depends on factors like climate, equipment age, and usage patterns. These challenges make it difficult to assess true efficiency gains and drive meaningful improvements.

However, there are growing efforts to develop composite indicator scores to make the metrics robust, including those of the World Bank's **Regulatory Indicators for Sustainable Energy (RISE)**, funded by the Energy Sector Management Assistance Program (ESMAP); and the **International Energy Efficiency Scorecard** supported by the American Council for an Energy-Efficient Economy (ACEEE). Each is presented below.

World Bank RISE

RISE indicators for EE cover 140 countries, equivalent to 98% of the world population. There are nine main indicator categories, ranging from overall governance for EE to financing and regulatory measures. Its comprehensive country-level assessments can serve as metrics through which to monitor development over time as well as benchmarks against regional and global peers for policymakers and investors alike (Figure B-1). In its latest assessment (2025), the area that assesses EE governance and planning continued to receive the highest scores, reflecting its essential role in the development of effective EE policies. In contrast, the advancement of building energy codes has been poor over the last decade, which is cause for concern given that buildings account for 30% of global energy consumption. Transportation, which covers EVs, modal shifts, congestion pricing and promotion of non-motorized transportation among others has also lagged.

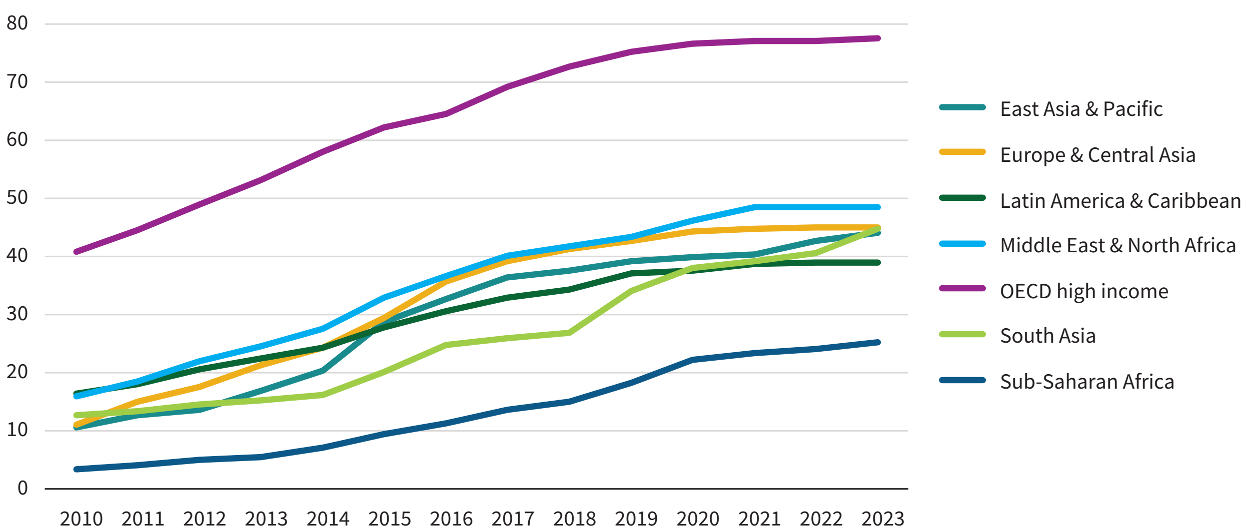
FIGURE B-1. RISE scores for energy efficiency and regional and country trends



Source: Latest data available from WBG Energy Sector Management Assistance Program (ESMAP) (2025). Regulatory Indicators for Sustainable Energy (RISE).

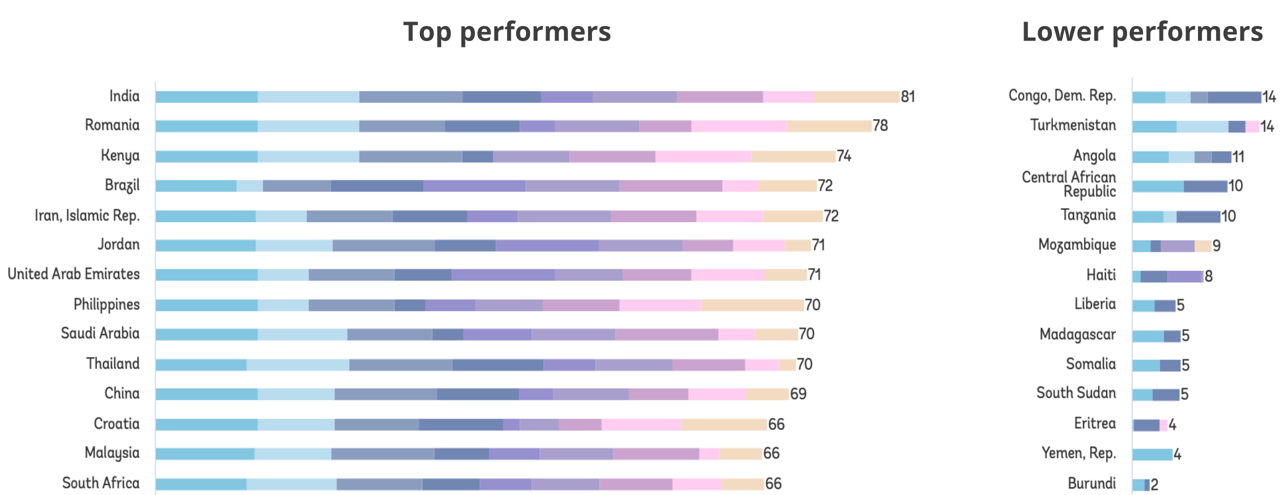
Figure B-2 shows that although improvements in regulatory scores over time for EE are evident across all regions, the pace of progress and the resulting levels of achievement vary considerably at both the regional and country levels. In OECD countries, for instance, rapid advancements have been driven by strong legislative commitments, such as the European Green Deal and various state-level mandates. Conversely, while regions such as Sub-Saharan Africa and South Asia also experienced improvements, the rate of progress was comparatively slower. At the country level (Figure B-3), the top four developing country performers were India, Romania, Kenya and Brazil, each representing a different region. Among the top 13 countries, nine were from Asia.

FIGURE B-2. RISE EE score by region, 2010-2023



Source: Latest data available from WBG Energy Sector Management Assistance Program (ESMAP) (2025). Regulatory Indicators for Sustainable Energy (RISE).

