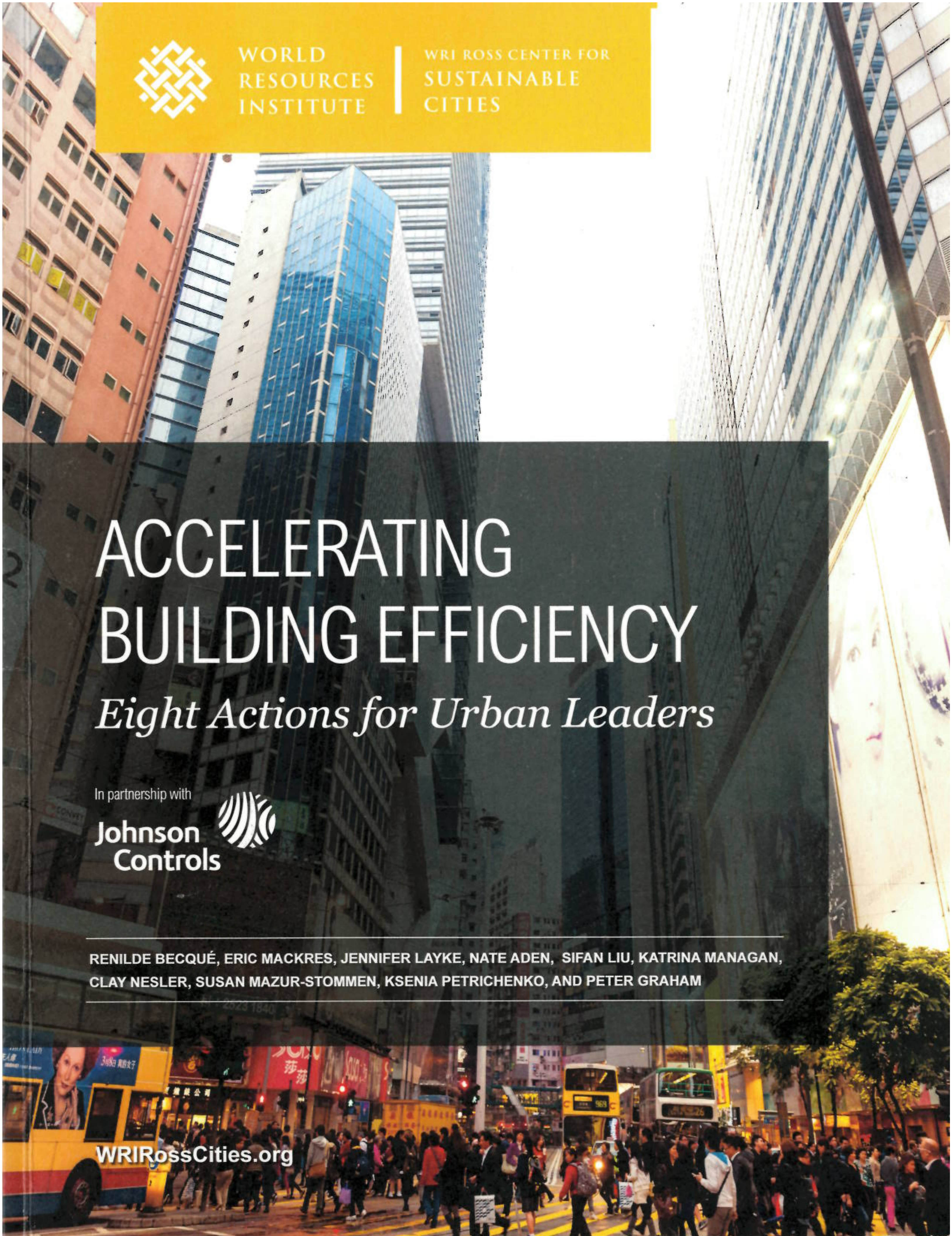

WORLD RESOURCES INSTITUTE | WRI ROSS CENTER FOR SUSTAINABLE CITIES

ACCELERATING BUILDING EFFICIENCY

Eight Actions for Urban Leaders

In partnership with

Johnson Controls

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UNEP Sustainable Buildings and Climate Initiative — Promoting Policies and Practices for Sustainability

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FOREWORD

Nearly 70 percent of the world's population will live in cities by 2050. Buildings form the fabric of these rapidly growing urban landscapes. Architectural designs, construction practices, and technologies are available today that minimize energy and resource use in buildings and optimize the benefits to people of high performance—cleaner air, more comfortable homes and workspaces, and lower utility bills. And improved building efficiency is a win for city leaders and local planners: every $1 invested in efficiency saves $2 in new power plants and electricity distribution costs.

Accelerating Building Efficiency: Eight Actions for Urban Leaders provides a path forward to deliver better buildings before cities "lock in" decades of inefficiency—taking this path will be key to meeting our global sustainable development goals (SDGs). The report focuses on eight categories of policies and actions that can help decision-makers plan for transformative change in their cities. It highlights policies that can drive building energy performance, actions that cities can take to lead by example, and the enabling conditions that will deliver success.

The United Nations Sustainable Energy for All Initiative aims to double the global rate of improvement in energy efficiency by 2030. Working in alignment with national policies, local governments can and must play a significant role if we are to deliver on this ambitious goal. The more efficient our energy use, the further we can stretch our existing power supplies, and the more our renewable energy technologies can contribute to meeting energy demand. We must shift public and private investment to deliver more efficient building solutions.

Our organizations—and over a dozen co-authors and contributors to this guidebook—are committed to working within markets and with policymakers to build a bridge from business-as-usual investments to innovative transactions that will create the sustainable buildings of the future. Sub-national jurisdictions have both the authority and the appropriate policy levers to build better, more efficient buildings, help direct budgets and investment into efficient buildings, and contribute to more livable cities. National governments can set the stage and provide support for the transformation. Sustainable Energy for All, the SDGs, and the recent Paris Climate Agreement mark a turning point from problem identification toward solutions and action.

We stand ready to help advance building efficiency in cities around the world.

Naoko Ishii
CEO and Chairperson
Global Environment Facility

Rachel Kyte
Chief Executive Officer and
Special Representative of the
UN Secretary-General
Sustainable Energy for All

Andrew Steer
President
World Resources Institute

EXECUTIVE SUMMARY

This guide provides local governments and other urban leaders in cities around the world with the background, guidance, and tools to accelerate building efficiency action in their communities. The primary intended audience is local government officials in urban areas.

Efficient buildings—those that make highly productive use of natural resources—are vital to achieving sustainable development: They align economic, social, and environmental opportunities, creating so-called "triple bottom line" benefits.

- **Economic development:** Buildings are responsible for 32 percent of global energy consumption and one-quarter of global human-induced CO_2 emissions.[1] Energy costs can be a significant burden on a household or business budget. Increasing energy productivity through measures like building efficiency has the potential to slow the growth of energy demand in developing countries by more than half by 2020. Each additional $1 spent on energy efficiency avoids more than $2, on average, spent on energy supply investments.[2] Building efficiency frees up capital for other strategic investments, helping city governments face multiple competing demands for scarce financial and human resources.[3]

- **Social development:** Current projections indicate that 66 percent of the world's population will live in cities by 2050.[4] Buildings form the fabric of our urban landscapes. There is a tremendous opportunity today to shape tomorrow's cities and buildings and avoid "locking in" inefficiencies by applying resource efficient planning and design to buildings and the urban environment. In the coming decades, as these cities face rapid urbanization, buildings will play an ever-increasing role. Efficient buildings can help improve the quality of life of millions of people because they are often higher-quality buildings, with greater comfort and improved indoor and outdoor air quality. Energy efficiency can stretch existing electricity resources further, helping to provide better energy access, reliability, and security to urban residents.

- **Environmental sustainability:** A study by the International Energy Agency (IEA) shows that, if implemented globally, energy efficiency measures in the building sector could deliver CO_2 emissions savings as high as 5.8 billion tonnes (Gt) by 2050, lowering greenhouse gas emissions by 83 percent below the business-as-usual scenario.[5] Most of these technologies are commercially available today and many of them deliver positive financial returns within relatively short payback periods.[6]

Rapid rates of urbanization in much of the world will lead to an unprecedented expansion of the built environment. The choices being made today about how to build, design, and operate these buildings will affect urban services and livability for decades. Efficient, high-performance, and productive buildings will be a major factor in creating sustainable cities, which, in turn, contribute to sustainable development goals at the regional and national level.

Local governments can influence the efficiency of new and existing buildings in their communities as owners/investors, conveners/facilitators, or regulators. They can deploy a variety of policy options, ranging from setting targets and leading by example to implementing codes and performance systems, providing financial and non-financial incentives,

and supporting stakeholders in buildings in ways that improve the business case for pursuing or financing energy or water efficiency.

Efficiency goals should connect to specific priorities of local governments and communities, ensuring that the government and citizens optimize, minimize, or manage water, energy, and waste, as appropriate. Policies and programs can support efficient use of resources to provide heating, cooling, lighting, and domestic water, as well as to operate appliances and equipment installed or used in a building. This report serves as a reference guide for identifying and prioritizing appropriate actions to advance efficiency in both communities and organizations.

Policy design processes incorporating multi-stakeholder, integrative planning efforts can be an effective tool. Integrative planning that engages the buildings sector will help inform governance, policies, and decision-making. Integration of building efficiency in broader urban planning activities can also help institutionalize efficiency strategies across disparate departments within a government.

Policy can help align the interests of all actors around implementing cost-effective efficiency options at each stage of a building's lifecycle. These stages and their relationship to energy and resource performance comprise the following:

- **Land-use and other urban planning** decisions may affect buildings both before and after their construction is proposed. Policies already in place determine many aspects of building design. Urban planning acts as a constraint on private development, and may be intended to improve health, safety, or other desired characteristics of a city or neighborhood. Combining

BOX ES.1 | NAVIGATING THE GUIDEBOOK: WHERE DO YOU BEGIN?

Leaders in the public and private sectors alike can influence the efficiency of buildings. This guide details eight actions that deliver accelerated building efficiency in cities:

Action 1: Building Efficiency Codes and Standards
Action 2: Efficiency Improvement Targets
Action 3: Performance Information and Certifications
Action 4: Incentives and Finance
Action 5: Government Leadership by Example
Action 6: Engaging Building Owners, Managers, and Occupants
Action 7: Engaging Technical and Financial Service Providers
Action 8: Working With Utilities

Some of these actions will have greater relevance to different leaders, so we provide guidance on where you may want to get started as you explore the content:

Sub-national government officials: To develop and articulate a vision and goals that align priorities, you may be interested in the multiple benefits of building efficiency (Chapter 1), how buildings are important for creating better cities (Chapter 2), and the actions available to sub-national governments (Chapter 3). To assist you in guiding your staff, we suggest the overview of basic barriers (Chapter 4), policy options (Part II, chapters 5–12), and a recommended process for taking action (Part III).

Sub-national government staff: The entire guide may be of value to you over time. The guide has background on the barriers to efficiency (Chapter 4) as well as the eight actions to deliver urban building efficiency (Chapters 5–12). Leading by example through government targets and buildings is a common starting point (Chapter 9). We also provide guidance on how to engage stakeholders and build your strategy (Part III). Chapters 1–3 offer context that will help with outreach and communications.

National government ministries: In addition to providing background on building energy efficiency, the guide introduces the links between urban energy systems, policy, and efficient buildings (Chapter 2) and explores how to connect national and sub-national policies for greater impact (Chapter 4). The eight actions in this report can also be implemented at the national level, including the role utilities can play in delivering building efficiency (Chapter 12).

Building owners, managers, or occupants: Chapter 10 is dedicated to options for action available to those who own, manage, or lease buildings. For those in the real estate sector, the policies in Chapters (5–12) may help you improve your buildings in cooperation with government and other partners. A primer on the importance of building efficiency can be found in Chapter 1.

Building energy technical and financial service providers: Chapter 11 focuses on the major barriers facing providers of building efficiency services and financing. For service providers considering how to support building efficiency policy development, many of the options described in Chapters 5–12 benefit from multi-stakeholder partnerships and private sector leadership.

urban planning with energy and resource planning provides a unique opportunity to accelerate efficiency in the built urban environment.

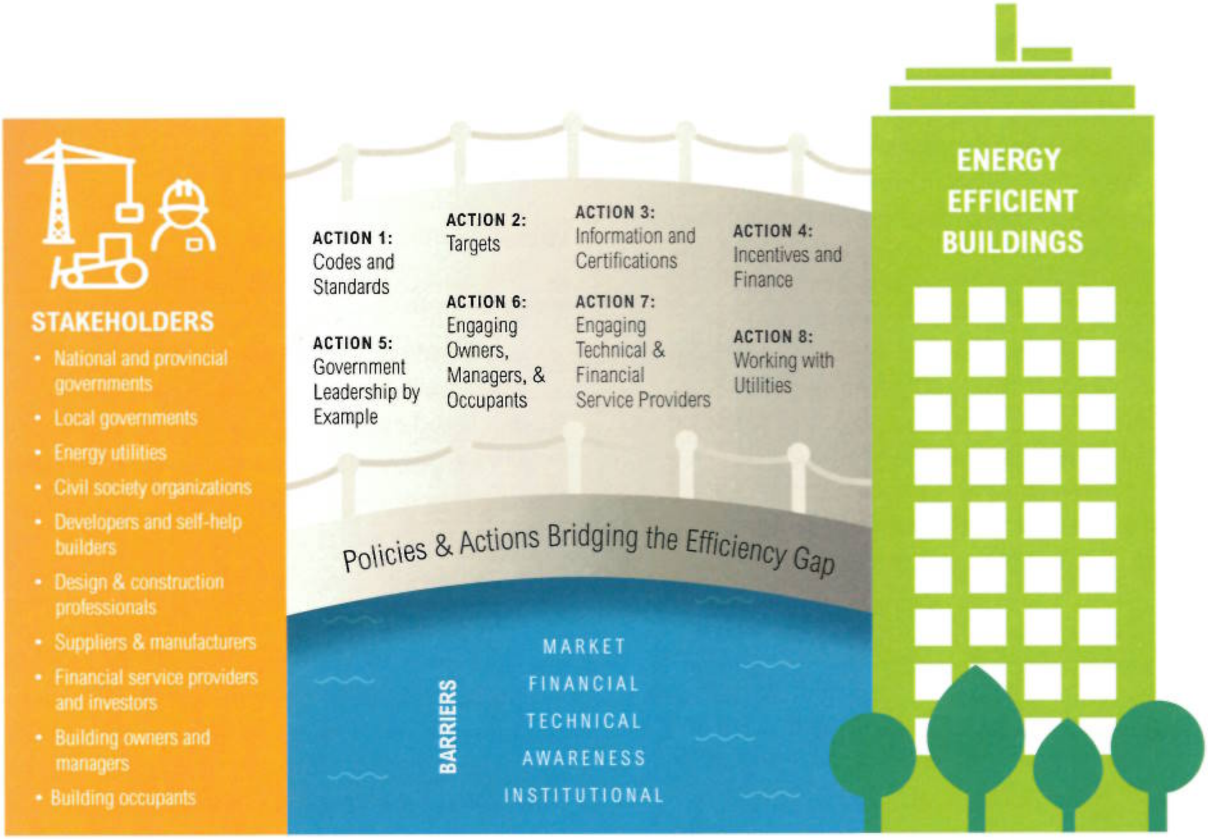
- The **design and construction** process includes the siting, orientation, shape, and height of a building as well as the materials and design features of the building. These factors, and the quality of the construction process, will determine indoor and outdoor comfort and energy performance of the building.
- When the building is put up for **sale or lease**, the developer, realtor, appraiser, owner, and lender should be able to consider the building's efficiency in the property value assessment. In addition, future operating costs, including energy use, should be a factor in the bank's loan evaluation of potential buyers.
- **Building out new tenant space** inside an existing building creates an opportunity to invest in high-performance, resource efficient options, including lighting and energy control systems.
- Tenants and owners make ongoing **operations and maintenance decisions**. Many of these decisions—from setting the schedule for heating or cooling to how often equipment is tuned up—affect resource usage, and provide an opportunity to improve efficiency.
- Existing buildings periodically need an efficiency **retrofit** to upgrade equipment, renovate the design, and ensure that building systems are performing well and are energy and water efficient. Improvements to space heating, ventilation and air conditioning (HVAC), water heating, insulation, water fixtures, energy control systems, and lighting are common retrofit measures.
- Finally, a building may experience major rebuilding, or be identified for **deconstruction** or **demolition**, which starts the cycle over again and offers new opportunities for finding efficiencies.

Multiple barriers to building efficiency exist, which may make efficiency a lower priority for investment. More specifically, local governments are often confronted with an "efficiency gap," which can be defined as the difference between technically possible savings, and the savings that are easily achieved. The barriers to improving efficiency are well established, although their severity varies among countries and cities.[7] Barriers consist of market, financial, technical, institutional, and awareness-related issues, which can prevent or deter people from making efficiency investments. Policies can help overcome these barriers when they align the interests of all actors at each stage of a building's lifecycle in order to make pursuing building efficiency a compelling choice (see Figure ES.1). Policy packages can be designed to target key barriers to energy efficiency in any given market, bridge the efficiency gap, and create an opportunity for scaling up efficiency solutions and investment.

The options for local government actions to improve the energy efficiency of the built environment fall into eight categories:

- ACTION 1: **Building efficiency codes and standards** are regulatory tools that require a minimum level of energy efficiency in the design, construction and/or operation of new or existing buildings or their systems. When well designed and implemented, codes and standards can cost-effectively decrease energy expenses over a building's lifetime.
- ACTION 2: **Efficiency improvement targets** are energy reduction goals that can be set by a local government, either at the citywide community level, or applied to its own publicly owned or rented building stock. City governments can also introduce voluntary targets as a way to incentivize the private sector.
- ACTION 3: **Performance information and certifications** enable building owners, managers, and occupants to make informed energy management decisions. Transparent, timely information allows decision-makers and city leaders to measure and track performance against targets. Examples of building performance policies include: requiring energy audits, retro-commissioning, formalizing rating and certification programs, and implementing energy performance disclosure requirements.

Figure ES.1 | **Crossing the Bridge to More Efficient Buildings**



- ACTION 4: **Incentives and finance** can help energy efficiency projects overcome economic barriers, such as those related to upfront costs and "split incentives." They include grants and rebates, energy-efficient bond and mortgage financing, tax incentives, priority processing for building permits, floor-area allowances, bond and mortgage financing, revolving loans, dedicated credit lines, and risk-sharing facilities.

- ACTION 5: **Government leadership by example** involves policies and projects undertaken by the government that serve as an example to create greater demand/acceptance for efficient buildings in the market. This approach can take the form of improving the public building stock, private-public partnership pilot projects, setting ambitious energy efficiency standards and targets, encouraging or mandating procurement of efficient products and services, and stimulating the energy service company (ESCO) market through municipal energy performance contracting (EPC) tenders.

- ACTION 6: **Private building owner, manager, and occupant engagement** includes technical programs that help motivate building stakeholders. These include local partnerships for efficient buildings, "green lease" guidance, and behavioral mechanisms such as competitions and awards, user-feedback information via kiosks or computer displays, and implementing strategic energy management activities.

- ACTION 7: **Technical and financial service provider engagement** can facilitate the development of skills and business models to meet and accelerate demand for efficiency. These include technical workforce training, procurement officer education on performance contracting, engagement with the financial industry to help standardize investment terms and reduce transaction costs, establishing revolving loan funds or dedicated credit lines, and considering public-private risk sharing facilities for investments.

- **ACTION 8: Working with utilities** can improve access to energy usage data and support utilities' efforts to make their customers more energy efficient. These programs include energy-use data access, utility public benefit funds, on-bill financing, revenue decoupling, and demand-response programs, to name a few.

Individual policies can strengthen and complement each other. City planners or officials may improve the outcomes and impact by considering and planning for a set of integrated, related policies through a buildings sector action plan or package of policy measures. This guide is designed to help with the development of such a plan. Key steps of an action plan include identifying the goal, identifying governance of the process, working with local technical experts, securing financing, mobilizing stakeholders, and tracking progress.

A central question faced by policymakers is how to get started with building efficiency and related policy development. One recommendation is to define the following (see Figure ES.2):

- *What* tools can be employed to accelerate energy efficiency in buildings
- *How* policy and programs can support and accelerate efficiency in buildings
- *Who* can leverage the acceleration of energy-efficient buildings

What?

- A necessary first step in answering the question of *"What?"* is assessing and understanding a city's current institutional and legal setting and framework, the data availability on building stock and energy use, and the key stakeholders (scoping).
- The next step is to focus on the selection of objectives and targets. Targets should be bold and ambitious. Cities can choose to set broad targets in terms of energy savings, CO_2 reductions, or other specific benefits. A target should also include a clear timeframe.

Figure ES.2 | **Indicative Roadmap for Taking Action on Building Efficiency**

- Designing a strategy to transform the built environment to be more energy efficient, however, is not a simple process, and to be successful it requires prioritization.

How?

- An action plan is an important part of the *"How?"* step because it helps to establish targets and assists in the transition from planning to implementation. A robust action plan will include a set of performance indicators allowing policymakers to assess progress over time.
- Identifying the local capacities that need to be developed is important. Early identification of workforce capacity strengths and gaps can inform a package of technical support measures and trainings that may be required on aspects related to enforcement, legal affairs, and technological knowledge.
- Investing time and resources in the design of a financial pathway is critical to successful implementation of a package of building efficiency policies. Without a quality financing strategy, these actions are unlikely to deliver much change.

Who?

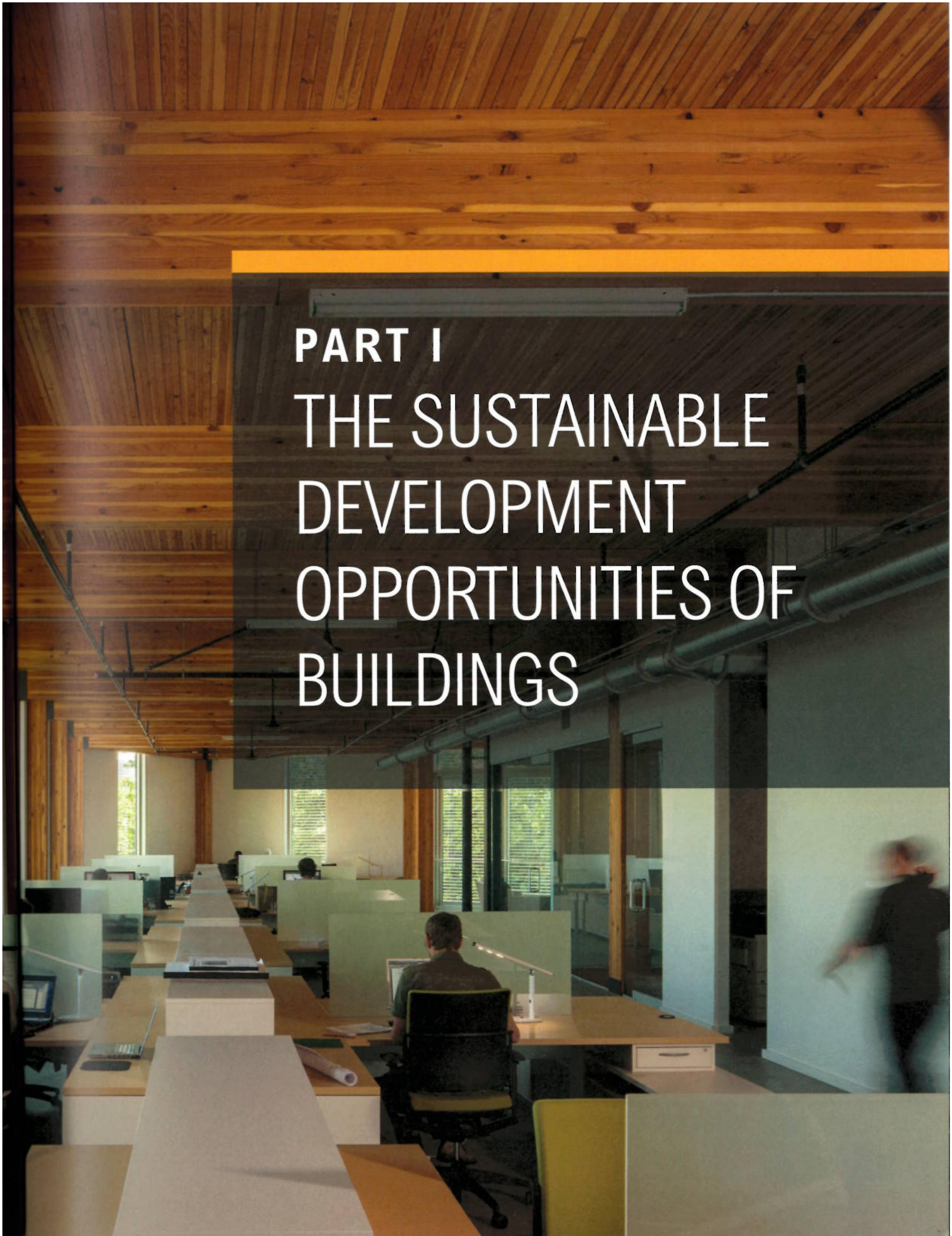
- The question *"Who?"* helps to establish the stakeholders who need to be involved in the process, and their roles.
- As part of the process, local governments can start by thinking about their own institution. Successful implementation generally requires significant coordination among municipal departments as well as with provincial/state and national governments. Problems tend to arise when actions taken by government ministries or departments are not aligned. In order to tackle institutional challenges and ensure that the right capacities are in place, it is helpful to specify key roles and players early in the planning process.
- The creation of multi-stakeholder processes allows cities to identify needs and interests of different groups and facilitates early assessment of program or policy feasibility. Stakeholder engagement can further serve to foster cooperative relationships with industry players and drive program acceptance. In the case of regulatory requirements such as mandatory building audits, it also encourages higher compliance rates.
- When policies fail or underperform, lack of clear authority or accountability is often to blame. Sufficient attention must be paid to the governance structure underpinning the program. In order to define a governance framework, it is necessary to define who within government will be responsible for what parts of the action plan.

Finally, to confirm that policy goals are being met, policymakers should include in their planning the metrics and evaluation approaches for tracking progress over time. The results of building efficiency actions can be tracked at the city, policy, building, or even building-occupant level.

A suite of tools, focusing on either building efficiency policy or technical assessment, is freely available in the market. Policy tools can help municipal policymakers go through the policy cycle and effectively implement policy packages, while project tools help to design a construction or renovation building project, calculate building energy performance, and estimate potential savings.

In conclusion, although no single government policy or program can drive the transformation toward more efficient buildings on its own, a clever combination of policies and other relevant actions can help transform buildings to be far more efficient over time, providing many benefits to cities and their residents for decades to come.

PART I
THE SUSTAINABLE DEVELOPMENT OPPORTUNITIES OF BUILDINGS



Introduction

Almost two-thirds of the world's energy is consumed in urban areas.[1] City leaders increasingly recognize that local actions and policies affect the energy future for their residents, as well as global issues such as climate change. Improving the efficiency of buildings, particularly their use of energy, is one of the fastest and most cost-effective ways of reducing carbon emissions and improving local economic development, air quality, and public health.

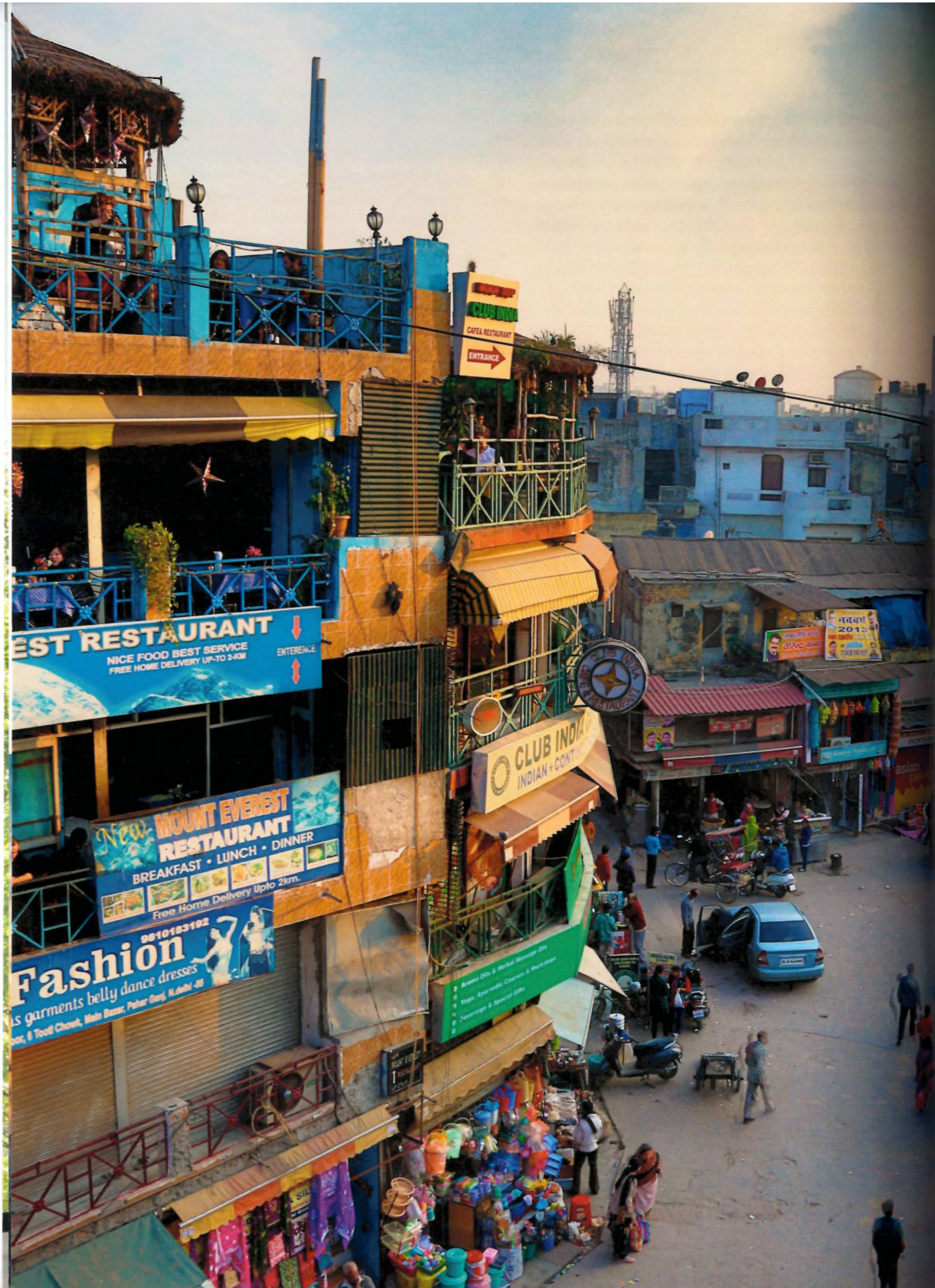
Cities in developing countries will need to accommodate 2.4 billion new urban residents by 2050.[2] Many of them will be increasingly wealthy consumers, with increasing levels of resource consumption; efficient energy and water use in new and existing buildings must therefore be a priority. Wasted resources represent an economic and environmental cost that is likely to prove unsustainable.

This report focuses on strategies to improve resource efficiency in buildings—the structures that provide shelter to families and businesses, and which range from single-family and multifamily housing to retail, office, and institutional structures. Building efficiency generally relates to how productively resources like energy and water are used to provide services such as heating, cooling, and lighting, and to run appliances and equipment installed or used in the building. We prioritize energy in this guide, but many of the strategies described can also improve the efficiency of other resources such as water, materials, and waste.

This guide provides local governments and other urban policy stakeholders with the background, guidance, and tools to accelerate building efficiency action in their communities. It is intended to be an accessible primer on the fundamentals of advancing efficiency in buildings. Cities aspiring to improve municipal building performance may find it especially valuable as a reference guide to be used as the city progresses from "making the case," to prioritizing and sequencing actions, then implementing and tracking results. Cities at a more advanced stage in their building efficiency programs may want to refer to specific sections of the report when initiating activities in a policy area that is new for them, or share content from it when engaging new stakeholder groups.

Our primary intended audience is sub-national government officials and staff who are aiming to improve resource efficiency in urban buildings. Sub-national action on energy efficiency can have a major impact on national energy use in all contexts and in all countries. However, the remit and authority of local governments differ considerably around the world, and the actions in this guide may require local governments to collaborate and align policies with leaders at the regional or national level.

Improving the efficiency of buildings, particularly their use of energy, is one of the fastest and most cost-effective ways of reducing carbon emissions and improving local economic development, air quality, and public health.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CHAPTER 1

THE BUILT ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

Key Takeaways

- Efficient buildings can advance economic, social, and environmental goals.
- Design, construction, operation, and renovation of buildings are large contributors to a city's economy and to local employment. Building efficiency creates many direct and indirect job opportunities for low and high skilled workers to provide energy related products and services.
- Efficient design and construction techniques could dramatically increase energy access and affordability for poor residents of cities. Energy, particularly electricity, is fundamental for access to many basic services such as education, clean water, and quality medical care.
- Building efficiency has the potential to significantly reduce energy demand and associated emissions of greenhouse gases and other pollutants, particularly in developing and emerging countries.

How Buildings Can Benefit the Triple Bottom Line

Sustainable development means having the capacity to provide people of today as well as future generations with the triple benefits of economic progress, social equity, and environmental protection. In this context, sustainable buildings are considered to be those designed with economic, environmental, and social impacts in mind—fostering sustainable livelihoods; minimizing required inputs of energy, water, and food; and minimizing waste outputs of heat, ambient air pollution, greenhouse gases, and water pollution.

Economic Development

Given the large role that buildings play in the urban economy, building efficiency can enhance and create new job opportunities, improve local competitiveness through energy productivity ,and strengthen a city's economic and climate resilience. Efficient buildings can also show improved financial performance, as a result of rental or sales premiums that such buildings can command, as well as through higher occupancy rates. The 2015 Global Real Estate Sustainability Benchmark (GRESB) study, covering 61,000 buildings mainly in North America, Europe, Australia, and Asia, found that a higher sustainability ranking correlates to superior financial performance in terms of both return on assets and return on equity.[3]

Efficiency as a Driver for Job Creation

Design, construction, and renovation of buildings are large contributors to local economic activity and employment. The construction sector represents 10 percent of world GDP and 10 percent of the workforce and, in emerging markets, it is estimated that it will make up 16.7 percent of GDP by 2025.[4] Making buildings more efficient will create additional economic opportunities and employment in the construction sector and among suppliers to the construction sector. For example, studies of the European market estimate that raising building efficiency requirements to achieve a 27 percent increase in energy efficiency in Europe by 2030 (compared to 2005 levels) would result in two million new jobs.[5] Another study estimated that retrofitting 40 percent of the United States' building stock would result in at least 600,000 additional, long-term jobs.[6] Of even greater impact are benefits to other local economic sectors and their employees that result from savings on building operating costs, which can then be spent elsewhere in the economy.[7]

Improved Energy Productivity

The concept of "energy productivity" considers how effectively energy resources are used per unit of economic product, generally measured as energy consumption per unit of GDP. Doubling the global rate of energy productivity improvement from approximately 1.5 to 3 percent per year has the potential to reduce global fossil fuel use by more

than US$2 trillion by 2030, and could create more than 6 million jobs by the year 2020.[8] Residential and commercial buildings make up approximately 34 percent of the opportunity to improve energy productivity. When compared to other sectors, the buildings sector has the largest unrealized potential for cost-effective energy and emissions savings (see Figure 1.1).[9]

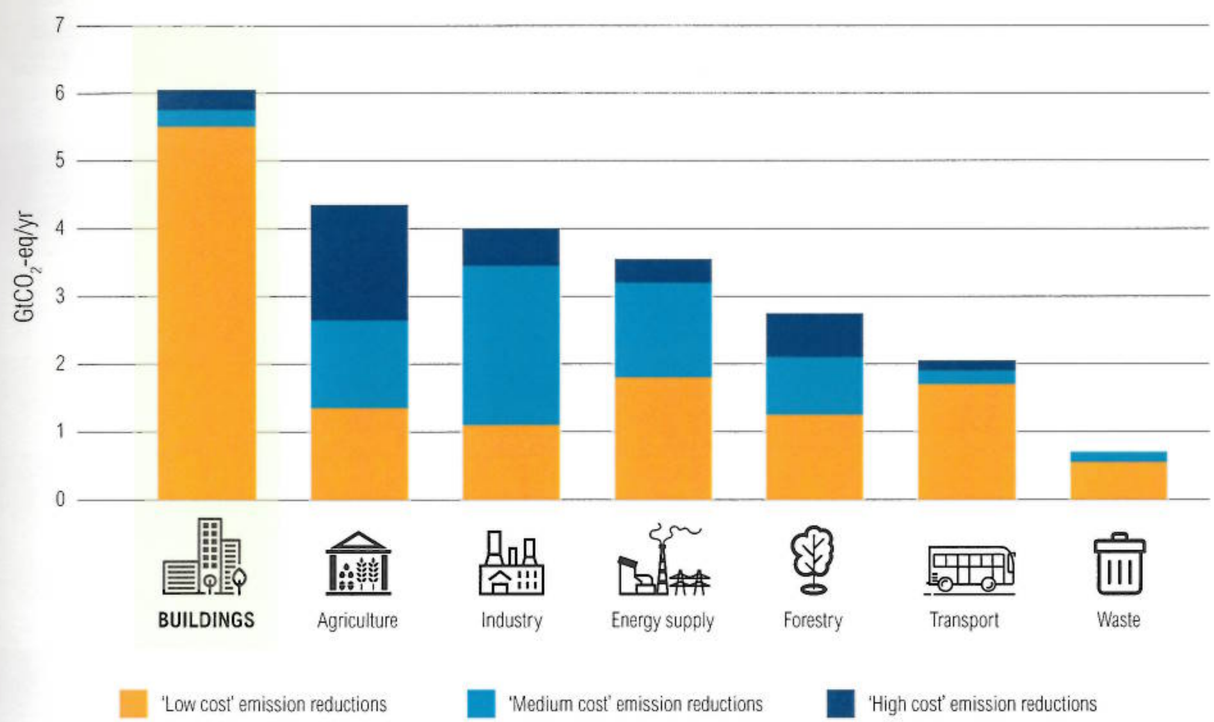
Improved Resilience and Energy Security

Energy disruptions can pose a significant risk to cities. Extreme weather can affect buildings because of increased exposure to hot and cold temperatures and/or changes in access and availability of energy and water. Disruptions can occur due to extreme weather events, aging supply infrastructure, or imbalances in supply and demand. Prolonged disruptions can cause significant detrimental economic and humanitarian impacts.[10] City buildings can play an important role in helping citizens and businesses improve their resilience to climate change and potential energy supply disruptions by reducing overall demand, as well as peak demand during extreme weather events, and by keeping indoor conditions habitable during energy supply disruptions (see Box 1.1).[11]

Social Development

Efficient design and construction techniques can dramatically increase energy access and affordability for poor residents of cities. Energy, particularly electricity, is fundamental for access to many basic services such as education, clean water, and quality medical care. Inadequate energy supply or provision can threaten economic development and social wellbeing, hindering a city's competitiveness and raising barriers to urban poverty eradication. The International Energy Agency estimates that 2.7 billion people rely on traditional biomass for cooking and an estimated 1.2 billion people lack access

Figure 1.1 | **Economic Mitigation Potential by Sector, 2030**



Note: 'Low cost' emission reductions = carbon price <20 US$/$tCO_2$-eq. 'Medium cost' emission reductions = carbon price <50 US$/tCO²-eq. 'High cost' emission reductions = carbon price <100 US$/$tCO_2$-eq.
Source: IPCC. 2007. IPCC Fourth Assessment Report: Climate Change 2007: Synthesis Report. "4.3 Mitigation options." https://www.ipcc.ch/publications_and_data/ar4/syr/en/mains4-3.html

BOX 1.1 | ENERGY RESILIENCE THROUGH BUILDING EFFICIENCY IN JOHANNESBURG

The city of Johannesburg and other major South African cities face regular power supply shortages, so utilities have implemented "load shedding," whereby citizens and companies are left without electricity for up to several hours at a time. Frequent load shedding is also impacting the country's economy, with key industries such as manufacturing and mining feeling the effects.

To reduce peak electricity demand, the city of Johannesburg introduced a set of basic requirements for energy-efficient building development, which started in February 2015. The approval of new building plans in the city now requires the incorporation of passive design features to reduce energy use, in particular the use of natural heating provided in winter through north-facing buildings; and eave overhangs on the north, east, and west facades to facilitate shade in summer and sun penetration in winter. Other measures that are strongly encouraged include solar water heating, roof insulation, energy-efficient light fittings, and motion or timer sensors. The city is also considering incentives to encourage the retrofitting of existing buildings and has commenced retrofitting selected council buildings with energy-efficient lighting systems. The city hopes to reduce electricity consumption by 25 megawatt-hours over a period of five years, reducing electricity outages and improving resilience.

Sources: City of Johannesburg. 2015. "New Buildings to Become Energy Wise." http://joburg.org.za/index.php?option=com_content&task=view&id=2176&Itemid=168#ixzz3spapys9X
SABC News. 2015. "Load Shedding Hits Home on SA Economy." http://www.sabc.co.za/news/a/84a24b00499e406387448fa84320b537/Loadundefinedsheddingundefinedhitsundefinedhomeundefinedonundefined SAundefinedeconomy-20152608

to electricity.[12] While around 80 percent of those without access are in rural areas, a large number of urban residents still suffer from poor quality of supply, which includes issues such as reliability, safety, and affordability.[13] Many people who do have access to electricity are low-income and under-served. Combinations of low income levels, high energy prices, and poor housing quality can force households to choose between adequate energy services and other essentials.[14]

Efficient buildings can help increase energy access and reduce energy poverty for low-income residents, leading to improved health, productivity, and comfort. Occupants of energy-efficient homes are likely to spend less money on lighting, heating, or cooling, resulting in more spending power for purchase of food and other essential items.

Making the best use of existing supply is crucial to improving access to energy, especially in high-growth countries such as Brazil, China, and India, where rapid increase in energy demand threatens to outstrip the costly expansion of energy supply.[15] Providing access to affordable efficient lighting, appliances, and weatherization services can be a policy tool for expanded and more reliable energy access, because more efficient buildings and appliances allow the available kilowatt-hours to be stretched across more people and to provide better quality energy services.[16] The issue of access includes consideration of how informal settlements in cities can be included in efficiency efforts, so that very low-income or otherwise vulnerable residents can also benefit from lower resource use and related benefits.