FIGURE B-3. RISE EE score by countries, 2023



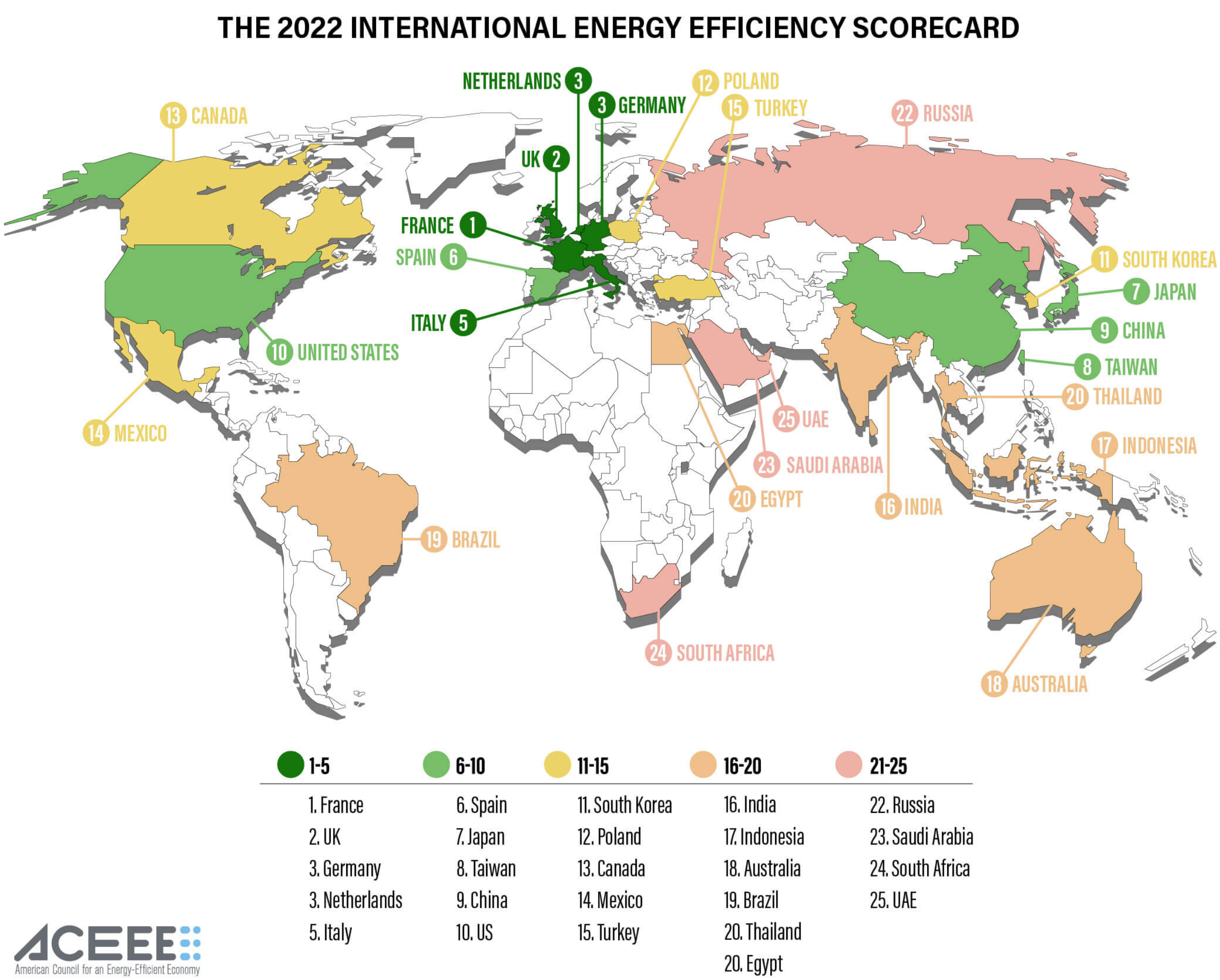
Source: Latest data available from WBG Energy Sector Management Assistance Program (ESMAP). Regulatory Indicators for Sustainable Energy (RISE).

Challenges such as limited access to funding, regulatory capacity, and technological infrastructure can hinder the swift implementation of effective EE measures. Despite these constraints, there are emerging initiatives aimed at increasing awareness and capacity-building, which are laying the groundwork for future regulatory advancements. In summary, while the global trend points towards stronger regulatory frameworks for EE, the disparity in the pace and extent of improvement highlights the need for tailored strategies that cater to the unique socioeconomic and technical landscapes of each region and country.

ACEEE's International Energy Efficiency Scorecard

ACEEE's International Energy Efficiency Scorecard ranks 25 of the world's largest energy users based on 36 efficiency metrics. It scores them on policy measures and performance metrics, awarding up to 25 points in each of four categories: buildings, industry, transportation, and national efforts. In its latest international ranking in 2022, no country came close to a perfect score, and the average—48.5 out of 100—dipped slightly following the previous scorecard in 2018 (Figure B-4). In the top 10 scores, the only developing country was China.

FIGURE B-4. International energy efficiency scorecard (2022)



Source: American Council for an Energy-Efficient Economy (ACEEE) (2024). International Energy Efficiency Scorecard.

Annex C. Barriers and global solutions for energy efficiency

STAKEHOLDERS	BARRIERS	ACTIONS
GOVERNMENT	Weak national policy, regulatory frameworks, and target	• Develop national energy efficiency policies and supporting legislative and regulatory frameworks • Set national targets for energy efficiency and align with national energy and climate strategies • Promote key policy reforms, including energy tariffs, to foster an enabling environment for energy efficiency investments
GOVERNMENT	Limited public awareness and information	• Initiate public awareness campaigns informed by behavior change to create demand • Publish and disseminate information such as appliance labels, case studies, procurement guidelines, product catalogs, etc.
GOVERNMENT	Public procurement and contracting regulations	• Mandate public agencies to set and meet energy efficiency targets • Adjust procurement rules to require purchasing of energy-efficient products and rank the highest value bidders (for ESCO contracts) based on life-cycle costing • Allow public agencies to enter into multi-year contracts/obligations with ESCOs
INSTITUTIONS	Low quality buildings and equipment & split incentives	• Develop and enforce building energy codes • Establish minimum energy performance standards for equipment • Monitor the compliance with codes and standards, and update them periodically
INSTITUTIONS	Weak institutional set up and authority	• Develop well-resourced nodal agencies for energy efficiency • Enhance capacities for policies, programs, M&E and data and information • Establish “one-stop shops” to provide technical assistance, information on financing, incentives, service providers, tools and templates
INSTITUTIONS	Lack of incentives	• Recognize and reward agencies for energy efficiency improvements and achievements • Set up performance-based incentives and penalties
FINANCIERS	High transaction costs	• Provide simple, standardized guidelines on energy efficiency procurement and technologies • Develop standard templates and tools for energy audits • Aggregate similar and small project and leverage bulk procurement
FINANCIERS	Contractual complexities	• Standardize contract templates and agreement • Educate public agencies and financiers on various energy efficiency financing and business models
PRODUCT & SERVICE PROVIDERS	Limited risk mitigation measures	• Develop and provide tailored risk mitigation measures such as guarantees, energy savings insurance • Strengthen product testing, measurement and verification, ESCO arbitration mechanisms, O&M training to reduce performance risks
PRODUCT & SERVICE PROVIDERS	High perception of risks	• Implement training programs with case studies for banks and financial institutions • Introduce public financing options first to demonstrate energy efficiency costs and savings, show repayment performance
PRODUCT & SERVICE PROVIDERS	Limited financing	• Develop dedicated energy efficiency financial products tailored to target markets • Streamline the loan application, appraisal and agreement documents and procedures

Source: Authors.