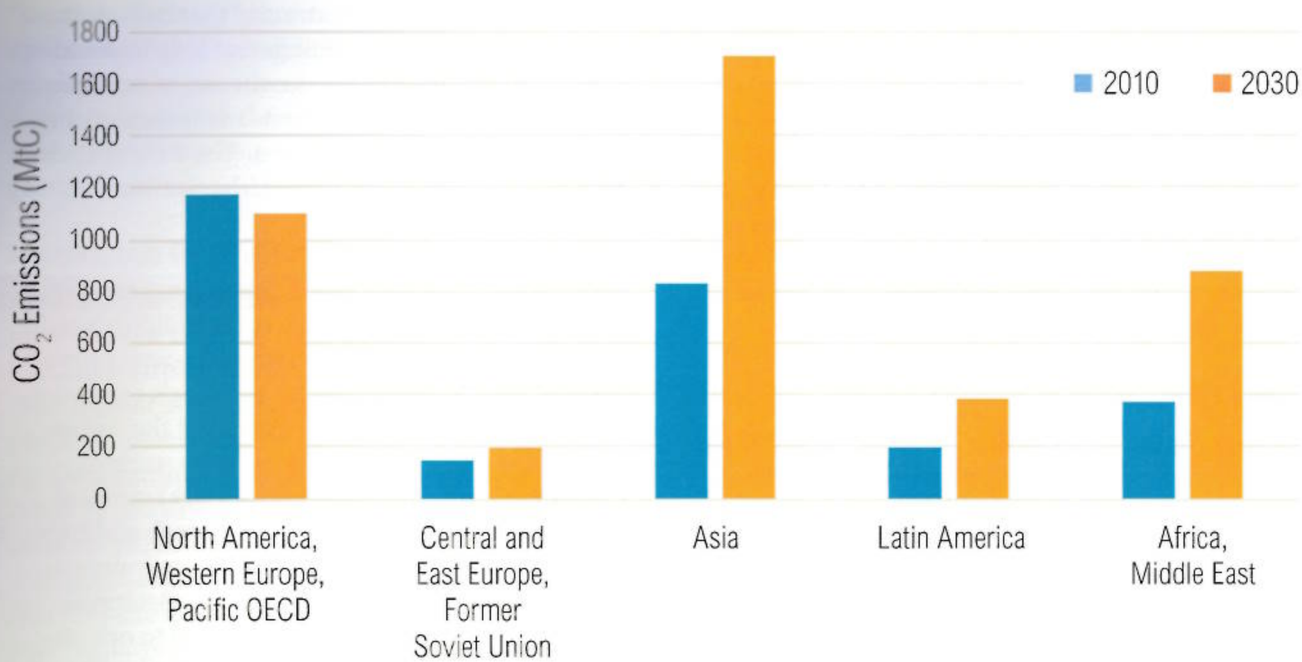
Environment and Health

Buildings use large quantities of resources, including energy, water, and construction materials. The environmental impact of the built environment can be minimized with energy-efficient buildings, as well as with environmentally sound siting decisions, materials selection, water use, and waste management. In addition, energy-efficient buildings contribute to better indoor and outdoor air quality through reduced pollution and improved ventilation, leading to health and economic benefits.

Mitigating Climate Change

Today, buildings and the energy used in them are responsible for one-quarter of all climate change causing greenhouse gas emissions, and under a business-as-usual scenario these emissions will continue to grow.[17] This trend is most obvious in the developing regions of Asia, Latin America, and Africa and the Middle East, as shown in Figure 1.2.

Figure 1.2 | **Building Sector Emissions by World Region, 2010 and 2030 Projections**



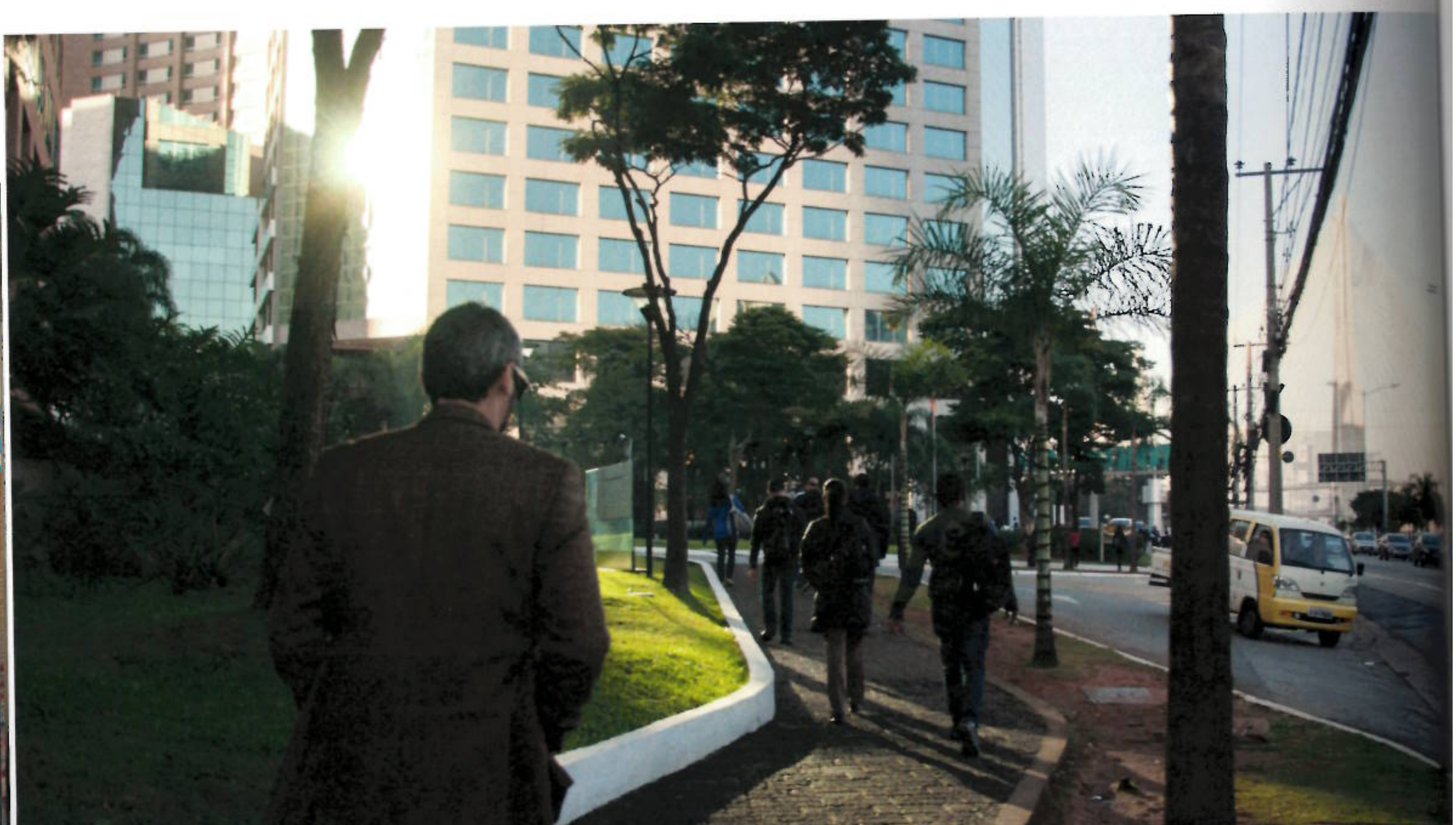
Source: du Can, Stephane de la Rue, and Lynn Price. 2008. "Sectoral Trends in Global Energy Use and Greenhouse Gas Emissions." Energy Policy (36)4: 1386–1403.

According to the International Energy Agency (IEA), low-carbon and energy-efficient heating, cooling, building shells, and lighting, coupled with system control technologies for buildings, have the potential to reduce CO_2 emissions by up to 5.8 Gt by 2050, lowering emissions by 83 percent below business-as-usual for the buildings sector.[18] Most of these technologies are commercially available today and many of them deliver positive financial returns within relatively short payback periods.[19] Nonetheless, strong policies will be needed to create the economic conditions that will enable such a transition to low-carbon buildings.

Resource Efficiency

Sustainable buildings go beyond a narrow definition of energy efficiency and minimize many other environmental impacts. Buildings have consequences for the environment, from land-use decisions at the planning stage, selection of materials during design and construction, the use of energy and water over the building's life, and the management of the waste produced in the building. Globally, buildings are responsible for nearly 40 percent of energy use (including 60 percent of electricity use), 12 percent of water use, 40 percent of waste generated (by volume), and 40 percent of material resource use.[20] In cities, buildings occupy 50 percent or more of land area.[21] An efficiency strategy that considers all resources used by buildings can help to prioritize the actions that minimize the use of multiple resources, minimizing the costs while maximizing resource savings (see Chapter 2: The Role of Buildings in Achieving Sustainable Urbanization).

The siting of a building has both direct and indirect impacts on the environment. Direct impacts stem from siting decisions that affect the building's sediment and erosion impacts, and storm-water runoff control. They include how the building's construction materials and footprint can affect the "urban heat island effect," which refers to the warming of cities as a result of impervious (dark) surfaces such as asphalt and concrete that absorb and trap heat radiated from the sun. Indirect environmental impacts follow from decisions that determine: whether a building is sited with regard to orientation for solar energy, natural heating and cooling, and optimal use of daylight, thereby reducing energy requirements; whether a building is located



close to services, employers, and other destinations; and whether it is served by public transportation, and walking and cycling infrastructure. These "location efficiency" choices impact transportation options available to building occupants and the resulting transportation energy usage.[22] They also determine whether the site will have access to high-quality distributed energy resources like solar and geothermal.

Improved Air Quality, Health, and Comfort

Air quality in both indoor and outdoor environments can be improved through efficiency in buildings. Urban inhabitants spend the majority of their time in buildings, but indoor air quality inside people's homes can be worse than outdoor air quality. Concentration of pollutants in some buildings is two to five times greater[23] than outdoors, with the problem particularly affecting developing countries with populations dependent on indoor fuel combustion for heating and cooking.[24] These "sick buildings" damage the health of their occupants. Properly implemented efficiency improvements can significantly improve indoor environmental health.[25]

Approximately 3.3 million deaths per year are caused by energy-related outdoor air pollution, with the highest rates of exposure in developing cities.[26] Combustion of fossil fuels used to generate electricity contributes to outdoor air pollution. Because buildings are among the largest users of electricity in cities, reducing energy consumption in buildings can reduce the fossil fuel pollution that results from power generation. Reduction in these pollutants can decrease incidence of illnesses such as asthma and lung cancer, as well as lower the rate of premature deaths, saving not only lives but also the financial and social costs of medical treatment and lost productivity.[27]

Efficient buildings can also help create healthier and more productive conditions by supporting more stable and comfortable indoor climates, with less draft from windows, walls, and floors in cold climates, and better shading and ventilation to reduce heat encroachment in hot climates. All of these benefits result in an improved quality of life for building occupants.

Air quality in both indoor and outdoor environments can be improved through efficiency in buildings. Urban inhabitants spend the majority of their time in buildings, but indoor air quality inside people's homes can be worse than outdoor air quality.


Hisamitsu
サロンパス
H&M
Essential
Euphoria
Melumo

CHAPTER 2

THE ROLE OF BUILDINGS IN ACHIEVING SUSTAINABLE URBANIZATION

Key Takeaways

- Rapid urbanization and expansion of the built environment create a major challenge as well as a tremendous opportunity to shape tomorrow's cities and buildings.
- Buildings are long-lived structures and the building choices being made today will impact urban services, livability, and the environment for decades.
- Efficient, high-performance, and productive buildings will be major contributors to solutions for sustainable cities. Many efficient technologies and practices can be deployed today.
- Buildings are critical components of urban systems, both as physical structures and as providers of social and economic services. Improving building energy efficiency is one of the fastest and most cost-effective ways to achieve economic, environmental, and social benefits for city inhabitants.
- If the efficiency of buildings in cities is improved, the effects radiate outward and the performance of urban energy and resource systems can be enhanced at the district and community scales.

The Challenge and Opportunity of Urbanization

In 2008, for the first time in history, more than half of the world's population—3.3 billion people—lived in urban areas, with the fastest rates of urbanization occurring in emerging economies. The number of urban residents is expected to increase to 6.3 billion by 2050, an unprecedented urban population size with the largest increases in Africa and Asia (see Figure 2.1).

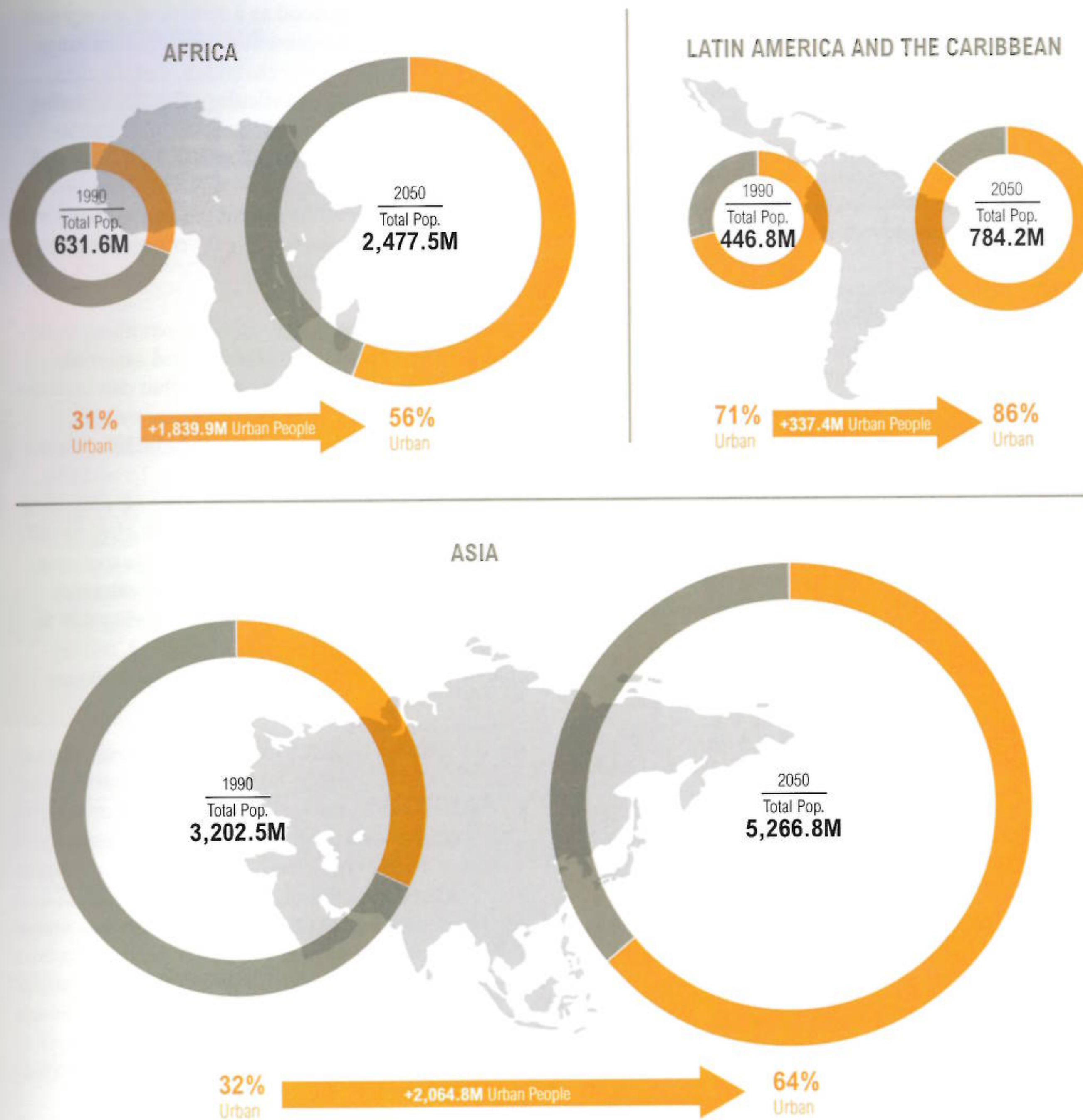
Rapid urbanization means rapid growth in construction of buildings, which creates a tremendous opportunity today to shape the cities and buildings of tomorrow.[1] According to projections, an area equal to roughly 60 percent of the world's current total building stock will be built or rebuilt in urban areas by 2030, mostly in developing or emerging countries such as China, India, and Indonesia.[2] Urbanization also correlates with increased wealth and consumption of products and services, including energy.

In emerging economies such as India, where 70–80 percent of the 2030 built environment has yet to be constructed,[3] there is tremendous potential to implement best-in-class building practices in current new construction in order to avoid "locking in" decades of inefficiency and more costly renovations later. In most developed economies, renovation of existing buildings provides the largest opportunity, as the majority of buildings that will make up the urban environment by the year 2030 already exist. For cities like New York this percentage is as high as 85 percent.[4] Nevertheless, both developed and developing countries need to focus on the sustainability of the built environment.

Building methods, materials, and technologies are important components of building efficiency, but where buildings are sited and their connections with the surrounding city are also crucial factors in how buildings contribute to the efficiency of cities. Buildings that are co-located with other destinations and easily accessible by multiple modes of transport can significantly improve access to services and economic opportunities, improve safety, and reduce transportation costs, congestion, and emissions.

The massive changes that urbanization, growth, and economic development are bringing to urban environments mean that cities are truly at a crossroads. They can choose to "lock in" inefficient buildings that will prove more expensive in the long term, or they can choose to pursue an energy-efficient urban future. There is a clear need today to design policies and markets that enable cost-effective, low-carbon opportunities.

Figure 2.1 | **Projected Urban Population as a Percentage of Total Population, Change from 1990 to 2050**



Source: United Nations. 2014. World Urbanization Prospects 2009, 2014 Revision. http://esa.un.org/unpd/wup/highlights/wup2014-highlights.pdf.

The Importance of Buildings to Cities

Globally, urban dwellers spend most of their time inside buildings. In the United States, people spend on average 90 percent of their lives in buildings.[5] The worldwide average is not yet as high but is increasing as a result of urbanization and economic development. The choices about buildings we make today will have long-lasting impacts on resource use and urban services because, as Figure 2.2 shows, buildings have the longest lifespans of major energy-consuming investments.

Buildings are thus critical components of urban systems—both as physical structures and as providers of social and economic services that can be influenced through institutional choices. Building efficiency, including the interactions of buildings with urban form, transport, and energy systems, should be considered as part of strategic urban planning efforts, infrastructure investments, and urban governance.

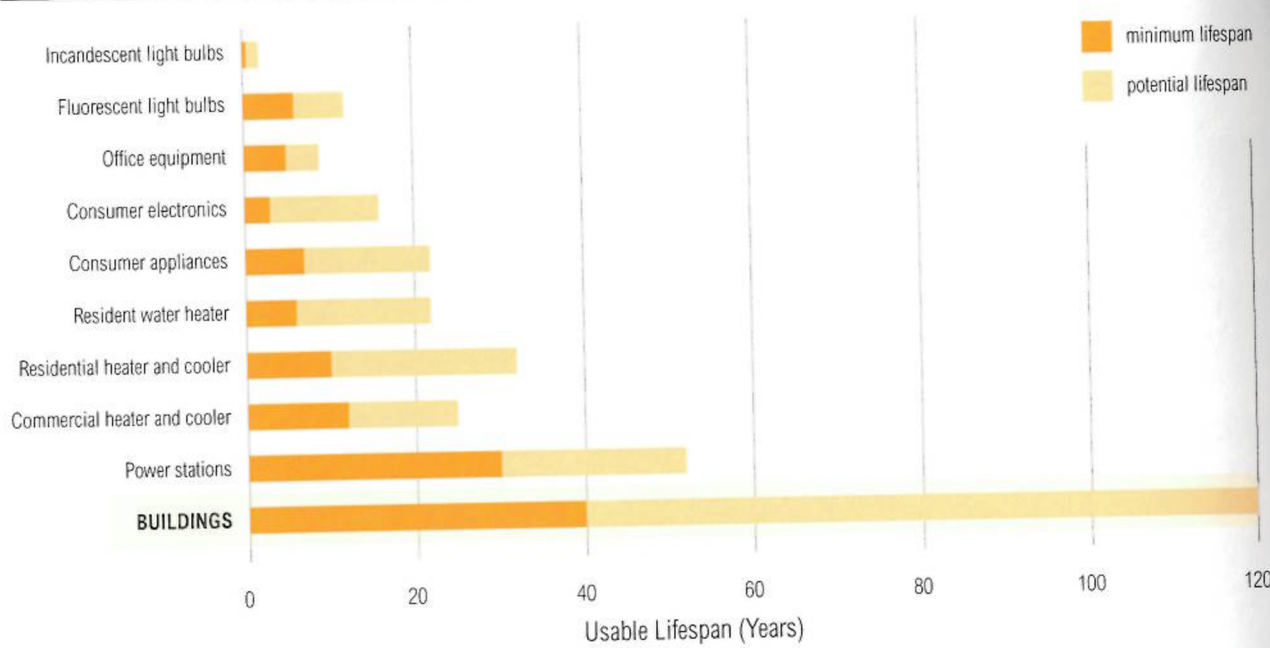
Buildings can shift from being contributors to the problems of unsustainable resource consumption and inadequate urban services to becoming part of the solution.

Buildings as Critical Elements of Urban Energy and Resource Systems

Cities can be understood as a system of energy and resource flows. The elements of this system range from energy sources to conversion, distribution, and use. Each plays a particular role in facilitating the flow of energy through the system, from the global scale down to cities, districts, buildings and other end uses, and individuals. Energy systems also interact with other urban resource systems and services such as water provision, transportation, urban form, and buildings.

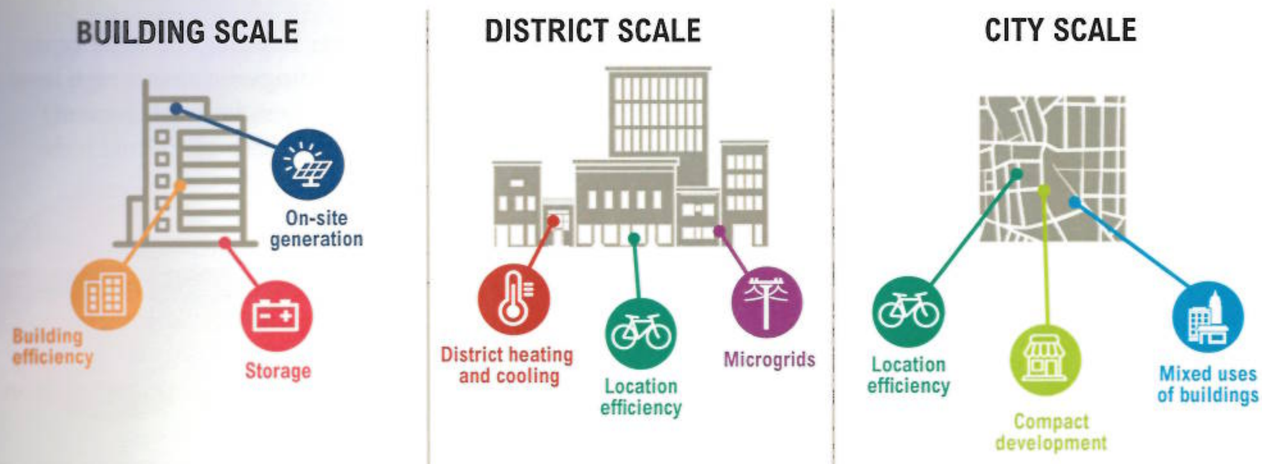
In addition to being large energy consumers, buildings are significant users of water and materials. There are many building decisions that can increase the water efficiency of the urban water system, including installing low-flow faucets, toilets, showers, and washers, and repairing leaks. In addition, rooftop water catchments can be used for collecting rainwater to be used for irrigation, reducing runoff, and relieving pressure on urban storm-water management systems. Many of these water efficiency measures further increase energy efficiency due to reduced energy requirements of treating, conveying, or heating water. Improved energy efficiency

Figure 2.2 | **Economic Lifespans of Energy-Consuming Equipment and Infrastructure**



Source: International Energy Agency. 2013. Transition to Sustainable Buildings: Strategies and Opportunities to 2050. http://www.iea.org/publications/freepublications/publication/Building2013_free.pdf.

Figure 2.3 | **Elements and Impacts of Efficient and High-Performance Buildings Across City Scales**



BENEFITS (Building scale)

- more efficient resource use
- manage resources consumed
- reduce costs
- reduce resource use
- reduce demand on the electric grid
- reduce storm-water infrastructure needs

BENEFITS (District scale)

- on-site resource management, production, and storage
- local aggregation of demand
- improve resource distribution
- improved performance and resilience

BENEFITS (City scale)

- avoided infrastructure costs
- avoided health costs
- reduce the need for services
- lower energy demand and related emissions from public infrastructure

can also lower water demand related to water use in the cooling of electric power plants and of fossil fuel extraction in electricity generation. These relationships are often referred to as the water-energy nexus.[6] In addition, materials used to construct buildings and interior design elements like furniture and carpeting can be produced with lower energy demand and can be sourced sustainably. Waste from building construction and everyday operations can be minimized and recycled during initial construction or major renovation, and on a daily basis.

Buildings are central to the urban energy system, because much of the system is designed around them. If the efficiency of buildings is improved, the effects radiate outward and the performance of urban energy and resource systems can be enhanced at wider, though interdependent, scales (see Figure 2.3).

If the efficiency of buildings is improved, the effects radiate outward and the performance of urban energy and resource systems can be enhanced at wider, though interdependent, scales.

1. **Building/end-use scale:** More efficient resource use and the ability to manage resources consumed in buildings provide multiple benefits to both residents and owners of buildings. In addition to efficiency measures, on-site energy sources such as solar photovoltaic cells can decrease demand on the electric grid, and on-site rainwater capture, storage, and reuse can reduce storm-water infrastructure needs.

2. **District scale:** Integration of building systems at the district scale, for example, through the use of microgrids and district heating and cooling, enables additional on-site resource management, production, and storage, which improves performance and resilience.

3. **Community (city or region) scale:** Reduced resource demand at the building or district scales has important upstream effects such as avoided infrastructure and health costs. These effects can benefit entire communities. Urban design and a building's relationship with its surrounding urban environment (especially compact development and mixed uses of buildings at the neighborhood and city scales) can reduce the need for services such as street lighting and transportation, and reduce energy demand and related emissions from public infrastructure.

Some cities, particularly in the United States and Europe, are now aiming for "net zero" buildings (i.e., buildings that produce as much energy as they consume over the course of a year) or "net positive" buildings and districts, which have the ability to provide energy, water, and other resources and related services rather than being purely resource consumers. Buildings that achieve net zero energy are highly efficient and meet their remaining energy needs or more through on-site production.[7]

Achieving net zero energy buildings or other types of high-performance buildings requires a high level of building efficiency (the foundational element) and usually one or more of three additional technologies and practices:

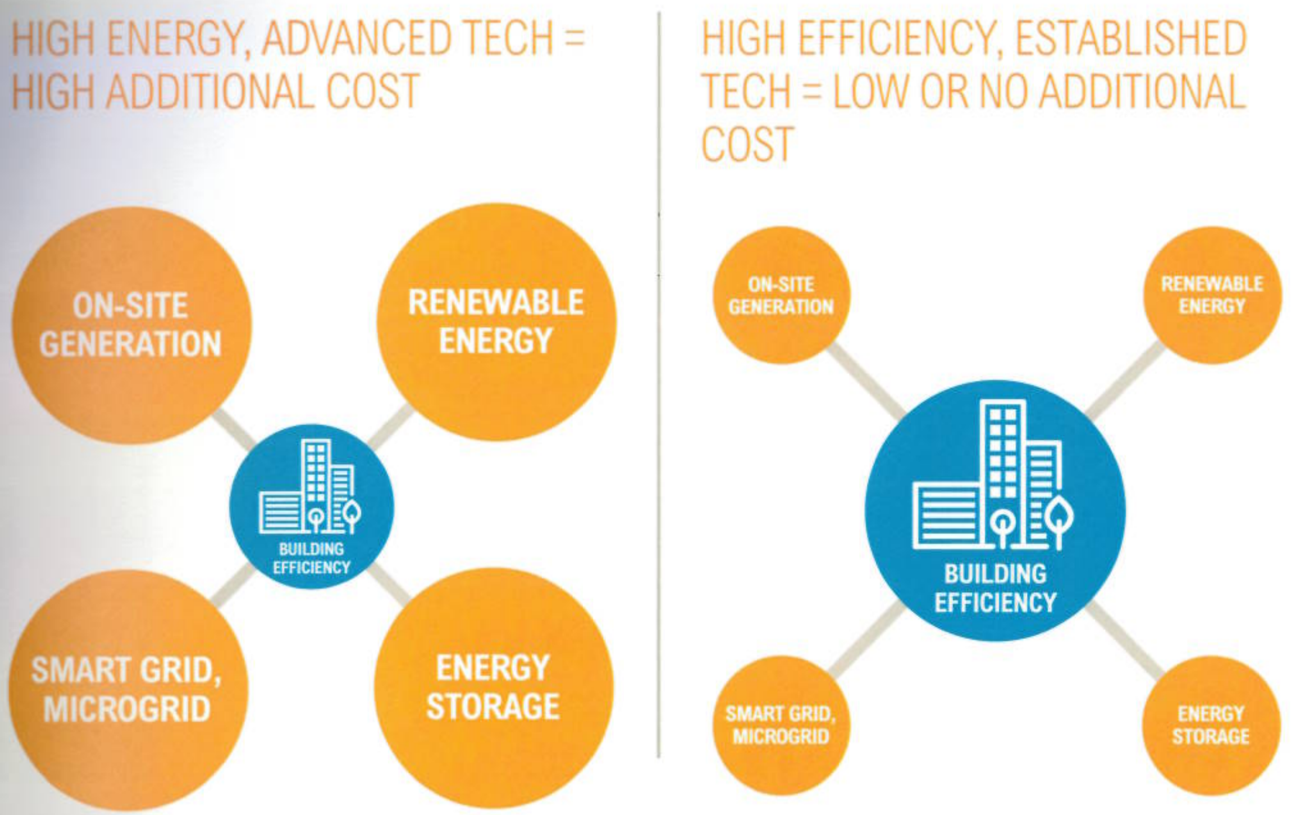
- Distributed/on-site renewable resource collection or generation—capturing available, often renewable, resources available on site (such as solar energy or rainwater) to supplement or replace resources imported from outside the building or district.
- District energy, micro-grid or smart grid—systems that enable the management, sharing, or trading at a district scale of resources based on real-time demand.
- Resource storage—systems that enable energy or other resources to be saved for later use at a time of high demand or scarcity.

Maximizing building efficiency using established technologies and practices allows investments in these three other areas to be reduced, keeping down the costs of high-performance buildings (see Figure 2.4).

The transition to efficient and high-performance buildings in the pursuit of high-performance cities is not a simple task. It requires coordinated actions from the many decision-makers and stakeholders involved with managing the built environment.

The transition to efficient and high-performance buildings in the pursuit of high-performance cities is not a simple task. It requires coordinated actions from the many decision-makers and stakeholders involved with managing the built environment.

Figure 2.4 | **Two Investment Paths to Sustainable Energy in High-Performance Buildings**



Note: Size of circles represents relative investment cost.
Source: Authors.

CHAPTER 3

THE ROLE OF LOCAL GOVERNMENT IN SHAPING LIVABLE CITIES

Key Takeaways

- Decisions about buildings in urban areas are governed by a mix of public and private actors with varied forms of formal and informal authority. Multi-stakeholder, integrative planning is an effective tool to support building sector governance, policies, and decision-making.
- Local governments have a variety of mechanisms available to influence the efficiency of buildings in their communities. Local governments can act as owners/investors, conveners/facilitators, and regulators.
- Building efficiency can be integrated into citywide plans for economic development, resource security, pollution reduction, sustainability, or other issues.

Governance of Buildings in Urban Areas

Decisions about buildings in urban areas are governed by a mix of public and private actors and subject to formal and informal forms of authority. Local governments generally hold authority to adopt and/or implement policies influencing building efficiency—from land-use planning and design and construction, through sale or lease to demolition—but their approach is heavily influenced by guidance or requirements from provincial and national governments. Traditionally, local government actions to influence building sector activity have been focused on either land-use planning or health and safety, with little attention given to economic or environmental impacts of building decisions.

Provincial or national governments are responsible for many other areas of policy that relate to the use of energy or other resources in buildings. Two important examples include regulation of energy utilities and the technical specifications of appliances and other building components available in the market, including their resource efficiency.

While local governments are the most obvious embodiment of a "city" and its governance, their influence may be limited, and it varies considerably from city to city. To appreciate the nuances of decision-making in a city or metropolitan area, it is appropriate to define a city more broadly than its government and to understand the contributions and influence of a variety of stakeholders. And, of course, governance is not only about institutions; individual leadership within governments and businesses is essential to implementing any change in practice or policy. In some urban areas, governments take little role in shaping building sector activities—often because of limited capacity, regulatory capture by private-sector interests, or laissez faire policy—and governance is left primarily to the private sector.

Beyond local government, public-sector influence on buildings is the result of interactions between the policies and practices of public authorities from different spheres and levels of government in a city, sub-national region, and country. Just as important are interactions among different government divisions within one level of government, such as between the building department and the planning department. How well goals are aligned between and within spheres of government and how effectively government personnel communicate with each other can clarify or confuse the environment in which decisions about buildings are taken.

Private-sector actors influence buildings in urban areas through their investments, design, construction and management choices, and behaviors. Their decisions are driven by economics, public policy, and social norms, as well as the missions, visions, leaders, and policies of individual firms and households. It is these decisions that public-sector policymakers often try to influence, just as private-sector actors try to influence public policy to shift the decision-making environment in their favor. Private-sector actors with an obvious interest in the buildings sector include building owners, investors, architects, and construction firms. It is important also to recognize other private-sector stakeholders, who may not be as actively or regularly engaged in decisions but who nonetheless have significant influence over buildings, or can provide capacity or expertise to improve decision-making. Such stakeholders include building occupants and civil society organizations, such as consumer and environmental advocates, or social-service providers. The major stakeholder groups involved in urban governance of buildings are noted in Figure 3.1.

Around the world, there is considerable variation regarding the degree of influence over buildings held by the public sector compared to the private sector, and the influence held by each sphere of government or stakeholder group. "Capacity to act"—the specific authority formally or informally vested in different spheres of government (and the private sector)—is an especially important consideration in clarifying which actions are available to which actors.[1]

Figure 3.1 | **Stakeholders Involved in the Governance of Buildings**

Source: Authors and World Business Council for Sustainable Development. 2009. "Transforming the Market: Energy Efficiency in Buildings." http://www.wbcsd.org/transformingthemarketeeb.aspx.

Strategies of Influence for Local Governments

Despite the complex systems by which urban buildings are governed, governments—and local governments in particular—still have a variety of mechanisms available to them by which to influence the efficiency of buildings in their communities.[2] These mechanisms for influence can be categorized according to the general roles undertaken by local governments. A local government may act as:

- owner/investor;
- convener/facilitator; and
- regulator.[3]

Owner/Investor

Local governments invest in, own, and manage physical infrastructure used to provide services. This infrastructure ranges from buildings (office buildings, schools, hospitals, etc.) to water systems, outdoor lighting, and vehicle fleets. In many cases, local governments also provide some investment in assets that they may not directly own, such as social housing or transportation infrastructure. These physical assets provide an opportunity for local governments to lead by example through taking actions to improve efficiency of energy use directly under their control (see Chapter 9). Such actions, if publicly communicated, can demonstrate the value of efficiency to private market stakeholders and catalyze additional private-sector action. Additionally, institutionalizing resource efficiency as a founding principle for how the government does business—through guidelines regarding procurement, investment, capital asset management, and operations—can stimulate the market for efficiency products and services and, as a result, help to develop local capacity to provide them.

Convener/Facilitator

The leadership role of local governments can also be used to enable voluntary private action through convening and planning partnerships with private-sector leaders, as well as programs to address barriers to action. Local governments play a unique role in most communities as a neutral convener and arbiter among competing interests, but one that also wields the stick of potential regulation. As place-based institutions, local governments also have a permanent stake in the community and are charged with planning for the best interest of the community over the long term. This function can be used to convene stakeholders to develop a shared vision regarding building efficiency, identify mutually beneficial actions, and catalyze action.[4]

Such efforts to organize action can help to identify and cultivate "champions for efficiency" who can use their roles in the community to lead. Influencing the practices and business models of a few building owners with large holdings as well as those of major service providers, such as construction firms and management companies, can change

expectations and transform local markets. Real estate and construction markets often operate at a metropolitan scale, so improved practices in one city can have regional impacts. Local governments in partnership with the private sector can also implement or improve uptake of voluntary programs. Community-driven efforts to promote energy-saving programs may increase demand for the services and lead to significantly higher participation rates and levels of energy savings.[5]

Regulator

Local governments may have the authority to set or enforce building efficiency regulations and other policies through a combination of mandates and incentives. Although specific areas of authority vary from country to country, and even from city to city, regulation of land use and building construction and management are usually under the purview of local governments. Land-use planning and zoning, business and building permitting, and urban codes are among the main regulatory mechanisms at their disposal. Specific mechanisms used to promote building efficiency include building codes; expedited permitting incentives; financial incentives; programs leveraging municipal finance for private buildings; building performance targets; and requirements for energy benchmarking, audits, retro-commissioning or equipment upgrades.[6]

Various actions are available in each of these roles.[7] Many local governments around the world are already taking action; as of 2015, over 1,700 building-related actions have been documented among 66 of the largest cities alone.[8] While details vary considerably from place to place, some actions are typically under greater control of local governments than others and, therefore, are easier for them to implement successfully. Table 3.1 presents a generalized, global perspective on actions available to local governments on a spectrum from easier to more difficult to implement. Each of these policy actions is explored in more detail in subsequent chapters.

Table 3.1 | **Local Government Roles, Policy Actions, and Typical Ability to Implement**

LOCAL GOVERNMENT ROLE	TYPICAL LEVEL OF LOCAL GOVERNMENT CONTROL / DIFFICULTY OF IMPLEMENTATION (HIGH/EASIER → LOW/DIFFICULT)						
Owner/investor	Information	Operations/ maintenance changes	Public-sector targets	Procurement policy	Retrofits		
Convener/ facilitator	Convene	Cultivate champions	Facilitate private-sector initiatives	Capacity building/service delivery			
Regulator	Code adoption	Code enforcement	Voluntary information	Incentives	Finance	Mandatory information	Private-Sector targets

Integrating Building Efficiency into Citywide Planning

Multi-stakeholder, integrative planning is an effective tool to support building-sector governance, policies, and decision-making. Planning processes can focus on building efficiency specifically, or integrate building efficiency as one component of broader urban development/climate action strategies to achieve citywide benefits.

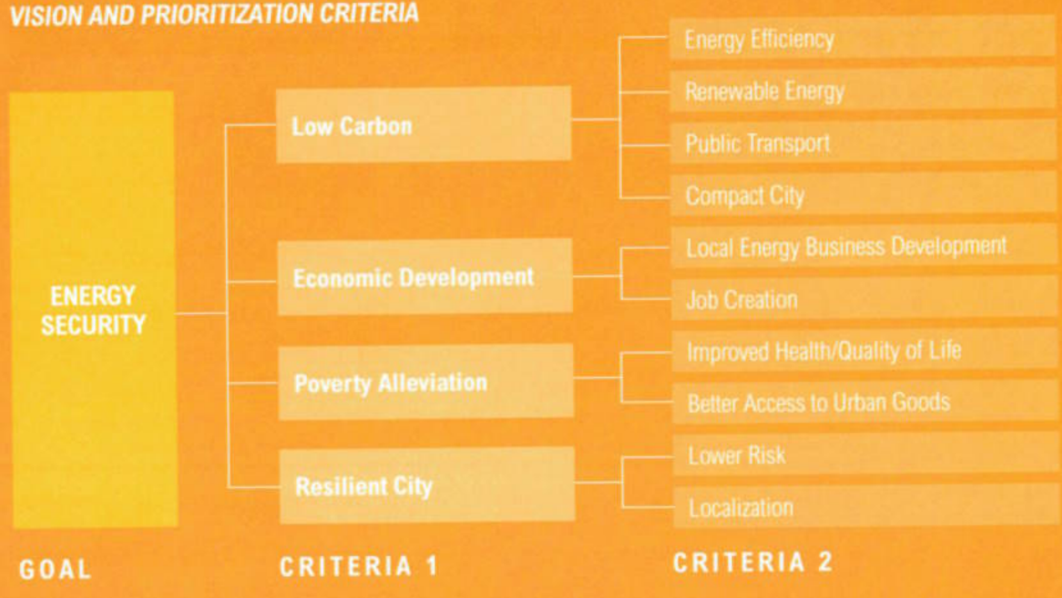
Building efficiency can be integrated into plans focused on economic development, resource security, pollution reduction, sustainability, or other topics. Such integration can help to institutionalize efficiency strategies across all departments of a local government as accepted mechanisms for improving city services. It also may be a good choice for smaller cities that are interested in improving buildings through efficiency strategies but are unable to devote staff specifically to building efficiency. One example of a broader citywide plan that includes building efficiency but is focused beyond energy or buildings is Cape Town's Energy and Climate Action Plan (Box 3.1), which sits under its Integrated Development Plan and is related to its Integrated Metropolitan Environmental Policy. The plan is aimed principally at reducing Cape Town's

BOX 3.1 | CAPE TOWN'S ENERGY AND CLIMATE ACTION PLAN

In May 2010, the Cape Town City Council approved the Energy and Climate Action Plan with the overarching goal of achieving energy security. Energy security is of great concern to the city of Cape Town. The city produces very little of its own electricity and depends heavily on national production, which has been highly unreliable: between 2006 and 2008, Cape Town experienced extensive load shedding, undermining the city's social and economic development. The plan consists of two levels of criteria and eleven separate objectives, including adapting and building resilience to climate change, enabling local economic development in the energy sector, raising awareness, and promoting behavior changes through communication and education. Building energy efficiency is integrated into actions to reduce energy consumption. The proposed projects related to buildings include:

- Solar water heating installations in residential houses
- Municipal building retrofits
- Street light and traffic light retrofits
- City rental stock upgrades with the installation of insulated ceilings, water meters, and compact fluorescent lights

VISION AND PRIORITIZATION CRITERIA



Sources: City of Cape Town. 2010. Moving Mountains: Cape Town's Action Plan for Energy and Climate Change. https://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/Moving_Mountains_Energy+CC_booklet_2011-11.pdf.

dependence on the national electric supply in South Africa, which is unreliable due to the frequent practice of load shedding.[9]

Some major cities in the United States, Europe, and Asia have developed citywide building efficiency plans. Such plans usually outline a city's long-term strategy for accelerating building efficiency while providing more structure and purpose around the various policies and programs being undertaken to drive uptake of efficiency in buildings. The plan acts as an overarching framework for a comprehensive set of building energy efficiency initiatives, sometimes also coupled with renewable energy or climate measures. Putting such a plan in place can help secure funding and staff resources for delivering on building efficiency. New York and Singapore provide good examples of citywide building efficiency plans. The New York plan, "One City: Built to Last," specifically links energy efficiency retrofitting goals to improved social equity and economic prosperity outcomes for lower-income citizens. Singapore's "Green Building Masterplan" (Box 3.2) combines energy, water and environmental quality, and conservation goals in order to accelerate the "greening" of Singapore's building stock.

BOX 3.2 | SINGAPORE'S GREEN BUILDING MASTERPLAN

In late 2014, Singapore unveiled its third Green Building Masterplan (GBM) since 2006. Through the GBMs, Singapore aims to increase the energy efficiency, water conservation, and environmental sustainability of at least 80 percent of all buildings in the city by 2030. The first and second GBM were instrumental in helping to increase the number of green buildings in Singapore by almost 100 times, from just 17 in 2005 to about 1,700, which amounts to 21 percent of Singapore's total gross floor area.

The first GBM required all new public-sector buildings and those undergoing major retrofits to meet minimum standards of environmental sustainability under Singapore's Green Mark green building scheme. Under the second GBM, all larger, new public-sector buildings have to achieve the highest Green Mark rating (Green Mark Platinum), while all existing buildings owned by government agencies have to achieve Green Mark Gold by or before 2020. The third GBM places greater focus on engaging occupants and tenants, while introducing building energy benchmarking to spur action among building owners and tenants.

Sources: Singapore Building and Construction Authority. 2009. *2nd Green Building Masterplan*. Singapore Building and Construction Authority. 2014. *3rd Green Building Masterplan*.

Multi-stakeholder, integrative planning is an effective tool to support building-sector governance, policies, and decision-making. Planning processes can focus on building efficiency specifically, or integrate building efficiency as one component of broader urban development/climate action strategies to achieve citywide benefits.

CHAPTER 4

POLICY PATHS TO TRANSFORMING BUILDINGS: BRIDGING THE EFFICIENCY GAP

Key Takeaways

- Opportunities to increase the efficiency of buildings exist at each stage of a building's lifecycle.
- Building efficiency faces many barriers in implementation; various policy options exist to tackle these barriers and enable markets to overcome the efficiency gap.
- Policies range from incentives to regulation, and vary in the ease of design and implementation, and in their relative importance as part of a local government-driven policy package at city level.
- Cities can map out their own policy pathways to transform the built environment in ways that are appropriate for them and take into account their "capacity to act."
- Working with stakeholders to leverage their expertise and unique perspective is essential for developing policies that are feasible to implement and provide the greatest benefit at the lowest cost.

This chapter helps city governments think about how to develop a policy pathway to move from vision to action in a logical, structured, and targeted manner while addressing key barriers that currently may impede uptake of building efficiency at the various stages of the building lifecycle. It also provides insight into the importance of building stock data and policy mapping for the prioritization and further tailoring of policies.

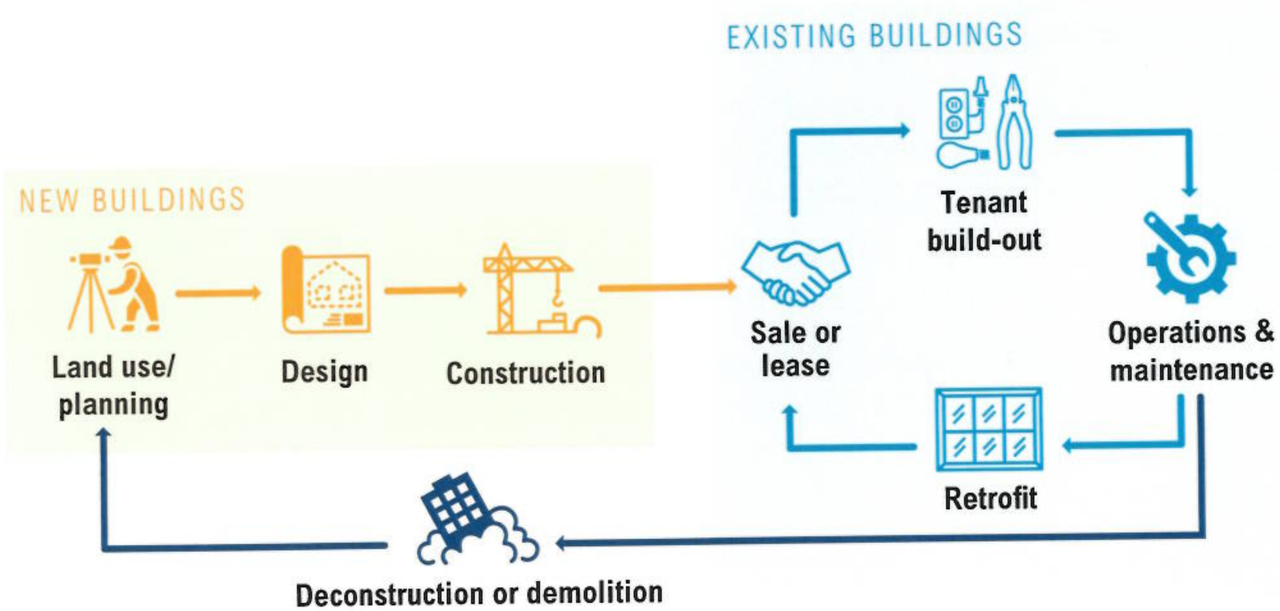
The Building Lifecycle

Buildings often begin their lives as designs in the imagination of a property developer/investor and architect, progress under the constraints of land-use, building, and property ownership policies, and end with demolition—decades or even centuries later (Figure 4.1). Making buildings energy efficient requires an upfront investment that can then be repaid many times over through savings on energy and other operating costs. In order to recover the upfront investment in energy-efficient buildings, actors at every stage in the building's life will need to select appropriate actions and technologies. Policies can help align the interests of all actors around implementing cost-effective energy efficiency options at each stage of a building's lifecycle.

The examples outlined below demonstrate how these efficiency options work throughout the lifecycle of a building.

- **Land-use and other urban planning** decisions happen before a building is even designed. These policies determine the uses, sizes, and efficiency of buildings that can legally be built in each jurisdiction. They act as constraints on private development and are usually implemented to improve health and safety or to enhance a desired characteristic of a city or neighborhood. In many developing and emerging countries, a considerable number of residential structures, in particular, are built without regard to planning and land-use laws; these developments are often referred to as informal or illegal settlements.

Figure 4.1 | Lifecycle of a Building



- The **design and construction process** includes the siting, orientation, number of floors, materials, heating/cooling systems, and insulation level selected for buildings. These factors help determine and may lock in the energy efficiency levels of the building, for example, through energy-inefficient façade and window design.

- When the building is put up for **sale or lease**, the developer, realtor, appraiser, owner, and lender should be able to accurately assess the future operating costs, so as to include them in the valuation of the property, and in the bank's evaluation of the owner's future ability to repay the loan.

- **Building out new tenant space** inside an existing building creates an opportunity to invest in high-performance, energy-efficient options, including appliances, lighting, and energy control systems.

- The tenant and owner will make **operation and maintenance** decisions on an ongoing basis. Many of these decisions—from the number of hours a building is heated or cooled to how often equipment is tuned up—affect energy usage and provide an opportunity to improve energy efficiency.

- Existing buildings that were not built with energy efficiency in mind may need an energy efficiency **retrofit** to upgrade the original design and construction and make the whole system more energy efficient. Improvements to space heating, ventilation, and air conditioning (HVAC), water heating, insulation, energy control systems, and lighting are common retrofit measures.

- Finally, a building may go through a major renovation or be slated for **deconstruction or demolition**, which starts the cycle over again.

Policies to support building efficiency should align the interests of all actors around implementing cost-effective energy efficiency options at each stage of a building's lifecycle. These policies are explored further in Chapters 9, 10, 11, and 12.

Understanding Your Building Stock

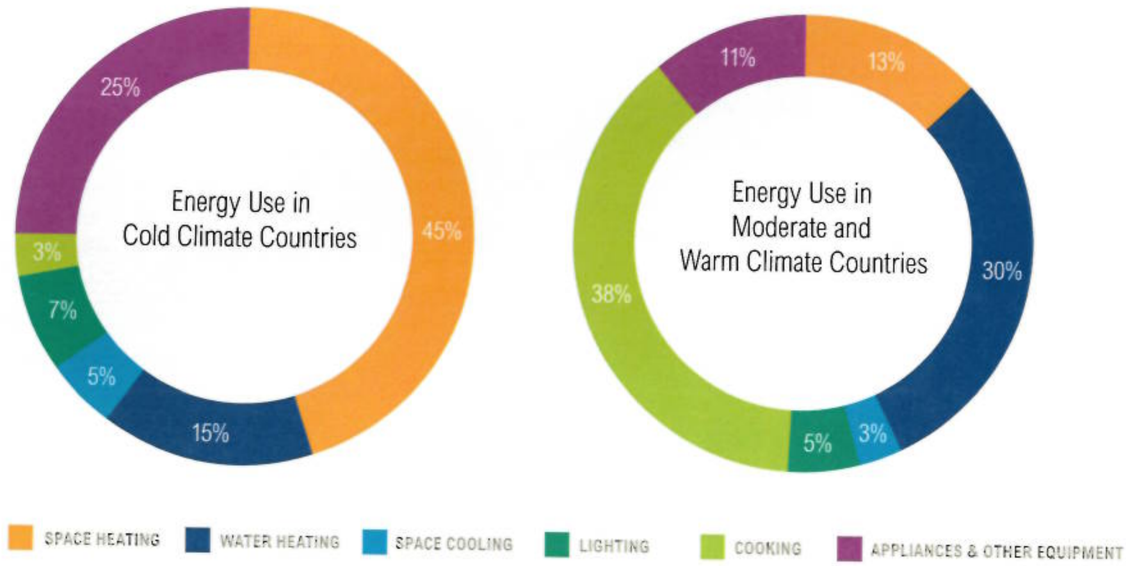
Understanding a city's building stock is an important first step in crafting policies and programs for reducing energy consumption. In many cities, commercial buildings (offices and retail buildings) and residential buildings (multifamily or single-family homes) make up the majority of the building stock. The local mix and relative shares of these building types have implications for the actions selected. For example, a community with many large commercial or multifamily buildings, which account for a large percentage of the city's energy consumption, may choose to improve the efficiency of these large buildings first.

Additionally, it is important to consider which measures improve efficiency for the highest energy loads of a building. In cold climates for instance lighting often accounts for only a small portion of total building energy end use, with space heating typically representing almost half of the building's energy load (See Figure 4.2).

An inventory of building stock will identify key building types, building age, and energy consumption. It will identify existing datasets on building characteristics and reveal how complete and comprehensive they are. Although data availability is often an issue, the local government department responsible for buildings may have records regarding the size, materials, and equipment of buildings in its jurisdiction, and perhaps documentation concerning major renovations and equipment replacement.

These records and other data can be used to develop a baseline of the types, numbers, and sizes of buildings within a jurisdiction, as well as major building energy loads. A baseline can be helpful to identify which buildings in the city are to be targeted first and which policies to prioritize. Communities interested in realizing the greatest energy savings may prioritize policies that result in large energy savings from targeting the fewest number of buildings. Alternatively, communities interested in reducing energy costs for their most vulnerable residents may develop policies to reach the buildings that are occupied by low-income households and small businesses.

Figure 4.2 | **Building Energy End Use Consumption in Cold and Moderate/Warm Climates (2010)**



Notes: Cold climate countries comprise OECD countries excluding Australia, Mexico, New Zealand and Israel, and non-OECD Europe and Eurasia and total 60 exajoules. Moderate and warm climate countries total 57 exajoules.
Source: International Energy Agency. 2013. Transition to Sustainable Buildings: Strategies and Opportunities to 2050. http://www.iea.org/publications/freepublications/publication/Building2013_free.pdf.

Introduction to Barriers and Policy Options

Summary of Barriers: The "Efficiency Gap"

Multiple barriers to energy efficiency exist, creating an "efficiency gap," which can be defined as the difference between efficiency actions that are technically and economically available and actions that are actually implemented. These barriers prevent or deter actors from making investments in energy efficiency. They range from market imperfections that prevent investors from valuing energy efficiency to limited awareness in the market and lack of information about building performance. Table 4.1 clusters the main barriers into five major categories.

Barriers vary in importance among countries and cities. For example, awareness and technical barriers play a bigger role in less-developed energy efficiency markets, whereas market and finance barriers are likely to be the biggest challenges in markets that have more experience pursuing energy efficiency opportunities.[1]

In this section, we focus on how to overcome the first four categories of barriers; the solutions to the final category, institutional barriers, are important for urban policymakers to take into account when planning building efficiency policies and may best be addressed by experts through place-specific technical assistance programs. It is important that local governments have sufficient capacity to design, implement, and enforce the policies and actions they select.

At the broadest level of barriers, there are at least two factors that influence the general environment for efficiency investments. First, efficiency approaches that depend on the cost savings of efficiency work best if energy prices are not heavily subsidized. If energy prices are lower than the true cost of supplying such energy, the energy savings resulting from efficiency projects will be too small to justify and repay the cost of action. Second, poor governance or limited legal recourse for settling disputes generally makes markets unattractive. It is difficult for companies to operate in markets where bribes and other forms of corruption are the norm. Markets with underdeveloped or unenforceable contract law, lack of standardization contract terms, and weak intellectual property regimes increase the risk of doing business.

Table 4.1 | **Barriers to Energy Efficiency**

TYPE	SUMMARY
MARKET	▪ Price distortions prevent consumers and investors from valuing energy efficiency ▪ Split incentives—transactions where economic benefits of energy savings do not accrue to those who invest in energy efficiency, as when building owners pay for investments in energy efficiency, but occupants pay the energy bills ▪ High transaction costs due to lack of standardized tools and methodologies to calculate and measure energy cost-savings versus investment ▪ Externalities associated with fossil fuel consumption are not priced; imperfect competition ▪ Dispersed and diffuse market structure with multiple locations and small end-users ▪ Multiple industries—construction, efficiency, energy industries—are involved in building efficiency, posing a multi-sectoral challenge ▪ Low energy tariffs discourage energy efficiency investments
FINANCIAL	▪ Organizations rely on constrained internal capital and operational budgets ▪ High upfront costs and dispersed operational benefits discourage investors ▪ Perception that energy efficiency investments are complicated and financially risky ▪ Perception in the financial sector that financial returns from energy efficiency are non-existent or exaggerated ▪ For building owners, a lack of external finance ▪ For financial institutions, small transaction sizes may require bundling of buildings or improvement measures to make them suitable for financing
TECHNICAL	▪ Lack of affordable energy-efficient technologies (or know-how) suitable to local conditions ▪ Insufficient capacity to identify, develop, implement, and maintain energy efficiency investments ▪ Lack of firms that can aggregate multiple projects; lack of implementation firms that can deliver cost-optimal energy efficiency projects ▪ Inability to understand or select across competing equipment choices, lack of trust in performance of projects
AWARENESS	▪ Lack of sufficient information and understanding on the part of consumers/tenants/building owners to make well-informed consumption and investment decisions ▪ Lack of information about the energy performance of buildings ▪ Energy information may not be provided or analyzed by end-users, energy providers, or other implementing agencies ▪ Benchmarks for performance may not exist ▪ Perception that energy efficiency measures make buildings more expensive
INSTITUTIONAL	▪ Local governments, especially in many developing countries, often have limited technical and human resource capacity to design and implement energy efficiency policies, programs, building codes, and standards ▪ Inter-departmental and inter-agency coordination to ensure policy coherence (at different levels of government, between various energy policy goals, or across scattered energy efficiency initiatives) is limited ▪ Regulators pay limited attention to demand-side measures. Traditionally, policy packages rely on supply-side interventions ▪ Energy providers/retailers are compensated for selling energy, but receive no financial income from promoting energy efficiency with their customers ▪ Government and the private sector rarely collaborate in public-private partnerships to tackle energy efficiency

Sources: International Energy Agency. 2010. *Energy Efficiency Governance.* http://www.iea.org/papers/2010/eeg.pdf; Institute for Building Efficiency. 2011. *Energy Efficiency Indicator: Global Survey Results.* http://www.institutebe.com/Energy-Efficiency-Indicator/2011-global-results.aspx?lang=en-US; Energy Efficiency Global Forum, Brussels. 2011. Statement by Christiana Figueres, Executive Secretary, United Nations Framework Convention on Climate Change. April 2011, Brussels, Belgium. http://unfccc.int/files/press/statements/application/pdf/110414_speech_ee_global_brussels.pdf.

Summary of Policy Options

A policy package for a local market can be designed to:

- target key barriers to energy efficiency;
- bridge the efficiency gap (between the current status and the potential for greater efficiency) by addressing these barriers; and
- scale up energy efficiency solutions and investment.

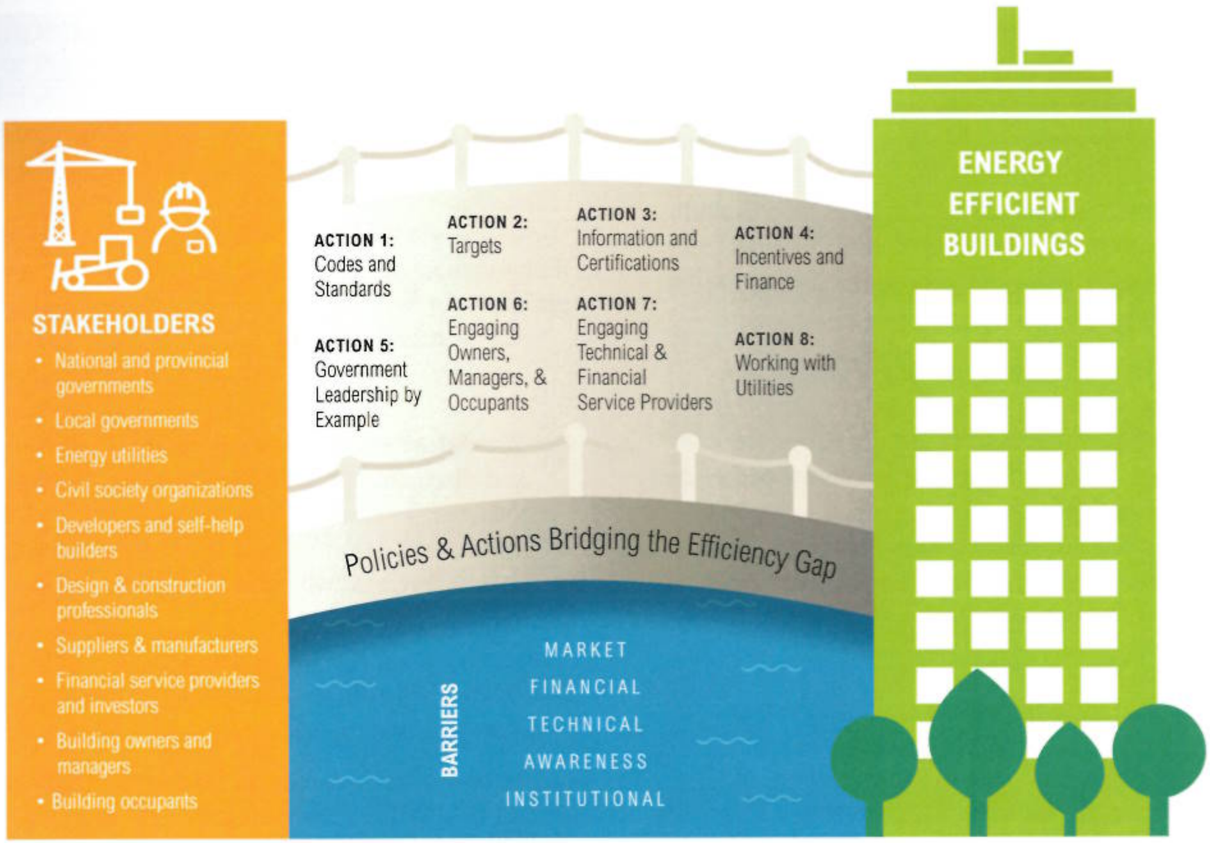
Many cities, as well as regions and countries, have developed policies to improve the energy efficiency of their built environments. Today, these policies are at different stages of implementation, and there are many lessons to be learned from these experiences. The policy options available to governments to improve the energy efficiency of the built environment can be grouped into eight categories, which are detailed in Table 4.3. Each policy category is then explored in detail in the policy options chapters (Chapters 5–12). Each community should choose a policy mix that transforms its built environment in a way that fits local circumstances.

Tackling the Efficiency Gap

Policies can enable the market to overcome barriers to energy efficiency at each stage in the lifecycle of any type of building. An effective policy package will build on an analysis of the barriers in a market (a specific community) and market segment (such as commercial office buildings) and may be targeted at specific decision points in a building's lifecycle. Figure 4.3 depicts how policies and related actions can help the market to overcome barriers to energy efficiency.

The following sections discuss policy combinations that can help the market overcome barriers at each stage in the building lifecycle. Given the unprecedented scale and pace of urbanization in many emerging economies, policies may need to pay explicit attention to actions such as introducing or strengthening building codes that can positively impact the energy performance of an entire new generation of buildings by setting minimum energy efficiency requirements. In less rapidly urbanizing cities, policies may focus more on retrofitting existing, aging building stock.

Figure 4.3 | **Crossing the Bridge to More Efficient Buildings**



Overcoming Barriers to Efficient Design and Construction

When architects, engineers, and developers plan a new building, resource-efficient design and construction may not be a high priority. Critical actors may not be aware of the opportunity, or have the technical capability to evaluate the cost-effectiveness of energy efficiency investments.

Policies that build awareness and technical capacity include:

- rating and certification programs that help building owners and users understand how their building compares to others in the market;
- programs that require mandatory disclosure of building performance, which increase information availability and transparency in the market while also allowing benchmarking;
- awareness and information campaigns that can disseminate knowledge; and
- workforce training programs to build technical capabilities in the market.

There are also market and financial barriers to making new buildings and major renovations more energy-efficient. For example, developers and construction companies may not be concerned about the cost of operating the building because the tenant or owner pays the utility bills. This is called a "split incentive" between the building owner/landlord and the occupant/tenant. The builder is concerned about the "first cost" of the construction and equipment and wants to minimize initial investments, whereas the owner may be more concerned about the operating expenses. The following actions can help ensure that efficiency is considered in new investments or developments:

- Building codes and standards: the perception of investment risk can be overcome with building efficiency codes that establish certain energy performance standards for the market, as well as through tools that engage private investment partners, such as dedicated credit lines and risk sharing facilities.

- Access to data and information: a more informed and transparent market can help actors accurately evaluate the value of an investment in energy efficiency. Building performance information and ratings schemes help provide information on the components and operational practices of a building that influence its efficiency.

- Government incentives: financial and non-financial incentives can help "buy down" the cost of more efficient technology to overcome part or all of the "first cost" obstacle for developers and owners.

Overcoming Barriers to the Sale, Leasing, and Operation of Efficient Buildings

When a building is sold or rented, there are various barriers that prevent owners and tenants from fully valuing energy-efficient components. In addition, many decisions are made in the operation and maintenance of a building that determine its energy efficiency. For example:

- Allowing longer payback time through innovative payback strategies: in some cases, an efficiency upgrade may take 5–10 years to pay back. Policies that allow an investment in energy efficiency to be repaid on the utility bill (by the tenant) or on a tax bill (by the owner), can help overcome barriers to the sale and lease of efficient buildings because, if the owner sells the building, the new owner can take over the payments for the improvements and will also receive the benefits of the lower utility costs.

- Aligning leases so that both owner and tenant benefit from energy efficiency: "Green Lease" clauses in leasing contracts can overcome "split incentives," by allowing the owner to recoup the cost of investments in energy efficiency, while allowing the tenant to benefit from lower energy bills.

When a building is sold or rented, there are various barriers that prevent owners and tenants from fully valuing energy-efficient components.

- Mandatory disclosure of energy use: ratings and disclosure policies allow buyers to factor the energy demand—and therefore costs—into purchasing decisions. Some markets provide energy "ratings" whereas others make only benchmark data available.

Overcoming Barriers to Efficiency Upgrades in Existing Buildings

In addition to the awareness and capacity barriers facing building owners described above, many owners of existing buildings who could undertake energy efficiency upgrades are unable to do so because of market and financial barriers. A number of policies have been specifically designed to help enable the market for energy efficiency retrofits:

- Government implementation of energy efficiency retrofits in public buildings can lead by example and bring down costs of efficient equipment.

- Financing programs and incentives targeted at building owners/managers (demand side) or investment partners (supply side), such as special loan programs, equipment or risk guarantees, and rebates, can change the economics of building efficiency and support greater investment.

- Policies that enable energy performance contracting (EPC) can enable energy service companies (ESCOs) to pursue more energy efficiency retrofits in the market.

Mapping Policy Options

The relevance of barriers and specific policies to tackle them varies by geography and by the sector or the market being targeted. For example, commercial high-rise buildings in China require a different set of policy solutions from those required by low-rise, low-income urban housing in Brazil. To identify and prioritize appropriate policy options, mapping the options against one or more key considerations can be a useful technique. An example is shown in Appendix 2: Assessment Tool for Building Efficiency Policies. Two important parameters for consideration are:

- The impact or importance of a policy on achieving a city's goals, which considers:
  - amount of direct energy or cost savings to the households, businesses or government;
  - amount of other efficiency-related benefits—such as job creation, pollution reduction, other resource savings or resilience—that will be achieved by the policy;
  - future opportunities that its success may open up, such as attracting additional funding or resources or better information to inform future policies; and
  - contribution of the policy to state or national priorities, which may provide opportunities to attract additional funding or resources.
- The ease or difficulty of designing and implementing specific policies, which considers:
  - level of direct local control over the policy area, such as utility policy or building regulations;
  - complexity of external stakeholder support and/or collaboration needed to design and implement the policy; and
  - existing relationships among stakeholders required for the design and implementation of the policy.

Mapping Trade-offs in Policy Sequencing

Two examples of policy mapping are provided in this section to illustrate how to map policy options. The first exercise (Figure 4.4) compares importance and difficulty of implementing multiple policies to help with prioritization and sequencing. The second (Table 4.2) goes more deeply into the potential role stakeholders play in developing and implementing multiple policy options. These policy-mapping exercises should serve only as high-level guidance, requiring further tailoring at the local level for each individual city.

For the initial policy phase, carefully selecting options that can provide "quick wins"—easy but impactful successes—can help demonstrate the feasibility of building efficiency policies and build confidence and momentum for future policies.

To identify and prioritize appropriate policy options, mapping the options against one or more key considerations can be a useful technique.

Figure 4.4 | **Illustrative Trade-offs Among Policy Options**

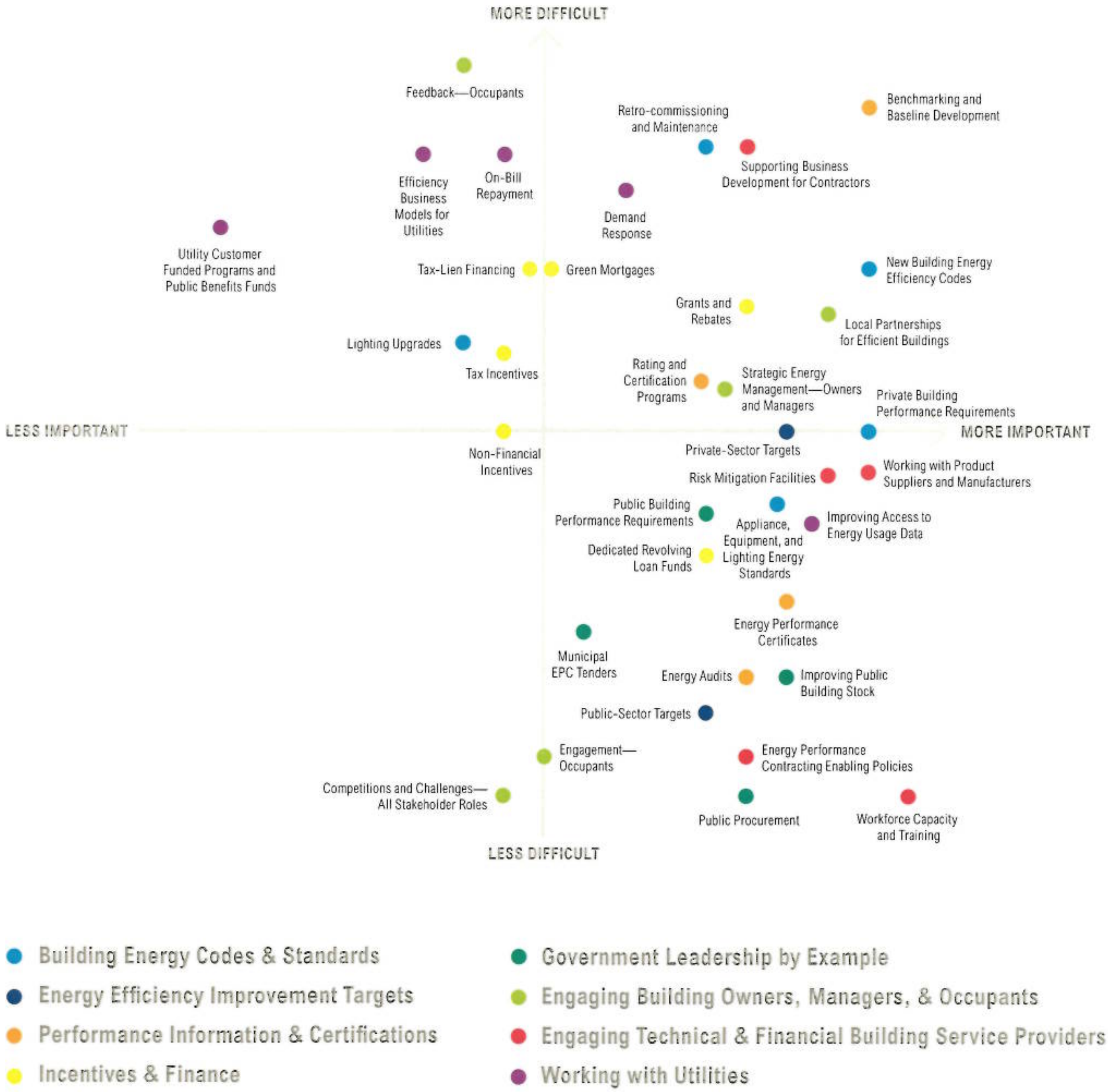
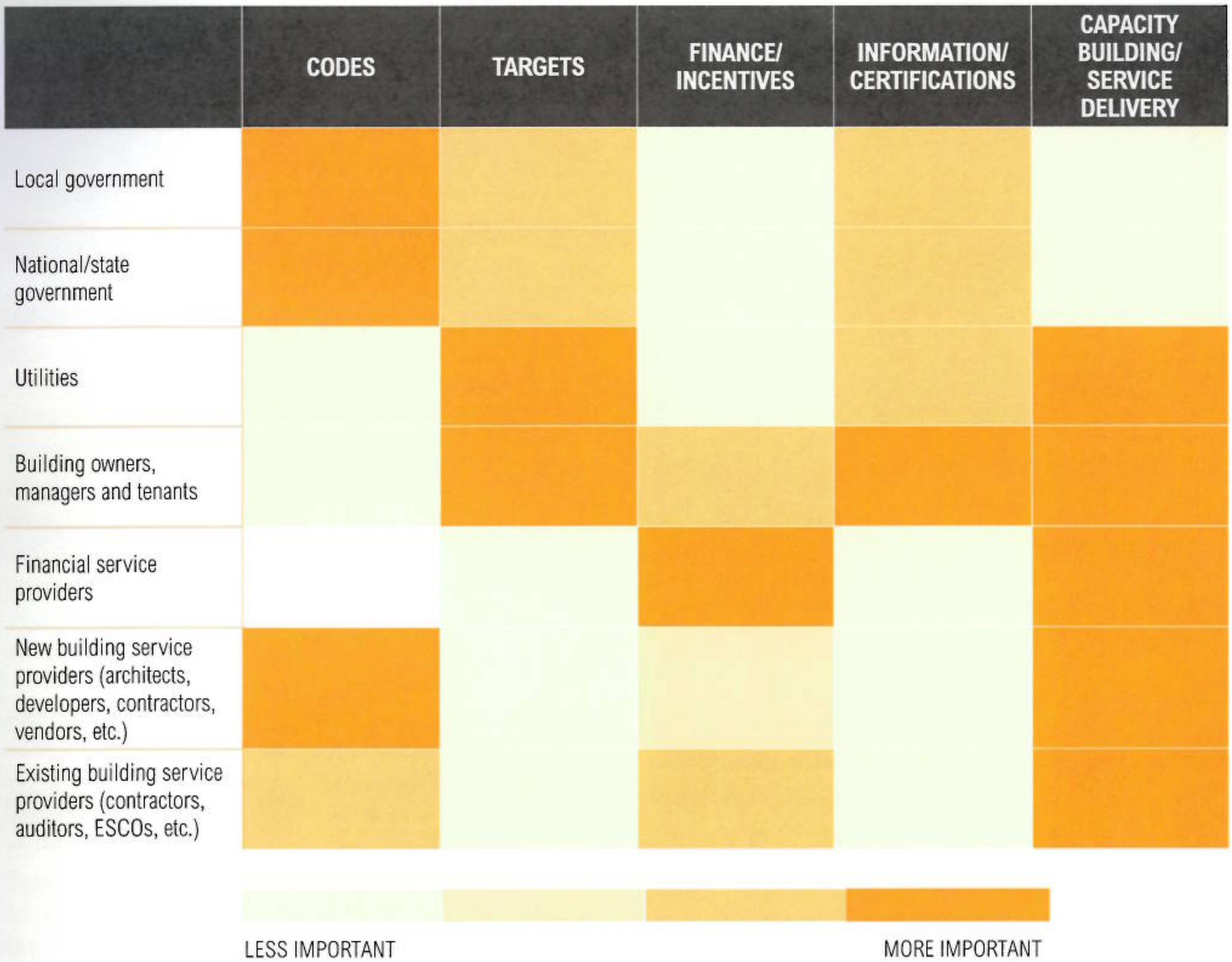


Table 4.2 | **The Role of Stakeholders in Policy Implementation**



Mapping the Role of Stakeholders in Policies

The influence of local government over building efficiency policymaking, implementation, and enforcement varies considerably from city to city. This relates to the "capacity to act," which is the specific authority that has been given to different levels or spheres of government.[2] Even in policy areas where a local government has considerable direct authority, working with stakeholders to leverage their expertise and unique perspective is essential for developing policies that are feasible to implement and provide the greatest benefit at the lowest cost. Stakeholder collaboration is even more important in areas where local government has little direct authority because stakeholders will need to take actions voluntarily for a policy to succeed. The market segment and the type of policy will determine which specific types of stakeholders are the most important to involve.

Table 4.3 provides an overview of the role of different stakeholder groups in the implementation of five key policy mechanisms. These roles vary by market and market segment and this table can be adjusted, depending on local circumstances, to better understand the stakeholders whose involvement is key to making a policy successful.

Table 4.3 | **Policy Options for the Built Environment**

TYPE	SUMMARY
ACTION 1: BUILDING EFFICIENCY CODES AND STANDARDS (CHAPTER 5)	■ New building energy efficiency codes ■ Retro-commissioning ■ Lighting upgrades ■ Performance requirements ■ Appliance, equipment, and lighting energy standards
ACTION 2: EFFICIENCY IMPROVEMENT TARGETS (CHAPTER 6)	■ Public-sector targets ■ Private-sector targets
ACTION 3: PERFORMANCE INFORMATION AND CERTIFICATIONS (CHAPTER 7)	■ Benchmarking and baseline development ■ Energy audits ■ Energy performance certificates ■ Rating and certification programs
ACTION 4: INCENTIVES AND FINANCE (CHAPTER 8)	■ Grants and rebates ■ Tax incentives ■ Green mortgages ■ Non-financial incentives ■ Dedicated revolving loan funds ■ Tax-lien financing
ACTION 5: GOVERNMENT LEADERSHIP BY EXAMPLE (CHAPTER 9)	■ Improving public building stock ■ Energy performance requirements ■ Energy efficiency targets ■ Public procurement ■ Energy performance contracting tenders
ACTION 6: ENGAGING BUILDING OWNERS, MANAGERS, AND OCCUPANTS (CHAPTER 10)	■ Local partnerships for efficient buildings ■ Green leases ■ Competitions and challenges ■ Occupant engagement ■ Occupant feedback ■ Strategic energy management
ACTION 7: ENGAGING TECHNICAL AND FINANCIAL SERVICE PROVIDERS (CHAPTER 11)	■ Supporting business development for contractors ■ Policies to enable energy performance contracting ■ Working with product suppliers and manufacturers ■ Workforce capacity and training ■ Overcoming lack of standardization and high transaction costs ■ Risk mitigation facilities
ACTION 8: WORKING WITH UTILITIES (CHAPTER 12)	■ Improving access to energy usage data ■ Customer-funded utility programs and public benefits funds ■ Efficiency business models for utilities ■ On-bill repayment ■ Demand-response

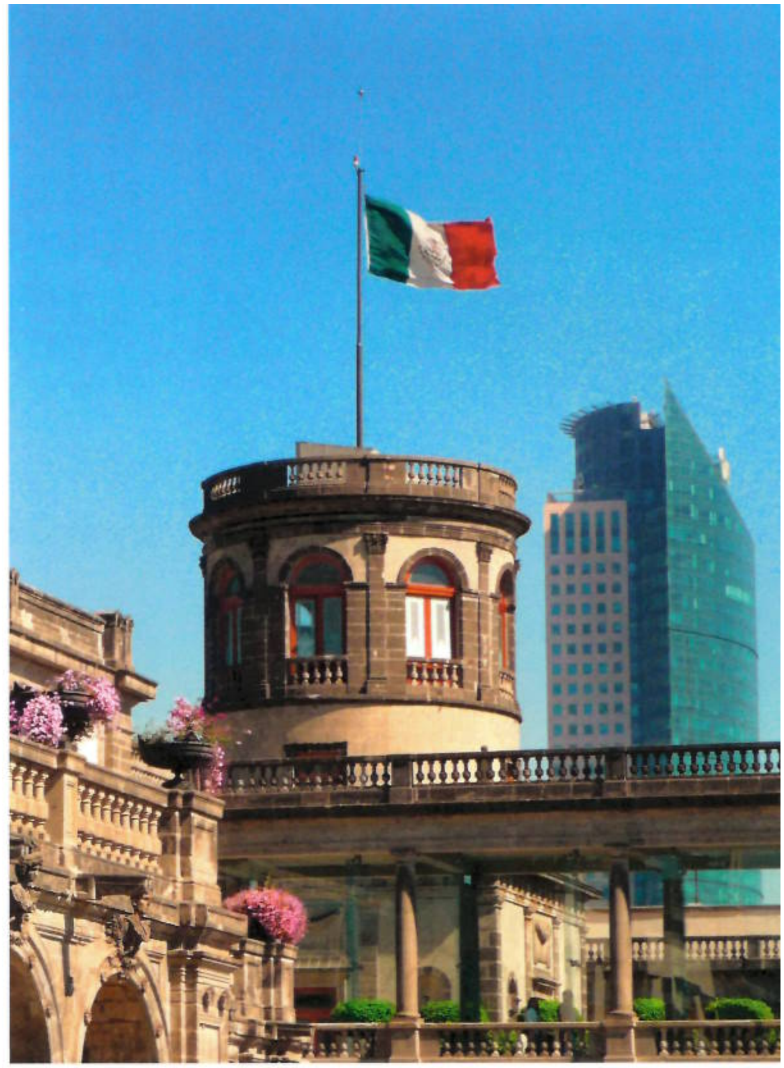
Municipal Energy Efficiency Program in Mexico: An Example of Stakeholders Coming Together to Transform the Built Environment

In Mexico, limited municipal authority and capacity often restrict policy development for energy efficiency at the municipal level. Limitations include a lack of technical resources, insufficient experience in project management, and limited access to financial resources, among other factors.

SENER, Mexico's Ministry of Energy, in partnership with many other stakeholders, initiated a national Municipal Energy Efficiency Program (PRESEM) in June 2014 with the goals of improving urban services through improvements in efficiency and meeting energy and climate objectives. The program has two components: a technical assistance component to support policy development and institutional strengthening, and a financial investment component to finance municipal energy efficiency projects.

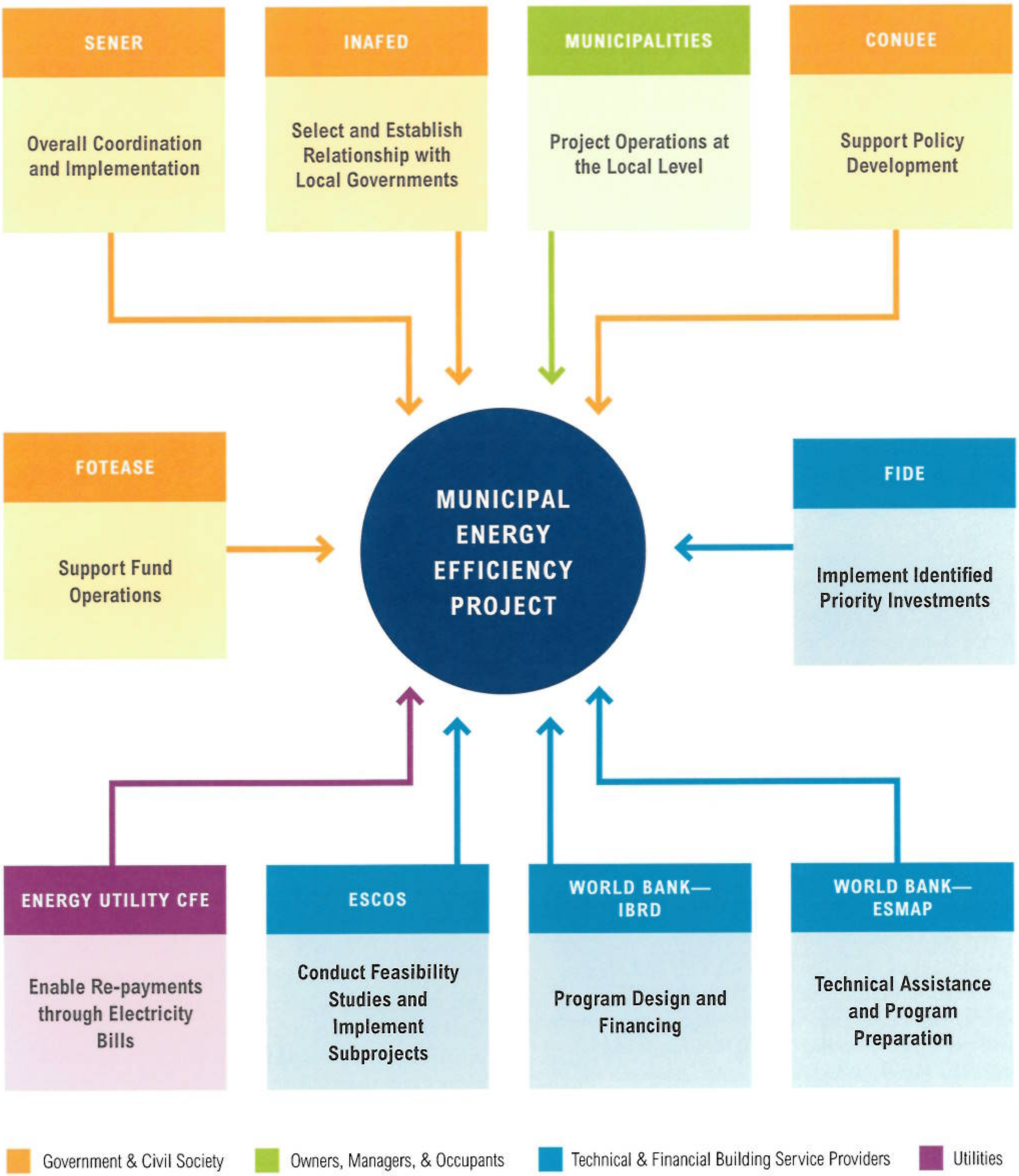
SENER leads the technical assistance component, with support from the National Commission for the Efficient Use of Energy (CONUEE) and the World Bank Group. The Energy Sector Management Assistance Program (ESMAP) at the World Bank is conducting energy efficiency diagnostics in 32 municipalities of the country, using the Tool for Rapid Assessment of City Energy (TRACE). The diagnostic identifies opportunities for energy efficiency improvements in transport, public lighting, buildings, water, and solid waste, helping city institutions to prioritize actions among these sectors and generating a list of recommendations for cities to consider.

As cities select the improvements they will make, the Trust Fund for Electricity Savings (FIDE), which operates the financial investment component with oversight from SENER, makes funds available. The Federal Electricity Commission (CFE), the state-owned electric utility, will help recover the funds through electricity bill surcharges and transfer those resources to FIDE. The World Bank provided capacity building to FIDE to improve its procurement and financial management guidelines, as well as for the preparation of bidding documents and the evaluation of economic and financial proposals. The International Bank for Reconstruction and Development (IBRD-WB) is providing a US$100 million loan to support the program. The IBRD loan and counterpart funds are channeled through the Energy Transition and Sustainable Energy Use Fund (FOTEASE).