Annex D. Debunking myths about energy efficiency in LICs and MICs

1. EE cannot be achieved when energy prices are low.

There are many examples of successful EE programs in countries where energy prices were low or below cost-recovery levels. Such programs can provide substantial fiscal benefits by lowering subsidy outlays by the government. An analysis showed that EE could mitigate the impacts of tariff reforms on the mining sector in Zambia, which received more than US$576 million in energy subsidies in 2016.[77] However, EE policies and programs are most effective when energy prices reflect their true costs.

2. EE makes sense for MICs but not LICs.

While MICs have higher EE potential, LICs can least afford to waste energy. EE programs can make energy services more affordable and reduce the impact of nonpaying customers. An EE roadmap for Rwanda identified cost-effective measures to reduce electricity demand by 22% and save US$25 million annually.[78]

3. Codes and standards drive up consumer costs.

Building codes and appliance standards set minimum performance requirements, usually based on lifecycle cost analyses, to ensure long-term benefits to consumers. Such measures, if properly enforced, are an important signal to markets to drive innovation in designs and attract new suppliers of efficient materials and equipment and increase competition which can help lower prices. An IFC report found green buildings only cost about 5-10% more than conventional construction, with much lower operating costs, despite the public perception that they cost 30% more.[79]

4. Utility demand-response programs are inconvenient and do not save consumers money.

Demand response programs are generally designed to be user-friendly and have little to no impact on participants' daily lives. Smart thermostats can automatically adjust temperatures during peak demand periods without customer actions or impacts on their comfort. By switching from peak or off-peak rates, coupled with DR program incentives, customers will see a benefit on their energy bills (if not, they would not voluntarily participate).

5. Private ESCOs will bring the needed investments, so there is no need for public financing.

Private ESCOs in North America and Europe were created over decades with substantial government support and enabling policies. In LICs and MICs, the complexities of the ESCO model, weak ESCO balance sheets, lack of creditworthy customers, poor M&V, etc. have all limited their successes. But well-designed financing and incentive schemes with public support, coupled with market enabling entities, can help.

6. Changing behaviors can only save a small amount of energy.

A recent study by the European Environment Agency found that up to 20% of energy use can be saved through behavior change programs.[80] During the global energy crisis in 2022, the IEA estimated that lowering the thermostat by just 1° C saved 7% of the heating energy and cut an average annual bill by €50-70.[81]

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[77] IISD (2018), *Subsidy Swap: Reducing fossil fuel subsidies through energy efficiency and renewable energy in Zambia*. International Institute for Sustainable Development.

[78] World Bank (2018), *Energy Efficiency Potential Assessment for Rwanda*. Washington, D.C. EEA (2013).

[79] IFC, 2023. *Building Green: Sustainable Construction in Emerging Markets*. Washington, D.C. World Bank Group, October 2023.

[80] EEA, 2013. *Achieving energy efficiency through behaviour change: what does it take?* Technical report no. 5/2013.

[81] IEA (2022), Global Energy Crisis.

Annex E. Lessons learned from two decades of energy efficiency

Substantial lessons have been learned since the WBG started lending for demand-side energy efficiency (EE) more than 30 years ago. As noted earlier, a range of benefits from demand-side EE programs have been realized. Overall, continued sector and energy pricing reforms are important to improve the enabling environment for EE, but many projects are financially viable even when pricing is below cost-recovery levels.

Project-level lessons

At the project level, key lessons include the following:

Prior to project preparation

- ***Introduce energy efficiency in policy dialogue.*** Early policy dialogue and sector analyses, the importance of EE and its multiple benefits to meet energy and other development goals, including curbing high energy demand growth and lowering the cost of the energy transition, must be articulated. This can help clients better appreciate the importance of EE within its strategies and help increase demand for lending. For needed policy reforms, including in DPFs, consider the need for policy implementation and their enforcement.
- ***Explore opportunities for pilots.*** Working with donor partners, the WBG can help initiate small scale pilots to help demonstrate the impacts EE programs and test programs designs and implementing agencies for potential, scaled-up interventions with WBG support.

During preparation

- ***Understand the market and adapt to local conditions.*** Before designing a project intervention, carefully study market capacity constraints, misaligned incentives, financing barriers, and reasons for past failures. Then identify market segment(s) and adapt EE implementation and financial models tailored to address the local context.
- ***Use public financing judiciously*** to demonstrate impacts and investment performance, test out business models, develop markets and processes (e.g., energy audits, M&V protocols) and minimize risks. During these early demonstration or pilot phases, have a clear line of sight how the project will be able to achieve ***implementation at scale*** once completed and evaluated. This includes transitioning from project units to sustainable institutions and from grants/public loans to blended or commercial financing.
- ***Select qualified, committed and capable implementing agencies*** and project partners, strengthen weak energy agencies when needed, and enhance their data and M&E capabilities.
- ***Use market-based mechanisms*** which can ensure sustainability backed up by strong regulations and end user obligations, incentives, and access to credible data and information. Develop multiple channels to ***aggressively identify project pipelines***. Sometimes, other co-benefits (e.g., lower maintenance costs, better service quality, etc.) can be more important than energy cost savings.

During implementation

- ***Maintain flexibility*** during implementation so that adjustments can be made based on lessons learned and evolving market conditions. Phase out incentives as prices come down and private sector activities increase.
- ***Lower transaction costs*** through technical assistance in such areas as standardization, use of templates (e.g., for energy audits, equipment inventories, ESCO agreements) and bundling of projects. Over time, the technical criteria and guidelines developed under operations can be converted to ***national standards*** and project data, guidelines and templates institutionalized.
- ***Capture and share lessons*** with other market actors (i.e., good case studies on financial performance to banks, business cases to industry, public benefits to ministers/mayors, etc.).
- ***Support sustainable financing mechanisms and national programs*** where energy and maintenance cost savings can be used for repayments, but some grants may be needed for underheating/undercooling, seismic and fire safety, structural deficiencies, etc. As operations are implemented, explore options for transitioning to national-level programs.

Implementation and Financing Models

Governments have used a range of implementation models to institutionalize and deliver EE programs. No model is perfect or better than the others; but models need to be based on local contexts and institutional capabilities, with proper incentives for success, sufficient resources, adaptable based on changing market conditions and backed up by strong policies, financing, and good governance. Having clear champions can be important to help initiate programs. However, programs cannot become dependent upon a strong "champion" manager, as many cases programs have deteriorated once the champion moved on. Some of the main models used are listed in Table D-1.

In addition to the models presented, specialized and temporary project units often embedded within line ministries or other government agencies are common in MDB/donor programs. These are often created for specific pilots or projects, usually for a period of 3-5 years, with dedicated staff and resources to implement specific activities. These units identify investments, finance them through the donor resources and carry out related functions (e.g., procurement, environmental and social aspects, measurement and verification). However, while common, such setups are very difficult to sustain once projects have been completed, and they lack the ability to scale up: the units are usually disbanded and their technical capacities lost once the projects are completed. If EE is to be scaled up, a clear transition plan is needed to ensure the capacities can be absorbed into a more sustainable institutional setup as scale up plans are realized.

Governments, the World Bank, and other MDBs/donors have also used a range of financing mechanisms to support EE programs where access to financing is a barrier. In less developed markets, this could mean some early investments are financed through grants to kickstart the market, demonstrate newer technologies, showcase the energy savings, etc. However, as the demonstration phase winds down, it will be necessary to introduce more sustainable financing mechanisms to enable the market to develop and scale up, i.e., phaseout out grants and budget financing to revolving schemes and blended financing. Where target sectors are generally creditworthy and banks are willing and able to lend, such mechanisms should involve commercial lending through local banks, etc. However, when this is not the case, some intermediate mechanisms relying more on public financing, such as through public EE funds may be warranted. Selecting and designing the most suitable mechanisms must be structured based on the local

TABLE E-1. Select financing and implementation models for energy efficiency programs

Implementation model	Description	Typical sectors covered	Conditions for success
Credit lines	Governments or MDBs extend long-term, often concessional loans to eligible local financial institutions to finance a portfolio of EE projects	Industrial, commercial, residential (often with parallel grants)	• Local banking partners have high-level commitment to develop EE business and work with marketing departments and regional/local branches to identify quality subproject pipeline • Strong technical capacity and internal appraisal, monitoring systems • Commercially oriented and flexible to changing market conditions • Robust creditworthy customer base, strong client relationships • Standardized applications, EE assessment tools, project agents (leasing, ESCOs, vendors) can help lower transaction costs
EE revolving funds	Public or PPP entity capitalized with MDB or government loans/grants to provide financing to support EE projects when banks are unable or unwilling to do so	Public, residential (when banks are not willing to lend)	• Strong demand for financing quality EE subprojects, with potential for full repayment from energy savings • Qualified fund manager, technical staff must act independently to finance subprojects based on merits • EERFs should be commercially oriented, flexible to changing market conditions, and avoid beneficiaries with poor financial performance and/or arrears • EERF financing should be designed based on target markets with mechanisms to ensure repayment • Full-service EERFs, that also manage the energy audits, designs and supervise renovations, can help municipalities and others with limited capacity
Super or public ESCOs	Public enterprises that receive government or MDB loans to serve as an integrator of EE projects, including the audit through completion and M&V	Public, commercial	• Super ESCO should be independent, with strong and well-compensated management, technical staff and well capitalized • Strong demand for financing quality EE subprojects, with potential for full repayment from energy savings • Super ESCO should target unserved markets and adapt to changing market conditions • Super ESCO must have an exit strategy and seek to crowd-in commercial financing and private ESCOs
Utility demand-side management	Utility, incentivized by regulations or tariffs, to lead programs to help consumers reduce loads, usually during peak periods or when supply cannot meet demand.	Residential, commercial, industrial, public	• Proper regulatory mechanisms and incentives for utilities to pursue DSM/DR programs • Utility management commitment to design and implement DSM programs • Robust system for customer data collection, strong program planning, implementation, measurement and verification and evaluation systems should be in place • Trust with customers, effective communications and customer outreach
Market transformation	Government programs to shift the market for efficient appliances and products through a range of schemes (e.g., labeling, bulk purchase, incentives/rebates, manufacturer partnerships)	Residential	• Programs should be designed to avoid market distortions and be done in close cooperation with suppliers and retailers • Need to ensure robust technical specifications of qualifying products to build market confidence • Incentives should be temporary to encourage early adopters and phased out over time to ensure sustainability • Programs should be designed based on good market data, with clear targets and objectives, properly monitored and evaluated and have exit strategies

legislative and regulatory environment, maturity of financial markets, capacity of public agencies, and the status of the energy services market, with a clear plan for how governments can maintain a high level of ambition and move to more commercial financing mechanisms over time. Public financing, when justified, should be used judiciously to crowd-in commercial financing and avoid creating market dependency on low-cost, public financing.

The poor tend to be subject to an implicit EE tax since they tend to live in older, sometimes informal, housing; often have older or second-hand equipment; and lack the information and means to reduce their high energy bills. Market studies, household surveys and other tools can help identify current income levels, practices and constraints so suitable programs can be designed to address local changes for poorer households. Because the upfront investment cost for more efficient products can be prohibitively high, suitable financing schemes, coupled with higher grant levels, may be necessary. Many programs have used bulk purchase schemes (often giveaways for LEDs) and utility on-bill financing to help make it easier for low-income consumers to participate and gain the benefits of energy saving schemes. However, the grant should not inadvertently encourage overconsumption or discourage private service providers from serving poor neighborhoods (as some bulk purchase giveaway programs have done). It is also important to ensure that, for poorer households that want to participate, the application process, access to information, etc. is prepared in a way that is easy for them to understand and make informed decisions.

Data, Information and Awareness

Access to high-quality data—from accurate building stock data to energy use in large consumers to credible market data—is essential to enable policymakers and practitioners to have the best information to make data-informed policy choices and design effective programs. Accessible and credible data is also important for end users to understand their options and to be able to make decisions to improve their facility's energy use and make quality investment and purchasing decisions.

Governments have responded with a range of actions to enable such data and information through: (i) the development and maintenance of building inventories with energy consumption data, reported by mandatory facility energy managers, (ii) development and maintenance of a database of large consumers (industrial, public and commercial) with mandates for annual energy and fuel use reporting, (iii) development of benchmark reports, so users can compare their performance to their peers and the government can identify high performers (for possible awards, recognition) and low-efficiency ones (for targeted support); (iv) development of technical specifications for high-efficiency products for public tenders; and (v) other actions to provide robust data and information to government decisionmakers.