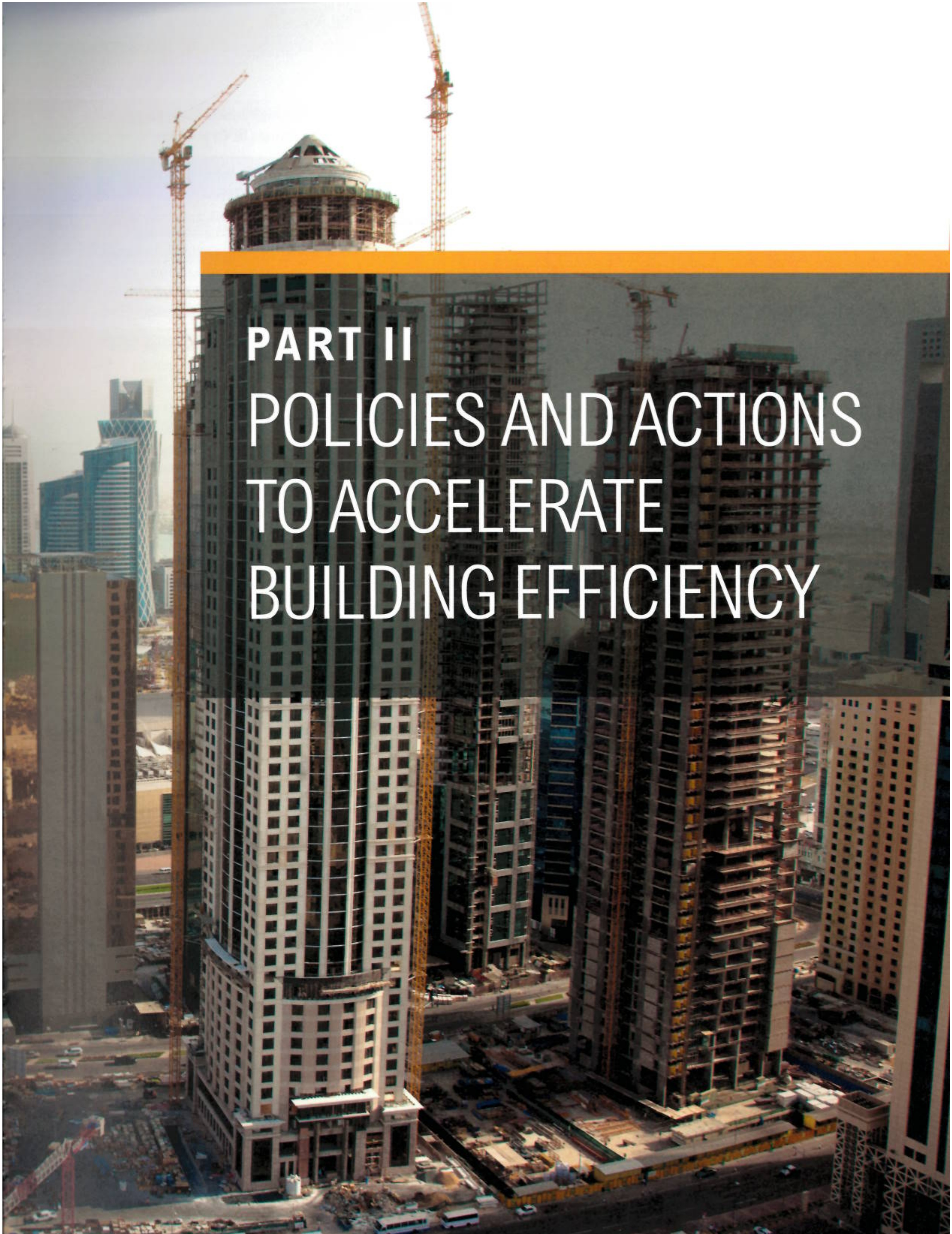
This project involves collaboration among federal and municipal government agencies, development banks, a private trust fund, non-governmental organizations, energy utilities, and local energy service companies. The stakeholders bring a variety of authorities, competencies, and resources to the project, as shown in Figure 4.5, each of which is required to successfully develop and implement such a comprehensive energy efficiency project.[3]

Figure 4.5 | **Stakeholder Contributions to Municipal Energy Efficiency in Mexico**



PART II

POLICIES AND ACTIONS TO ACCELERATE BUILDING EFFICIENCY



Introduction

Cities can take many actions to improve building efficiency. The following chapters (5–8) review policy options that can be used by local governments to accelerate building efficiency in the public- and private-sector building stock. They can be applied to mandate, encourage, or incentivize a variety of stakeholders in the building sector. Chapters 9–12 examine in turn the principal stakeholders involved in implementation—local governments; building owners, managers, and tenants; technical and financial service providers; and utilities—and practices that can be implemented to encourage each of them to take efficiency actions. The options for local government policy and implementation action fall into eight categories:

1. **Building efficiency codes and standards** are regulatory tools that require a minimum level of energy efficiency to be achieved in the design, construction, and/or operation of new or existing buildings.

2. **Efficiency improvement targets** are energy reduction goals that a city can set for its own publicly owned or rented building stock, or voluntary targets for the private sector.

3. **Performance information and certifications** can enable building owners, managers, and occupants to make more informed energy management decisions. These policies and actions include energy audits and retro-commissioning, rating and certification programs, and disclosure of energy performance.

4. **Incentives and finance** can help energy efficiency projects overcome economic barriers, such as those related to upfront costs and "split incentives." They include grants and rebates, tax incentives, priority processing for building permits, floor-area allowances, bond and mortgage financing, revolving loans, dedicated credit lines, and risk-sharing facilities.

5. **Government leadership by example** includes policies that enable local governments to create greater demand for efficient buildings and related products and services. These include improving the public building stock, encouraging or mandating procurement of efficient products and services, and stimulating the ESCO market through municipal energy performance contracting (EPC) tenders.

6. **Private building owner, manager, and occupant engagement** through technical programs to motivate stakeholder action, such as local partnerships for efficient buildings and green lease guidance, and through behavioral mechanisms including competitions and awards, occupant engagement, feedback programs, and strategic energy management.

7. **Technical and financial service provider engagement** can encourage businesses to provide services by increasing demand for efficiency. Engagement measures include general programs to support the technical building service industry, provide workforce capacity building, facilitate energy performance contracting, improve standardization, and reduce transaction costs of efficiency financing.

8. **Working with utilities** can improve access to energy-use data and make their customers more energy efficient. These programs include energy-use data access, utility public benefit funds, on-bill financing, revenue decoupling, and demand-response programs.

Local governments may adopt a variety of approaches to drive and implement these policies. Their ability to act may be constrained or facilitated by political decisions made at the state/provincial or national level. For each policy, decision-makers must also consider the ease or complexity of policy implementation (see Table 3.1), and the importance of upfront stakeholder support (see Table 4.3). The summary table below illustrates these considerations from the local government perspective.

Local governments typically need external stakeholder support during policy design, whether from private-sector building owners/managers, occupants, building service providers, or other stakeholders in the building market. The ease of policy design, introduction and/or enforcement in the absence of strong existing stakeholder relationships can vary significantly. Careful consideration of the level of necessary upfront stakeholder support is recommended before moving ahead with a specific policy option.

Summary Table. Policy Options and Local Government Role, Influence, and Effort

POLICY OPTION	ROLE OF LOCAL GOVERNMENT	EASE OR COMPLEXITY OF IMPLEMENTATION
Codes and standards	[Develop] / adopt / enforce	Easy to moderate
Efficiency improvement targets	Set / facilitate	Moderate (public) to more difficult (private)
Performance information and certifications	Facilitate / adopt / implement	Easy (voluntary) to more difficult (mandatory)
Finance and incentives	Facilitate / develop / [implement]	Easy to difficult
Government leading by example	Set / implement	Easy to moderate
Engaging building owners/ managers and occupants	Facilitate / implement	Easy to moderate
Engaging technical and financial building service providers	Facilitate / implement	Moderate to difficult
Utility actions and working with utilities	Facilitate / [implement]	Moderate to difficult

Note: Action on items in brackets are sometimes, but not always, within the authority of local governments.


United

CHAPTER 5

ACTION 1: BUILDING EFFICIENCY CODES AND STANDARDS

Key Takeaways

- Building efficiency codes and standards are regulatory tools that require a minimum level of energy and resource efficiency in buildings. No single energy code or set of requirements will suit all types of economy and climate.
- In the absence of minimum efficiency codes and standards, rapidly urbanizing emerging economies risk "locking in" an inefficient built environment for years to come.
- Codes commonly focus on measures that optimize the design and construction of buildings and core building services such as heating, cooling, ventilation, and lighting. Building energy codes are generally prescriptive requirements. Increasingly, however, performance-based codes are emerging in advanced markets.
- Local governments are often responsible for adapting, adopting, and implementing national building codes in their jurisdiction.
- Local governments can also require existing buildings to meet energy standards to improve their performance. Often these policies make use of building performance information or appliance and equipment standards.

Building efficiency codes and standards are key tools to improve the energy performance of buildings and equipment by mandating minimum levels of energy performance. This chapter covers the different types of building codes, their targeted scopes and performance levels, and best practices in code implementation and compliance. It also describes policies for energy standards in existing buildings, and appliance, equipment, and lighting standards.

Building Efficiency Codes

Building efficiency codes are regulatory tools that establish minimum levels of energy or other resource efficiency for different building types; they can cover the design and construction of any kind of building system. Codes are most effective when developed within a policy package of mandatory regulations and standards, financing programs, and incentives for actors to go beyond minimum performance requirements. Energy codes play a fundamental role in energy efficiency objectives, making them a priority policy pathway for developing and emerging economies.[1] Building energy codes are most commonly focused on new buildings but they are also applied to existing buildings, usually during renovations. That energy codes can be a powerful tool is shown by the experience of countries such as the United States, where such codes saved more than US$44 billion in energy costs and 300 million tons of carbon emissions between 1992 and 2014.[2]

Types of Building Efficiency Codes

Building efficiency codes are commonly designed as prescriptive, simple trade-off, or performance-based codes.

Prescriptive codes specify performance requirements for elements such as wall and ceiling insulation, window and door specifications, roofs and foundations, heating, ventilation, air-conditioning, equipment efficiency, water heating, lighting fixtures, and controls. These codes can also include expected standards for natural ventilation, shading, and renewable energy integration. The primary form of compliance is through design review and checklists as part of the building permit application process.

Simple trade-off codes also prescribe performance for components but allow trade-offs among them, for example, less insulation but more efficient windows. Compliance with these codes is commonly assessed by checking project designs and specifications that refer to appropriate material or component standards, and/or through use of simple energy simulation software.

Performance-based codes, rather than prescribing performance of components, specify a required maximum level of energy consumption or intensity for the whole building. They require energy modeling to be conducted at the design stage. Compliance is commonly checked by comparing the modeled energy performance of the design with the performance of a reference building of the same type.

Outcome-based codes are now being developed in some jurisdictions, although they are not yet common. They require a specified performance to be achieved and verified during building operation over a period of at least 12 months.[3]

Building Efficiency Codes: Scope and Performance Levels

There is no single energy code or set of requirements that will suit all types of economy and climate. Countries and cities developing building energy codes will need to tailor them to existing best practices for the area's climate as well as locally available resources and technologies.[4] Typically, building energy codes set different energy performance and compliance requirements for residential and non-residential buildings. The most ambitious building energy codes in the world require buildings to be net zero energy (see Box 5.1).

Policymakers can implement a regular revision cycle for updating codes. Some opt for gradual code tightening over time (typically every three to five years), beginning with a code that raises energy efficiency requirements to levels that can be met by the majority of building developers, while signaling that the code will gradually be tightened. This helps create buy-in for energy efficiency codes while also supporting the development of energy-efficient products, technologies, and services in anticipation of compliance with stricter codes.

BOX 5.1 | THE EUROPEAN NEARLY ZERO ENERGY BUILDINGS DIRECTIVE

The European Parliament enacted the Energy Performance of Buildings Directive (EPBD) in 2002. The EPBD is a performance-based code, applying to both new construction and existing buildings, and including commercial and residential building types. The EPBD directive was superseded in 2010 by the Recast EPBD.

The Recast EPBD includes a mandate that new buildings occupied and owned by public authorities become nearly zero energy buildings (nZEBs) by the end of 2018, with nZEB to become the norm for all new buildings from end 2020 onward. Nearly zero energy buildings are defined as buildings that require a very low amount of energy to operate, and that use energy provided from renewable sources, to the extent possible, and especially from sources produced on-site or nearby. The Directive allows EU countries to set their own nZEB standards, providing flexibility over whether to focus more on energy efficiency or renewable-energy generation. The goal is to achieve a high load match between building energy demand and on-site and nearby supply.

The three regions of Belgium—Brussels-Capital, Flanders, and Wallonia—have adapted the policies to their local contexts. Brussels has set a stricter target, aiming to achieve the directive six years ahead of the deadline. Moreover, while the EU defines nZEB as maximum primary energy consumption of 160 kWh/m^2/yr for residential buildings and 170 kWh/m^2/yr for non-residential buildings, the Brussels metropolitan standard has set the limits considerably lower and made Passive House construction mandatory from 1 January 2015. In 2007, no buildings in Brussels complied with this standard; low-energy buildings are now the norm for all new construction. This was achieved after three trial rounds of a voluntary "Exemplary Buildings" program, which built broad support for a mandatory standard by demonstrating that passive standards are affordable, achievable, and provide many benefits.

Sources: European Union. 2014. *Energy Efficiency Directive.* http://ec.europa.eu/energy/efficiency/eed/eed_en.htm;
Leefmilieu Brussel. 2015. "De EPB eisen vanaf 2015." http://document.environnement.brussels/opac_css/elecfile/IF%20NRJ%20ExigencesPeb2015NL.PDF;
BPIE. 2015. *Nearly Zero Energy Buildings: Definitions Across Europe.* http://bpie.eu/uploads/lib/document/attachment/132/BPIE_factsheet_nZEB_definitions_across_Europe.pdf;
Intelligent Energy Europe. 2012. *The Success Model of Brussels: A Case Study.* http://nypassivehouse.org/wp-content/uploads/2014/12/Detailed-description-of-the-Success-Model-of-Brussels.pdf

Building Efficiency Codes: Implementation and Compliance

National governments are usually responsible for establishing building codes (see Box 5.2). Cities and local authorities commonly must adapt, implement, and enforce them. Jurisdictions that demonstrate best practices in code implementation often include the following activities and stakeholders in their approach:

BOX 5.2 | SINGAPORE'S BUILDING ENERGY CODE

In Singapore, the building energy code defines mandatory energy efficiency standards for new residential, commercial, and public buildings with a gross floor area of at least 2,000 m^2. Energy performance criteria are based on a points system, allowing the project to decide which energy efficiency measures to include in order to meet the 50-point minimum requirement.

The code includes several mandatory prescriptive elements, such as thermal-envelope performance, HVAC efficiency, lighting, air-tightness, and sub-metering. Bonus points are awarded for use of renewable resources. Compliance with the code is checked during design, construction, post-construction, and post-occupancy. Non-compliance penalties comprise fines, refusal of permission to occupy, and refusal of permission to construct.

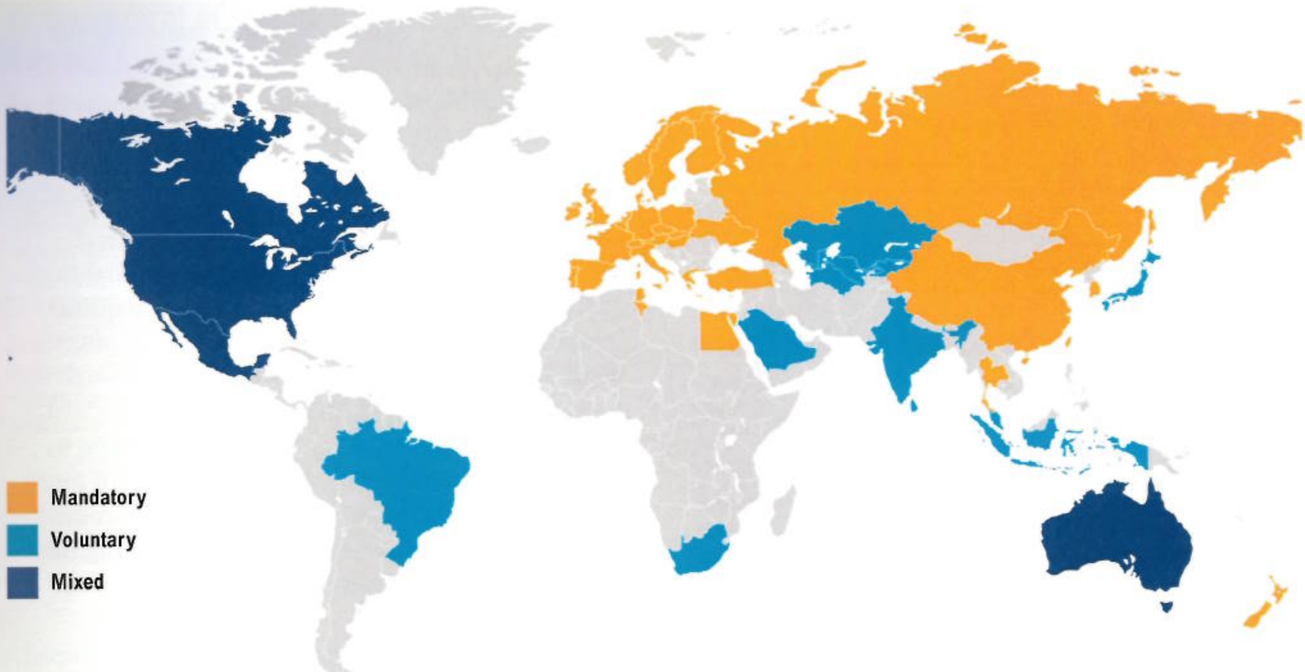
Sources: Singapore Building and Construction Authority. 2008. *Code on Environmental Sustainability of Buildings*. http://www.bca.gov.sg/EnvSusLegislation/Environmental_Sustainability_Legislation.html;
Green Buildings Performance Network. n.d. Singapore. http://www.gbpn.org/databases-tools/bc-detail-pages/singapore#Summary and http://www.bca.gov.sg/envSuslegislation/others/env_Sus_Code.pdf

- conducting a review that checks the building's design against energy code requirements;
- ensuring on-site inspections at key points in the construction process;
- implementing end-of-pipe or pre-occupancy testing involving commissioning of equipment and, in some cases, air-tightness testing;
- considering post-occupancy evaluations. Although currently rarely mandatory, periodic monitoring and reporting can verify minimum energy performance as required by the code;
- contracting for support. Where local authorities lack capacity or staff, third-party assessors can be commissioned to conduct compliance checks on behalf of the project developers or the local codes authority;
- applying meaningful penalties for non-compliance, such as withholding design, construction or occupancy approval and/or using fines; and
- providing incentives to achieve beyond-code performance.

The number of building energy codes around the world is on the rise (see Figure 5.1), because they are one of the most effective policy instruments to improve the efficiency of new homes and commercial buildings.

The number of building energy codes around the world is on the rise, because they are one of the most effective policy instruments to improve the efficiency of new homes and commercial buildings.

Figure 5.1 | **Global Status of Building Energy Codes and Standards for the Non-Residential Sector**



Source: IEA Building Energy Efficiency Policy Database. https://www.iea.org/beep/.

Standards for Existing Buildings

Minimum energy requirements can also be set for existing buildings, through applying efficiency codes to building renovations, outcome-based codes, or required actions to improve building performance. Some of these requirements are enabled by the availability of performance information regarding a building's energy use, as described in Chapter 7: Performance Information and Certifications. Some mandatory standards to improve efficiency in existing buildings are described below.

Retro-commissioning

Retro-commissioning involves conducting periodic testing and maintenance of a building's equipment and operating systems in order to ensure that the building performs as intended. Retro-commissioning can be included in building standards, incentivized, or targeted through public education campaigns. Some cities require mandatory retro-commissioning for low-performing buildings, often preceded by a mandatory energy audit that provides data on operational energy performance.

In New York City, for instance, Local Law 87 mandates that public and private buildings over 50,000 gross square feet undergo periodic energy audit and retro-commissioning measures. Within four years of submitting an energy audit report to the local government, a building owner must also complete retro-commissioning. The retro-commissioning process and accompanying report must address 28 measures specified in the law, which fall into three basic categories: (a) operating protocols, calibration, and sequencing; (b) cleaning and repair; and (c) training and documentation.[5]

Lighting Upgrades

Lighting upgrades require existing buildings to bring their indoor lighting systems in line with lighting standards. In New York, Local Law 88 mandates that by 2025 covered buildings must replace or install all lighting to meet the city's Energy Conservation Code, introduce sub-meters, and provide a monthly statement based on sub-metered electricity consumption to tenants.[6]

Performance Requirements

Hong Kong is one of many cities that require existing buildings to come up to code when undertaking major renovations.[7] Additionally, some cities are now phasing in or considering minimum energy performance requirements for all or a subset of their existing buildings, independent of renovations. Austin, Texas, for example, requires that efficiency improvements be made to low-performing multifamily buildings.[8]

Appliance, Equipment, and Lighting Energy Standards, and Labeling

Setting minimum energy efficiency standards for appliances, equipment, and lighting has proven to be a highly successful policy approach in many countries around the world. Energy efficiency standards ensure a minimum level of energy efficiency performance for technology used in buildings. They can also prohibit the production or import and sale of certain appliances, equipment, and lighting products that do not meet the minimum requirements. The energy efficiency of products is often made immediately visible to consumers through the use of labels that depict the appropriate standard and the performance of the product in relation to that standard. Labels help consumers make a more informed decision about the true cost of a product (purchase plus use), while also demonstrating that minimum standards have been met or exceeded.[9]

In most cases efficiency standards are set, developed, and mandated at a national or provincial level, with cities playing the role of promoter and enforcer for those products sold by retail businesses within their jurisdiction. Cities can also make use of these standards or labels for their own policies, such as lighting or equipment upgrade requirements.

ADDITIONAL CASE STUDIES ON BUILDING EFFICIENCY CODES AND STANDARDS

Enforcement of Residential Building Energy Efficiency Codes in Tianjin

Tianjin has enforced a more stringent residential BEEC than the national standards, and achieved a high degree of compliance with a well-established building construction management system; standardized and structured procedures for compliance enforcement; broad-based capacity of the construction trades to meet compliance requirements; and local government resources, support, and commitment to implementing increasingly stringent BEECs.

Source: Energy Sector Management Assistance Program (ESMAP). "Good Practices in City Energy Efficiency: Tianjin, China—Enforcement of Residential Building Energy Efficiency Codes." http://www.esmap.org/node/1280. Last accessed February 22, 2016.

Green Building Codes in Karachi

Building codes in the city of Karachi are controlled by the Sindh Building Control Authority (SBCA). The base codes for SBCA were established in April 2002, and the government has since created several revisions related to sustainability measures.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Karachi City Market Brief." http://www.usgbc.org/resources/karachi-city-market-brief. Last accessed March 1, 2016.

Green Building Codes in Jakarta

The city's brand-new Green Building Code, which establishes seven key points as the standard for buildings exceeding certain floor areas, is a set of government requirements that will transform the construction landscape with the potential to reduce CO_2 emissions from buildings by approximately 140 million tons annually.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Jakarta City Market Brief." http://www.usgbc.org/resources/jakarta-city-market-brief. Last accessed March 1, 2016.

CHAPTER 6

ACTION 2: EFFICIENCY IMPROVEMENT TARGETS

Key Takeaways

- A citywide efficiency improvement target or goal can align interests and spur action.
- Government efficiency targets for the public building portfolio can build capacity and drive uptake of building efficiency in the market.
- Voluntary efficiency targets for the private sector can spur interest in and accelerate uptake of building efficiency, particularly in the commercial building sector.

Efficiency-improvement goals, also known as energy efficiency targets (intended reductions in energy use that have been defined in a "SMART" manner, with consideration for making them specific, measureable, actionable, realistic, and time-bound), can be a highly effective way for decision-makers to improve the use of energy in their communities and operations. Political leaders with a vision of an energy-efficient, sustainable built environment can articulate a specific future path by setting an energy efficiency improvement target or goal for their city or metropolitan region. Energy efficiency targets can be mandatory or voluntary (aspirational), with short or longer-term timeframes. They can be implemented at many scales: jurisdictional (city, state, utility), institutional (business or public sector) or building level. Targets can help focus the work of the many stakeholders who will need to be involved in their achievement. Targets are even more powerful if specific parties are held responsible for meeting them. The policy measures discussed in this chapter highlight the ways in which cities can set and implement energy efficiency targets.

BOX 6.1 | REDUCING ENERGY CONSUMPTION IN PUBLIC BUILDINGS IN LVIV, UKRAINE

The Ukrainian city of Lviv is actively reducing annual energy consumption in its public buildings by at least 10 percent, and tap water consumption by about 12 percent, through a "Monitoring and Targeting" program to control energy and water consumption. The program includes retrofitting hundreds of buildings with replacement windows, improved heat insulation, upgraded radiators fitted with thermostats, or new heat exchangers.

The program administrator in Lviv provides the city management with monthly consumption data for district heating, natural gas, electricity, and water in all of the city's 550 public buildings. Targets for monthly utility consumption are determined annually. Actual consumption is reviewed monthly against the target, with deviations spotted and acted upon immediately. The performance of buildings is communicated to the public through a display campaign. In cooperation with international partners, the city is running a number of private-public partnership initiatives to accelerate energy efficiency improvements in the public building stock.

Source: ESMAP. n.d.. "Good Practices in City Energy Efficiency: Lviv, Ukraine—Energy Management Systems in Public Buildings." https://www.esmap.org/node/1246.

Public-Sector Targets

City governments can "lead by example" by setting targets to improve the energy efficiency of buildings that they own or operate (see Box 6.1 and Chapter 9). A local government might adopt and publicly announce an energy- or carbon-reduction goal for government-owned buildings, such as aiming to achieve a "30 percent reduction in energy consumption by the year 2030." This efficiency target could be further divided into smaller, more tangible milestones, such as five-year incremental reductions toward the 2030 goal. Local governments often own and manage a considerable number of buildings, ranging from commercial buildings to schools, hospitals, and public housing, so establishing a target can significantly influence the market for efficient equipment or services. Targets can help build local technical capacity, expertise, and awareness, as well as provide business opportunities.

Targets may also be introduced at the national or state level, and cities then sign up to participate. This is the case for the U.S. Department of Energy "Better Buildings Challenge," which aims for 20 percent energy savings over 10 years with local governments and other parties voluntarily taking on the challenge.[1] Local governments can create confidence in the use of energy-saving technologies in privately owned buildings if they publicize successful efficiency projects of their own. As early adopters, governments can produce case studies and guidance that highlight the benefits and processes of undertaking energy efficiency in privately owned buildings.

Implementing a city target successfully requires dedicated financial and human resources. New York City, which committed to reducing energy use and greenhouse gas emissions from municipal buildings by 30 percent over ten years, has 17 full-time employees working toward the target, although this is an exceptionally large team.[2] Many cities employ only a few people to manage their retrofitting programs. In some cases, cities have considered budget shifts that would allow utility cost savings from existing energy efficiency measures to fund further energy efficiency programs.

Private-Sector Targets

Governments may choose to introduce targets for private-sector action on a voluntary basis. In some cases, local governments may have the authority to set mandatory private-sector targets, but this power is often reserved for national or provincial governments.

Voluntary "challenge" programs ask real estate owners to sign up to meet an efficiency target. Such challenges have proven to be popular and successful in several major U.S. cities. A private-sector challenge can be used to show how the private sector can initiate, implement, and finance comprehensive building efficiency initiatives. A voluntary program can build momentum and create the necessary support and capacity to help strengthen and expand a city's energy efficiency program.

If a voluntary private-sector target and challenge is to be successful, the government must ensure that:

- the energy-reduction target and subsequent challenge is not merely a paper agreement; it must come with an effective support program;
- incentives are put in place to maximize energy savings;
- participants proactively interact with each other to create peer-to-peer learning; and
- participants are provided with a suite of simple tools to track progress along the way.

The City of Tokyo, Japan has established a mandatory target to reduce carbon dioxide emissions from large commercial and industrial buildings, which is implemented via a cap-and-trade program (see Box 6.2).

BOX 6.2 | TOKYO'S CAP-AND-TRADE PROGRAM

The City of Tokyo has the first cap-and-trade program requiring CO_2 emissions reductions from large commercial and industrial buildings. The program was implemented in April 2010 and regulates the 1,400 largest CO_2-emitting facilities in the Tokyo area, each of which consumes more than 1,500 kiloliters of crude oil equivalent and which, in aggregate, account for approximately 40 percent of the city's building sector emissions. Between 2010 and 2014, the program required an 8 percent reduction below base-year emissions for most buildings, and a 17 percent reduction in the second compliance period between 2015 and 2019. Buildings that achieve greater reductions can sell these excess reductions to others. Tenants are obliged to cooperate with building owners in reducing their emissions. The program realized a 13 percent reduction in building CO_2 emissions in its first year and a 23 percent reduction by its fourth year of operation.

Sources: International Carbon Action Partnership. 2015. "Japan: Tokyo Cap-and-Trade Program." https://icapcarbonaction.com/index.php?option=com_etsmap&task=export&format=pdf&layout=list&systems%5B%5D=51; Environment Tokyo. 2010 "Tokyo Cap and Trade Program." http://www.kankyo.metro.tokyo.jp/en/attachement/Tokyo-cap_and_trade_program-march_2010_TMG.pdf; ICLEI. 2012. Tokyo, Japan: *Reducing Emissions Through Green Building*. http://www.iclei.org/fileadmin/PUBLICATIONS/Case_Studies/ICLEI_cs_144_Tokyo.pdf; U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Tokyo City Market Brief." http://www.usgbc.org/resources/tokyo-city-market-brief. Last accessed March 1, 2016.

Energy efficiency targets (intended reductions in energy use) can be a highly effective way for decision-makers to improve the use of energy in their communities and operations.

Setting Targets

Once a local government has decided to set an energy efficiency target, it faces a number of decisions, which generally include at least the following considerations:[3]

- Which segments of the building market will be addressed by the target, for example, public buildings or commercial buildings?
- At what level will the target be set?
- Will the target be mandatory or voluntary?
- What kind of target will be used: an absolute target expressed as a quantity of energy savings denominated in, for example, megawatt-hours (MWh) or tons of carbon dioxide equivalent (tCO_2e); or a ratio target, expressed as, for example, a percentage of appliances to be upgraded, or the quantity of energy used per unit of floor area?
- What will be the base year used, reporting interval, and timeframe?
- Are the program objectives clear (for example, reducing peak load, or using energy performance contracting)?
- How will progress or compliance be tracked?

Targets must be easily and accurately measured, so that progress toward the target can be tracked and communicated. It needs to be clear which department or agency within the local government is responsible for the target. Furthermore, decision-makers should ensure that the target does not conflict with other targets at city or national level.[4]

ADDITIONAL CASE STUDIES ON EFFICIENCY IMPROVEMENT TARGETS

Achieving Zero Energy Target by 2023 in Seoul

The national government of South Korea has set a target that all new multifamily housing will achieve net zero energy by 2025. The Seoul Metropolitan Government has set 2023 as its target year, two years ahead of the national government.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Seoul City Market Brief." http://www.usgbc.org/resources/seoul-city-market-brief. Last accessed March 1, 2016.

Public Buildings Targets in Turkey

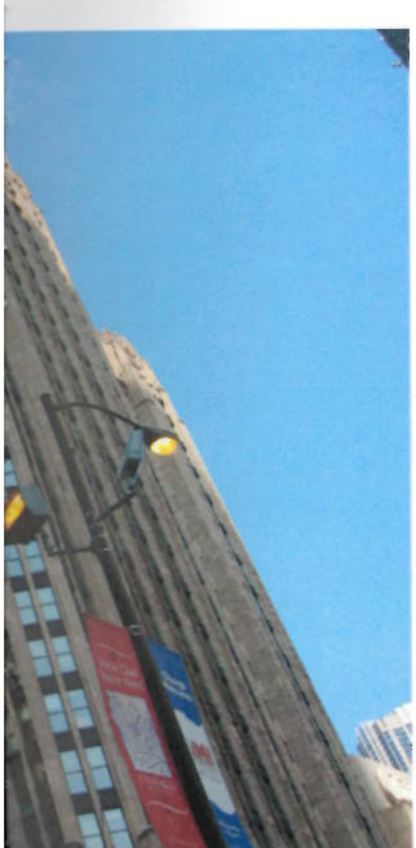
Under the National Climate Change Strategy, energy consumption in public buildings is to be cut by 10 percent by 2015 and by 20 percent by 2023, both compared with 2011 levels.

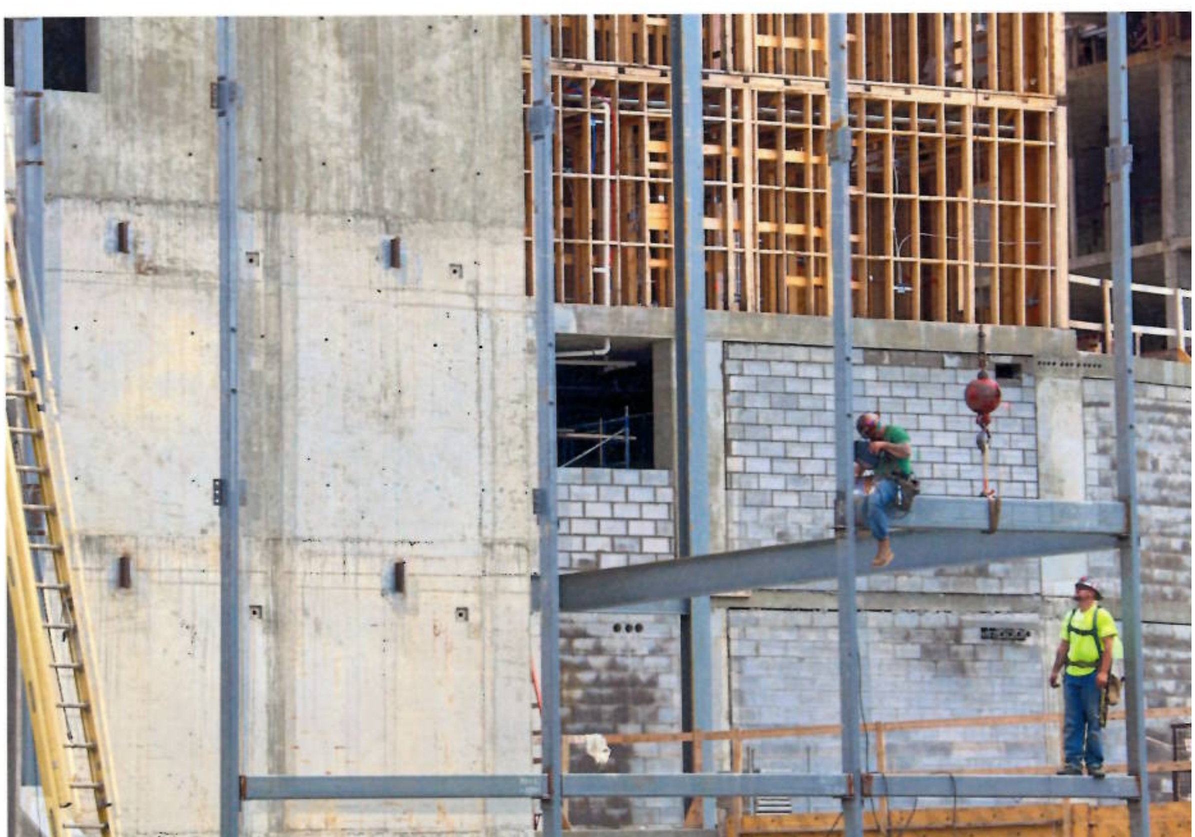
Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Istanbul City Market Brief." http://www.usgbc.org/resources/istanbul-city-market-brief. Last accessed March 1, 2016.

Building Electricity Consumption Targets in Hong Kong

In an effort to reduce the environmental burden of the buildings sector, the Hong Kong Green Building Council launched the HK2030 campaign in March 2013, to drive an absolute reduction in electricity consumption in buildings of 30 percent below 2005 levels by the year 2030.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Hong Kong City Market Brief." http://www.usgbc.org/resources/hong-kong-city-market-brief. Last accessed March 1, 2016.



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CHAPTER 7

ACTION 3: PERFORMANCE INFORMATION AND CERTIFICATIONS

Key Takeaways

- Access to information on building energy and resource consumption enables owners, operators, and tenants to make informed management decisions, and is often a prerequisite for implementation of other actions. Transparent, timely information can help track performance against goals.
- The collection of general statistical information about energy use in buildings at the jurisdictional or building scale enables better policy and program design.
- Energy performance certificates (EPC) for buildings share energy consumption information, enabling energy efficiency information to be factored into real estate decisions.
- Rating and certification programs organize building data and information into a format that enables benchmarking across a number of buildings. Benchmarking is increasingly used to differentiate buildings in the real estate market.

BOX 7.1 | USING DATA FROM BENCHMARKING IN NEW YORK CITY

An example of how energy data can be used to inform, tailor, and improve on (existing) building efficiency policies is Local Law 84 on Benchmarking in New York City. Since 2010, owners of large buildings in New York City have been required annually to measure and report on their energy consumption in a standardized manner through a free online benchmarking tool. In order to obtain whole-building energy use data for benchmarking, building owners can either acquire such information by requesting data from their tenants or by requesting aggregated monthly data from their utility.

Analysis of collected benchmarking data indicates that total energy use for these large buildings in New York City varied by a factor of about three to seven among similar properties, showcasing the potential for energy efficiency improvements. A promising use of benchmarking data in this regard is the development of the New York City Energy Efficiency Corporation's Energy Savings Potential (ESP) Tool, which uses a building's own benchmarking data to predict energy savings based on building type and fuel consumption. This can provide loan originators with greater trust in a building's projected energy savings and help standardize energy efficiency loan products.

Sources: City of New York. 2014. "LL84: Benchmarking." http://www.nyc.gov/html/gbee/html/plan/ll84.shtml.
City of New York. 2014. New York City Local Law 84 Benchmarking Report. http://www.nyc.gov/html/planyc/downloads/pdf/publications/2014_nyc_ll84_benchmarking_report.pdf.

Ratings and certificates provide an opportunity to earn public recognition and enhance the market value of high-performing buildings.

Cities and urban stakeholders are better informed and can tailor their actions to improve building efficiency when they have access to high-quality, comprehensive, and granular data on building design and energy performance. Information enables stakeholders to make better decisions on the purchase, rental, or upgrade of buildings, while ratings and certificates provide an opportunity to earn public recognition and enhance the market value of high-performing buildings.

This chapter covers a number of policy tools that help generate and disseminate building energy-performance information. Some focus on the performance of a building in use (an operational rating), while others provide an estimate of the expected performance of the building based on its design, construction, and components (an asset rating). Operational ratings can encourage improved operations and maintenance practices and encourage competition. Alternatively, the evaluation of a building's design and equipment that underlies an asset rating can provide actionable information on specific technology or design improvements to reduce energy use in the building.

Benchmarking and Baseline Development

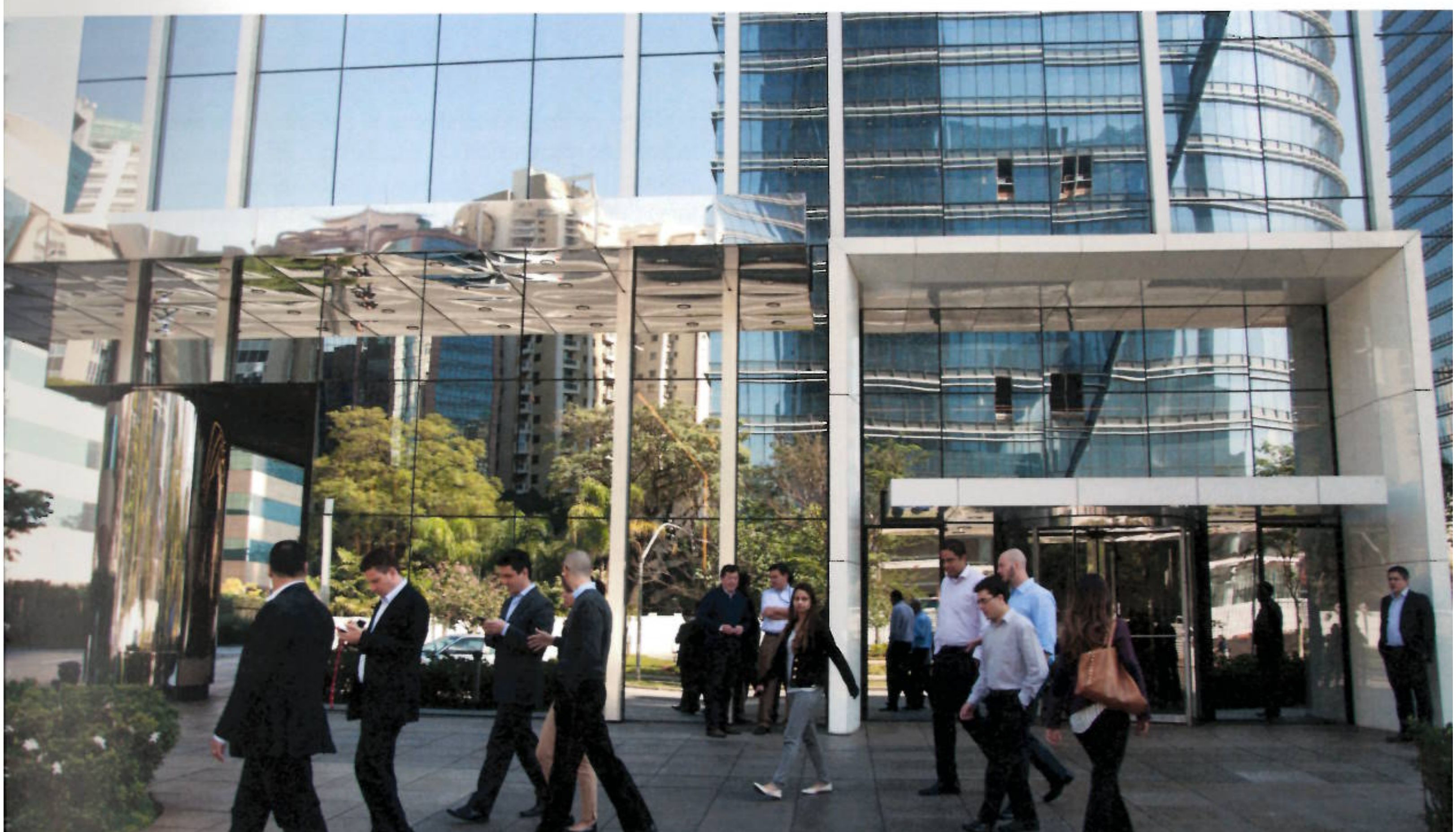
Reliable information and baselines of energy use in buildings can help support efficiency investment planning in individual buildings, as well as inform broader policy planning.

Building owners and managers can make better energy management decisions if they have reasonable and convenient access to data on energy consumption and building characteristics. Consumption data collected by utilities are particularly valuable. Building owners in possession of such data are better able to develop energy-efficient building operations, energy benchmarking, measurement, and verification of energy savings, and to participate in voluntary green building recognition programs.[1]

Benchmarking is a process for tracking energy use in a building over time, in relation to the size of the building or other building characteristics (see Box 7.1). Benchmarking results are frequently expressed as energy use intensity (EUI), measured in kilowatt-hours per square meter per year ($kWh/m^2/yr$). These results allow the building's performance to be monitored over time, and to be compared to other similar buildings. The recognized value of voluntary benchmarking in helping building owners and managers to understand and decrease their energy use has led to the introduction of benchmarking and transparency requirements in many jurisdictions.[2] Most of these policies require large building owners to benchmark their buildings regularly and report the results annually to the government or the general public. Buildings that consistently tracked their energy use have experienced energy savings.[3]

Gathering energy data is also a priority during policy design. Knowing a city's building energy baseline is key to establishing a policy monitoring, reporting, and verification system. While data availability may be limited at the outset, it can be expanded and refined over time, allowing for more tailored policies. The results of benchmarking policies, or metering data from energy utilities, can be used to develop a citywide baseline by which to manage energy use and measure progress toward goals. They can also help with market adoption of efficiency measures by providing information on technology performance and the financial payback for measures such as lighting, insulation, and cooling or heating load reduction.[4]

At a minimum, the development of building or citywide baselines requires two conditions. The first is easy access to reliable building-level utility data. If not already available, government jurisdictions may have to work with local utilities to (a) gather city-level energy-use data for baseline development, or (b) make aggregated whole-building-level energy data available to building owners for benchmarking.[5] Second, baseline development requires technical assistance and realistic policy formulation. To help manage concerns about the capacity and costs associated with benchmarking, New York City's benchmarking program initially required only the largest buildings to benchmark and submit their results. By selecting large buildings, the city tapped buildings that were likely to have the most knowledgeable managers and also allowed the city's own staff to manage a smaller data set at the outset of the program.