Governments also incorporate data into their outreach to consumers and information to support government programs designed to boost EE market development. Such activities can include (i) information about qualified or certified service providers (energy auditors, building designers, ESCOs); (ii) information about program offerings, procedures and benefits to participation; (iii) general awareness raising about energy efficiency; (iv) case studies and tools (e.g., EE calculators, spec sheets, project-related templates); (v) behavior change initiatives; and (vi) data on policy and program impacts to justify program activities and expenditures.

More governments are realizing the benefits of incorporating behavior change elements into their outreach efforts. Understanding behavioral insights can often lead to relatively lower cost interventions that help overcome some of the barriers associated with uptake of energy efficiency programs. This has been the experience of utilities in the United and States and Canada: only 2% of their overall DSM expenditures, on average, goes to residential behavioral interventions, but these interventions generate 10% of the energy savings achieved. Well-designed behavioral interventions, which are intentional activities often undertaken by a government or institution with the intention of overcoming behavioral barriers, can lead to increased participation of EE financing programs and can enhance the level of energy savings for a given program. As a good practice, EE behavior change programs should be conceived and designed considering local contexts, social norms, customs, and behavioral habits, and using the most accurate data about consumers' energy use to provide innovative, usually inexpensive, solutions that are often used as complements to traditional policy approaches. Its application usually starts with defining the problem, diagnosing any barriers preventing people from adopting the desired behavior, and then designing interventions to address these.[82]

Big data and artificial intelligence can also support EE programs by analyzing vast amounts of energy consumption data to identify patterns, predict future usage, pinpoint areas of inefficiency, and optimize energy usage in real-time, allowing for targeted interventions and automated adjustments to maximize energy savings across buildings, homes, and industrial facilities, all while providing valuable insights for program design and improvement. While this remains an area under development, such tools are expected to provide (i) predictive analytics based on past energy use patterns; (ii) building performance models, (iii) automated system optimization, (iv) personalized recommendations to end users; (v) DR opportunities; (vi) anomaly detection; (vii) targeted outreach for low performing facilities; and (viii) many other applications.

The World Bank Independent Evaluation Group's Assessment of a Demand-Side Energy Efficiency Portfolio

An independent evaluation found the Bank's portfolio was successful but needed to place greater effort to achieve scale. In 2023, the World Bank's Independent Evaluation Group (IEG) issued a report entitled "World Bank Group Support to Demand-Side Energy Efficiency" which assessed the Bank's demand-side EE portfolio for the past decade. While the report found that Bank EE operations were effective and that they mostly met their intended outcomes, there was a need to accelerate and scale-up EE in the Bank's client countries. They recommended that the Bank: (i) intensify EE support to MICs, since this would have the largest impact on closing the GHG emissions gap; (ii) develop sector-specific approaches for LICs where productivity gains are achievable even if relevant policy reforms are at early stages; (iii) explore options to incorporate indirect GHG emissions, including Scope 3 and embodied carbon, within project analyses; and (iv) develop innovative approaches, including in the financial and digital areas, to allow countries to potentially leapfrog.[83]

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82 Energy Sector Management Assistance Program (ESMAP). 2020. *Integrating Behavior Change in Energy Efficiency Programs in Developing Countries: A Practitioner's Guide*. ESMAP Knowledge Series; No. 029/20. World Bank, Washington, DC.

83 World Bank, 2023. *World Bank Group Support to Demand-Side Energy Efficiency: An Independent Evaluation*. Independent Evaluation Group. Washington, DC: World Bank.

Annex F. WBG case studies on scaling up energy efficiency

Title: Reducing air pollution through energy efficiency in industry in China

Country/project name: China *Innovative Financing for Air Pollution Control in Jing-Jin-Ji*

Financing: US$1.226 billion [IBRD: US$413.04 million, Borrower/Commercial banks: US$815.2 million]

Program implementation period: August 2016 – June 2022

Development objective: To reduce air pollutants and carbon emissions through increasing energy efficiency (EE) and clean energy, with a focus in Beijing-Tianjin-Hebei (Jing-Jin-Ji) and neighboring regions.

Description: To address deteriorating air pollution, the Bank supported the Chinese government with a program-for-results loan to support investments in EE, RE and air pollution controls. These investments were made in parallel to a robust set of broader initiatives and action plans introduced by the government. The Bank loan was disbursed to Hua Xia Bank as the implementing agency, which provided sub-loans to sub-borrowers to implement EE activities focused on retrofit and renovation of industrial facilities, commercial buildings, and public buildings and facilities. These mainly included (i) replacing inefficient energy-intensive industrial equipment with highly efficient equipment; (ii) replacing inefficient industrial processes and technologies with highly efficient ones; (iii) recovering and utilizing by-product gas, waste heat, and pressure for electricity generation or cogeneration; and (iv) implementing green building EE.

Results: The program was completed in 2022 and, together with RE investments, exceeded most of the results indicators for particulate emissions, SO_2, NO_x, as well as reducing CO_2 emissions by 2.88 million tons. The bank also introduced new and innovative green financial products, provided financing to local ESCOs, and established a green finance center. The bank was able to leverage over US$815 million in commercial financing and private capital to support these investments and achieved a Highly Satisfactory overall outcome rating.

Source: World Bank, 2022. *Innovative Financing for Air Pollution Control in Jing-Jin-Ji Program Implementation Completion and Results Report*. Report No. ICR00006070, December 21, 2022.

Title: Scaling up energy savings through bulk purchase schemes in India

Country/project name: India *Energy Efficiency Scale-Up Program-for-Results*

Financing: US$767.91 million [IBRD: US$187.61 million, Borrower: US$351.1 million, Other donors: US$229.2 million]

Program implementation period: November 2018 – September 2023

Development objective: The program objectives are to scale up energy savings in residential and public sectors, strengthen EESL's institutional capacity, and enhance its access to commercial financing.

Description: In 2018, the Bank provided a loan to India's public ESCO, Energy Efficiency Services Ltd. (EESL), to help curb energy demand to allow the country to continue to fuel its economic growth while achieving its climate targets. Established in 2009, EESL was set up to finance and deliver EE solutions and financing, and to support and grow the local private ESCO market. The PforR supported (i) the bulk purchase and distribution of efficient appliances, notably residential lighting and ceiling fans; (ii) bulk purchase and installation of lighting in public buildings and street lighting; (iii) set up a sustainable development unit within EESL; and (iv) leverage commercial financing through a parallel Bank guarantee.

Results: The program distributed more than 351 million lights, 2.3 million ceiling fans, 12.9 million streetlights, and set up a sustainable development unit—leading to 329 million MWh of energy savings, 267 million tons of CO_2 reduction and leveraged over US$580 million in counterpart and other donor financing. The guarantee, in the end, was not used due to some markets already being ready to absorb commercial financing and the fact that the guarantee was not competitive with other financing sources available to EESL.

Source: World Bank, 2024. *India Energy Efficiency Scale Up Program Implementation Completion and Results Report*. Report No. ICR00006624, April 30, 2024.

Title: Transitioning to sustainable heating and cleaner air with energy efficiency in Poland

Country/project name: Poland *Clean Air Through Greening Residential Heating Program-for-Results*

Financing: US$5.714 billion [IBRD: US$291 million, Borrower: US$2.994 billion, Commercial banks: US$1.458 billion; Household beneficiaries: US$0.972 billion]

Program implementation period: September 2018 – present

Development objective: The program objectives are to reduce energy use and air pollution emissions from heating sources in single-family buildings.

Description: The Clean Air Priority Program (CAPP)—a PLN 103 billion (US$26.0 billion), 10-year initiative implemented by the National Fund for Environmental Protection and Water Management (NFOŚiGW)—aimed to provide a mix of a subsidies[84], tax incentives, and targeted loans to help nearly 3 million owners of single-family buildings replace their coal boilers and conduct thermal retrofits of their homes. Since residential space heating contributed almost 80% of $PM_{2.5}$ emissions and about 60% of the target population relying on coal for were in the bottom 40% of the income distribution, the program was essential for both environmental and social causes. In 2021, the Bank provided a US$291 million IBRD program-for-results loan to the government of Poland to reinforce CAPP.

Results: Since the program began, NFOŚiGW has received over 1 million applications and the pace of applications has increased over time. Over 355,000 coal boilers have been replaced and almost 145,000 homes retrofitted, leading to over 101.4 million MWh in lifetime energy savings, and reductions in emissions of 162,000 tons of $PM_{2.5}$ and 42.8 million tons of CO_2. Seven partner banks have signed on to the program with over US$76 million mobilized so far. To address changing market conditions and incorporate lessons so far, CAPP simplified the application processing, increased the subsidy levels for the lowest income participants, extended bonuses for comprehensive housing retrofits, introduced an eligible list of materials and equipment, and introduced support for program agents (mostly municipalities) to support low-income households to recruit participants and help prepare applications. CAPP is expected to run through 2030 with more enhancement measures underway.

Source: World Bank, 2021. *Clean Air Through Greening Residential Heating Program Appraisal Document*. Report No. PAD4081, November 12, 2021.; Program Implementation Status Report, June 30, 2024; CAPP website: https://czystepowietrze.gov.pl/efekty-programu/czyste-powietrze-w-liczbach

84 The subsidies are set to vary based on the types of measures implemented and currently vary from 30–90%, with the highest levels reserved for low-income homeowners.

Title: Reducing energy use in municipal water utilities in China

Country/project name: China *Liaoning Safe and Sustainable Water Supply*

Financing: US$197.1 million [IBRD: US$150.7 million, Borrower: US$46.4 million]; ~US$78.8 million of the IBRD loan is for energy efficiency related investments

Program implementation period: October 2018 – June 2024

Development objective: The project development objectives are to improve water quality and operational efficiency of selected water supply utilities in the project areas.

Description: Liaoning Province, located in the northeast of China, experienced a lag in infrastructure maintenance and development leading to (i) obsolete water supply systems with high nonrevenue water (NRW)[85] losses that averaged 38% across the province and were as high as 64% in some areas; (ii) water quality risks; and (iii) low operational efficiency of several water companies (45% below the national average). An IBRD loan was provided to help improve urban water supply services in five cities—Shenyang, Anshan, Fushun, Fuxin and Gaizhou; Shenyang and Fuxin were later dropped. EE investments focused on a reduction in NRW and energy use through the upgrading of water supply infrastructure (including replacement of pipes, meters and pumps), improvements in water supply service management including NRM reduction and energy management plans, and an innovative smart water management system with real-time flow and pressure monitoring for optimal operation.

Results: The project substantially reduced NRW and energy use. The project addressed these issues by rehabilitating water plants and pipelines, installing district meters and smart household water meters, upgrading pumps (including booster pumps) and pumping stations, and developing a smart water management system which reduced physical and non-physical leakages and energy use. Gaizhou reduced NRW from 64.1% to 33.3%; Anshan and Fushun lowered NRW from 30.9% and 38.8% to 23.6% and 21.6%, respectively. The reduction of NRW saved approximately 45 million m^3 of water. These combined efforts reduced the specific energy of water supply (kWh/m^3) in all three cities (Anshan from 0.46 to 0.45), Fushun (from 0.55 to 0.504) and Gaizhou (from 1.60 to 0.95).

Source: World Bank, 2024. *Liaoning Safe and Sustainable Urban Water Supply Project Implementation Completion and Results Report*. Report No. ICR00006500, November 18, 2024.

Other program examples

IFC has pioneered the green buildings market through an effective certification scheme. EDGE is designed to promote resource-efficient building practices in emerging markets, making it easier and more affordable for developers to construct green buildings. The EDGE certification system focuses on three key areas: energy efficiency, water efficiency, and the efficient use of materials. By providing a streamlined certification process[86] and a user-friendly software tool, EDGE enables developers to quickly assess the financial viability of incorporating green building measures into their projects. The goal is to reduce the environmental impact of buildings while also lowering operational costs and enhancing marketability.

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85 NRW is a result of physical leakage (e.g., pipe leakage), non-physical leakage (e.g., meter omissions) and non-charge legal water use (e.g., water used for firefighting and public utilities).

86 EDGE certification is achieved through a three-step process: preliminary assessment, design audit, and final certification. During the preliminary assessment, developers use the EDGE software to input building parameters and receive an instant estimate of potential savings in energy, water, and materials. The design audit involves a detailed review by an EDGE Auditor to ensure that the proposed measures meet the required standards. Finally, the post-construction phase includes a thorough verification process to confirm that the building has been constructed as per the approved design.

Since EDGE was first introduced, IFC has supported over US$17.9 billion investment in green buildings (broader than just EE). IFC has also certified buildings in 115 countries with total value of more than US$100 billion, resulting annually in over 4.13 million MWh in energy savings, 120 million m^3 of water saving and 2.29 million tons of CO_2 emission reductions. To date, about 40% of EDGE certified buildings are renovated buildings. While IFC's work has largely been with private developers, the EDGE program has worked with World Bank housing investments in Argentina, Senegal, Egypt, Mongolia and Indonesia.

Source: Personal communication, Ommid Saberi (Principal Industry Specialist, IFC).