Energy Audits

A building energy audit, or assessment, is an on-site inspection of technologies in a building; sometimes it also includes an analysis of building energy consumption (see Box 7.2). An analysis of the data then identifies opportunities to reduce the amount of energy used. Energy audits can range from cursory to very detailed.

Policies that make energy audits mandatory can aid awareness about energy consumption and savings opportunities. In cities where energy audits are mandatory, they are usually applied to buildings over a certain size or age and conducted in 5- or 10-year cycles. Energy audits are most effective when paired with complementary policies and incentives for energy efficiency upgrades or efficient building operations. These include retro-commissioning (giving building systems a "tune-up") to ensure that building equipment is operating as intended.[6]

BOX 7.2 | HONG KONG'S ENERGY AUDIT CODE

Hong Kong's 2012 Energy Audit Code requires owners of commercial buildings, or the commercial part of composite buildings (i.e. buildings which combine several functions), to carry out an energy audit on four main types of central building services once every ten years. Recommended measures derived from the energy audit are to be classified and reported on in three categories:

- Maintenance measures with practically no investment costs and no disruption to building operations
- Measures that involve changes in operations with relatively low-cost investments
- Measures with relatively high capital investment costs

An estimate of energy savings has to be made for each measure, while for the second and third categories, a cost-benefit analysis must be conducted if capital costs are involved. Building owners may consider implementing the energy efficiency measures recommended in the energy audit but implementation is not mandatory.

Source: Yip, C.H., and W.Y. Ho. 2013. *Enhancing Building Energy Efficiency—A Concerted Effort of the Trade and the Government.* Hong Kong SAR: HK Government Electrical and Mechanical Services Department. http://www.emsd.gov.hk/filemanager/conferencepaper/en/upload/42/4th_Greater_Pearl_River_Delta.pdf.

Energy Performance Certificates

Disclosure of building energy performance provides building owners and users with information on building energy consumption. Often the performance information disclosure occurs at the time of sale or rental of the building. Energy performance certificates (EPCs) and other forms of building certification increase awareness and integrate energy performance information into real estate decision-making. Information about poorly performing buildings can incentivize efficiency improvements. Most countries in the European Union have introduced mandatory EPC labels. Some of the national policies provide asset ratings, while others provide operational ratings.[7]

In the United Kingdom, the EPC for residential buildings provides an asset rating and comes with an assessor report, using standardized assumptions about energy performance based on a building's occupancy, design, technology, and geographical location. The report includes a table indicating the approximate costs of providing lighting, heating, and hot water to the unit. It also provides a list of things the property owner can do to improve energy efficiency. For each measure, typical energy cost savings per year and the potential EPC performance ratings after the improvements have been made are provided.[8]

Rating and Certification Programs

Building rating and certification programs are used to provide recognition for a building's efficiency or sustainability. These programs are usually voluntary; they can create a spirit of competition and reward top performers. These programs can have a powerful transformative effect on the buildings market and incentivize building owners to improve building design and performance. Many programs, called green building certifications, measure a range of sustainability features in addition to energy efficiency. Governments can support voluntary rating and certification programs through public-private partnerships, financial incentives for the private sector, and by integrating them into public buildings and procurement policies.

There are numerous green building certifications in use around the world.[9] The activities of many of their governing organizations are coordinated globally through the World Green Building Council. Examples of green building certification programs include the Leadership in Energy and Environmental Design (LEED) rating system, developed in the United States, which now has projects in over 140 countries including Brazil, China, India, and Mexico,[10] and the UK-based Building Research Establishment Environmental Assessment Method (BREEAM). BREEAM has certified over 425,000 buildings since 1990, including an increasing number of buildings in other European countries, some of which use a localized version of BREEAM.[11] An example of a government-driven rating program is the Three Star Rating System for commercial buildings used by China's Ministry of Housing and Urban and Rural Development (MOHURD). As of June 2013, all new buildings constructed in Beijing, whether public or private, must achieve at least a one-star rating.[12]

ADDITIONAL CASE STUDIES ON PERFORMANCE INFORMATION AND CERTIFICATIONS

Pearl Building Rating System in Abu Dhabi

The Pearl Building Rating System (PBRS) is the green building rating system developed by the Abu Dhabi Urban Planning Council as part of its sustainable development initiative, Estidama. An Executive Council Order of May 2010 states that all new buildings must meet the 1 Pearl requirements starting in September 2010, while the minimum standard for all government-funded buildings is to meet 2 Pearl requirements. Following this mandate, significant effort has been made to align the PBRS with the Abu Dhabi Development and Building Codes.

Source: Estidama. 2010. "Pearl Building Rating System." http://estidama.upc.gov.ae/pearl-rating-system-v10/pearl-building-rating-system.aspx. Last accessed 22 February, 2016.

LOTUS Rating System in Vietnam

The LOTUS rating system, run by the Vietnam Green Building Council (VGBC), is the proprietary green building rating system for the country. LOTUS rates buildings at the design, as-built, and operational stages, measuring environmental effects, energy efficiency, and impact on occupants. VGBC's online Green Database provides consumers and stakeholders alike the opportunity to examine and explore different elements of green building.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Ho Chi Minh City—City Market Brief." http://www.usgbc.org/resources/ho-chi-minh-city-city-market-brief. Last accessed March 1, 2016.

CHAPTER 8

ACTION 4: INCENTIVES AND FINANCE

Key Takeaways

- Upfront cost is a major barrier to improving energy efficiency in buildings. A variety of programs can be designed to overcome this barrier and encourage greater investments by building owners, managers, and occupants.
- Incentives can lower the costs or increase the benefits of action. Grants and rebates as well as tax incentives help pay down some of the upfront cost of investing in energy efficiency.
- Non-financial incentives, such as granting developers priority processing of permits or a greater allowed floor area for development, may be attractive to the private market while requiring little or no investment by local governments.
- Financing products can spread the initial cost of efficiency investment over many years, allowing financial benefits to be received sooner. Revolving loan funds, trust funds, and tax-lien financing are mechanisms to expand the pool of available funds for efficiency investments.

Most building efficiency improvements require upfront investment while the benefits accrue over many years. Some efficiency measures have an attractive payback time ranging from only a few months (e.g., lighting upgrades) to a few years (e.g., highly energy-efficient HVAC equipment). In addition, replacing equipment at the end of its useful life with the most efficient option on the market makes smart investment sense, but building developers, owners, managers, and occupants do not always prioritize using their capital for energy efficiency investments. Incentives and finance are important tools to encourage decision-makers to make efficient building choices.

Financial Incentives

Cities and their partners can shift investment choices by offering financial incentives. Some of the more common types of incentives for energy efficiency programs are summarized below.

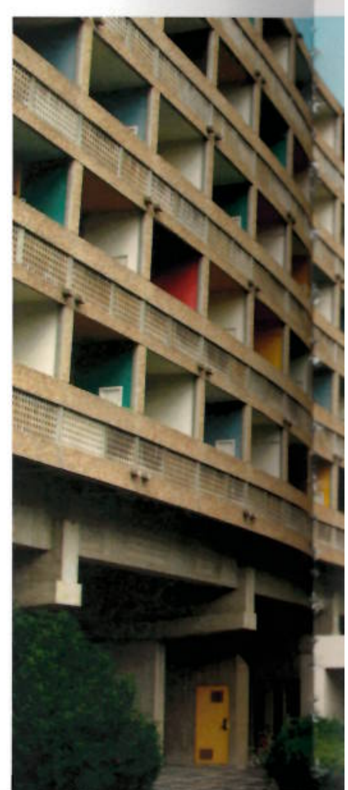
Grants and Rebates

Grants are available primarily to the commercial, industrial, utility, and education sectors. Grants are usually awarded via competitive processes. Some grants, such as the German "Kfw Energy-Efficient Renovation" program, tie their level of financial support to the energy performance pursued. This can incentivize buyers to undertake deeper energy savings rather than opt for less ambitious savings levels.

One popular market mechanism is to provide rebates for purchases of efficient equipment by households or large energy consumers. These rebates pay down costs of systems and equipment, and encourage the use and development of energy efficiency. Most rebate programs offer support for multiple technologies to promote the installation of energy-efficient products or projects, and many are run in partnership with allies like utilities. Singapore, for example, offers a "Design for Efficiency Scheme," which encourages the developers of new buildings or expansion projects to integrate energy- and resource-efficient improvements into their development plans early in the design stage. Funding is provided for up to 50 percent of the qualifying costs or S$600,000, whichever is lower.[1]

Tax Incentives

Local government can offer tax deductions to cover some or all of the costs related to building efficiency. In Tokyo, tax incentives have been made available through the "Energy Savings Promotion Scheme," targeting small- and medium-sized enterprises and exempting them from enterprise



tax when introducing energy-efficient equipment and renewable energy.[2] In Italy and France, a reduction in sales tax on energy-efficient equipment purchases reduces the cost of households' investments in energy efficiency.[3] In Brazil, the capital city Rio de Janeiro has combined a green certification scheme with tax incentives (see Box 8.1).

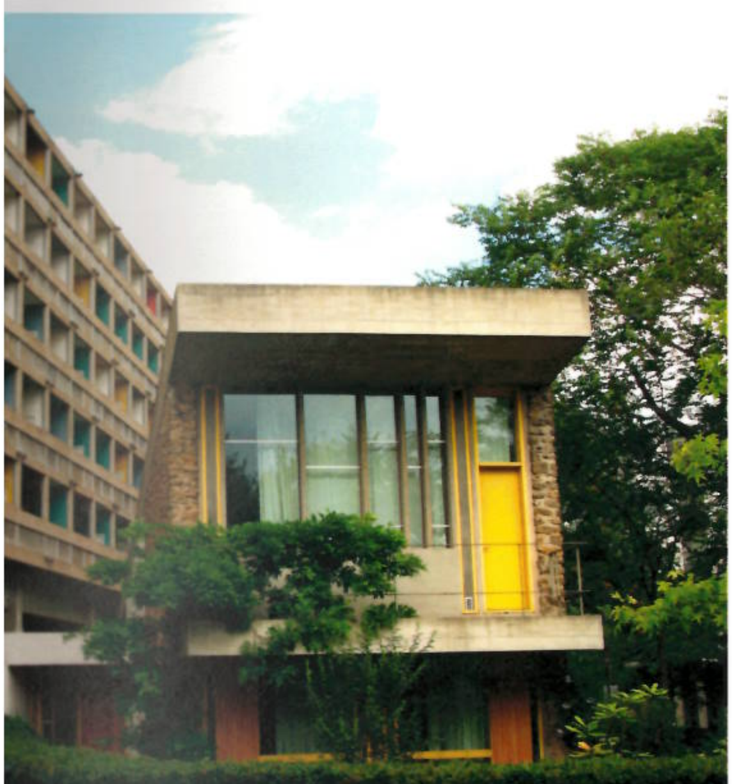
Green Mortgages

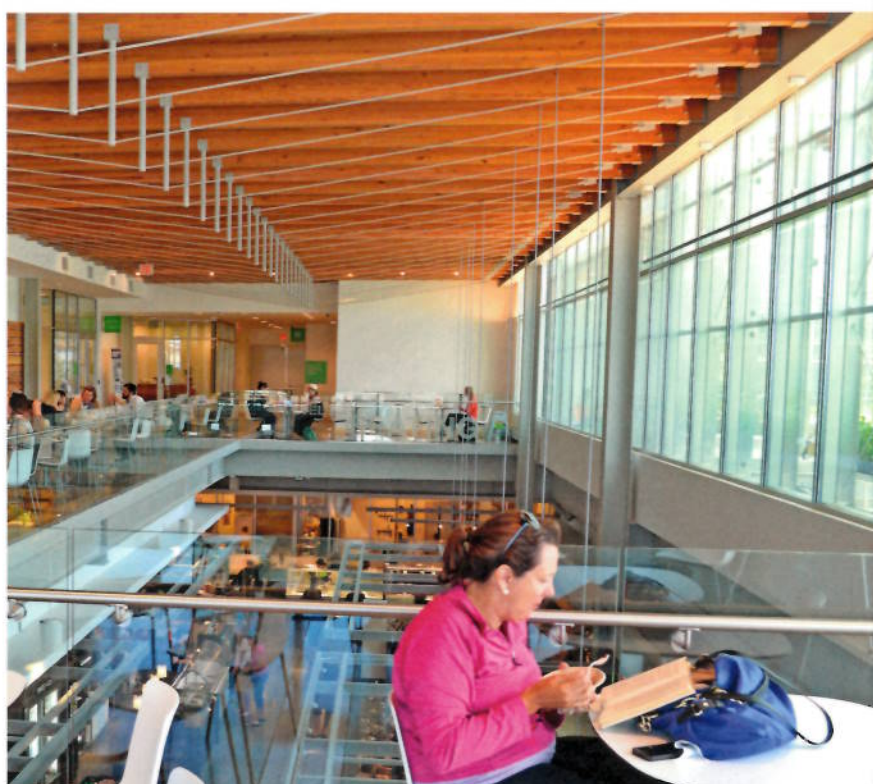
An innovative approach that allows homeowners to borrow money for energy-efficient features and repay them gradually on a monthly basis comes from Infonavit, Mexico's federally owned social housing institute. Infonavit is the largest mortgage lender in Latin America, with over 5 million mortgages on its books. Its Hipoteca Verde (Green Mortgage) Program was introduced to allow prospective homeowners to solicit additional finance as part of their mortgage to install efficient features and technologies in their future homes and thereby reduce their consumption of electricity, water, and/or gas. From 2011 onward, the Hipoteca Verde was made mandatory for anyone soliciting credit from Infonavit to buy, build, enlarge, or remodel a house. The maximum amount that can be added to the mortgage depends on salary level as well as the anticipated monthly energy and/or water cost savings.[4]

BOX 8.1 | RIO DE JANEIRO'S QUALIVERDE PROGRAM

In 2012, Rio de Janeiro adopted the Qualiverde Program, which provides a municipal definition for green building projects. New commercial and multifamily residential buildings that implement sustainability measures and achieve Qualiverde certification are eligible to receive tax benefits. Qualiverde certification is flexible and offers an array of sustainability measures for consideration and inclusion, although all certified projects must meet a minimum of 70 points derived from the measures proposed in the decree. Additionally, projects that receive 100 points are awarded Qualiverde Total certification. The decree includes various actions relating to water management, energy efficiency, and thermal performance of a project. Qualiverde-certified projects may be eligible for tax incentives, property tax reductions, or exemptions from certain local building regulations.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Rio de Janeiro City Market Brief." http://www.usgbc.org/resources/rio-de-janeiro-city-market-brief. Last accessed March 1, 2016.





Non-Financial Incentives

Government can also provide non-financial incentives, which are valuable to developers. Usually these incentives target new rather than existing buildings.

A non-financial incentive of great appeal in high-density cities with limited sites available for development is an allowance for extra height or floor area given to new buildings that meet certain green building or energy efficiency standards (see Box 8.2). Developers in Hong Kong can receive a gross floor area (GFA) concession of up to 10 percent if they pursue certification under BEAM Plus, which is Hong Kong's local green building rating and certification scheme.[5] Singapore and Tokyo have similar non-financial incentives allowing extra floor area in return for efficiency measures.

Fast-track permitting, or expediting building permits through priority processing in exchange for constructing buildings with energy-efficient or green features, is another common type of non-financial incentive offered by cities such as Seattle, San Francisco, and Chicago.[6]

Finance Mechanisms

Many efficiency investments are financed through traditional financial sources, alongside other, non-efficiency investments. However, over the past few decades, various financing mechanisms specific to energy efficiency have emerged. These mechanisms are most valuable when efficiency investments are made independently of other building investments such as a major renovation or mortgage refinance. Two important mechanisms are dedicated revolving loan funds and tax-lien financing.

Dedicated Revolving Loan Funds

A revolving loan fund uses public funds to finance energy efficiency loans (see Box 8.3). These loans are repaid to a dedicated entity, which collects and re-invests the funds in new energy efficiency projects. In most cases, the interest and fees paid by the borrowers support the cost of program administration so that the fund's capital base remains intact. Most revolving loan programs have a maximum allowable payback period and explicitly state what types of projects are eligible for funding.

BOX 8.2 | INCENTIVE SCHEMES FOR SUSTAINABILITY AND EFFICIENCY

Delhi's Sustainable Buildings Incentive Scheme
The government of Delhi National Capital Territory in India requires sustainability measures to be included in the layout plans of new buildings for plots measuring 3,000 square meters and above. The government encourages features that include but are not limited to: rainwater storage tanks, groundwater recharge measures, treatment of wastewater, sewage treatment, and solar heating systems for buildings with a roof area larger than 300 square meters. To promote these features, density bonus incentives of 1–4 percent extra ground coverage and FAR (floor area ratio) can be awarded by local bodies to project developers. Incentive amounts are based on the buildings' performance as achieved under the Indian Green Rating for Integrated Habitat Assessment (GRIHA) scheme.

Changwon's Carbon Mileage Scheme
The Changwon City Government in South Korea governs the Carbon Mileage System—an energy efficiency point system, in which households or companies earn points for their water and energy savings. The government incentivizes the program by providing cashback, coupons for various goods, and Nubija rewards (Changwon's bike share program). The more points a household or company earns, the more rewards it can receive. In 2013, 90,000 households participated in the program, contributing to an estimated CO_2 reduction of 7,580 tons for that year.

Sources: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Delhi NCT." http://www.usgbc.org/resources/delhi-nct. Last accessed March 1, 2016; U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Changwon City Market Brief." http://www.usgbc.org/resources/changwon-city-market-brief. Last accessed March 1, 2016; Neuhoff, K., K. Stelmakh, and A. Hobbs. 2012. "Financial Incentives for Energy Efficiency Retrofits in Buildings." http://aceee.org/files/proceedings/2012/data/papers/0193-000422.pdf.

Typically, revolving loan funds lend money with specific goals or borrowers in mind. Examples include funds that specifically target energy service companies (ESCOs) or educational institutions interested in enhancing the energy efficiency of their building portfolio. Most of these funds do not target individual building owners.[7] Traditional investors tend to be unfamiliar with efficiency projects and reluctant to advance funds. Revolving loan funds help to address this problem. In the case of ESCOs, for example, the number and size of projects they can take on can be severely restrained by their lack of access to the capital required for upfront financing of energy-efficient equipment. Revolving loan funds can help overcome this barrier by expanding the pool of funds available to ESCOs. Similarly, other segments of the building market, such as institutions and businesses with a sizeable property portfolio, could benefit from enhanced access to capital funding.[8]

In order for investment partners to extend such revolving loans, a dedicated credit line with the financial institution will usually be established by a public entity such as a local or federal/national government agency. The funds are provided at a low interest rate, with the finance partner lending to its customers at a higher interest rate, often the market rate.[9] Generally, the private-sector financier is expected to provide additional financing, that is, co-financing for efficiency projects. Credit lines often include technical assistance to the participating investment partner to strengthen its capacity to identify investment opportunities and manage project risks.

BOX 8.3 | THAILAND'S ENCON REVOLVING LOAN FUND

In 1992, Thailand enacted the Energy Conservation Promotion (ENCON) Act, in order to encourage energy efficiency. The ENCON Act includes a compulsory program, directed by the Ministry of Energy's Department of Alternative Energy Development and Energy Efficiency (DEDE), for certain "designated factories and buildings" to manage energy use, conduct energy audits, set energy efficiency targets, and develop a plan to reach these targets.

The ENCON Fund was financed by a levy of US$0.001/liter on petroleum products. The fund provides capital at no cost to Thai banks, which then provide low-interest loans with maximum loan terms of seven years to energy efficiency projects, including ESCOs. This has contributed to the rise of a thriving ESCO market for building efficiency in Thailand.

Source: Jyukankyo Research Institute. 2009. "Current State of ESCO Activities in Asia: ESCO Industry Development Programs and Future Tasks in Asian Countries." http://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2009/Panel_2/2.057/paper

Most building efficiency improvements require upfront investment while the benefits accrue over many years. Incentives and finance are important tools to encourage decision-makers to make efficient building choices.

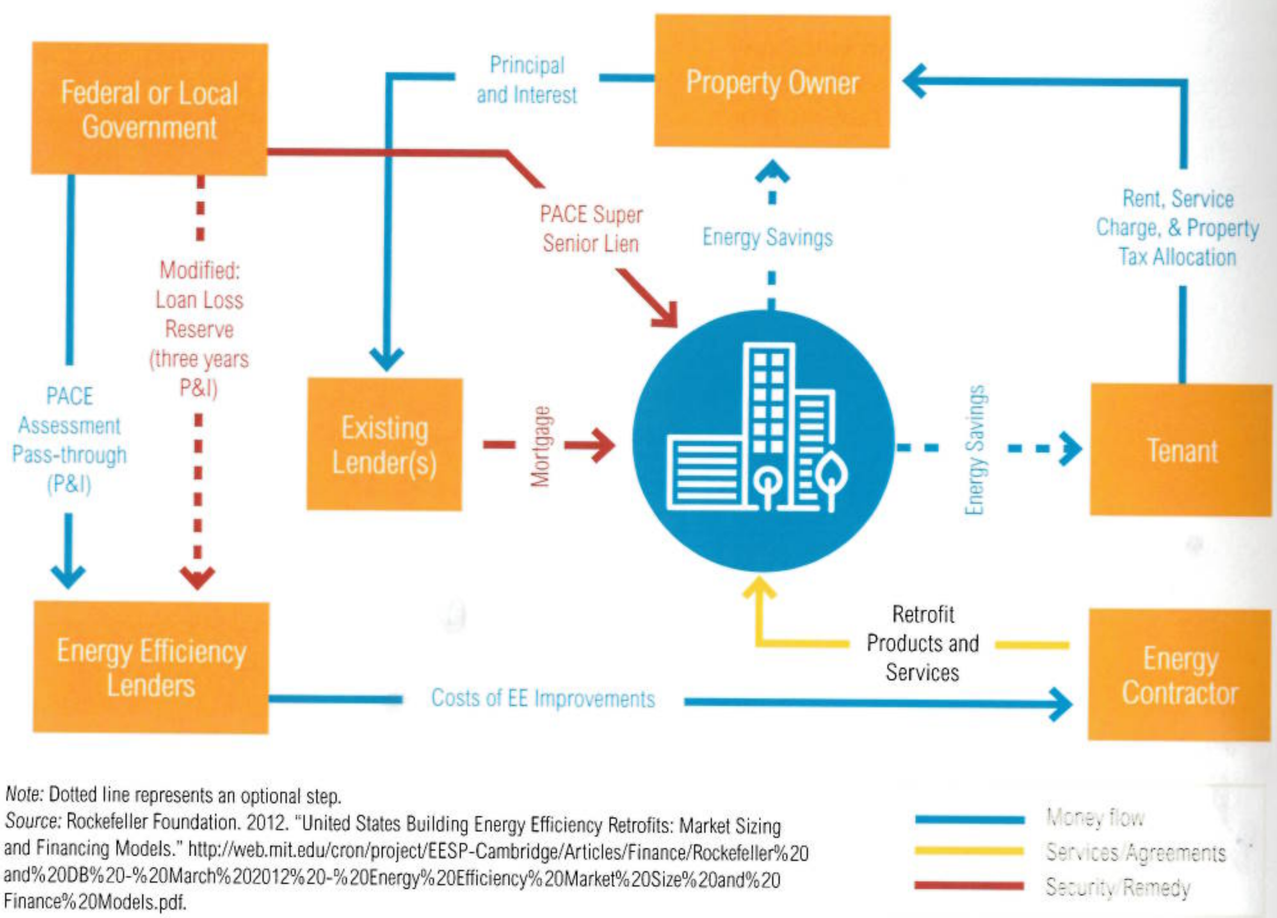
It is key that the public partner is actively engaged in review and oversight of the private investment partner's activities to determine whether modifications to the scheme are needed, and to provide supervision, oversight, and implementation support. Commitment on the part of the private investment partner's top management is also key to the long-term viability of the scheme after the public funds provided through a dedicated credit line are no longer available.

Tax-Lien Financing

Energy efficiency bonds (known in the United States as Property-Assessed Clean Energy bonds, or "PACE") allow property owners to borrow money to pay for energy efficiency improvements and repay it over several years through a special assessment on their property taxes.[10]

If a city offers bond financing linked to a program such as PACE, building owners can borrow from a government financing mechanism created exclusively for energy efficiency retrofits and small renewable energy projects. Owners repay the money over a certain period, for example a 20-year term, through a special assessment on their property tax bill. This approach makes retrofits more affordable because it spreads the cost over a longer time span. If building ownership changes, repayment will generally remain in place because it is attached to the building and not the owner.[11] For the United States, it has been estimated that US$279 billion in residential PACE investments across the country would yield more than US$1 trillion in energy savings in 10 years.[12] Figure 8.1 provides an overview of a typical PACE financing program in the United States.

Figure 8.1 | **Overview of Typical PACE Financing Model**



Note: Dotted line represents an optional step.
Source: Rockefeller Foundation. 2012. "United States Building Energy Efficiency Retrofits: Market Sizing and Financing Models." http://web.mit.edu/cron/project/EESP-Cambridge/Articles/Finance/Rockefeller%20and%20DB%20-%20March%202012%20-%20Energy%20Efficiency%20Market%20Size%20and%20Finance%20Models.pdf.

ADDITIONAL CASE STUDIES ON INCENTIVES AND FINANCE

1200 Buildings Program in Melbourne

The City of Melbourne's 1200 Buildings Program was launched in 2010 and aims to catalyze the retrofit of commercial, non-residential buildings. Access to finance is a major barrier to retrofitting and the city has worked closely with industry to develop an innovative finance mechanism called Environmental Upgrade Finance.

Source: C40 Cities. 2012. "Case Study: 1200 Buildings Program." June 15. http://www.c40.org/case_studies/1200-buildings-program. Last accessed February 22, 2016.

Building Retrofit Program in Seoul

Seoul's Building Retrofit Program (BRP) aims to save energy and boost efficiency in buildings by installing new—or improving existing—equipment. The program allows energy companies to recover their upfront investments through energy savings over time, and Seoul makes these investments possible by offering competitive loans to building owners and energy service companies.

Source: C40 Cities. 2014. "Case Study: Seoul's Building Retrofit Program." December 18. http://www.c40.org/case_studies/seoul-s-building-retrofit-program. Last accessed February 22, 2016.

Green Mark Incentive Scheme for Existing Buildings in Singapore

The Green Mark Incentive Scheme for Existing Buildings provides S$100million for owners to undertake retrofits and renovations to improve energy, water, and resource efficiency. The scheme provides cash incentives for upgrades and retrofits and co-funds up to 50 percent (capped at S$3 million) of the costs of energy-efficient equipment.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Singapore City Market Brief." http://www.usgbc.org/resources/singapore-city-market-brief. Last accessed March 1, 2016.

Tax Incentives for Building Energy Efficiency Investment in Moscow

Russian taxpayers are entitled to a three-year exemption on corporate property tax for newly introduced energy-efficient systems such as air conditioners, elevators, and computer technology. For tax purposes, investments in energy-efficient equipment can also qualify for accelerated depreciation at twice the standard rate.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Moscow City Market Brief." http://www.usgbc.org/resources/moscow-city-market-brief. Last accessed March 1, 2016.

CHAPTER 9

ACTION 5: GOVERNMENT LEADERSHIP BY EXAMPLE

Key Takeaways

- Local governments can lead by example by making their own building portfolio more energy- and resource-efficient and setting ambitious efficiency targets that create demand for efficient buildings.
- Budgeting and procurement procedures can be amended so that all government-owned and leased building space meets certain efficiency standards, and buildings use only efficient appliances, equipment, and lighting.
- Local governments can promote the use of energy performance contracts, allowing public agencies and institutions to outsource efficiency projects to an energy service company.

When local governments lead by example, making their own building portfolio more energy efficient and encouraging others to follow suit, they create demand for efficient buildings and equipment. This chapter outlines a number of strategies that governments and other local institutions can use to take a leading role in driving efficiency in the local building sector.

Improving Public Building Stock

Local governments that focus on improving the buildings they own or operate can hope to realize a number of benefits. Public agencies may save money on their energy or water bills, freeing resources for other public programs. Increased demand from local government buildings for efficient products and services will stimulate the market for such products and services and possibly lead to job creation. Further economic and social benefits can result in the form of lower utility bills for vulnerable populations living in public housing who depend on government support. And reduced overall energy consumption will reduce emissions of greenhouse gases and other air pollutants, thereby leading to improvements in public health (see Box 9.1).

BOX 9.1 | BUENOS AIRES ENVIRONMENTAL PROTECTION AGENCY: LEADING BY EXAMPLE

The City of Buenos Aires aims to reduce greenhouse gas emissions by 30 percent below 2008 levels by 2030. In 2008, Buenos Aires Environmental Protection Agency launched the "Energy Efficiency Program in Public Buildings," which analyzes and monitors energy consumption patterns from five different public buildings types in order to promote energy efficiency improvements. The program requires the implementation of a number of measures, including the development of energy management tools, employment of energy audits, and improvement of a building's operation and maintenance procedures. As of early 2015, approximately 20 buildings have undergone an energy audit and are implementing recommended efficiency improvements. Additionally, new public buildings are required to meet certain minimum environmental sustainability criteria.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Buenos Aires City Market Brief." http://www.usgbc.org/resources/buenos-aires-city-market-brief. Last accessed March 1, 2016.

Policies to improve the public building stock can be structured to apply efficiency criteria to numerous buildings including hospitals, schools, libraries, and social housing. Increasingly, the starting point for such policies is the collection and benchmarking of energy-use data for government buildings, in order to develop appropriate targets, or standards and performance requirements.

Public building portfolio improvements require funding, and local governments can consider a variety of financial sourcing options ranging from public to commercial financing. These options include budget-based funds, creating or accessing dedicated energy efficiency funds, public sector financing provided by national or regional governments, finance provided by international organizations such as the World Bank, direct access to commercial financing by banks, or issuing local government bonds.

These funding options can be represented by a "financing ladder" (see Figure 9.1), whereby local governments progress up the ladder as they move from using funds directly under their budgetary control to accessing market financing. A higher level of government capacity and capability is required in order to be able to access commercial funds, where investment parties are looking to invest only in projects with a credible implementation team and a sufficiently high return on investment. Commercial financing may also come at a greater cost.

Energy Performance Requirements

Governments can reduce energy consumption in publicly owned or managed buildings by mandating minimum energy standards or establishing energy-savings targets. Increasingly, local governments require new public buildings, as well as major retrofits of existing public buildings, to achieve a certain certification level under a relevant local or international green building rating and certification scheme.

Some cities also use public buildings to showcase innovative sustainability features, such as the Municipal Entrepreneurial Testing System in the city of New York, which allows entrepreneurs to test new green building technologies in municipal buildings before release to the market. Another step could be to use government buildings to test or promote energy-efficient appliances.[1] Establishing a private-sector advisory committee for the process of upgrading public building stock may help enhance the performance of public building improvement efforts.

Energy Efficiency Targets

A key step for a local government to "lead by example" would be to adopt and publicly announce an energy or carbon reduction goal for government-owned buildings, as discussed in Chapter 6: Efficiency Improvement Targets. This shows that the government is taking building efficiency seriously and is not placing more stringent requirements on the private sector than it places on itself. With municipal governments often owning or managing a considerable number of buildings, such a move could significantly influence the market.

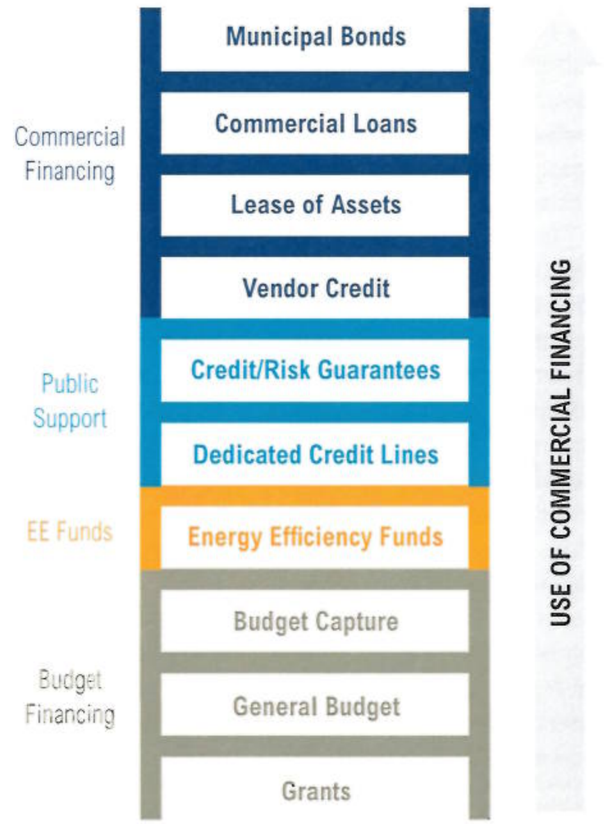
Targets can help build technical capacity, expertise, and awareness; increase opportunities for local companies; and create confidence in the feasibility and profitability of energy-saving technologies. Governments that become early adopters can subsequently produce useful case studies and guidance.

Public Procurement

How a city purchases goods and services can have a substantial impact on its overall energy costs. Indoor lighting, for example, can cost many times more to operate than its initial purchase price. Given that municipal purchasing often represents 10 to 20 percent of a local government's spending, cities can save money while demonstrating leadership in energy efficiency. Two procurement strategies—energy-efficient purchasing initiatives and energy performance contracts—have proven to be particularly effective.

Energy-efficient purchasing is ideal for new equipment purchases and simple replacements, with cities requiring or encouraging their municipal agencies to include energy efficiency requirements or preferences in procurement trajectories that favor products offering the best value in terms of energy efficiency over their lifetime, even if this comes at a higher initial purchase price. This may require clear public procurement rules, to encourage or obligate government agencies to seek the best "lifecycle" cost rather than go for the lowest upfront cost.[2]

Figure 9.1 | **The Financing Ladder: Leveraging Public or Commercial Sources of Finance**



Source: ESMAP. 2014. "Financing Municipal Energy Efficiency Projects—Energy Efficient Cities, Mayoral Guidance Note #2." https://www.esmap.org/node/4794.

When local governments lead by example, making their own building portfolio more energy efficient and encouraging others to follow suit, they create demand for efficient buildings and equipment.

Many traditional procurement policies have rigid criteria that effectively mandate the purchase of products with the lowest initial price. Other common barriers, presented in Figure 9.2, include limited institutional knowledge on energy efficiency, a lack of incentives due to budgetary restrictions and limited commercial awareness, limited financial resources to pay the higher upfront cost, behavioral inertia in a risk-averse public sector, and weak governance that can result in new risks when engaging in more complex procurement arrangements.[3]

Some common strategies for implementing energy-efficient procurement include mandating the purchase of appliances or materials with energy-efficient product labels, developing catalogues of technical specifications or qualifying products, requiring lifecycle cost (LCC) analyses to be conducted before making a purchase decision, and providing sample language for bidding documents. While cities may have little influence on national or international labeling programs, requiring products labeled at a certain performance level is an easy way to specify minimum energy performance, whereas product catalogues and LCC analyses generally require considerable time and knowledge to compile.

Successful energy-efficient procurement depends on the ability of local governments to undertake the following actions:[4]

- establish and enact sound energy efficiency procurement policies and guidelines;
- create tools to facilitate municipal agents in their procurement efforts;
- provide training and create awareness of the "what," "how," and "why;"
- conduct independent, periodic inspections to ensure the integrity of the procurement process;
- develop incentive strategies, if relevant, to counteract behavioral inertia; and
- monitor compliance and track progress.

It can be beneficial to seek partnerships with other levels of government to exchange experiences or bundle procurement to achieve better pricing. Partnerships with manufacturing associations can also ensure a ready supply of available energy-efficient products in the market.

Figure 9.2 | **Common Barriers to Energy-Efficient Procurement**

Source: ESMAP. 2014. "Driving Energy Efficiency Markets through Municipal Procurement: Energy Efficient Cities: Mayoral Guidance Note #1." https://www.esmap.org/node/4490.

Energy Performance Contracting Tenders

Chapter 11: Engaging Technical and Financial Service Providers offers more detail on the concept of energy performance contracting (EPC) and energy service companies (ESCOs). Outsourcing building efficiency to an ESCO under an EPC contract allows municipal agencies to reap the gains of energy cost-savings without the hassles of completing each step of a project using city facility management. EPC contracts are also an attractive option for municipal agencies that have only small discretionary and capital improvement budgets and a low tolerance for risk.[5]

While EPCs can be a powerful mechanism, it is more complex than purchasing a product or service. EPCs are generally a blend of goods, works, services, and financing under a public-private partnership (PPP) agreement. Furthermore, EPCs are designed to be output-based contracts (energy cost savings) rather than equipment-purchasing contracts involving delivery of pre-specified materials or goods.

Public budgeting is also a critical element because agencies need to be able to retain the accrued energy savings from their operating budgets in order to compensate the ESCO. If the municipal budget were to be reduced when energy costs fall, the municipality would be unable to repay the financing costs of the energy efficiency projects.

ADDITIONAL CASE STUDIES ON GOVERNMENT LEADERSHIP BY EXAMPLE

Energy Efficiency of Public Buildings in Kiev

1,270 public buildings in the city of Kiev—including healthcare, educational, and cultural facilities—were retrofitted with cost-effective, energy-efficient systems and equipment. Based on the project's success, many other cities in Ukraine have requested information on the project and expressed interest in implementing similar retrofits in their public buildings.

Source: ESMAP. Case Study: Good Practices in City Energy Efficiency, Kiev, Ukraine—Energy Efficiency in Public Buildings. http://www.esmap.org/node/656. Last accessed February 22, 2016.

Energy Efficiency of Public Buildings in Buenos Aires

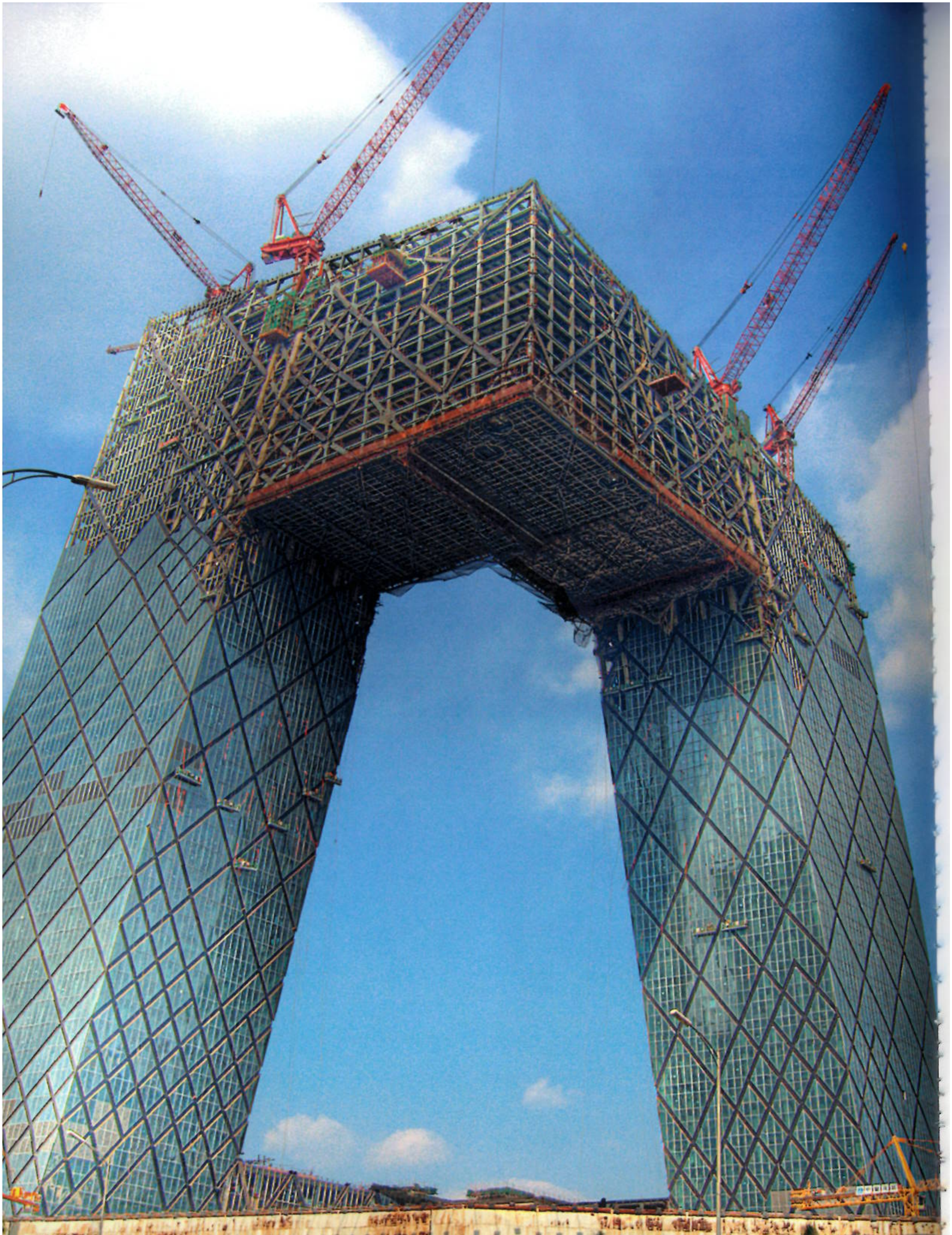
The financial savings of building retrofits were not significant due to the low cost of energy in Buenos Aires. Therefore, implementation of the program was based on the leadership's decision to send a signal that reducing energy consumption was a priority, without consideration of economic aspects.

Source: ICLEI. 2011. "Buenos Aires, Argentina—Energy efficiency of public buildings in Buenos Aires: The case of an office building." https://casesimportal.newark.rutgers.edu/storage/documents/budgeting_finance/public/case/energy_efficent_public_buildings.pdf.

Green Building Standards for Affordable Housing Projects in Shenzhen

In 2010, the Shenzhen Municipal Government issued mandatory rules to employ specific green building standards for affordable housing projects.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Shenzhen City Market Brief." http://www.usgbc.org/resources/shenzhen-city-market-brief. Last accessed March 1, 2016.



CHAPTER 10

ACTION 6: ENGAGING BUILDING OWNERS, MANAGERS, AND OCCUPANTS

Key Takeaways

- Buildings are generally designed, constructed, financed, and managed by private-sector actors. Partnerships between the private sector and local governments are essential to achieve widespread success.
- Cities can help overcome "split incentives" between building owners and occupants by guiding the real estate market with green lease contract clauses, which align the interests of owners and tenants.
- Behavior change among private-sector actors can be motivated by workplace engagement programs, competitions, challenges, awareness campaigns, and other incentives that reward the best performers.
- Strategic energy management (SEM) uses coaching, education, and training to teach building owners and managers the business case for energy efficiency practices, and to adopt them.

This chapter and Chapter 11 discuss the strategies that can be employed by local governments to mobilize a variety of actors—building owners, managers, occupants, technical service providers, and financial organizations—to contribute to building efficiency. The majority of buildings in any city are usually built, managed, maintained, and retrofitted by private-sector actors. Transforming buildings to be more energy efficient is an easier task when these actors can clearly see the benefits of making energy efficiency investments. Aligning the interests of all these stakeholders to deploy building efficiency at scale requires engagement with and buy-in from the private sector.