MIGA supported the Kasada Hospitality Fund, to support improved water and energy efficiency in hotels to meet IFC EDGE green building certification standards. MIGA provided Euro 225.9 million in guarantees to support the Kasada Hospitality Fund, a US$500 million hospitality sector focused private equity fund backed by the Qatar Investment Authority (QIA), Qatar's sovereign wealth fund and Accor, Europe's largest hospitality group. Its mission is to support hotel development in Sub-Saharan Africa. The investments support the acquisition, refurbishment, and improvement of up to 20 hotels acquired by Kasada across various countries in Sub-Saharan Africa. Under this operation, MIGA will provide a total coverage of Euro 225.9 million to Kasada and its subsidiaries for their equity, quasi-equity and/or shareholder loan investments against the risks of expropriation, transfer restriction, and war and civil disturbance. The individual sub-projects will be issued for a maximum tenor of up to 15 years and the guaranteed percentage will be up to 90% for equity /quasi equity investments and up to 95% for shareholder loans. Kasada will seek EDGE certification in at least 20% of its hotels by 2025.

Source: MIGA project summaries, available at: https://www.miga.org/project/kasada-hospitality-fund-lp-15.

Annex G. Institutional set-ups for energy efficiency

A variety of institutional setups have been used globally to support energy efficiency (EE). These models represent a range of different structures, from national energy agencies, with broad-based responsibilities that include EE, to independent EE agencies to nongovernment organizations. Whereas the older EE agencies, established during the 1990s or earlier, were mainly broad-based national energy agencies, in more recent years specialized agencies or public companies focused on EE and related clean energy investments have become more common (see Table G-1). Several implementing institutions established in the last decade have been independent statutory authorities or government-owned corporations with greater ability to leverage commercial financing, given the urgent need to shift from policy formulation to major clean energy investments.

TABLE G-1. Energy efficiency institutional models

Institutional model	Advantages	Disadvantages	Examples
Broad-based national energy agency (with EE department)	• Greater credibility with stakeholders • Larger resource availability • Greater clout in obtaining funds	• EE may get low priority • Slower bureaucratic decisions • Difficulty in retaining staff	United States Department of Energy (US DOE) Danish Energy Authority (DEA) Natural Resources Canada (NRCan) Turkish Ministry of Energy and Natural Resources (MENR)
Government agency focused on clean energy (EE, RE)	• Focus consistent with EE • Common goals, functions, etc. • Easier to attract dedicated staff	• Smaller size provides less clout • EE may get less emphasis due to lower capital intensity/visibility	Australian Greenhouse Office Thai Department of Alternative Energy Development and Efficiency (DEDE) Soth African National Energy Development Institute (SANEDI) French Agency for Ecological Transition (ADEME)
Government agency focused on EE	• EE focus creates strong culture/ motivation • More flexibility in program design • Possible leveraging of other resources	• Agency part of a larger organization • May face difficulties in obtaining adequate resources	Indian Bureau of Energy Efficiency (BEE) Mexico National Commission for Efficient Energy Use of Energy (CONUEE)
Independent statutory agency	• Independence facilitates decisions/operations • Can obtain external advice/ funding • Greater flexibility in decision-making	• Agency may not be viewed as mainstreamed • Less direct access to public funding • May require new legislation	U.K.'s Energy Savings Trust (EST) Sustainable Energy Authority of Ireland (SEAI) Energy Conservation Center of Japan (ECCJ) Sri Lanka Sustainable Energy Authority (SLSEA) Armenia Renewable Resources and Energy Efficiency Fund (R2E2 Fund)
Independent corporation focused on EE	• Can access private sector talent and technical capacity • Flexibility in decision-making/operations • Ability to access external funding	• Agency may not be viewed as mainstreamed • Less direct access to public funding • Potential competition with public agencies	Korea Energy Agency German Energy Agency (dena) Polish National Energy Conservation Agency (NAPE) Croatian Energy Institute (EIHP) Motiva (Finland) Enova (Norway) Spanish Institute for the Diversification and Saving of Energy (IDAE)
Public-private partnership focused on EE	• Access to private sector inputs/funding • Flexibility in decision-making/operations	• Potential conflicts between public and private sector interests and perspectives • Less direct access to public funding	
Nongovernmental organization focused on EE	• Greater credibility with some stakeholders • Flexibility in decision-making/operations • Access to private sector inputs/funding	• Some stakeholders may find NGOs less credible or accountable • Less direct access to public funding	Austrian Energy Agency

Source: Updated from World Bank, 2015. *Republic of Turkey: Institutional Review of Energy Efficiency*. World Bank, Report No. ACS12738, May 2015.

Annex H. Action plan to scale up energy efficiency

Barrier or Challenge	Proposed Actions	By Whom	Timeframe
	Increase awareness and advocacy for EE		
Limited examples with data documenting linkages between EE and other development priorities in LICs and MICs, energy access and other development priorities	Leverage World Bank portfolio to document linkages between EE and other development priorities in MICs and LICs. Develop case studies, economic and financial analysis toolkits, etc. to help teams and clients better document and quantify non-EE benefits.	WBG, ESMAP and development partners	Short term (6 months)
Perception that EE is small, hard, expensive or may not materialize	Leadership to advocate and raise awareness to show EE is achievable and affordable (and not doing EE can be costly) with case studies and models to show how to do it at scale, document benefits of scale (new supply chains, lower prices, new jobs).	WBG, ESMAP and development partners	Short term
No incentives or visibility to do more on EE	Develop coalitions to promote EE, recognize leadership in all sectors.	World Bank, ESMAP and development partners	Short term
	Policies and regulations		
Identify main policy gaps in EE scorecards and develop good practice notes to help clients overcome them	World Bank and ESMAP should analyze RISE and other scorecards to identify persistent gaps and develop guidance notes to help countries address them.	World Bank, ESMAP	Short term
Low energy pricing	TA funds and policy advocacy are needed to support tariff methodologies, development and implementation of tariff reform roadmaps including strengthening of social safety nets and strategies to incorporate EE to mitigate impacts of reforms. Explore simple DR programs, with tariff incentives, to help lower energy supply costs.	World Bank and development partners	Short to medium term (6-18 months)
Poor performance of buildings, low quality appliances, split incentives (owner-tenant)	Introduce standards and codes, improve stringency over time, offer incentives/recognition to exceed minimum requirements, strengthen enforcement mechanisms, upgrade testing facilities, introduce building and appliance labeling, harmonize standards to facilitate trade. World Bank could adopt EDGE (green building certification) as a standard for all new buildings, better promote EE as part of existing policies (e.g., ESS3, Paris Alignment), push for more universal lifecycle costing for new infrastructure, prohibit the purchase of very inefficient technologies (e.g., incandescent bulbs), encourage NZEBs where some concessional financing is available.	WBG, development partners and clients	Medium term (1-3 years)
Public sector has inefficient buildings and facilities, lack incentives to save energy	Convert public sector into EE leader, mandate stringent EE targets for public facilities with financing, amend budgeting and procurement rules, introduce purchasing requirements for energy-efficient products	WBG, development partners and clients	Medium term
Potential lock-in from urban sprawl and poorly designed cities	Improve city planning, densification and urban designs to help lower future energy and infrastructure needs.	WBG, development partners and clients	Medium-to-long term (1-7 years)
	Institutional		
Policymakers do not see EE as a reliable, scalable resource or requiring unaffordable incentives to end users	Better documentation of scalable models should be developed and disseminated. EEX Academy will showcase models to implement EE at scale.	WBG with development partners	Medium term

Barrier or Challenge	Proposed Actions	By Whom	Timeframe
Local energy agencies responsible for EE programming are severely understaffed and under-resourced	The World Bank should encourage governments to designate responsible EE agencies to formulate EE policies and programs, and provide adequate resources (institutional mandates, budgets, staffing) to ensure their success, require periodic targets to keep them accountable for results.	World Bank, development partners and clients	Medium term
Poor coordination across EE-related agencies, between national and local governments	Establish coordination bodies (e.g., inter-ministerial councils) to align policies, regulations and enforcement, programs including financing and incentives, data collection and sharing, etc.	Clients	Short term
Different MDB approaches to scaling up EE, joint programs take more time, resources and effort	Regular sharing of successful EE approaches should be institutionalized across MDBs and other key donors. The GCP-E, World Bank projects, EEX Academy and other initiatives should more systematically require joint programs and partnerships.	WBG with development partners	Short term
Programming and financing			
Many programs are not designed to be scalable, with institutional set ups, financing, information, etc. Governments often lack budget provisions or clear financing sources to develop scaled-up, national programs. Limited international models which have successfully delivered at scale without access to substantial financial resources for incentives	Expand the use of MPAs to support EE, ensure project preparation considers higher levels of ambition and commercial financing, EEX Academy showcases models to implement EE at scale. Programs should be designed with a clear line of sight to scalability. This includes transitioning from project units to sustainable institutions and from grants/public loans to blended or commercial financing. Engage with banks early to ensure their future participation. Continue to innovate on scalable program models and share experiences (successes and failures) in international fora. Models that have shown their ability to scale should be promoted aggressively. More documents of scalable models for LICs and MICs leveraging examples and models from the WBG portfolio along with lessons.	WBG, ESMAP development partners and clients	Medium term
High upfront costs for EE equipment for end users	Consider programs to lower costs, through bulk purchase schemes, manufacturer coupons, public procurement, etc. to bring in new suppliers and competition to bring costs down over time. Consider leveraging carbon markets to boost project returns.	World Bank, development partners, clients and private sector	Medium term
High transaction costs associated with project preparation, program design, implementation	Leverage World Bank platforms (e.g., Open Social) and programs (GCP-E, projects, EEX Academy) to share World Bank and country documents, templates and tools, TORs, bidding documents, etc. to facilitate information sharing. Establish government one-stop-shops to bring information together (on financing schemes, service and equipment providers, ESCOs, case studies) to facilitate transactions. Mobilize concessional financing to help lower transaction costs; blended financing with other donors, and carbon markets can also help.	World Bank, ESMAP, development partners and clients	Short term
Insufficient financing and incentives available within the public budget to launch large-scale programs	Phase programs, so financing can be gradually mobilized, but identify indicative sources of funds for future phases. Consider performance targets or triggers to future phases. Shift to increased commercial financing to reduce program dependence on public budgeting. Where banks are willing to lend, partnerships with banks can be very effective. This may include public support for program marketing, training, dissemination of tools, risk sharing mechanisms, etc. Access to concessional financing, leveraging carbon markets, pooling donor funds to offer blended finance, etc. can increase the pool of financing while lowering its costs, making it more attractive to end users.	WBG with development partners	Medium-to-long term

Barrier or Challenge	Proposed Actions	By Whom	Timeframe
Many of the target end users (e.g., households, SMEs, municipalities) have limited access to affordable financing or are not deemed creditworthy	Where banks are not willing to lend, establishing public entities (e.g., budget capture scheme, EE Fund, public ESCO) to demonstrate financial viability and allow target market to prove their repayment discipline. Then replication through banks should be encouraged.	World Bank with development partners and clients	Medium-to-long term
High risk perception of banks, lack of EE performance data, limited capacity to appraise EE projects Limited tenor financing, foreign currency risks	Design of suitable risk mitigation instruments (e.g., partial credit guarantees, energy savings insurance), capacity building and sharing of actual EE project performance. MDB financing can provide longer tenors but introduce additional forex risks since savings accrue in local currencies. Using a broader range of WBG hedging products can help address these risks.	WBG with development partners	Short to medium term
High capital costs for clients, especially LICs	Mobilizing concessional financing can help lower financing and upfront costs and incentivize needed reforms. Blended financing with other donors, and carbon markets can also improve returns on EE investments.	WBG with development partners	Short to medium term
Suppressed energy demand due to undercooling, underheating or need to expand infrastructure services to those without access Need for structural or functional improvements to buildings and other infrastructure to make EE investments viable	World Bank financing, concessional financing and budgetary resources need to be mobilized and provided alongside EE loans to address deficiencies in building, functionality, increasing access, etc.	World Bank, development partners and clients	Medium-to-long term
Information and Data			
There is a lack of national-level data, such as building inventories, databases of large energy users, appliance data, etc.	Develop national registries of key energy-using infrastructure (buildings, public lighting) and databases on energy use (from mandatory reporting of energy use for buildings, industry), to allow low performing systems to be prioritized for upgrades. (Use of proxy or representative data can be done when none is available.) Require benchmarking so users can compare with their peers, share data analyses for public awareness, identify high and low performers. The World Bank and development partners should mobilize concessional funding to support such efforts. New digital and AI-enabled tools can facilitate analyses, thereby simplifying energy audits, energy management, etc.	WBG with development partners and clients	Medium-to-long term
Lack of information about successful policies and programs, scalable models and how to design, implement, monitor and evaluate programs	The GCP-E, EEX Academy and other initiatives should be expanded to be accessible to all clients, with periodic engagement mechanisms to address emerging challenges and implementation issues. Development of one-stop shops with EE information, including case studies, certified service providers, tools, templates, etc.	WBG, development partners and clients	Short term
Lack of networks and systems for clients to request information when they need it, learn how other countries addressed similar issues in real time	Develop global communities of practice (supported by GCP-E, EEX Academy, donor partners) to share experiences, case studies and leverage its platforms to allow for real-time information sharing on policy and implementation issues.	World Bank with development partners	Medium term

Source: Authors.

FIGURE F-1. Framework for scaling up actions

Source: Authors.

Energy Sector Management Assistance Program

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