Motivating Private-Sector Action for Energy Efficiency

Local Partnerships for Efficient Buildings

A range of major cities including London, Toronto, and Sydney have started "Better Buildings" partnership programs to proactively support real estate markets with information, tools, and technical and market support in order to accelerate building efficiency. These programs, which are often low-cost and relatively simple to run, set a broad voluntary building efficiency goal, share best practices, and facilitate a degree of competition among participants. Cities typically provide a range of toolkits or playbooks that answer critical questions such as how to engage and motivate people within the organization, and offer strategies on how to pay for building efficiency, how to access data, and how to implement projects and track progress.

In most buildings challenge partnership programs, participatory partners either self-organize in technical working groups to work on overcoming common barriers, or the city provides a dedicated team to offer technical resources, provide matchmaking support for participants, and identify technical and market solutions helpful in implementing projects.

Partnerships can be leveraged to develop and pilot new energy efficiency deployment models, support members as they test these models for viability in real-world settings, and help members to commercialize and scale up their projects. Results of such pilots can subsequently be shared in the wider marketplace through knowledge dissemination and events.[1]

Green Leases

A common barrier to energy efficiency is split incentives (mismatched incentives between parties, where, for example, a building owner is financially responsible for making building improvements but the tenant benefits from the lower energy bills). One approach to overcome this is the use of "green leases."

These leases, now applied in a range of countries such as the United States and Australia, and more recently in Singapore and Hong Kong, motivate tenants to conserve energy and/or water, produce less waste, and choose environmentally friendly products, furnishings, and office equipment (see Box 10.1). They often include provisions to ensure that tenants comply with the building's green practices.

BOX 10.1 | SINGAPORE'S GREEN LEASE TOOLKIT

In 2014, Singapore released a green lease toolkit to "aid landlords and tenants in working together to improving their environmental performance over the life of the building which they manage or occupy." The toolkit includes examples of a green lease agreement between owner and tenant for offices and for retail. It sets out environmental objectives on how the building is to be improved, managed, and/or occupied in a sustainable manner.

The green lease toolkit provides a list of standard clauses that can be included in a lease contract. It also includes specific provisions for monitoring and improving energy efficiency, water efficiency, outdoor and indoor air quality, sustainable material and waste management, as well as instruction on how efficiency improvement costs and energy bill savings can be attributed.

Source: Singapore Building and Construction Authority. N.d. "Sustainable Built Environment." http://www.bca.gov.sg/sustain/sustain.html.

Three key elements of a green lease are:

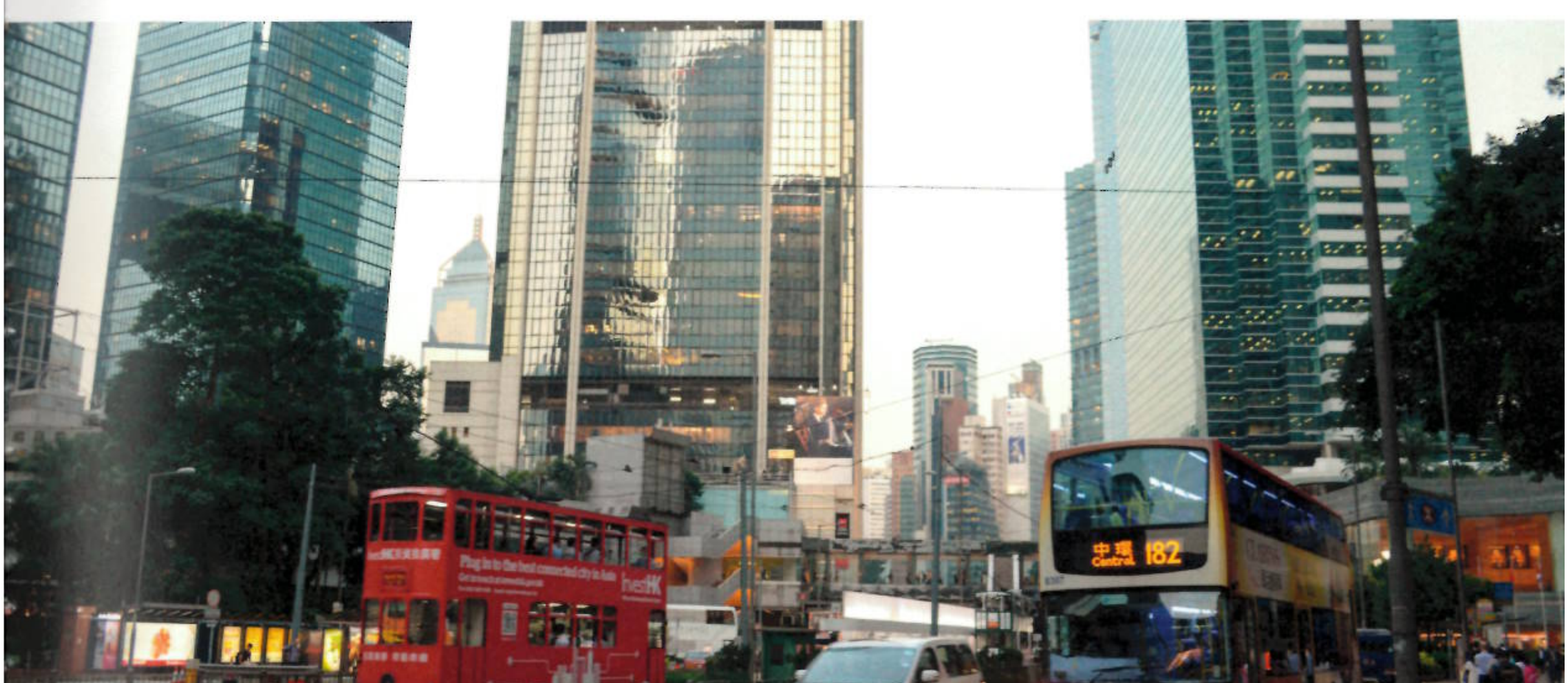
- **Net lease contract.** Unlike an all-inclusive lease, a net lease requires the tenant to pay for taxes, insurance, maintenance, and utility expenses in addition to a basic monthly rent for the premises. This gives the tenant incentive to make energy efficiency a priority, because the tenant directly recovers any investments in efficiency over the lease term.
- **Sub-metering.** By sub-metering energy and water delivered to individual tenants, building owners can bill for actual usage and peak demand. This practice, combined with a net lease structure, motivates tenants to conserve. It also allows the owner to use a fee/rebate incentive system to install appropriately sized electrical and mechanical systems.
- **Capital cost pass-through.** Under a green lease, owners have the right to pass on to tenants the cost of capital improvements such as window replacements or HVAC systems that lower total operating costs. The tenants, who pay the utility bills, then benefit from energy savings as a return on investment.

A collaborative green leasing process can create a win-win, helping tenants to lower operating costs, and helping owners by improving building value and marketability.

Certification Schemes and Building Upgrades

The demand for efficient office buildings is increasing rapidly, driven in part by the success of green building rating and certification schemes (see Box 10.2). Nonetheless, building efficiency investments often require additional upfront costs and, in the case of retrofits of existing buildings, may cause disruptions to building occupants' daily activities. The payback period of the efficiency measures can also differ considerably. These inconveniences and capital investments mean that a business case for efficiency investments for building owners and managers may require more than a simple energy cost savings story. To make the case regarding the value of investing in efficiency, it is helpful to tap into the motivations of decision-makers and demonstrate how energy efficiency can contribute to those goals.

For example, building efficiency upgrades can be made more feasible, affordable, more financially valuable, and less disruptive, if they are timed to coincide with other events in a building's lifecycle, such as a scheduled replacement of roof, windows, HVAC, or other major envelope or equipment, or at the time of a major occupancy change. This approach of timing the efficiency investment along with other investments was adopted successfully for the retrofit of the Empire State Building in New York City.[2]



BOX 10.2 | BETTER BUILDINGS IN HO CHI MINH CITY THROUGH EDGE

EDGE (Excellence in Design for Greater Efficiencies) is a voluntary building certification system, developed by the International Finance Corporation (IFC), which comes with free software for designers to select technical solutions while estimating the additional upfront costs and the payback period.

Developer Nam Long Investment Corporation was among the first to receive an EDGE certification in Vietnam for its Bridge View Apartments. The company aims to build an average of 2,000–3,000 energy-efficient residences annually, providing affordable housing units for 70,000 low- to middle-income families in Ho Chi Minh City. With additional construction costs of merely 2 percent, Nam Long's building concept deploys building efficiency solutions that will cut energy use by up to 31 percent, water use by 22 percent, and construction materials by 34 percent. This in turn lowers the monthly utility bills for owners and tenants.

RESOURCE EFFICIENCIES	TECHNICAL SOLUTIONS
Up to 31% lower energy bill	Reduced window to wall ratio, external shading devices, reflective paint for external walls and roof, insulation of external walls and roof, higher thermal performance glass, and energy-efficient lighting
Up to 22% lower water bill	Low-flow showerheads, low-flow faucets for washbasins and kitchen sinks, and dual-flush water closets
Up to 34% less material use	In-situ reinforced concrete slab for floor and roof, autoclaved aerated concrete blocks for internal and external walls

Sources: International Finance Corporation. 2015. "Nam Long—EHome 5: The Bridgeview." http://www.ifc.org/wps/wcm/connect/a4104880476dea4f880ffd299ede9589/Snapshot+-+Nam+Long.pdf?MOD=AJPERES; International Finance Corporation. 2015. "IFC Launches EDGE Green-Building Certification System in Vietnam." http://ifcextapps.ifc.org/ifcext%5CPressroom%5CIFCPressRoom.nsf%5C0%5CA9DCEA482492AC7B85257E5A0008F34A.

Energy Savings through Improved Operations and Behavior-Change

How buildings are used, operated, and maintained by their owners, managers, and occupants are primary factors in determining energy use. In some buildings, like owner-occupied single-family residences, the owner, manager, and occupant are the same person. But in many other buildings the relationship is more complicated. Owners, who may be off-site, may not be directly responsible for any energy consumption, yet have control over the building itself and major services and equipment. The building may be under third-party management, with the building manager, who reports to the owner, handling the maintenance and operations of the building. Occupants, or tenants/lessors and their employees, may set the thermostats, etc., but have little physical or financial control over the energy use of the building itself. These distributed and different influences over energy use and decision-making are at the heart of the split-incentive issue. To address them, "behavior-change" programs to motivate greater energy efficiency practices have become increasingly popular. These programs focus on changing habits and values and are popular because they are:

- adaptable to diverse building types and operational settings;
- flexible and responsive to specific cultural practices;
- inexpensive, needing little to no capital investment;
- independent of technology; and
- quick to begin paying returns.

Successful behavior-change programs occur across a spectrum of building types, and are popular with hospitals, universities, and managers of municipal properties.[3] However, it is always important to take the local setting into account when designing a behavior-change program because cultural factors can affect the energy savings generated.

Behavior-Change Strategies

Four major strategies for behavior-change, targeting specific actors, are described here. These strategies are competitions, occupant engagement, feedback, and strategic energy management (SEM). Their costs range from inexpensive (competitions) to relatively capital-intensive solutions such as feedback devices.

Competitions and Challenges

Competitions and challenges have become commonplace in the energy efficiency and sustainability arenas. They involve games that use a combination of social interaction and reward mechanisms to engage building stakeholders. Games have the advantage of being a true "cultural universal" in that they have been a part of every human culture in history. Competitions refer to games where one or more players play against one or more players. Competitions scale well because individuals, school campuses, neighborhoods, cities, even states can all play them. Challenges refer more specifically to baseline-improvement scenarios. Challenges typically involve an individual, household, or community trying to improve performance relative to its own baseline, as opposed to outperforming another group.

Competitions and challenges are flexible enough to be applicable to a variety of uses and settings—owners of commercial properties can challenge their tenants, as Shorenstein Associates (USA) did with their "I will if you will" tenant engagement program, which was inspired by WWF Earth Hour. With a portfolio of 20 participating buildings, over a period of three months, the challenge netted a "1,600 kWh reduction and 18 percent below baseline [energy] use."[4] Governments at all levels can design and run competitions and challenges to publicly reward the best performers as a way of encouraging building efficiency. Rewards can be, but do not have to be, monetary so they are appropriate for budgets of any size.

Similarly, indexes like the Urban Competitiveness Index (IMCO) and the Urban Sustainability Index (Banamex) in Mexico have cities competing for the top spot, while New York City's "Carbon Challenge" program has seen 17 leading universities, 11 of its largest hospital organizations, 12 global companies, and 16 residential management firms accept its challenge, pledging to match the local government's goal and reduce building-based emissions by 30 percent or more in ten years.[5]

When considering implementing a challenge, competition, or other type of game, a good question to ask is, "What kind of experience do you want your player to have through your game?" Research on games suggests that these kinds of programs are most effective when they provide an engaging experience first, and only secondarily operate as a platform for behavior change.[6] Different cultures have different values, and so local building challenge implementers should take care to align with those values when designing a program.

Occupant Engagement

Occupant engagement programs seek to change levels of energy consumption by tenants in commercial office buildings. With the rise in sub-metering, and leases that charge for energy consumption, more and more commercial tenants are seeing the benefits of curbing energy usage and saving money. Effective programs use multiple means to reach office workers, including messaging and educational efforts, some form of short-interval feedback, behavioral "nudges," and the presence of a social component (e.g. forums, teams, peer champions). Key factors for producing successful engagement programs can include:[7]

- mapping traditional local habits with negative or positive impact to the environment;
- avoiding charts and other abstract representations when faced with low-literacy users; and
- creating local connections with a user's location.

A workplace program in the United Kingdom, where four office buildings in London with 1,100 employees took part in a month-long program, aimed at reducing energy consumption through behavioral interventions alone. The program resulted in a 40–50 percent decrease in energy use from computer monitors left on during non-working hours.[8]

Regardless of the methods used, people will tend to fall back into old behaviors unless there are ongoing incentives and program structures that offer support for new behaviors. Tools from the social sciences that are effective in changing behaviors more permanently include such things as commitment pledges, physical prompts, and the removal of barriers that prevent people from adopting the desired behavior.

Occupant Feedback

Feedback refers to behavior changes that result when individuals receive information about their actions as they affect energy consumption. Energy consumers, for example, may receive "real-time feedback" about appliances in their home, delivered via a smartphone application. Such programs often yield average energy savings in the range of 3–12 percent.[9] A study of occupants of university residential housing in China showed that their feedback program ultimately resulted in 23 percent of participants adopting the program for long-term use, and more than 60 percent saying they would continue to use at least one feature.

Depending on the cultural context, feedback might be "tweaked" to reap the best results. Researchers in India recommend providing "point-of-use feedback" or messages suggesting what efficiency actions should be taken rather than simply providing consumption data and expecting a subsequent action. A UK study reviewed the literature on energy-related behavior change in office buildings, and the authors identified a number of successful features, including:

- group-level feedback facilitates energy-saving behavior;
- peer educators (coaches) facilitate energy-saving behavior; and
- moderate changes are more effective in the long term than are drastic changes.

Strategic Energy Management

Strategic energy management (SEM) is a comprehensive approach enabling firms to assess their opportunities for energy savings and efficiency investments (see Box 10.3) It comprises an audit and a set of trainings for staff responsible for various energy-related decisions, or who otherwise engage in energy management. SEM is best conducted by a neutral, external party such as a utility (or comparable energy provider) or other program administrator. SEM approaches generally aim to collect data on how buildings are operating, then target some "low-hanging fruit" for early energy efficiency wins. Energy-savings measurements then strengthen the case for future, larger capital projects, and savings are used to pay down larger projects.[10]

BOX 10.3 | IMPROVING ENERGY EFFICIENCY AT PERSTORP IN SWEDEN

Swedish-based chemical company Perstorp was energy intensive, with energy costs approaching 15 percent of costs. In 2005, when the Swedish Energy Agency launched the Programme for Improving Energy Efficiency Act (PFE), Perstorp decided to join and improve efficiency through better strategic energy management. At that time, strategic decision-making around energy at the corporate level in Perstorp included matters such as investment analyses and implementation of safety regulations.

Through 2007 and 2008, Perstorp initiated a set of energy-saving programs aimed at increasing the awareness of energy management at the corporate level. Engineers from cross-functional departments met and discussed energy issues. Optimization of energy was on the agenda, including measures for minimizing energy losses and finding additional savings potential across the company. The authors argue that even more could have been done in terms of generating additional revenues by, for example, finding new markets for waste heat generated through production. Because this was an internal effort, it could have been refined through engagement of external advisors in the energy sector.

Source: Rudberg, M., M. Waldemarsson, and H. Lidestamb. 2013. "Strategic Perspectives on Energy Management: A Case Study in the Process Industry." Applied Energy (104): 487–496. http://www.sciencedirect.com/science/article/pii/S0306261912008203.

Research by the Houston Advanced Research Center identifies five basic components of SEM, best implemented in the following order:[11]

1. Plan for measurement and verification activities.
2. Introduce data management and benchmarking protocols.
3. Implement low-cost and no-cost measures (retro-commissioning, preventative maintenance).
4. Start behavioral management programming.
5. Perform capital investments and upgrades.

Much of the value from strategic energy management, as well as the other behavioral efficiency strategies, comes from the human element. Owners and managers of buildings can implement many of the suggestions described here with relatively little upfront capital investment. However, all of them require a commitment to managing people and processes that need time, labor, and some capital to maximize their effectiveness.

ADDITIONAL CASE STUDIES ON ENGAGING BUILDING OWNERS, MANAGERS, AND OCCUPANTS

Empire State Building Retrofit in New York City

A comprehensive retrofit of the Empire State Building saved $4.7 million in two years. The project provides an important example of what can be achieved in large commercial buildings when owners, managers, tenants, and partners come together to improve energy performance of buildings.

Source: C40 Cities. 2013. "Empire State Building: Class-leading Project Exceeds Efficiency Targets." Blog, June 24. http://www.c40.org/blog_posts/empire-state-building-class-leading-project-exceeds-efficiency-targets. Last accessed February 23, 2016.

Build Back Smarter in Christchurch

Build Back Smarter, which supports homeowners in making informed choices about repairs and new building projects, aligns funding (if needed) and assists with installation to make homes warmer, dryer, more affordable to heat, and more water-efficient.

Source: Christchurch City Council. "Build Back Smarter." http://www.ccc.govt.nz/environment/sustainability/build-back-smarter. Last accessed February 23, 2016.

Behavior Change Program in Cape Town

The city began to retrofit its public buildings in 2010. Each building that receives a retrofit also receives a smart meter and is included in a comprehensive Behavior Change Program that provides training and resources to building managers and occupants.

Source: World Green Building Council. 2013. WorldGBC Government Leadership Award Winners. http://www.worldgbc.org/files/4513/8489/6954/Govt_Leadership_Awards_Publication_2013_-_Web.pdf. Last accessed March 1, 2016.

Low-Income Energy Efficiency Housing Project in Cape Town

Through the installation of solar water heaters, ceiling insulation, and compact fluorescent lamps in over 2,000 homes, the Kuyasa project has been able to save 7.40 million kWh and 6,437 tons of CO_2 emissions on an annual basis, savings of 34 percent and 33 percent respectively compared to the pre-project baseline. The project partners actively engaged the Kuyasa residents to help with implementation of the retrofits and, as a result, the community benefitted immensely from technical training and capacity building for residents, job creation, and an enhanced sense of ownership and responsibility.

Source: ESMAP. "EECI Good Practices in City Energy Efficiency: Cape Town-Kuyasa Settlement, South Africa—Low-Income Energy Efficiency Housing Project." https://www.esmap.org/node/1329. Last accessed February 23, 2016.


SEGUROS
LATINOAMERICANA

CHAPTER 11

ACTION 7: ENGAGING TECHNICAL AND FINANCIAL SERVICE PROVIDERS

Key Takeaways

- Local governments can design policies, programs, and guidance to support the development of building efficiency products and services, including financing.
- Policies that enable energy performance contracting can speed up the deployment of this business model in which energy bill savings are used to repay an investment in energy efficiency.
- A skilled workforce is essential to completing projects that effectively achieve energy and resource savings. Local government can support workforce training.
- Risk mitigation programs, such as loan guarantees, make efficiency financing a more attractive market for private lenders and can help overcome the reluctance of financial institutions to invest in energy efficiency.

This chapter covers strategies for local governments and other urban stakeholders to engage and support private-sector technical building service providers who develop, install, maintain, and retrofit construction materials, components, and equipment. It also addresses the investment partners who must be involved in order to accelerate the uptake of building efficiency. While Chapter 8 focused on financial incentives that can be implemented by local government to stimulate demand for efficiency (e.g. grants and rebates) this chapter includes measures that can help to mobilize improved supply of finance from commercial lenders and investors. Figure 11.1 shows the position of all these stakeholders in the building efficiency value chain.

Accelerating energy efficiency requires the presence of suppliers in the market to provide energy-efficient materials, equipment, and technical services, as well as financial services. Suppliers include manufacturers, architects, contractors, building science specialists, and private investment partners such as banks. These stakeholders not only provide services, they can also play an important role as "ambassadors" for energy efficiency, helping to persuade owners and tenants of the value of efficiency investments and, thus, increasing demand.[1]

Cities can support these stakeholders in the market with specific guidance on how to make building efficiency work for everyone. Successful guidance depends on local governments and other city stakeholders working with providers in order to understand the supply side of the current market, including the providers' concerns and market, policy, or other barriers, before developing a supportive policy framework.

Engaging Technical Service Providers

Supporting Business Development for Contractors

Contractors and construction trades are on the frontline of interacting with building owners and occupants. It is their business to understand what building occupants may need or want to improve the performance of their building space. Developing workforce standards, extending incentives and training, and providing marketing materials and other support to these service providers can enable and spur them to make building efficiency a central element of their businesses.

Figure 11.1 | **Stakeholder Roles and Periods of Engagement in the Process of Enhancing Building Efficiency**

NEW BUILDINGS			EXISTING BUILDINGS				
Land Use/ Planning	**Design**	**Construction**	**Sale or Lease**	**Tenant Build-Out**	**Operations & Maintenance**	**Retrofit**	**Demolition & Deconstruction**
Local governments Developers and self-help builders	Design & construction professionals National and provincial governments Local governments	Design & construction professionals Building investors Suppliers & manufacturers	Buildings owners and managers Developers and self-help builders Building occupants	Buildings owners and managers Building occupants Design & construction professionals	Buildings owners and managers Energy utilities Building occupants	Buildings owners and managers Building investors Building occupants Design & construction professionals	Design & construction professionals Buildings owners and managers

Source: Adapted from World Business Council for Sustainable Development. 2015. Figure adapted from "Energy Efficiency in Buildings, Business Realities and Opportunities: Facts and Trends."

For many contractors, "selling" efficiency requires a significant shift in their business models, from simply selling products to selling managed product-service offerings, which include a combination of products and related services to ensure optimum performance and value. Sales and marketing training, as it relates to selling energy-efficient products and/or services, and helping qualified contractors to develop project pipelines by including them on preferred or pre-approved vendor lists, can boost the availability of energy-efficient offerings in the local market. Setting workforce standards or certifications for contractors involved in energy efficiency can help develop trust and ensure quality. Introducing energy efficiency program incentives such as rebates to lower upfront project costs for their customers helps enlarge the market share of energy-efficient offerings.[2]

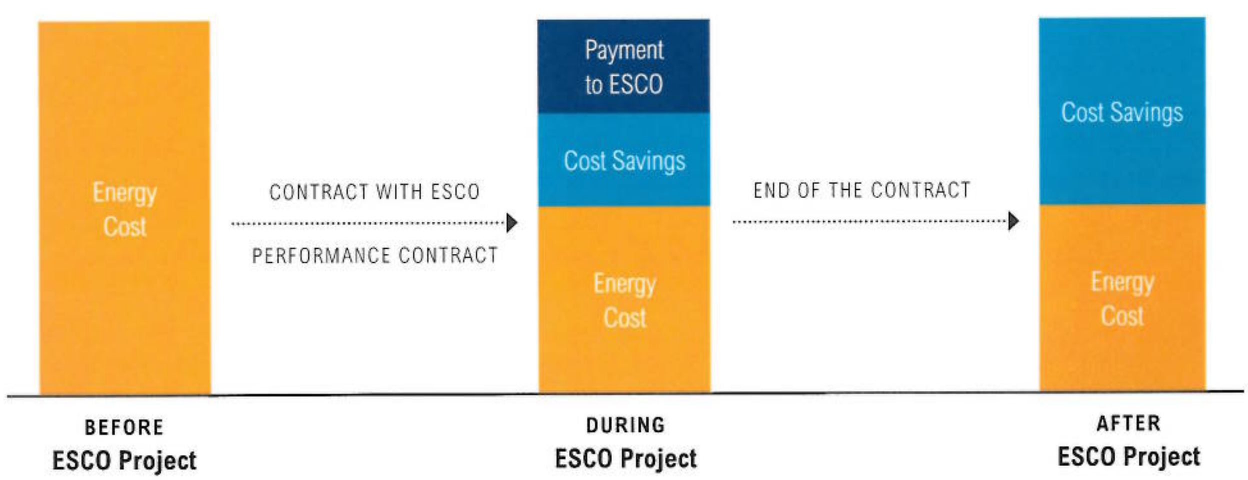
Policies to Enable Energy Performance Contracting

Energy performance contracts (EPCs) are financing mechanisms that allow energy efficiency investments to be repaid through realized energy savings over time. Energy-inefficient equipment and systems are replaced with energy-efficient technologies, and the capital investment, installation, commissioning, and ongoing management are paid for by an Energy Service Company (ESCO) or third-party financier. The building owner pays the ESCO from the operational energy savings created over a set period of time up to 20 years.[3] ESCO payments are directly linked to the amount of energy saved, with no need for upfront capital investment by the building owner. One of the appealing features of performance contracting is that, during installation and for the duration of the contract, the ESCO assumes the performance risk of the project.[4]

The largest ESCO markets can be found in the United States and China. In Asia, other successful examples include Japan, Thailand, and Malaysia. Market-focused ESCOs usually work in specific sectors. In the United States and Europe, for example, "MUSH" buildings (municipal, utility, schools, and hospitals) are a key focus for many ESCOs.

One of the most common types of EPC in the United States is the guaranteed savings contract. These contracts are characterized by an agreed minimum rate of savings to be met, and the difference between the current energy use and the new energy use levels is used to pay back the ESCO or the financial institution. Another popular type of EPC contract is the shared savings contract, whereby energy cost savings are shared between the building owner and the ESCO. Generally, shared forms of contract are financed by the ESCO rather than by a third-party financial institution. Payments to the ESCO may be a fixed percentage of savings, a minimum fee plus a share of the savings, or a scaled fee that decreases over time as the ESCO recoups its investment. Figure 11.2 shows the typical cash flows before, during, and after an energy performance contract with an ESCO.

Figure 11.2 | **Example of Exchanged Cash Flows Throughout a Shared Savings EPC/ESCO Project**



Source: Syntropolis. "Energy Service Companies." http://syntropolis.net/knowledgehub/encyclopedia/energy-service-companies/.

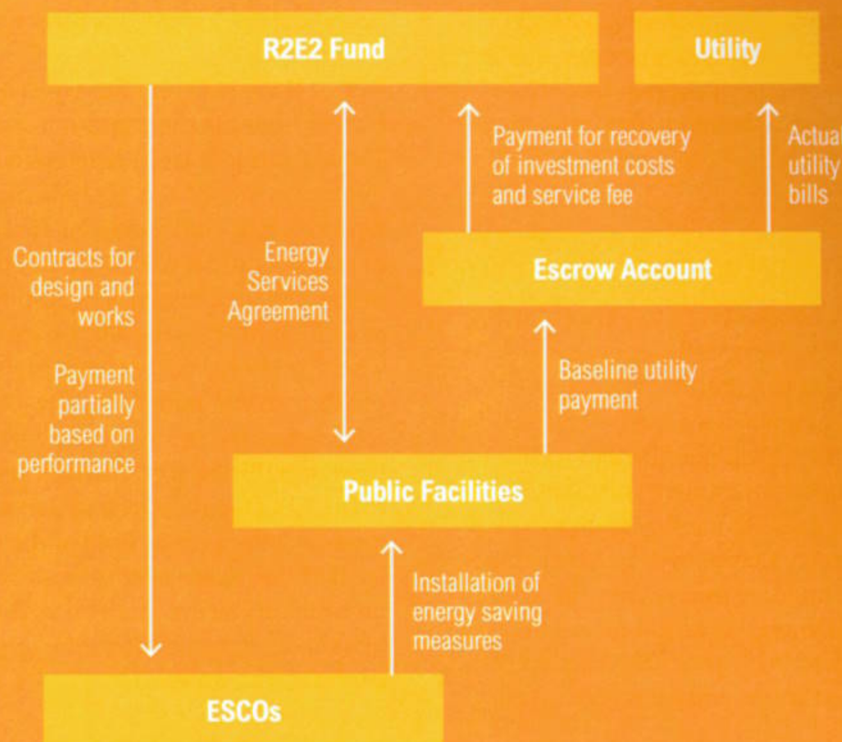
BOX 11.1. MUNICIPALITIES IN ARMENIA CAPTURE ENERGY SAVINGS

The R2E2 Fund is an investment facility for renewable energy and energy efficiency in Armenia, which finances municipal building retrofit projects through the scheme illustrated below, with ESCOs being contracted through the fund for the installation of energy-efficient equipment.

The scheme enables municipalities to retrofit their public buildings and use the resulting energy cost savings, through an escrow account, to repay the budget investments provided by the R2E2 fund.

Two critical conditions are needed for this scheme to work: (i) a dedicated energy efficiency fund whose main objective is to invest in financially viable public-sector energy efficiency retrofits and (ii) participating cities' ability to set aside utility bill payments in a protected escrow account.

RELATIONSHIPS AND TRANSACTIONS IN R2E2 FUND SCHEME



Source: ESMAP. 2014. "Improving Energy Efficiency in Buildings: Energy Efficient Cities, Mayoral Guidance Note #3." http://www.esmap.org/sites/esmap.org/files/DocumentLibrary/ESMAP_Energy_Efficient_MayoralNote_2014.pdf.

Energy performance contracts are a viable business model for providing energy efficiency services but they can be hindered by institutional barriers presented by local awareness, regulation, procurement, or budgeting. Policies that help create standardized, streamlined, and transparent project development and vendor selection processes can lower the transaction costs for the use of EPCs to retrofit existing buildings (see Box 11.1). Such policies include guidance on tendering for EPC and standard EPC contracts; pre-approved lists of EPC providers, project facilitators, or consultants; and standardized measurement and verification (M&V) protocols for the calculation and verification of energy savings.[5] Furthermore, local governments can support local growth and maturation of the ESCO market by using EPCs to tender energy efficiency improvements of municipal buildings, as covered in Chapter 9: Government Leadership by Example.[6]

Workforce Capacity and Training

A major barrier to deploying energy efficiency projects in developing countries is lack of workforce training. This gap in training represents a missed opportunity in places with high unemployment, particularly among low- and semi-skilled labor forces. Even in many highly developed countries, governments and utilities have difficulty hiring candidates with sufficient education or training in energy efficiency.

Building and retaining local capability takes time and requires an explicit plan and funds. Local governments can increase knowledge and skills by:

- offering training through local colleges and training institutes;
- establishing dedicated "green collar" funds to finance workforce training;
- creating a resource center that can help train the trainers, provide guidance for developing curricula, identify career pathways, and conduct local labor market studies; and
- aiming for workforce inclusion by tailoring programs toward low-income or other disadvantaged groups in the labor market.

Working with Product Suppliers and Manufacturers

The products and services available in a local market determine the building efficiency options that are available to building owners. Local governments can work with product manufacturers and suppliers to make sure that more efficient products are made available in the local market. In some cases, this may require demonstrating that there is local demand for those products. Urban areas with locally based manufacturers of building equipment and materials may be able to work with their local manufacturers on demonstration projects to showcase their efficient products.

Local governments also have a role to play in ensuring that locally sold products comply with mandatory energy efficiency standards and labels (see Appliance, Equipment, and Lighting Energy Standards in Chapter 5).

Engaging Private-Sector Investment Partners

Investment decisions in building efficiency depend on factors including perception of risk, the size of the market, the anticipated return on investment, the regulatory regime, the transaction cost, and the presence of a stable investment framework. Typical barriers to financing for efficiency are shown in Figure 11.3. Understanding which of these factors are the most important to finance providers in a local market is an essential starting point to creating an investment climate where building efficiency is considered an attractive and profitable investment opportunity.

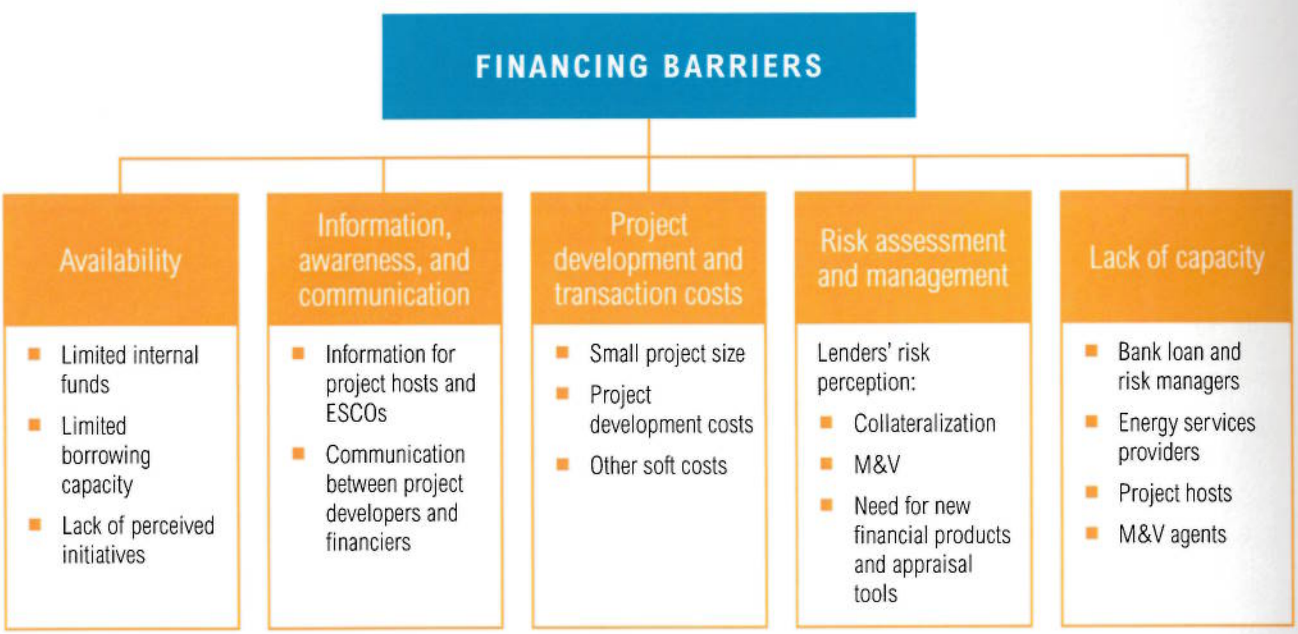
Risk is the greatest obstacle to investment by financial institutions. Risk can come from many sources. Two of the most important—transaction costs and repayment failure—are covered in the following sections.

Overcoming Lack of Standardization and High Transaction Costs

Given the great variety in building stock and the wide range of climate zones around the world, few energy efficiency projects look alike. This makes it hard to anticipate energy performance after efficiency measures have been implemented. In many markets, there is limited awareness of what mechanisms or methodologies can be used to measure and verify savings after project implementation. This lack of standardization may contribute to the view held by many potential investors that energy efficiency is a risky investment.

From the point of view of banks or investors, the relatively small size of a building efficiency project (compared to an industrial manufacturing or power generation plant) and the variety of technology measures that may be included make these transactions more specialized. The relatively small size of

Figure 11.3 | **Barriers to Financing Faced by Local Financial Institutions**



Source: International Energy Agency. 2011. "Joint Public-Private Approaches for Energy Efficiency Finance: Policies to Scale-up Private-Sector Investment." https://www.iea.org/publications/freepublications/publication/finance.pdf.

many energy efficiency projects can result in high time and resource investments for the financing party. Long or unclear tendering processes also lead to disproportionately high transaction costs and reduce the attractiveness of certain markets. Building efficiency projects also typically have a higher proportion of "soft costs" (project due diligence, design, and development) than many traditional loans. Packaging or bundling a number of smaller building efficiency projects can increase their attractiveness by reducing soft costs through a standardized approach. However, such securitization of loans is only possible if the projects bundled together have similar technical and financial characteristics.

The Investor Confidence Project (Box 11.2) has developed frameworks to standardize how energy efficiency projects are developed and documented, and how energy savings are calculated and measured. This allows for bundling of projects, significant reductions in transaction costs, increased confidence in future energy savings, and eventually scalability of the building efficiency portfolio to an aggregated investment level that is attractive to local investment partners.

BOX 11.2 | INVESTOR CONFIDENCE PROJECT, UNITED STATES AND EUROPE

The Investor Confidence Project (ICP), developed by the NGO Environmental Defense Fund, is helping to accelerate the development of a global building energy efficiency market by standardizing the way in which energy efficiency projects and energy savings are calculated and measured. The ICP is developing consensus frameworks in the United States and in Europe. The frameworks are not meant to define a single acceptable approach to energy efficiency projects but rather to provide a foundation for consistent, predictable, and reliable energy savings outcomes.

The ICP system offers a series of protocols that define industry best practices for energy efficiency project development and a credentialing system that provides third-party validation. This leads to increased confidence among building owners and investors in the reliability of projected savings. Standardizing the process by which energy efficiency projects are developed and measured allows investors to finance energy efficiency projects more easily and have more confidence in the energy and financial savings expected from these projects. More information can be found at: www.eeperformance.org.

Source: EDF. 2012. "Energy Efficiency Finance: Investor Confidence Project." http://www.edf.org/sites/default/files/EDF-ICP_fact-sheet.pdf.

Packaging or bundling a number of smaller building efficiency projects can increase their attractiveness by reducing soft costs through a standardized approach.

BOX 11.3 | ENERGY EFFICIENCY LOAN GUARANTEES IN BULGARIA

The Bulgarian Energy Efficiency Fund (BgEEF) was established with support from the World Bank and the Global Environment Facility (GEF), in cooperation with the governments of Bulgaria and Austria. BgEEF offered partial credit guarantees (PCGs) to share in the credit risk of energy efficiency finance transactions and to improve loan terms for project sponsors. The PCGs covered potential loan loss claims up to 70 percent of the outstanding loan portfolio of the financial institution involved. The PCGs applied to projects with an investment cost between €15,000 to €1.5 million, involving the application of well-proven technologies, with a maximum payback of five years, and 10–25 percent equity financing contribution by the project developer.

Between its launch in 2006 and the end of 2013, BgEEF has provided loans to 160 projects, with total project investment reaching more than US$45 million. Additionally, the fund provided partial credit guarantees or portfolio guarantees to 32 projects with a total project investment of $15.5 million. Using an initial $15 million in capital, the fund catalyzed more than $60 million in energy efficiency investments in Bulgaria between 2006 and 2013.

Source: Econoler. 2014. "The Bulgarian Energy Efficiency Fund 2005–2014: A Success Story and Inspiring Example of Energy Efficiency Financing." http://www.econoler.com/pdf/The%20Bulgarian%20Energy%20Efficiency%20Fund.pdf
ESMAP. 2008. "Financing Energy Efficiency: Lessons from Brazil, China, India, and Beyond." http://www.esmap.org/sites/esmap.org/files/financing_energy_efficiency.pdf.

Risk-Mitigation Facilities

Commercial banks and other financial institutions often perceive energy efficiency projects as more risky than traditional investments. Risk-sharing or mitigation facilities address this perception by providing participating local investment partners with partial risk coverage when extending loans for efficiency projects.

Under a risk-sharing program, a public agency signs a guarantee facility agreement with participating partners. The agency agrees to cover a portion of the partners' potential losses by providing a partial guarantee in case of loan default (see Box 11.3). Such programs are also known as loan-loss reserves. The actual amount or percentage of loss covered varies, but is often a 50–50 ("pari passu") sharing of losses between the private investment partner and the public agency. Sometimes the agreements also include a "first-loss" facility that absorbs a high percentage of the initial losses (up to 100%) up to a specified amount.

Participating private-investment partners sign agreements with project developers, specifying the loan targets and conditions, while being responsible for conducting proper due diligence and processing of the loans. The risk-sharing facility may offer individual project guarantees or portfolio guarantees. Risk-sharing facilities generally also provide technical assistance to stimulate deal flow, that is, the rate at which new investment proposals are made to lenders, and uptake of financial products. Risk-sharing facilities require less direct funding from the public partner than dedicated credit lines.[7] In addition to direct investment by the private investment partner in energy efficiency projects, such funds can also be used to on-lend to ESCO companies.

Local governments and other public agencies can also provide indirect risk-mitigation support to the ESCO industry by providing recourse mechanisms for non-payment. Start-up ESCOs have limited performance track records for their projects or technologies, which can make potential investment partners reluctant to extend a loan for efficiency projects. This hurdle may be overcome if the public agency can provide, or incentivize the use of, energy-savings warranties, or some other insurance product protecting the investment partner against poor performance of an EPC project. One example of this approach is the development of a financing and risk insurance mechanism for ESCO projects in the hotel and hospital industry in Colombia, financed by the Inter-American Development Bank.[8]

Yet another option for risk mitigation is to use public funds to lower the interest rate on building owners' loans to a point where external financing becomes an attractive option. This can be done by making an upfront payment to the lender, based on the difference between the sum of all principal and interest payments that a lender—that is, the investment partner—would be projected to receive at the market-based interest rate, and the sum of payments that the investment partner would receive from the incentivized, reduced interest rate. Interest rate buy-down can be a tool to increase participation in a newly launched energy efficiency-financing program and build market demand.[9]

The success of any risk-mitigation facility depends on a mature commercial investment sector, local investment partners with sufficient liquidity, and appropriate procedures in place for due diligence, project appraisal, and risk assessment. If the local financing market is very immature or not able to generate deal flow due to lack of energy service providers, risk-sharing facilities may not be appropriate.

ADDITIONAL CASE STUDIES ON ENGAGING TECHNICAL AND FINANCIAL BUILDING SERVICE PROVIDERS

Performance Contracting for Street Energy Efficiency in Akola

More than 11,500 streetlights (standard fluorescent, mercury vapor, sodium vapor) were replaced with more efficient, T5 fluorescent tube lamps as part of an energy-efficient street-lighting project. Akola Municipal Corporation in India used an energy-savings performance-contracting approach, under which the contractor, Asia Electronics Limited (AEL), financed all investment costs, implemented the project, maintained the newly installed lamps, and received a portion of the energy savings to recover its investment.

Source: ESMAP. 2009. Good Practices in City Energy Efficiency: Akola Municipal Corporation, India—Performance Contracting for Street Lighting Energy Efficiency. http://www.esmap.org/sites/esmap.org/files/CS_India_SL_Akola_020910.pdf. Last accessed 1 March 2016.

Energy Performance Contracting in Cape Town

Cape Town's energy performance contract with an ESCO was the first performance contract successfully implemented by a municipality in South Africa. Should the savings be less than anticipated, the ESCO will be required to supplement the realized savings with its own funding to reach the guaranteed amount. If the savings are higher than guaranteed, the guarantee period is shortened, and the ESCO is released from the commitment earlier.

Source: World Green Building Council. 2013 WorldGBC Government Leadership Award Winners. http://www.worldgbc.org/files/4513/8489/6954/Govt_Leadership_Awards_Publication_2013_-_Web.pdf. Last accessed March 1, 2016.

Risk-Sharing Scheme for Energy-Efficient Equipment in Singapore

Under the Building Retrofit Energy Efficiency Financing (BREEF) scheme, the government shares 50 percent of the risk of any loan default with the participating financial institution and provides credit facilities for the purchase and installation of energy-efficient equipment.

Source: U.S. Green Building Council and C40 Cities Climate Leadership Group. 2015. "Singapore City Market Brief." http://www.usgbc.org/resources/singapore-city-market-brief. Last accessed March 1, 2016.

CHAPTER 12

ACTION 8: WORKING WITH UTILITIES

Key Takeaways

- Utilities have direct access to building energy- and water-use data, which provide critical insights into usage trends and patterns, and they have valuable relationships with owners and tenants.
- Many countries, states, and cities have enacted programs that require energy and water utilities to invest in helping their customers consume more efficiently. Others have implemented policies, such as revenue decoupling and performance incentives, to ensure that utilities have the financial incentive to work actively to achieve greater customer efficiency.
- Some utilities have programs in which individual customers can repay investments in efficiency through their utility bills.
- Through demand response programs, utilities encourage their energy users to reduce energy use at times of peak demand on the electricity grid.

Utilities hold a wealth of data on the energy and water use of a city's building stock and they can also be valuable partners in promoting energy efficiency to building owners and tenants. This chapter considers how cities can partner with energy utilities to improve access to usage data and incentivize their customers to reduce energy demand. Similar strategies are available for partnerships with water utilities to improve water efficiency.

Improving Access to Energy-Use Data

Energy utilities use meters to collect information on energy use in buildings in order to bill their customers. These data when tracked over time can provide highly valuable information on trends and patterns in energy use, especially if analyzed in combination with other data sources such as weather patterns and comparative data for other similar building types. Utility data, whether at an individual or aggregated whole-building level, play a critical role in identifying appropriate actions to address high levels of energy use.

Utility data may be available at different levels, including:[1]

- **Account-level data**, which display energy use at the meter or household level. Depending on the meter installed, such data may be available on a monthly basis or even in real time. Providing customers with access to these data allows them to make more informed decisions about their energy use.
- **Building-level aggregated data**, which provide energy-use data at a whole-building level. Data may be aggregated from many meters, which helps to protect privacy, or they may be the only form of data available if individual meters are not installed. Access to building-level data is a critical first step for both cities and building portfolio owners. Building owners/managers and municipal bodies can use such data to compare their buildings' energy use to others of a similar type in the same region and identify high- or low-performing buildings.
- **Community- or regional-level data**, which aggregate data across many buildings in an area. These data can be used to identify patterns and establish and track area-wide energy efficiency goals.

Local governments can work with their utilities and utility regulators to develop policies or practices that help make energy-use data available to residents, building owners, and public agencies.

It is important to address potential privacy concerns by limiting the detail of data made available by, for example, providing only aggregated or anonymized monthly energy-use data to building owners/managers, not individual account data. Accordingly, utilities will have to develop separate release policies for different types of data.[2] Developing a user-friendly standardized means of disclosing data can greatly improve accessibility and use of data to improve energy efficiency.

Customer-Funded Utility Programs and Public Benefits Funds

In many places, government regulation requires that utilities administer programs to assist their customers with implementation of efficiency measures (see Box 12.1). Assistance mechanisms include consumer rebates, energy consumption information, financial incentives, and technical assistance regarding a variety of efficient technologies and practices. These programs are typically funded through either a separate charge on customers' utility bills or general utility revenues. In the United States, total spending on customer-funded utility energy efficiency programs was US$4.8 billion in 2010. Of this, $3.9 billion was spent on electricity efficiency programs and the remainder was dedicated to natural gas efficiency programs. This is equivalent to roughly 1 percent of total annual U.S. utility revenues.[3]

Even without formal authority, local governments can develop partnerships with the utilities that serve their community to leverage combined resources to improve outreach and targeting of programs. Utility-administered programs are often the implementation mechanism for an energy efficiency standard, under which a utility is required by its regulator to meet a certain percentage of customer energy demand through efficiency measures.

Efficiency Business Models for Utilities

Utility operations are traditionally structured such that, the more energy they sell, the more revenue they earn. Under such a business model, it is against a utility's interests to engage in energy-saving efforts. A variety of mechanisms exist to adjust the business models of regulated utilities in order to align efficiency investments with utilities' financial interests, or to at least prevent them from being in conflict. Mechanisms include revenue decoupling, lost-revenue adjustment mechanisms, and utility performance incentives. Revenue decoupling and lost-revenue adjustment mechanisms separate a utility's profits from the amount of electricity it sells, ensuring that it is not penalized for decreased sales. Utility performance incentives are policies that reward utilities with additional profits for meeting or exceeding efficiency targets.[4]

On-Bill Repayment

Utilities use on-bill repayment (OBR) to allow energy efficiency investments to be repaid as a line item on a customer's regular bill. These programs leverage the unique relationship between utilities and their customers, whether residential or commercial, which allows utilities to provide convenient and secure access to funding for energy efficiency investments. If structured properly, an OBR program can substantially improve access to financing and be bill-neutral, meaning that energy cost savings are sufficient to cover or even exceed the monthly repayments. Access to financing can also encourage customer participation in other energy efficiency programs.[5] This mechanism has the benefit of being "off balance sheet," an important consideration for businesses who want to avoid taking on debt that must be reflected in their corporate accounting. Credit losses on both consumer and commercial utility bills tend to be far lower than for other financial obligations, so on-bill repayment also has benefits to lenders.

Utilities and other program administrators can implement OBR in a variety of ways, although it is most commonly structured as a loan or tariff. Typically, the purchase and installation of efficiency measures in OBR programs are paid upfront, either by the utility or financial partners, and a charge is added to the participants' utility bills until all costs are repaid. Tariff-based systems assign the financing obligation to a building's meter, allowing the obligation to transfer to subsequent owners or tenants. This transferability facilitates the implementation of energy efficiency measures with longer payback periods. An overview of a typical OBR tariff-based financing model is provided in Figure 12.1. In contrast to a tariff-based system, loans assign financing to an individual customer and the financing is often non-transferable. Establishing a clear definition of who bears the risk for potential loan defaults is therefore critical during the design phase.

BOX 12.1 | BRAZILIAN UTILITIES HELP CUSTOMERS TO REDUCE ENERGY USE

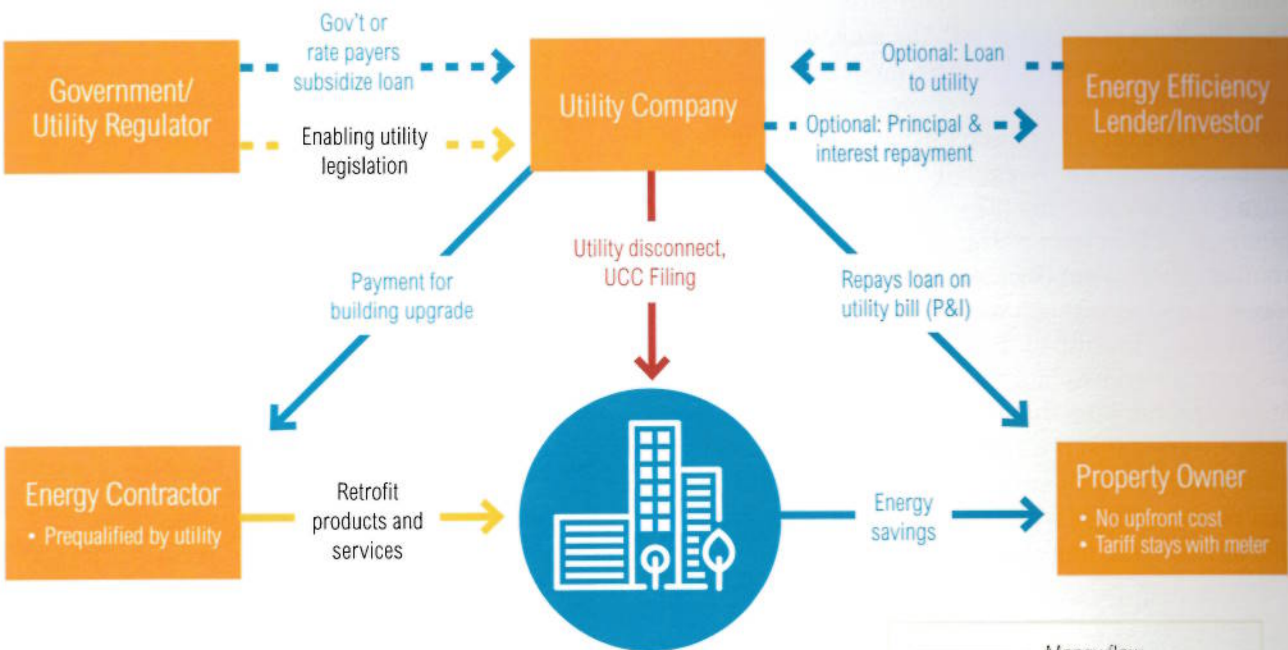
The Brazilian Electricity Regulatory Agency (ANEEL) Resolution 300/2008 made it mandatory for energy utilities to invest at least 0.5 percent of their net operating revenue each year in initiatives that reduce energy wastage. Subsequently, CEMIG, the regional electricity retailer in the state of Minas Gerais, has created an Intelligent Energy Program to promote energy efficiency in cities. Major projects include:

- Energia do Bem (Energy for Good): Installation of solar heating systems and replacement of inefficient lighting in hospitals, day care centers, and nursing homes
- Conviver (Live Together): Replacement of energy-inefficient showers, light bulbs, and refrigerators by more efficient models in low-income communities
- Eco-efficient city halls: Transfer of knowledge on energy efficiency to municipal technicians for better municipal energy management

The project Conviver Interior was executed under the Conviver program and focused on countryside settlements. In its first phase, from February 2010 to September 2011, a total of 95 municipalities benefited from the replacement of 858,934 incandescent light bulbs with compact fluorescent lamps, installation of 8,910 more efficient showers with heat exchangers, and 15,594 efficient refrigerators. These changes resulted in estimated energy savings of almost 47,000 MWh/year as well as reduced peak-hour demand.

Source: CEMIG. "Energy Conservation and Efficiency." http://www.cemig.com.br/en-us/Company_and_Future/Sustainability/Programs/Energy_Efficiency/Pages/default.aspx. Last accessed February 24, 2016.

Figure 12.1 | **Overview of a Tariff-Based On-Bill Repayment Program**



Note: Dotted line represents an optional step

Source: Rockefeller Foundation. 2012. "United States Building Energy Efficiency Retrofits: Market Sizing and Financing Models." https://www.rockefellerfoundation.org/report/united-states-building-energy-efficiency-retrofits/.

Demand Response

Demand response describes an energy-saving strategy used to encourage consumers to reduce electricity used during periods of high demand, thereby reducing the peak energy supply requirement of the utility grid. When demand for electricity approaches available supply, the risk of electrical emergencies such as blackouts or brownouts increases. Demand-response programs use rates, incentive payments, and other strategies such as the integration of energy efficiency and renewable energy schemes, to manage electricity use during periods of high demand. Demand response differs from energy efficiency because the energy savings that result from it only occur at particular times during the year or day. However, as with efficiency, reducing peak electricity use can help utilities avoid the need to build costly additional generation capacity to cover rising electricity demand, while encouraging consumers to shift consumption to cheaper hours.[6]

Demand-response programs typically rely on the use of advanced metering infrastructure (AMI). AMI systems measure, collect, and analyze energy use through two-way communication metering devices. The advanced communication infrastructure communicates to a network of aggregators and the utility, relaying price signals and data surrounding usage, failures, and demand response triggers. Smart meters enable the demand response policies described below.

Time-Based Pricing

This concept includes time-of-use pricing policies that set prices for specific times of day, and dynamic pricing, whereby electricity prices may change as often as hourly or even more frequently. Dynamic pricing is also known as inverted block tariffs. Prices rise in relation to (peak) demand—which is affected by consumers' use of electric power, generation capacity, the market, and even extreme weather events—with the goal of stimulating a demand response (see Box 12.2). A consumer pays a low rate for using less electricity and a higher rate for using more, particularly at peak times. A survey of experience in the United States found evidence that residential users did respond to higher prices by lowering consumption.[7]

Pay for Performance

Peak loads in energy consumption are expensive because they require utilities to build permanent additional capacity to handle temporary peaks in demand. Utilities therefore often enter into agreements with their largest energy customers to actively implement demand management and reduce peak loads.

One way to finance efficiency upgrades in buildings known for high (peak) energy demand is a Pay for Performance incentive program; these programs are applied in various parts of the United States. They target whole-building energy savings by determining an energy-savings threshold for the entire building and providing financial incentives for energy savings beyond that threshold. In this way, utilities encourage partners to find deeper savings from energy efficiency retrofit measures than they might otherwise pursue.

For example, a large office building participating in the program might target energy savings of 30 percent for the entire building and receive incentives from the utility for each verified kWh reduction. This creates a win-win profit dynamic for building owners as well as utilities by helping to reduce (peak) demand burdens on the electricity grid.[8]

BOX 12.2 | TIME-OF-USE PRICING IN YOKOHAMA, JAPAN

The city of Yokohama in Japan has been running demand-response trials for home energy management systems (HEMS) as part of its Yokohama Smart City project. HEMS were installed in over 1,500 households to analyze consumer behavior in response to the use of critical peak pricing (i.e. energy prices fluctuate according to energy demand and supply) and other functions available via a user-operable digital demand-response screen.

The trial assigned five different menus to consumer households, divided into rate menus and incentive menus:

- The rate menus tested consumer behavior in response to time-of-use charging, with higher rates during critical peak times in order to influence consumption behavior and restrain demand.
- The incentive menus on the other hand aimed to optimize supply and demand by means of various rebate schemes: peak-time rebates, limited peak-time rebates, and committed peak-time rebates.

Source: New Energy Promotion Council. Japan Smart City Portal. http://jscp.nepc.or.jp/en/. Last accessed February 24, 2016.

ADDITIONAL CASE STUDIES ON WORKING WITH UTILITIES

Free Energy Efficiency Retrofit Program for Low-Income Families in Houston

The city partnered with CenterPoint, its electricity distribution company, and offered free energy efficiency retrofits to low-income families. The utility hired contractors to do the work, which led to cost savings for families and reduced CO_2 emissions.

Source: C40 Cities: "Free Energy Retrofits Saving Poorer Homes $335 and Slashing 1,200 tons CO_2 per Year." Case Study. http://www.c40.org/case_studies/free-energy-retrofits-saving-poorer-homes-335-and-slashing-1100-tons-co2-per-year. Last accessed February 24, 2016.

Utility-Implemented Energy Green Building Program in Austin

In 1991, Austin Energy, America's eighth largest public utility, modified national building codes to better align with its ambitious local climate action plan. Austin Energy became the first utility to launch its own green building program, known as Austin Energy Green Building (AEGB). To complement the AEGB, the city offers regular workshops that train and connect builders in eco-friendly construction.

Source: ICLEI. 2014. "Austin, USA: The Austin Energy Green Building Program for Eco-Efficient Construction and Consumer Empowerment." http://www.iclei.org/fileadmin/PUBLICATIONS/Case_Stories/Urban_NEXUS/01_Urban_NEXUS_Case_Story_Austin_ICLEI-GIZ_2014.pdf.

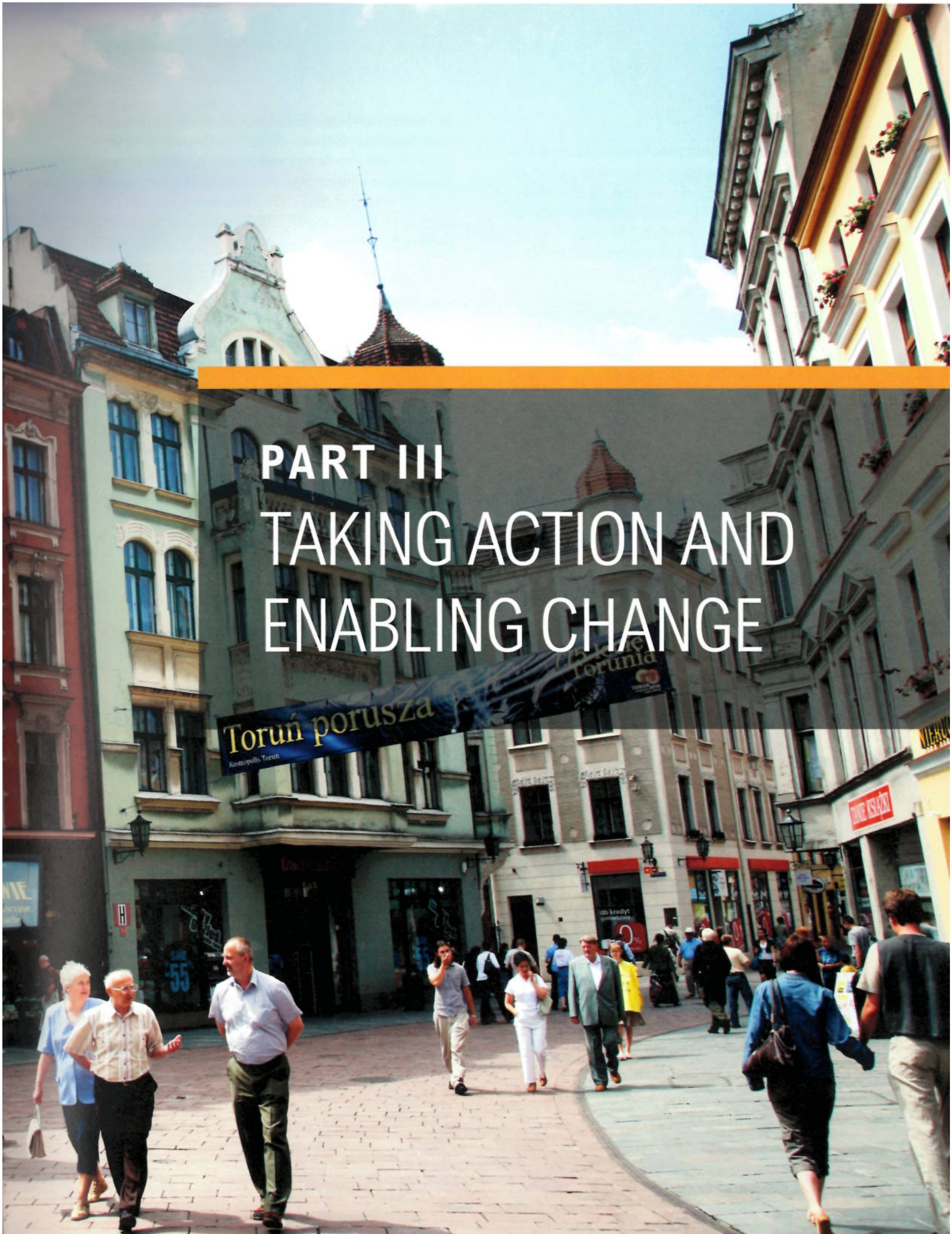
Improving Access to Energy-Use Data in Seattle

The city is partnering with the publicly owned electric utility Seattle City Light. This utility is currently comparing benchmarking results with internal data and is using findings to improve and inform existing and future efficiency-rebate programs. It also offers automatic data upload to ENERGY STAR Portfolio Manager on behalf of customers as a data exchange service.

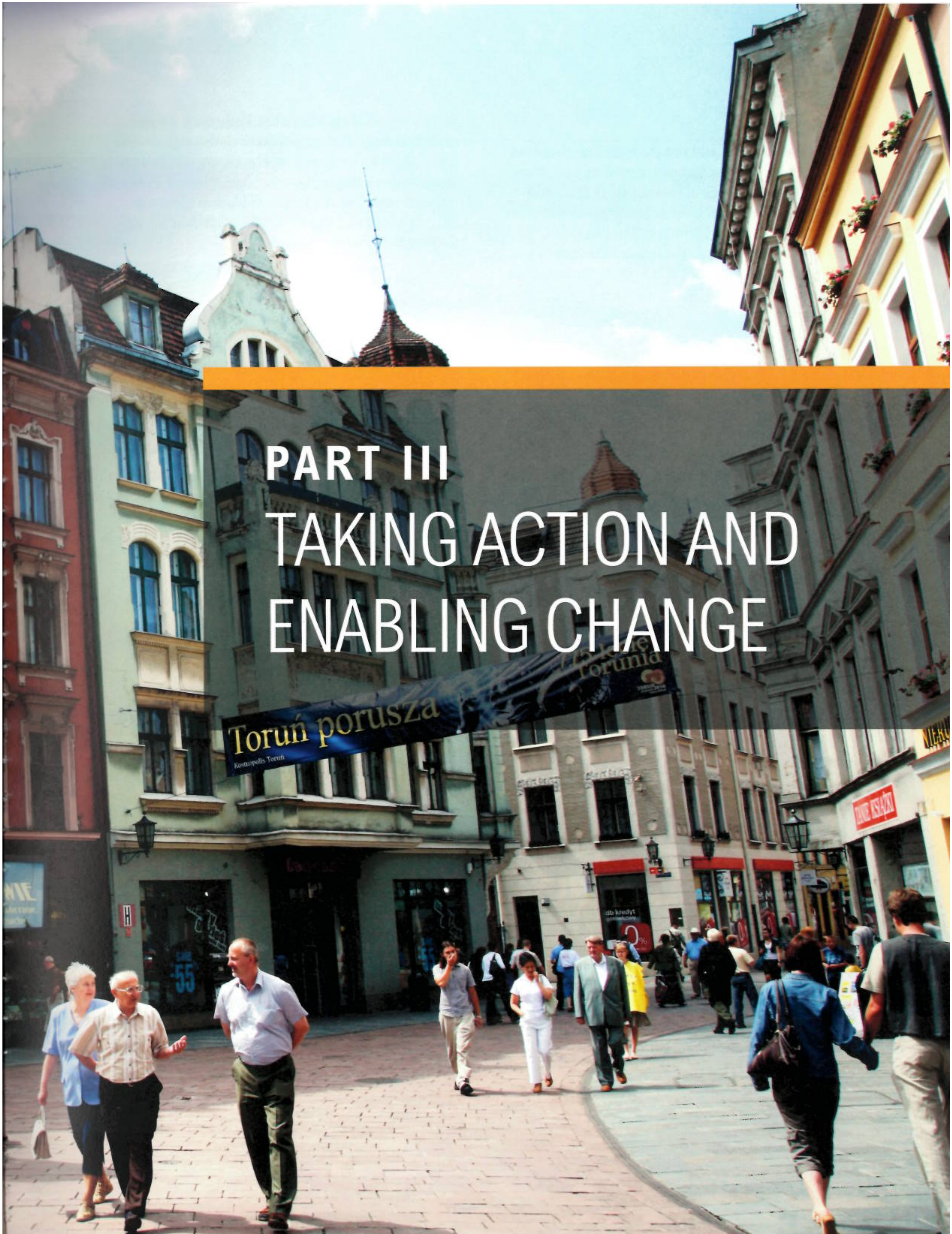
Source: C40 Cities. "City of Seattle Fosters Market Transparency through Building Energy Benchmarking." Case Study. http://www.c40.org/case_studies/city-of-seattle-fosters-market-transparency-through-building-energy-benchmarking. Last accessed February 24, 2016.


BRATPOL
SKLEP MUZYCZNY
OBUWIE

PART III
TAKING ACTION AND ENABLING CHANGE



PART III
TAKING ACTION AND ENABLING CHANGE



Introduction

In order for policies and programs to succeed, they must be developed and implemented as part of an action plan or package of measures. This should involve a clear roadmap for achieving success, with the right enabling conditions put in place and the right partners on board. These key ingredients will help cities get started, but it is equally important to track subsequent progress and improve practices over time.

This chapter identifies key enabling conditions, outlines how to develop an action plan, build local capacity and secure financing, get stakeholders on board, and track subsequent progress. It concludes with an overview of common success factors and challenges by drawing on case studies from cities around the world.

A central question for many policymakers concerns how to get started. No universal approach exists to designing a policy and program pathway for delivering building efficiency. Policymakers can meet building efficiency objectives through a wide array of policy tools and mechanisms, which were suggested in Chapters 5–12. Local governments can take advantage of the multiple lessons from pioneering cities and modify them as needed to apply to their local circumstances.

The nature and scope of a particular policy package will vary depending on a city's objectives, its institutional structures, and market characteristics, among other factors. One possible way to organize the process of policy development is to begin with the following core questions:

- What to do? Scoping and prioritizing policy and program objectives and instruments.
- How to do it? Defining ways to support policy and program implementation.
- Who is responsible? Creating a framework to deliver effective governance.

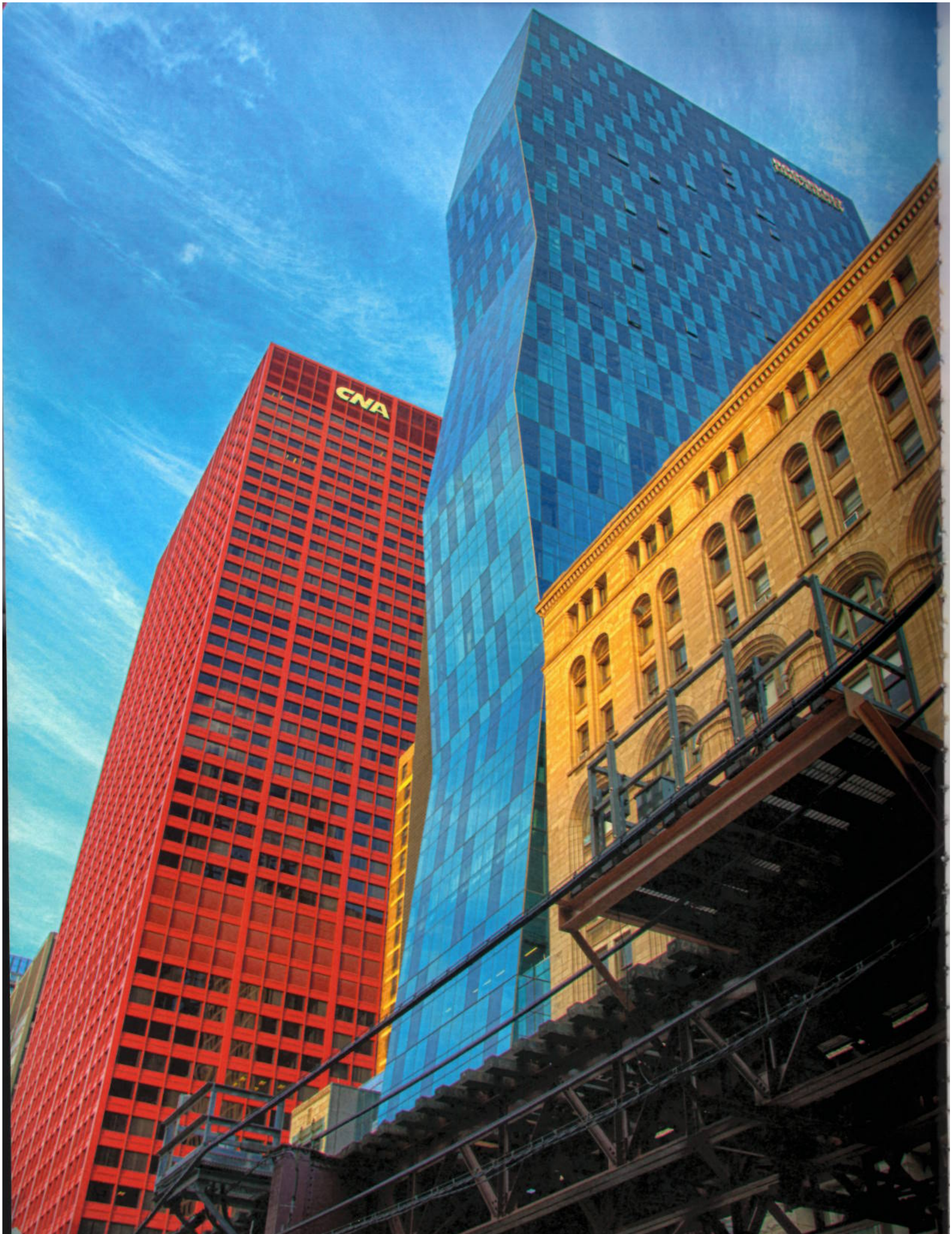
Indicative Roadmap for Taking Action on Building Efficiency

This chapter:

- provides guidance on answering each of these three core questions;
- describes methods of tracking results; and
- outlines common success factors and challenges.

Appendices 1 and 2 then provide detailed, practical descriptions of:

1. Policy and technical tools for assessing building efficiency that can be used by city authorities.
2. A tool for assessing building efficiency policies.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CHAPTER 13

DEVELOPING A POLICY AND PROGRAM PATHWAY

Key Takeaways

- Designing a strategy to improve building efficiency is not a simple process, but a clever combination of policies and other relevant actions can effectively transform buildings to be more energy-efficient over time.
- Maintaining stability of staffing levels, capacity, and project financing is a critical element of long-term success. Stability may be enhanced through careful design of the action plan.
- Early identification of key players within and outside government, and of their roles and responsibilities, is essential to maintain program coherence and coordination.
- Policymakers should include metrics and evaluation approaches in their planning to track progress over time and confirm that policy goals are being met.

WHAT? SCOPING TARGETS PRIORITIES

What? Scoping and Prioritizing Policy Objectives and Instruments

Scoping and Inventory

A necessary first step is to assess and understand a city's current efficiency baseline and status. Ideally, such a scoping and inventory exercise is done for each segment of the building market (e.g. residential or commercial), and also for each phase of the building lifecycle. Important tasks to include in a scoping and inventory exercise may therefore include:

- the current status of municipal energy supply and distribution, including tariff structures;
- the current status of municipal energy end-use;
- a building stock analysis, such as the number of buildings, types, size, age, and energy use;
- an analysis of existing policies and programs, including their effectiveness;
- an assessment of key issues (barriers) impeding uptake of energy efficiency; and
- an analysis of the current opportunity to act.

Targets

After the scoping phase comes a focus on the selection of objectives and targets. To be inspiring, targets should be bold, ambitious, and require a degree of "stretch." In order to facilitate implementation, any target should be simple to understand and straightforward to monitor. Common options are:

- defined improvements in performance (GWh or CO_2);
- intensity (energy consumption or CO_2 emissions per unit of economic activity);
- benchmarks (energy consumption or CO_2 emissions relative to others); and
- transactions (e.g., number of buildings constructed or retrofitted, number of efficient components installed).

Once a target is chosen, it is necessary to set a clear timeframe, for example, annual, medium-term (5–10 years), and long-term (10+ years) targets with interim reviews. This allows for efforts to be adjusted if it becomes clear that progress is not on track to meet the set targets or, conversely, if targets are being met earlier than anticipated, which could trigger an adjustment to more ambitious targets.

When defining the scope of the targets, choices may have to be made early on: Will the strategy focus on the design and construction of new buildings? Will it tackle retrofits? Will it combine both? And which stakeholders will be the focus of the policy intervention? Stakeholders typically involved include construction companies, energy service providers, building owners, and managers of public and commercial buildings.

Priorities

Several processes and assessment tools are available to support governments in the process of prioritizing building policies, helping them to identify important, easy policies that might make good starting points, and important, difficult policies that might make good longer-term goals. In addition, policymakers may want to analyze the pros and cons of using incentives versus mandatory requirements (carrots versus sticks) to achieve the right balance and promote complementary actions.

For example, when examining a set of ten case studies from major cities around the world, the C40 Cities Climate Leadership Group and Tokyo Metropolitan Government jointly found that most programs chose the following priorities:[1]

- commercial buildings, rather than residential buildings;
- regulatory approaches, which prevailed over or were being developed in conjunction with voluntary ones;
- large buildings, because the capacity of owners of small- to medium-sized buildings to comply with energy efficiency requirements is often more constrained by lack of expertise and lack of dedicated staff reporting on energy. Nevertheless, smaller and medium-sized buildings should not necessarily be excluded. Financial incentives, raising awareness, and technical support can go a long way toward getting this group on board;
- building owners and managers rather than tenants, although tenant cooperation is usually required for energy efficiency upgrades to take place.

The cities considered in the C40 set of case studies generally spent between one and two years to design, consult, and prepare for implementation of their programs, with knowledge typically acquired either in-house, through existing studies or commissioned research, or knowledge exchange with other cities via platforms and networks. Most cities deployed between three and five full-time staff to design and implement these programs, although in reality teams may consist of more people who spend only part of their time working on the program. Several cities indicated that the limited staff was a challenge to the success of the program—especially because many cities adopted different communication, incentive, and support programs when targeting different audiences and building types.

How? Defining Ways to Support Policy Implementation

Action Plan

Complementing the guiding objectives with an action plan is the first step in the transition to implementation (see Box 13.1). In some instances, cities have designed ambitious strategies but lack an implementation roadmap that will guide actions on the ground. An action plan is based on a set of performance indicators that allow policymakers to assess progress over time. How to track progress is a fundamental task and will be addressed separately.

BOX 13.1 | BUENOS AIRES CLIMATE CHANGE ACTION PLAN

The city of Buenos Aires first developed its Climate Change Action Plan in 2009, addressing mitigation strategies in the energy, transport, and solid waste sectors. In September 2011, the city passed the Climate Change Action Act, transforming government action into state policy. The law recognizes the Buenos Aires Environment Protection Agency (AprP) as the highest environment authority in the city of Buenos Aires, outlines dissemination and communication strategies to manage stakeholders, and defines measures for mitigation and adaptation strategies.

In the building sector, the city initiated the Public Buildings Energy Efficiency Program, aiming to achieve minimum savings of 20 percent in energy consumption in municipal buildings by 2015. Through a partnership with Philips Argentina, the city is also aiming at a 100 percent replacement of street lighting with LED technology by 2017. Furthermore, the city offers incentives for the purchase of energy-efficient appliances to achieve energy efficiency in residential buildings. The city of Buenos Aires has also been actively involved with international climate initiatives including C40, CDP, and the Carbonn Climate Registry, among others, to exchange experiences and good practices with other cities.

Sources: City of Buenos Aires. (N.d.). Energy Sector. http://www.buenosaires.gob.ar/agenciaambiental/cambioclimatico/english-information-available-here/mitigation/energy-sector; City of Buenos Aires. n.d.. Ley de Cambio Climatico. http://www.buenosaires.gob.ar/agenciaambiental/cambioclimatico/ciudad-de-buenos-aires/ley-de-cambio-climatico.

In order to ensure continuity of the action plan through political changes, such as turnover in local government staff as a result of elections, it is important to consider timing as well as institutionalization of the action plan. Ideally, an action plan would be enacted at the beginning of a mayoral term in order to allow for the proposed efficiency actions to gain critical success and acclaim. Furthermore, institutionalization would make energy efficiency an integral part of local policy frameworks rather than a one-off action.

Workforce Capacity and Training

The effectiveness of implementation and the assessment of building efficiency performance depend, to a large degree, on the quality of training of the staff involved with enforcement. For example, projected energy savings from building energy codes can be dramatically affected by the ability to enforce them. Providers of energy audits and energy efficiency improvements may also need to be certified for their knowledge and skills to ensure safety, quality, and performance. An early identification of workforce capacity needs can inform the later definition of a package of technical support measures related to enforcement, legal affairs, and technological issues (see Figure 13.1).

Workforce capacity building measures should, where possible, be introduced in tandem with efficiency policies for a further reason: policies that leverage private-sector finance or lending schemes require stable governance and lending environments. Building the right capabilities takes time and requires an explicit plan with the right allocation of funding. International cooperation programs can play a catalytic role in helping cities build the right capacities.

Finance

Investing time and resources in the design of a financial pathway is critical to successful implementation of a package of building efficiency policies. Without a quality financing strategy, these actions are unlikely to deliver much change. One possible starting point in designing a financial pathway for a city is to define the objective of the financing at different phases. What exactly is being financed at each phase? Figure 13.2 proposes a framework for addressing this question.

- The initial **Readiness** phase aims to mobilize financing for policy development. Because a market might take years to create, it is essential to invest resources in establishing the right conditions during the early stages of policy design (e.g. a sectoral and holistic approach rather than pursuit of isolated projects).
- The **Prototyping** phase represents the early stage of implementation and focuses on financing catalytic projects—a mix of priority policy options (e.g. codes and standards) and financing mechanisms to enable the most promising projects to attract public and private capital. The goal is to create local precedents, build confidence, and demonstrate that building efficiency is financeable.

Figure 13.1 | **Building Local Workforce and Implementation Capacity: A Suggested Pathway**

Figure 13.2 | **Phases and Objectives of City Efficiency Finance: A Suggested Pathway**

- In the more mature **Critical Mass** phase, the focus is on further market development and scaling up. Policymakers can achieve critical mass by adjusting financial mechanisms and creating new ones, depending on local market dynamics.

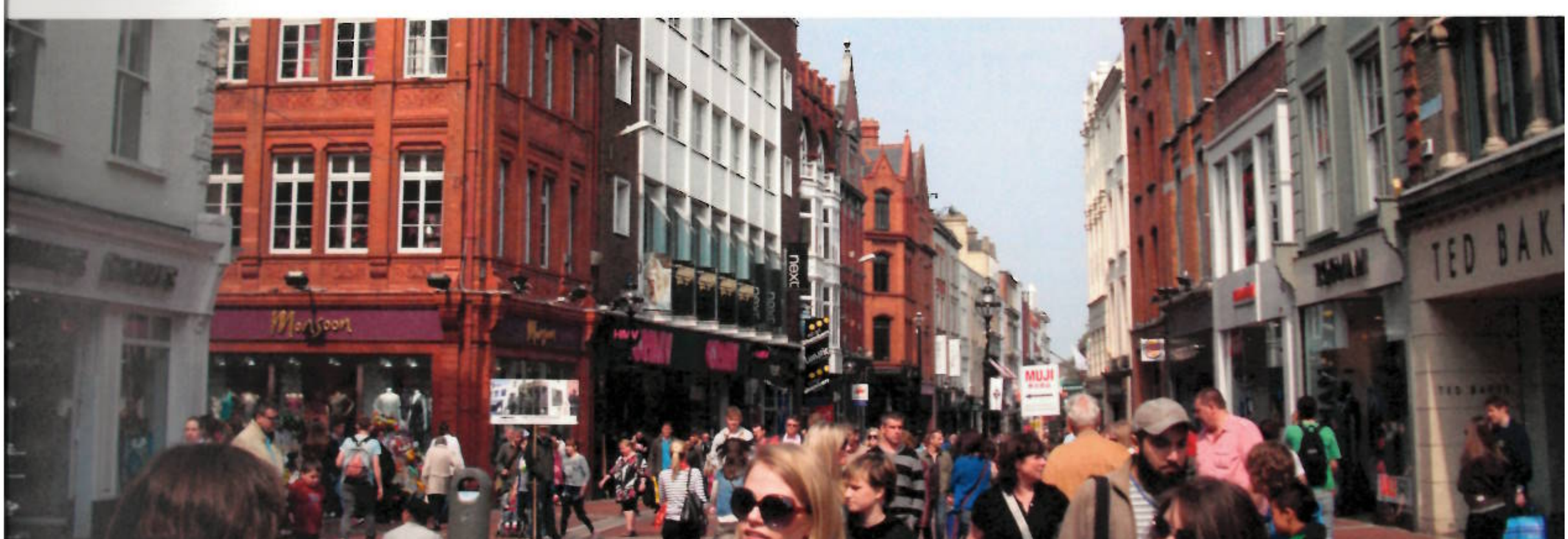
Local governments need to decide whether private capital will be leveraged and how, for example, through public-private partnerships. It can be useful in this regard to map the pools of capital that could be mobilized: public and private, local and international, grants and loans. This can help to identify potential financing gaps and to understand the link between these gaps and the pace of implementation (see Box 13.2).

BOX 13.2 | GREEN BONDS IN JOHANNESBURG

The city of Johannesburg issued South Africa's first Green Bond (COJG01) on the Johannesburg Stock Exchange on June 9, 2014. Maturing in 2024, this 1.46 billion rand (US$140 million) Green Bond will finance the city's green initiatives such as the biogas to energy project and the solar water heaters project. As a fixed-income, liquid financial instrument, the Green Bond offers an attractive option for investors to finance energy efficiency projects. The bond auction was oversubscribed by 150 percent.

The sound financial situation of Johannesburg has been key to attracting investors. The city issued its first municipal bond in 2004 and, since then, it has been a consistent and responsible issuer in the bond market with seven municipal bonds totaling 8.5 billion rand. The city of Johannesburg also received a positive investment rating from major ratings agencies.

Source: City of Johannesburg. 2014. "04/06/2014: The City of Johannesburg Issues the First Ever JSE Listed Green Bond." Press release. http://www.joburg.org.za/index.php?option=com_content&view=article&id=9073:04062014-the-city-of-johannesburg-issues-the-first-ever-jse-listed-green-bond-&catid=217:press-releases-2013&Itemid=114.



WHO? INSTITUTIONS · STAKEHOLDERS · GOVERNANCE

Who? Creating a Framework for Delivering Effective Governance

Institutions

The experience with implementing efficiency policies in various cities demonstrates the difficulties associated with coordination at many levels. Coordination within and among municipal departments, and between the municipality and other levels of government, is often imperfect, and once one department sets a policy, ensuring policy coherence among departments and at other levels of government can pose challenges. In order to tackle institutional bottlenecks and ensure that the right capacities are in place, it is necessary to specify and clarify key roles and players early on. Players must also be properly equipped to act, in terms of both financial and human capacity.

Identifying and Engaging Stakeholders

In tackling institutional challenges, it is helpful to adopt a proactive approach to engaging the relevant players in delivering building efficiency. Although the process of stakeholder engagement will vary from city to city, a common first step is to identify key stakeholders and understand their roles in different segments of the local building market. The creation of multi-stakeholder processes is critical before and during the policy design process. This allows for the identification of needs and interests, and facilitates early assessment of the feasibility of program elements. Stakeholder engagement can also serve to foster cooperative relationships with key industry players, drive acceptance of policies, and improve compliance. Stakeholders who come on board early may go on to become valuable partners for outreach and mobilize wider public and industry support.

Governance and Responsibility

When energy efficiency policies fail to deliver their full potential, it may be because insufficient attention was paid to the governance underpinning the implementation. Four principles of good governance are relevant.[2]

Clarity and transparency:

- ensure comprehensiveness, timeliness, availability, and comprehensibility of information;
- provide regular public reports and updates; and
- define responsibilities of various agencies or departments and establish cooperation norms and approaches.

Participation:

- commit to seek diverse and meaningful public input. This helps local decision-makers consider different issues, perspectives, and options in the formulation, implementation, monitoring, and evaluation of policy;
- provide a formal space for public participation in relevant forums;
- use appropriate and sufficient mechanisms to invite participation; and
- ensure an inclusive and open process and take stakeholder input properly into account when making decisions.

Accountability:

- clarify the roles of the various institutional stakeholders in decision-making;
- conduct monitoring of programs and processes;
- share the criteria or considerations used as the basis for decisions; and
- establish legal systems to uphold public interests.

Capacity:

- strengthen the ability of government bodies to practice good governance.

An effective governance framework for building efficiency must clearly define who within the government will be responsible for what parts of the action plan. The responsibilities need to be set at different levels and be explicit and transparent, making clear who will need to be involved, in what capacity, and at what stages. The institutional responsibility for the monitoring system also needs to be planned at the outset. This includes responding to concerns raised by stakeholders. For cities in developing countries, the capacity for monitoring can be limited, and cities may want to define a system for gradual improvement.

Engaging the Public

A city may choose to develop a "strategic narrative" to describe how its building efficiency strategy or action plan will be communicated. The narrative can set out the current situation, the intended direction and the various options, the likely changes, what this will mean for different stakeholders, and the benefits and opportunities presented by the plan. Above all, the strategic narrative should be inspiring, creating compelling and desirable images of the intended future state (see Box 13.3).

Policymakers need to regard public engagement as a crucial aspect of the implementation process and embed it at all levels, both to realize the benefits it can deliver and to avoid potential conflict and additional costs. An engagement program should be tailored to local conditions, and designed on a case-by-case basis. Engagement will preferably focus not merely on consultation and communication—which is too often a one-directional exercise of informing the public—but also on participation and dialogue facilitating two-way discussion and inviting the public to contribute thoughts and ideas.[3]

Poorly designed or implemented engagement can lead people to feel they are not being treated fairly or that decisions are being imposed on them. Resistance can also arise when stakeholders feel they are bearing the cost, with little or no compensation or benefit, while others are reaping the benefits.

BOX 13.3 | GREENEST CITY PLAN: PUBLIC ENGAGEMENT IN VANCOUVER, CANADA

In 2009, the city of Vancouver formed a Greenest City Action Team to explore how Vancouver could become the greenest (most sustainable) city in the world by the year 2020. This laid the ground for an action plan with ten long-term goals. Engagement with stakeholders, in particular the general public, was conducted in two phases between mid-2010 and mid-2011.

Phase 1 focused on building a constituency to achieve the greenest city goals: creating a sense of ownership among the community, building partnerships with organizations for implementation, collecting ideas from the public to assist the city's working groups, and testing new and innovative engagement methods and tools.

Phase 2 aimed to educate and communicate recommended actions to the public, collect feedback on the draft plan and gauge level of support, reflect back public comments, build support for and ownership in the final plan, and get stakeholders and staff engaged for implementation. A wide range of innovative engagement tools was applied to spread the word and let the public participate in co-creating the plan, as shown in the overview below.

ENGAGEMENT TOOLS USED IN THE DEVELOPMENT OF THE GREENEST CITY PLAN

INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
▪ Website ▪ Direct mail ▪ Flyers ▪ Listserves ▪ Fact sheets ▪ Pecha Kucha ▪ Twitter ▪ Videos ▪ Ads	▪ Surveys ▪ Facebook ▪ Online forums ▪ Open houses	▪ Workshops	▪ Co-organized events ▪ Unconference ▪ Zero waste assets ▪ Multicultural roundtables	▪ Greenest City Grants ▪ Neighborhood action teams ▪ Organizational partnerships

Better potential to reach more people — Increased public responsibility / impact → Better potential for deeper engagement

Source: City of Vancouver. 2011. "The Greenest City Public Engagement Story." Powerpoint presentation provided by City of Vancouver.

Tracking Results

To confirm that policy goals are being met, policymakers should include metrics and evaluation techniques for tracking progress over time. The results of building efficiency actions can be tracked at the city, policy, building, or even individual occupant level.

Tracking Progress at the City Level

Once a city has initiated building efficiency goals, reliable and sufficiently comprehensive data sets are crucial to track progress relative to an established baseline. Data also help with adjusting and amending policies based on observed progress and lessons learned. Audit and benchmarking schemes, as discussed in Chapter 7: Performance Information and Certification, can greatly expand the available pool of data for analysis, including data on compliance rates, differences in energy use between similar types of buildings, and the pace of energy savings as policies are introduced. Furthermore, cities are increasingly participating in external tracking initiatives, such as the Carbonn Climate Registry and the CDP Cities Program.[4]

Tracking Progress at the Policy Level

Establishing how policy performance will be tracked over time is essential to confirm that building efficiency goals are being met. Several methodologies are available to help policymakers assess progress.

- Policy impact studies. An independent assessment is carried out to assess a specific policy, often in the form of comparative or benchmarking studies. These assessments play an important role as governments try to justify publicly a particular policy or budgetary contribution needed to achieve energy-savings objectives.[5]
- Energy consumption surveys. These surveys take a sample of buildings, analyze their energy-related characteristics, energy consumption, and expenditures, and extrapolate the results to represent the entire building stock. The process helps track progress toward energy efficiency goals.[6]
- Assessments by utilities or government agencies. An array of methods has been developed for evaluation, measurement, and verification of energy savings due to policy efforts in order to demonstrate good stewardship of ratepayer and taxpayer funds.[7]

The ambition and scope of a monitoring system will vary depending on the policy choices each city makes, such as scope (building segment or citywide performance), timeframe (short, medium, or long term) and level of aggregation (performance at the building unit or aggregated information according to type of building: public, commercial, residential).

Tracking Progress at the Building Level

A key barrier to energy efficiency projects in individual buildings, especially in emerging economies,[8] is that building managers or occupants lack confidence that they will see any benefits. Their skepticism may be overcome by evidence of energy savings that comes from a credible tracking system using methodologies that stakeholders find reliable.

Protocols already established for measuring and verifying energy upgrades in buildings can help. At the building level, measurement and verification (M&V) of energy savings is the process of "quantifying a reduction in energy use, peak demand, greenhouse gas emissions, or some other quantity, usually resulting from a program or project."[9] Because M&V plays a key role in scaling up energy efficiency and carbon reduction, decision-makers in governments and the private sector are paying increasing attention to these activities. The basic concept behind all types of M&V is the comparison between actual and business-as-usual consumption. In practice, calculating the baseline—what would happen if the project were not implemented—poses one of the biggest challenges for M&V.

International organizations have focused on standardizing approaches to measuring and verifying energy efficiency at the building level, and development of standards and guidelines has increased in recent years. The International Performance Measurement and Verification Protocol (IPMVP), for example, offers best-practice techniques for verifying the results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities. It is supported by the Efficiency Valuation Organization[10] and has worldwide application. It provides four M&V options, with selection depending on the scope of the project (single piece of equipment or whole building), predictability of savings (climate sensitivity, operational factors) and the availability of data.[11]

Success Factors and Common Challenges

The experience of other cities with designing and implementing building efficiency offers many lessons regarding the success or failure of their programs or initiatives. The C40 Cities Climate Leadership Group and Tokyo Metropolitan Government jointly identified the following success factors for energy efficiency programs or action plans based on a range of case studies drawn from major cities around the world:[12]

- **Stakeholder engagement.** This creates buy-in and elicits feedback on the design and feasibility of the intended policy measures.
- **Partner support** from key industry groups or utilities. This should be sought where stakeholders are willing to provide assistance for the successful implementation of a program or plan.
- **Buy-in and recognition** from mayors and elected officials. Such buy-in will secure top-level political support.
- **Flexibility in implementation.** For example, compliance can be encouraged through extended grace periods rather than by issuing fines—various cities have found that non-compliance may actually reflect lack of ability or knowledge rather than unwillingness to comply.
- **Targeted strategies** should be used for different segments and audiences within the local building market.
- **Well-designed linkages** are necessary between regulatory and voluntary programs and related incentives or capacity-building efforts.

At the same time, cities seeking to implement policies in order to accelerate energy efficiency will inevitably encounter obstacles, many of which can be successfully overcome. Common challenges and possible solutions include the following:

- **Data accuracy.** Incorrect data stem mostly from human error. This can be overcome by, for example: developing automated reporting platforms and data-cleaning methods to identify common errors; highlighting error tendencies to reporting parties; or requiring building owners to engage a registered energy professional for the auditing and reporting process.
- **Aggregated whole-building data** can be difficult for building owners and managers to obtain. For example, tenants may be unwilling to provide data. Cooperating with utilities to make energy consumption data available can be a solution.
- **Outreach and marketing** may require significant efforts and time-consuming adaptation to accommodate specific groups or building segments.
- **Moving on to implementation** of energy efficiency measures from mere benchmarking and auditing compliance to actual implementation can be a big step. It may require educating building owners/managers on how the results from their building can be used to generate economic savings and improve the building's market value.
- **Tenant engagement.** Most programs to date have not focused on tenants, nor have they sufficiently addressed split-incentive obstacles.
- **Staffing limitations.** The design and implementation of energy efficiency policies can be time-intensive, and some cities have overcome this by pooling resources and expertise with other government departments. The mandatory use of registered energy professionals for compliance-based policies such as audits broadens the knowledge base available to building owners/managers and increases the quality of data submitted to the city.

APPENDIX 1.

BUILDING EFFICIENCY TOOLS FOR CITIES

Key Takeaways

- There is no single tool that will enable all cities to increase their building efficiency; rather there is a range of tools to help municipal officials develop targets, implement new programs, and track performance.
- Tools use modeling, assumptions, and best-practice data to link policy goals with building- and city-level outcomes. Such tools are effective only when they are used with due consideration of local data and context.
- Tools can leverage consensus-based multi-stakeholder collaboration to better prioritize building efficiency actions.
- Policy-assessment tools provide a simple framework to help municipal officials set policy priorities based on input from stakeholders.
- Building-project tools can help municipal officials, building owners, and developers improve building efficiency and quantify the contribution of such actions to achieving city-level policy goals.

POLICY AND PROJECT TOOLS FOR BUILDING EFFICIENCY

This appendix provides an overview of technical assessment tools applicable to building efficiency policies and projects, which municipal policymakers can use to set targets, draft and implement programs, and assess performance. The tools described here are a subset of the large and diverse range of resources available to city stakeholders. The available tools have been categorized into two groups: policy tools and project tools.

Policy tools provide assistance to policymakers at every stage of the policy cycle illustrated in Figure A1.2. Each stage of the policy cycle has its challenges and involves a number of steps. Policy tools can help policymakers go through the policy cycle and effectively design and implement policy packages, as well as track their impacts. To maximize cost-effectiveness, policymakers can use multiple analytical and information tools to support their decisions and actions.

Project tools help stakeholders comply with and go beyond minimum efficiency standards. They can be used to support the design, construction, or renovation of a building project, calculate building energy performance, and estimate potential savings that support and/or comply with energy efficiency policies. Project tools can play an important role at the implementation as well as the evaluation and reporting stages. Evaluation of the actual performance of constructed or renovated buildings provides feedback on the effect of the policies and the energy efficiency measures that were utilized. The data from this evaluation can be fed back into the tools.

Where comprehensive data are available, building performance assessment tools can provide detailed benchmarking, savings potential, project management, and ex-post measurement information. When local building-specific data are limited, municipal officials can use online asset-rating systems to estimate energy use. Given that building design differs considerably between countries, climates, and even cities, estimates based on data from another region are likely to have a considerable error margin.[1]

DECISION TREE FOR TOOL OPTIONS

A decision tree that can guide policymakers through choosing among some publicly available policy tools is set out in Figure A1.1 and Table A1.1. The selected analytical tools are identified and mapped to the appropriate stages of the cycle where they can support the key steps of policy development. An example of the application of one of these tools, TRACE, in Mexico, is provided in Box A1.1.

THE POLICY CYCLE

The policy cycle, presented in Figure A1.2, involves five key stages of policy development. Each stage requires policymakers to make a number of important decisions and acquire necessary data and inputs, which are in many cases not readily available. Lack of reliable data and necessary methodologies often undermines effectiveness of policymaking and slows down the process of energy efficiency acceleration. Each stage of the policy cycle is described in more detail below, while specific tools that are best matched to each phase or phases of the policy cycle are presented in Table A1.1.

Scoping

The beginning of the policy development process involves collecting information on a number of parameters that characterize the status of energy efficiency in the jurisdiction under analysis. If the jurisdiction does not yet have an established baseline, one can be created using various modeling tools. Data availability for the building sector can be a significant challenge. Potential data gaps will have to be identified at an early stage of the baseline construction and options to fill these gaps analyzed. A number of sources, including online tools and databases presented in the initial scoping stage, can be used to obtain necessary data or access information to use as a proxy for estimates.

Existing barriers to energy efficiency improvements must also be identified in order to determine the most crucial energy efficiency instruments that are appropriate to the current situation. Tools related to this stage provide information on how policy instruments can be matched to particular barriers.

Identification of Options

Policymakers must then analyze potential policy instruments to target these barriers. Tools for this stage help with selection of relevant types of policy instruments, taking into account existing barriers, and suggest policy-development starting points.

Once potential policy options have been identified, they should be prioritized in accordance with short-term and long-term goals for the local jurisdiction, and with local capacity and knowledge available to design and implement each instrument. One approach to analyzing a number of policy instruments from this point of view is provided by the Assessment Tool for Building Efficiency Policies presented in Appendix 2.

Figure A1.1 | **Decision Tree Diagram and Relevant Building Efficiency Tool**

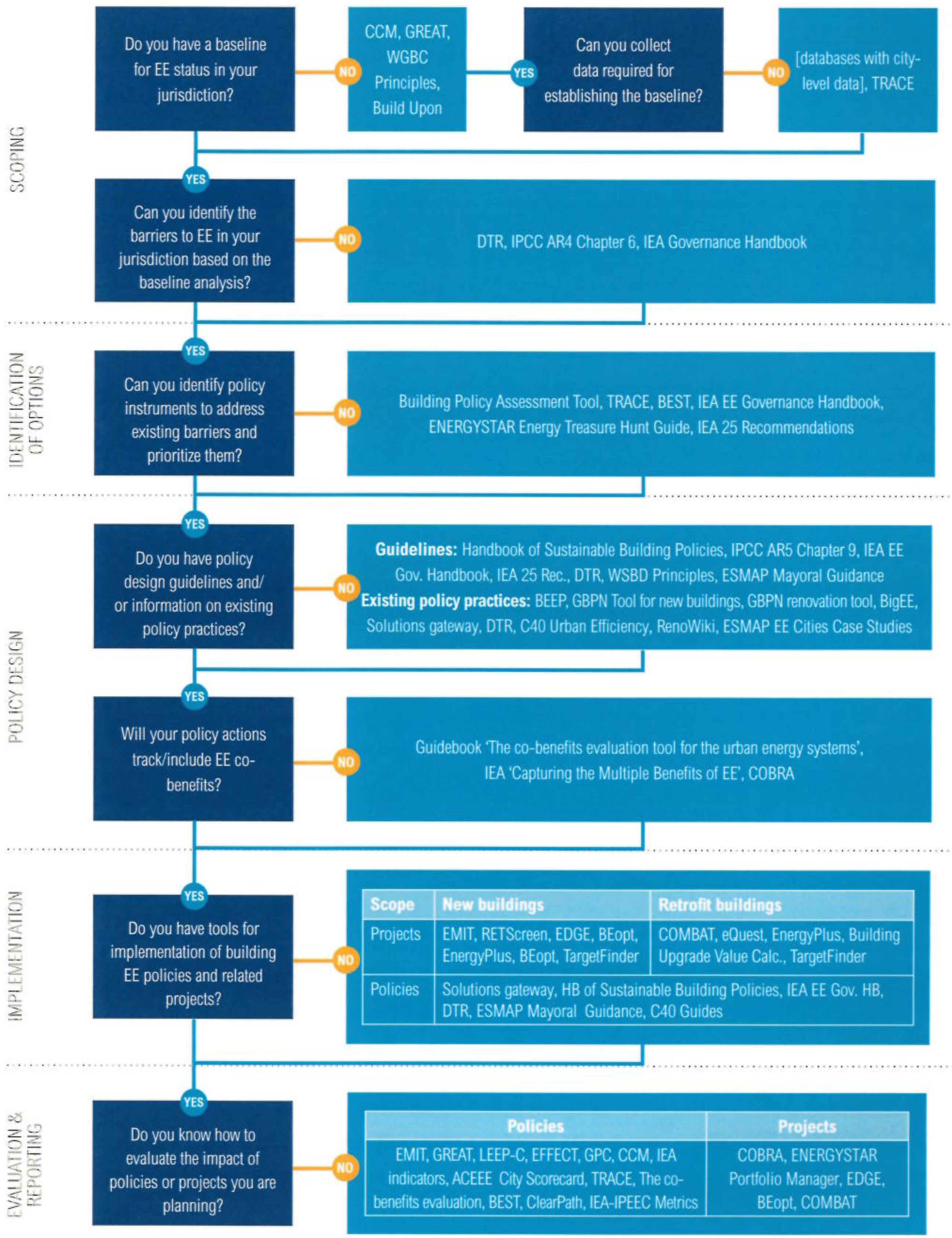


Table A1.1 | **Building Efficiency Tools**

NAME OF THE TOOL	DEVELOPER	SCOPE		STAGE OF THE POLICY DEVELOPMENT CYCLE				
		PROJECT	POLICY	SCOPING	IDENTIFICATION	DESIGN	IMPLEMENTATION	TRACKING
25 Recommendations for Buildings	IEA		●		●	●		
Assessment Tool for Building Efficiency Policies	World Resources Institute		●		●			
Benchmarking and Energy Saving Tool for Low Carbon Cities (BEST)	LBNL		●		●			●
BigEE Policy Guide	Wuppertal Institute		●			●		
Build Upon Resources	World Green Building Council		●	●				
Build Upon Stakeholder Mapping Tool	World Green Building Council		●	●				
Building Energy Efficiency Policies (BEEP)	IEA		●			●		
Building Energy Optimization (BEopt)	NREL	●					●	●
Building Energy Performance Metrics	IEA-IPEEC		●					●
Building Upgrade Value Calculator	U.S. EPA, U.S. DOE	●					●	
Capturing the Multiple Benefits of Energy Efficiency	IEA		●			●		
City Energy Efficiency Scorecard	ACEEE		●					●
ClearPath	ICLEI USA		●					●
Co-Benefits Risk Assessment (COBRA)	U.S. EPA		●			●		●
Commercial Building Analysis Tool for Energy-Efficiency Retrofits (COMBAT)	LBNL	●					●	●
Common Carbon Metric (CCM)	UNEP		●	●				●
EE Governance Handbook	IEA		●		●	●	●	
EE Indicators	IEA		●					●
Energy Efficient Cities Case Studies Database	World Bank, ESMAP		●			●		
Energy Forecasting Framework and Emissions Consensus Tool (EFFECT)	World Bank, ESMAP		●					●
Energy Model Input Translator (EMIT)	RMI	●					●	
EnergyPlus and eQUEST	U.S. DOE	●					●	

Table A1.1 | **Building Efficiency Tools (continued)**

NAME OF THE TOOL	DEVELOPER	SCOPE		STAGE OF THE POLICY DEVELOPMENT CYCLE				
		PROJECT	POLICY	SCOPING	IDENTIFICATION	DESIGN	IMPLEMENTATION	TRACKING
ENERGY STAR Energy Treasure Hunt Guide	U.S. EPA, U.S. DOE	●			●	●		
ENERGY STAR Portfolio Manager	U.S. EPA, U.S. DOE	●						●
Excellence in Design for Greater Efficiencies (EDGE)	World Bank / IFC	●					●	●
Fifth Assessment Report (AR5), Chapter 9	IPCC		●			●		
Fourth Assessment Report (AR4), Chapter 6	IPCC		●	●		●		
Global Protocol for Community-Scale GHG Emissions (GPC)	C40 Cities, ICLEI, WRI		●					●
Good Practice Guide: Muncipical Building Efficiency	C40 Cities		●				●	
Green Resources & Energy Analysis Tool (GREAT)	LBNL		●	●				●
Handbook of Sustainable Building Policies	UNEP		●			●	●	
Improving Energy Efficiency in Buildings: Mayoral Guidance Note	World Bank, ESMAP		●			●	●	
Key Principles for Colaborative Policy-Making	World Green Building Council		●	●		●	●	
Local Energy Efficiency Policy Calculator (LEEP-C)	ACEEE		●					●
Policy Tool for New Buildings	GBPN		●			●		
Policy Tool for Renovation	GBPN		●			●		
RenoWiki	World Green Building Council		●			●		
RETScreen	NRCAN	●					●	
Solutions Gateway	URBAN LEDS, ICLEI, UN HABITAT		●			●	●	
Target Finder	U.S. EPA	●					●	●
The Co-benefits Evaluation Tool for the Urban Energy System	UNU-IAS		●			●		●
Tool for Rapid Assessment of City Energy (TRACE)	World Bank, ESMAP		●	●	●			●
Urban Efficiency report	C40 Cities		●			●		

Figure A1.2 | The Building Policy Cycle

Policy Design

Policy design is a crucial stage of policy development, because it pre-determines the content and impact of selected policies. Existing tools and handbooks can provide general information on design principles for different policy instruments, as well as an outline of the most common, effective interactions.[2] It is important to use these principles only as guidance and carefully analyze local conditions to ensure maximum alignment of the policy package's design.

Information on existing policies and best practices in other cities can provide important insights for transferring lessons learned and adapting them to local conditions. Tools for this stage include databases and online analytical tools that contain detailed information about specific policies, planned or implemented (e.g. building codes, building performance ratings).

Implementation

At the implementation stage, the policy package is translated into concrete actions. Policymakers and implementation partners should have sufficient information on success factors and potential hidden obstacles that will affect implementation. The implementation stage policy tools in Table A1.1 offer information on the main implementation steps for different policy instruments.

Policymakers must also take into account the potential co-benefits of energy efficiency improvements, which may leverage additional investments and increase ambition of policy efforts. The tools may assist with identifying and in some cases in quantifying these co-benefits, as well as learning from existing experiences.

Monitoring, Evaluation, and Reporting

In order to understand and demonstrate the impact of a policy package, it is crucial to monitor, evaluate, and track progress against a baseline, that is, the situation prior to policy implementation. The tools for this stage can assist with constructing scenarios or inventories for the building sector. They usually offer options for the visual outputs of such analysis, which can be valuable for reporting on results. Indicators and benchmarking frameworks can also be useful to demonstrate the progress of policy and compare results with other locations.

Project tools applicable to this stage of the policy cycle usually provide the opportunity to estimate potential energy use, emissions, and/or costs of the analyzed building project, and to calculate the savings that might be expected from implementation of one or more specific energy efficiency measures.

The outcomes of monitoring, evaluation, and reporting can generate a significant amount of data and lessons learned, which may (and should) inform the scoping stage of a new policy cycle, enriching its starting point.

BOX A1.1 | TRACE TOOL IMPLEMENTATION IN PUEBLA, MEXICO: AN EXAMPLE OF THE EFFECTIVE USE OF TOOLS FOR POLICY IDENTIFICATION

The Tool for Rapid Assessment of City Energy (TRACE), developed by ESMAP (Energy Sector Management Assistance Program), a unit of the World Bank, helps prioritize sectors with significant energy savings potential, and identifies appropriate energy efficiency (EE) interventions across six sectors—transport, municipal buildings, water and wastewater, street lighting, solid waste, and power & heat. It consists of three principal components:

- An energy benchmarking module which compares key performance indicators (KPIs) among peer cities (with an underlying database of 28 KPIs collected from 80 cities);
- A sector prioritization module which identifies sectors that offer the greatest potential with respect to energy-cost savings; and
- An intervention selection module which functions like a "playbook" of tried-and-tested energy efficiency measures.

These three components are woven into a user-friendly software application that takes the city through a series of sequential steps: from initial data gathering to a report containing a matrix of energy efficiency recommendations tailored to the municipality's individual context, with implementation and financing options.

In 2013 TRACE was implemented in Puebla, Mexico with the aim to contribute to the development of the urban energy efficiency strategy by the Mexican Secretary of Energy (SENER). More than 54% of total energy use in the city is consumed by the transport sector. Residential, commercial, and public sectors account for 23.8% of total consumption, with industry consuming 21.6%.

As a result of the implementation of TRACE four priority areas were identified for Puebla with municipal buildings being the second largest in terms of energy spending and potential savings. Most of the 134 municipal buildings in Puebla are public offices, as all schools and most of the hospitals are managed by state and federal authorities. Many of the government buildings in the large downtown area are historic, which implies additional difficulties for renovation.

The application of the tool identified several energy efficiency measures, which can improve the management of municipal buildings in the city, save energy and reduce utility expenditures, for example:

- A Municipal Building Database and Benchmarking Program in order to identify buildings and end-uses with the largest energy saving potential, enable competition among building managers and the exchange of data and best-practices;
- A Municipal Buildings Audit and Retrofit in order to identify and prioritize energy efficiency upgrades for city managers;
- A mandatory Energy Efficiency Codes for New Buildings in order to establish best-practice standards based on new or existing international codes.

Note: The TRACE Tool is available for download at http://esmap.org/TRACE.

Source: ESMAP. 2014 "Tool for Rapid Assessment of City Energy: Puebla, Mexico." http://www.esmap.org/sites/esmap.org/files/DocumentLibrary/TRACE_Mexico_Puebla_Optimized.pdf.

APPENDIX 2.

ASSESSMENT TOOL FOR BUILDING EFFICIENCY POLICIES

Key Takeaways

- The right combination of policies can help transform buildings to be far more energy efficient over time.
- The Assessment Tool for Building Efficiency Policies provides a simple framework to help policymakers set policy priorities with input from stakeholders.
- The tool supports a collaborative process for exploring building efficiency policy options based on local importance and difficulty, as well as current policy status and the desired suite of policies for implementation.
- The tool includes a facilitator's guide to running a workshop, templates, and analysis tools.
- The workshop is designed to support consensus-based multi-stakeholder collaboration and uses visual tools to build consensus and prioritize building efficiency policy options and strategies.

Designing a strategy to transform the built environment to be more energy efficient is not a simple process. No single government policy can drive the transformation on its own, but the right combination of policies can help transform buildings to be far more energy efficient over time. The Assessment Tool for Building Efficiency Policies presented in this section provides a simple framework to help policymakers get started with designing a policy strategy that will achieve transformation of the built environment.

The tool will be most effective when used to assess policy options and priorities for one market segment at a time, such as new residential construction or existing commercial buildings. Market segments might be selected based on potential energy savings, economic impact, or other factors.

The tool provides a framework for structuring discussions in a workshop setting with key stakeholders from across the building efficiency market, including government, civil society, and the private sector. Stakeholders that might be involved include local government agencies and bodies, other levels of government where relevant, architecture and engineering firms, energy service companies, manufacturers, energy service providers, financial institutions, real estate management companies, and non-governmental and community organizations. The recommended workshop agenda includes three activities—visioning, assessment, and action planning.

THE BUILDING EFFICIENCY POLICY WORKSHOP

The most important step in organizing a policy workshop is inviting the right set of stakeholders. The goal should be to have balanced representation from all key stakeholder groups—public sector, private sector, and non-profit/community organizations. Participants should have a comparable and complementary level of knowledge of market conditions and opportunities. If the differences in experience or position are too large, it will be difficult to maintain engagement and build consensus around specific strategies. Workshops that include 15–30 diverse stakeholders will be large enough to facilitate active collaboration without being so large as to inhibit discussion. Figure A2.1 provides an overview of the flow of such a workshop.

The policy workshop framework has been designed around a nominal half-day format but can be easily expanded or shortened to meet any timeframe. The workshop space should ideally include a U-shaped seating area for facilitated discussion and plenty of wall space for hanging flip chart paper and policy assessment sheets.

Necessary materials include tent-style name cards, flip chart paper, masking tape, flip chart markers, sticky notes, thin-point markers, sheets of small colored sticky dots (three colors), and the building efficiency policy assessment sheets.

WORKSHOP FACILITATOR'S GUIDE

The workshop should open with a welcome from the sponsoring organization and short introductions from each participant. Tent cards should be used to identify each participant's name and organization. Each participant gets a pad of sticky notes, a thin-point marker and a sheet of small colored sticky dots with the colors assigned to specific stakeholder groups (e.g., green for government, blue for private sector, red for non-profit and community organizations).

Visioning

The first exercise is a visioning exercise to get the participants thinking positively about how policy can enhance the efficiency of the built environment. The facilitator asks the following:

"If we transported ourselves ten years into the future and were interviewed by a reporter, what would we like to say we had accomplished because of enacting new building efficiency policies?"

Every participant writes a couple of future accomplishments or desired outcomes on individual sticky notes. The facilitator then asks for volunteers to share one of their ideas with the group while grouping the sticky notes into categories on flip chart paper. When all ideas are shared, the flip charts are hung on the wall and the first assessment exercise begins.

Assessment

Step 1—Current Policy Status

The policy assessment tool includes eight building-efficiency policy assessment sheets (hereafter called policy assessment sheets or assessment sheets), which should be printed. Ask all participants to stand near the policy assessment sheets, which have been taped individually to the top of a sheet of flip chart paper and placed along a large wall. Each policy assessment sheet covers one of the eight policy options described in this report. A spreadsheet containing the assessment sheets is available in an Excel format in English and Spanish at **www.buildingefficiencyinitiative.org/tool**. Where necessary, it may be valuable to translate the assessment sheets into another language. Additional policy option sheets can be created or customized as well, depending on the scope and goals of the workshop.

Figure A2.1 | **Flow of Building Efficiency Policy Workshop**

The first exercise involves establishing the current state of policy in the city under consideration. Using the policy assessments sheets, each participant assesses what he or she believes to be the current state of the policy for the selected sector in the given city by placing one of the colored dots in one of the five areas of each sheet labeled Step 1—Current Status. The categories are:

- No policy or planning currently in place
- Planning to pilot or implement policy
- Piloting the policy on a limited basis
- Limited sub-local implementation
- Comprehensive citywide implementation

The participants should be encouraged to ignore the other participants' votes and rely on their own first impressions. After everyone has voted, the facilitator should discuss the results for each policy and encourage participants who voted outside of the norm to explain (but not defend) why they did so.

Step 2—Policy Importance and Difficulty of Implementation

The next exercise assesses the relative importance and difficulty of implementing each policy for the specified sector. The assessment sheet includes a five-by-five grid that allows participants to place a colored dot in one of 25 locations, indicating a rating for both importance (ranging from "not at all important" to "extremely important") and difficulty (ranging from "not at all difficult" to "extremely difficult"). The facilitator needs to clearly define both importance and difficulty with the help of the participants so that everyone is using a consistent set of assessment criteria. Building efficiency policies often involve various government agencies and departments at many levels of jurisdiction from local to sub-national and national level. The assessment criteria and workshop participation need to be matched to the sector, city, and jurisdiction of interest.

The importance of each building efficiency policy depends on its potential to:

- Generate energy and carbon reductions
- Reduce energy costs for building owners and occupants
- Drive economic development and create multiple benefits
- Attract private capital

The difficulty of implementing each building efficiency policy depends on having the requisite:

- Capacity to implement ("capacity to act")
- Capability to implement
- Readiness to implement
- Willingness to implement

Such capacity is likely to differ at local government level versus the national or federal scale. The availability of sufficient resources can also be more limited at the local level; on the other hand, implementation is easier if a local government can count on willing partners.

After everyone has voted once on each sheet, the facilitator should again discuss the results for each policy and encourage participants who voted outside of the norm to explain (not defend) why they did so. Policies with a large concentration of dots in the lower right hand corner are relatively high in importance and relatively low in difficulty. These would be good options for short-term priorities. Similarly, policies with a large concentration of dots in the upper right hand corner are relatively high in importance and relatively high in difficulty, making them candidates for longer-term priorities.

A helpful next exercise is to have the participants identify the key barriers and challenges facing implementation of each policy (i.e., why implementation is difficult). The facilitator can capture these on the flip chart page located under each assessment sheet. Next, the facilitator should list ideas that participants contribute to address the barriers and challenges and reduce the difficulty of implementation. This is a good time to share examples, case studies, and best practices from this report and other sources.

Step 3—Desired Short-Term and Long-Term Policy States

The next exercise uses the remaining area of the policy assessment sheet to define the desired future states of each policy in the short and long term. It is important that the facilitator defines what constitutes short and long term so that all participants are using the same criteria. A policy workshop focused on a city policy in a specific sector may choose, for example, two years for short-term and five years for long-term futures.

The participants should be encouraged to review the consensus input on current policy status, importance, and difficulty before making their selections for desired short-term and long-term states. After everyone has voted, the facilitator should discuss the results for each policy and encourage participants who voted outside of the norm to explain (not defend) why they did so.

The final exercise in the assessment activity is to facilitate a discussion about which policies should be implemented in combination, in both the short and long term, in order to maximize the beneficial impact and improve the chances of success. This exercise may involve trade-offs among policies in order to optimize benefits in the face of different degrees of importance and difficulty presented by different policy combinations. Many of the policies have natural complements, such as building codes, performance disclosure, and green building rating systems, which should be considered as a group.

NEXT STEPS AND ACTION PLANNING

After the assessment exercises are complete, the facilitator should lead a discussion on the next steps and actions the group should take to maintain interest and momentum in the transformation process. The first priority should be to schedule a time for the group to get back together to review the results of the workshop and develop a strategy and detailed action plan—the who, what, when, and where—to gain support and sponsorship for the selected strategies and policy initiatives. This meeting may include additional stakeholders, who were not involved in the policy workshop, in order to begin broadening the education, outreach, and support for the initiative. The facilitator should be responsible for preparing a report that summarizes the activities of the workshop, including visual output and analysis of the assessment input. A spreadsheet-based report generator has been included in English and Spanish at **www.buildingefficiencyinitiative.org/tool** to assist in creating standard charts using input from the assessment sheets.

POLICY ASSESSMENT SHEET

Figure A2.3 provides an example of a policy assessment sheet included in the Assessment Tool for Building Efficiency Policies, and illustrates what the sheet might look like after participants complete the assessment exercises.

Sample Report Generator Output

Figure A2.2 provides an example of a policy importance vs. difficulty map. This example is city-specific and the ranking of policies assigned on this map should therefore not be taken as guidance.

Figure A2.4 provides an example of a policy radar map, illustrating the current and desired status of various policies.

Figure A2.2 | **Building Efficiency Policy Map: Importance versus Difficulty**

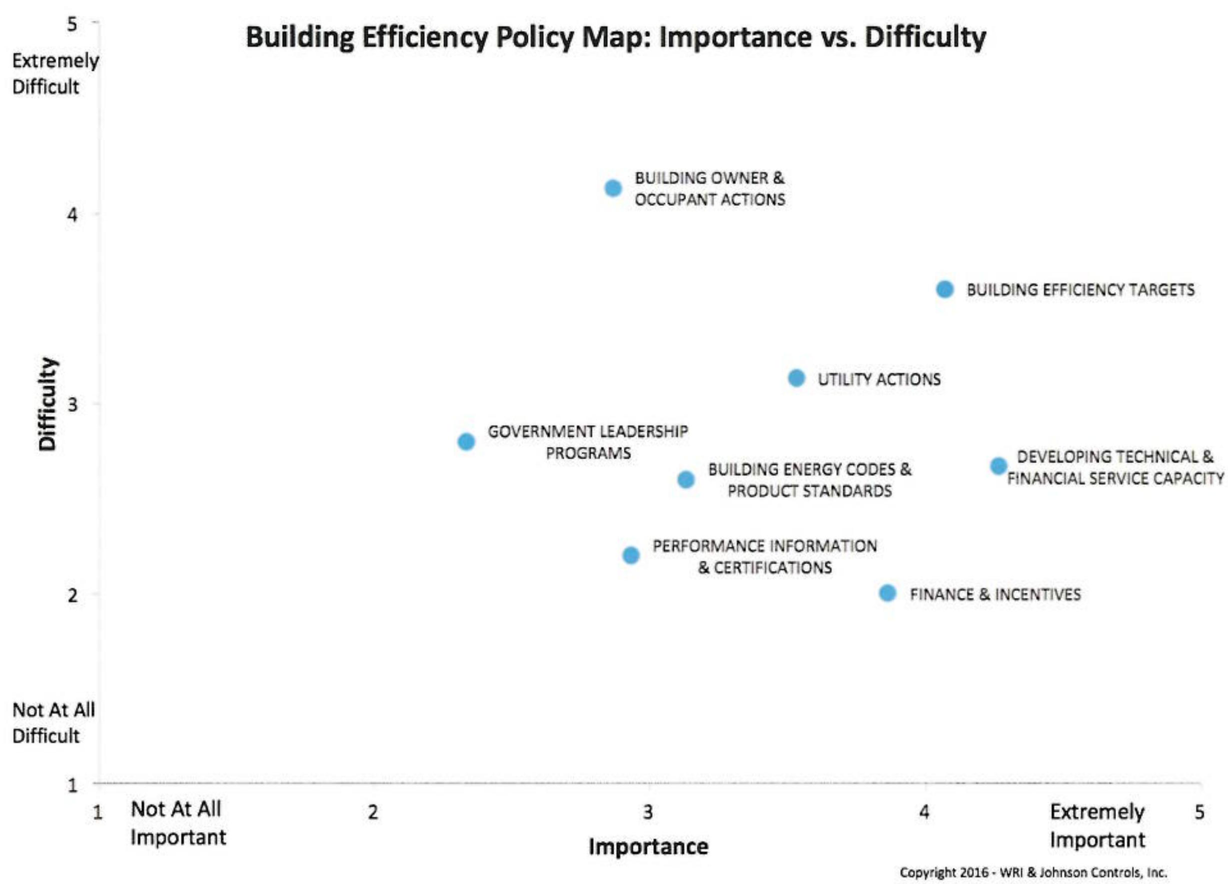


Figure A2.3 | **Sample Policy Assessment Sheet After Exercise**

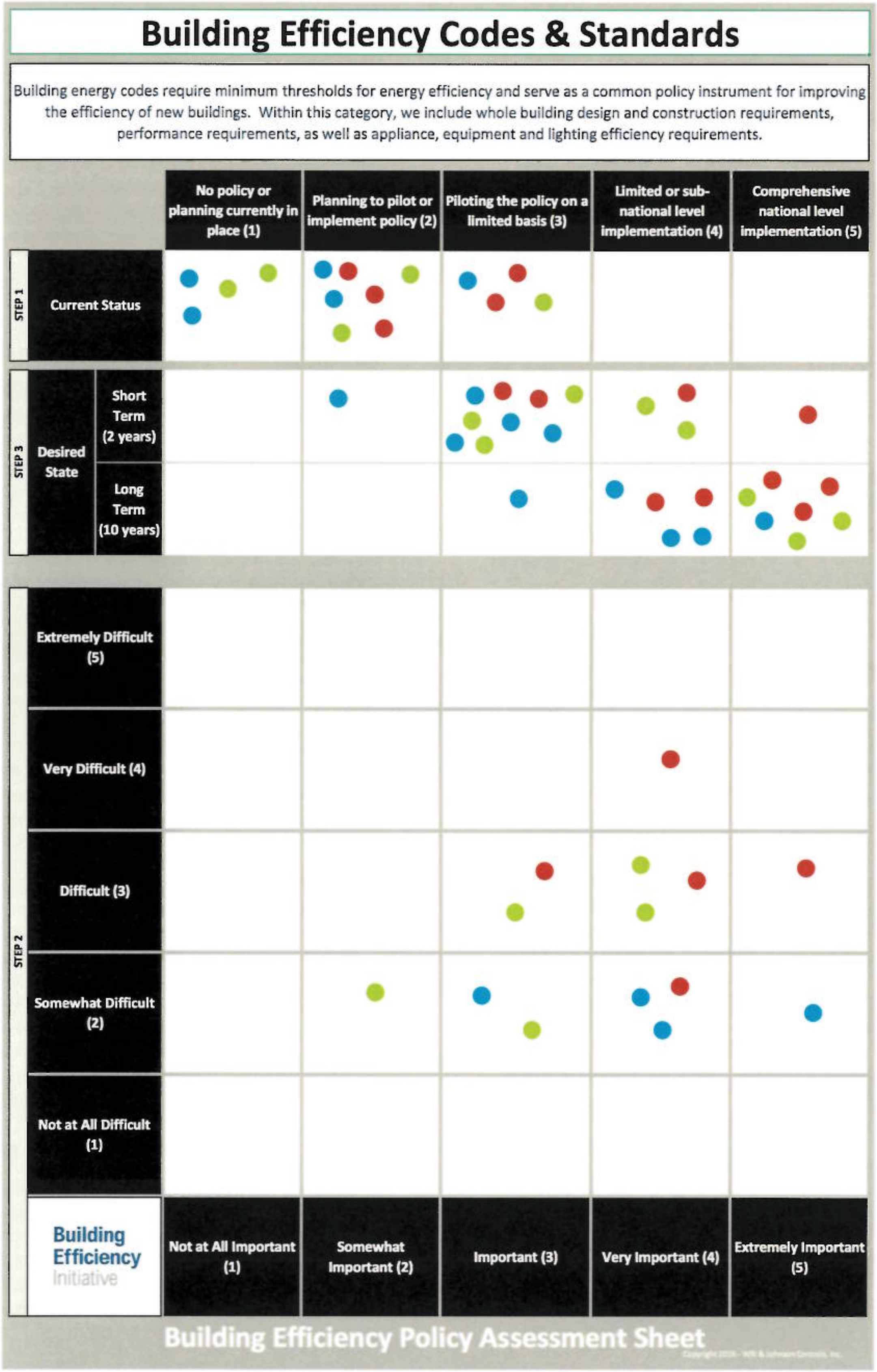
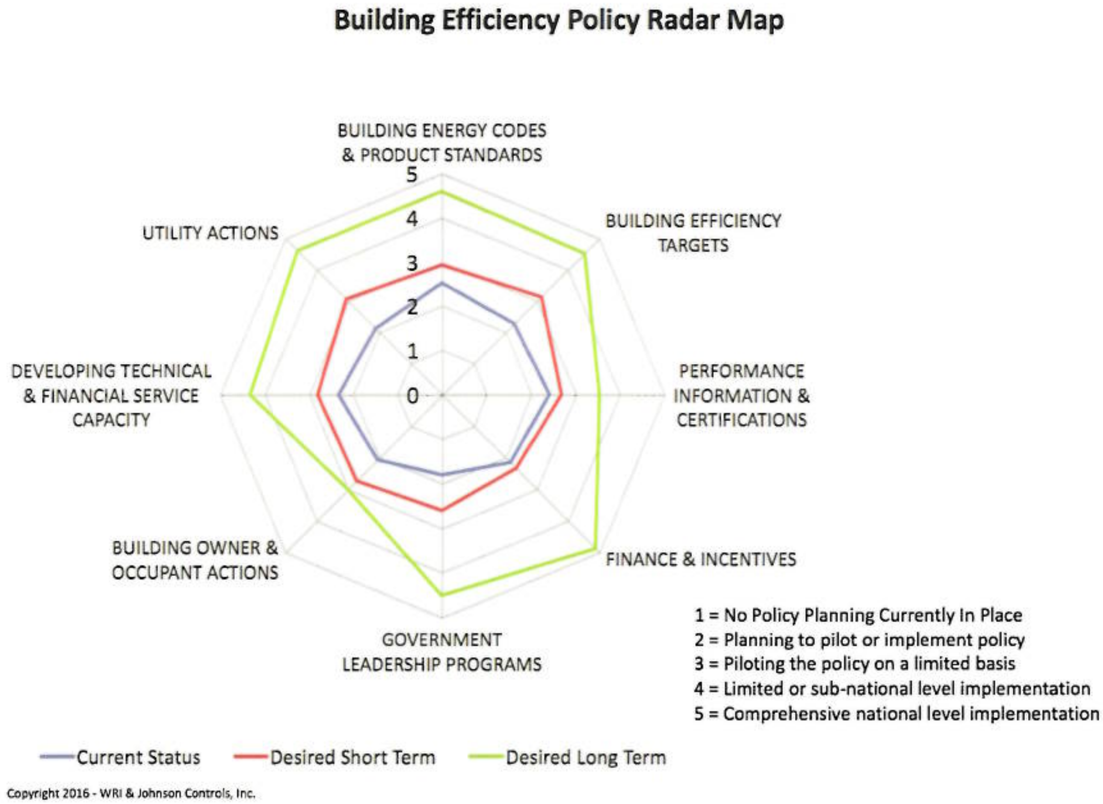


Figure A2.4 | **Building Efficiency Policy Radar Map**



ADAPTING THE TOOL FOR MULTIPLE PURPOSES

The simple framework presented here can be adapted as needed to serve different purposes and audiences. For example, a different version of the tool might be adapted by local policymakers to guide decisions for different spheres of local government—one tool might focus more on making political assessments, while another might focus on technical questions. The tool also can be adapted to cover additional policy categories and sub-categories as well as to consider additional assessment factors that may be of interest to stakeholders. We hope the tool and workshop format described in this section can help guide and accelerate collaborative, multi-stakeholder efforts to make that critical first step toward transforming the built environment through strategic policymaking.

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Appendix 1

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