

Working Paper

Building Thriving, Low-Carbon Cities: An Overview of Policy Options for National Governments

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Abstract

Action by national governments is crucial for achieving sustainable, economically productive urban development. A range of benefits can be achieved through development focused on compact, accessible urban forms; clean and efficient urban transportation options; efficient building energy use and local clean energy solutions; and efficient urban waste management – all of which can also lower greenhouse gas emissions (i.e., a “low-carbon” approach). National governments can use a wide range of measures to promote such a model – not all of which need be strictly urban-focused or traditional parts of national urban development policies. A comprehensive strategy should include both targeted national policies and enabling approaches that enhance the capacities of local government, increase their access to finance, and mobilize private investment in urban infrastructure. Measures should also be chosen to achieve a coherent package that exploits synergies and avoids conflicting incentives. Key considerations include budgetary impacts, administrative burdens, technical capacity requirements, impacts on local government budgets and capacities, coordination challenges, and equity concerns. The “right” set of measures will depend on a country’s particular national circumstances. Countries that are already pursuing low-carbon strategies have adopted different approaches that reflect their respective capacities, policy and political contexts, and urban development challenges and opportunities.



Photo credit: Visty Banaji

About this working paper

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Executive summary

People around the world are rapidly concentrating in cities. Already, more than half the global population lives in urban areas, and by mid-century, it will be two-thirds. This means that if we want to drive economic growth, improve human welfare, reduce poverty, and protect the environment, we increasingly need to focus on managing urbanization and associated opportunities and risks. In this context, there is a growing recognition of the need for effective national urban policies to address key development priorities.

Urbanization is also a major focus of efforts to address climate change. As social and economic hubs, cities account for a large share of global energy consumption and resulting greenhouse gas (GHG) emissions. Alternative modes of urban development could conserve energy and substantially reduce emissions – in particular, by focusing on:

- Compact, accessible urban forms;
- Clean and efficient urban transportation options;
- Efficient building energy use and local clean energy supply; and
- Efficient urban waste management.

These four traits are not only important for addressing climate change – they are also linked to benefits such as improved public health, enhanced employment opportunities, greater economic productivity, and reduced local pollution. “Low-carbon” urban development is therefore highly aligned with broader social and economic urban development goals, and can provide a strong foundation for sustainable national growth as part of a “new climate economy.”

Still, few countries have made low-carbon urban development a priority for national policy. This report aims to encourage national governments to adopt low-carbon national urban policies by clarifying the critical role they can play in driving urban development and providing a comprehensive overview of available options. Drawing on a rich literature informed by national- and local-level efforts around the world, we present an array of national policy tools for low-carbon urban development, along with guidance on how to design national urban policies appropriate to different national circumstances.

WHY CITIES NEED NATIONAL POLICY SUPPORT

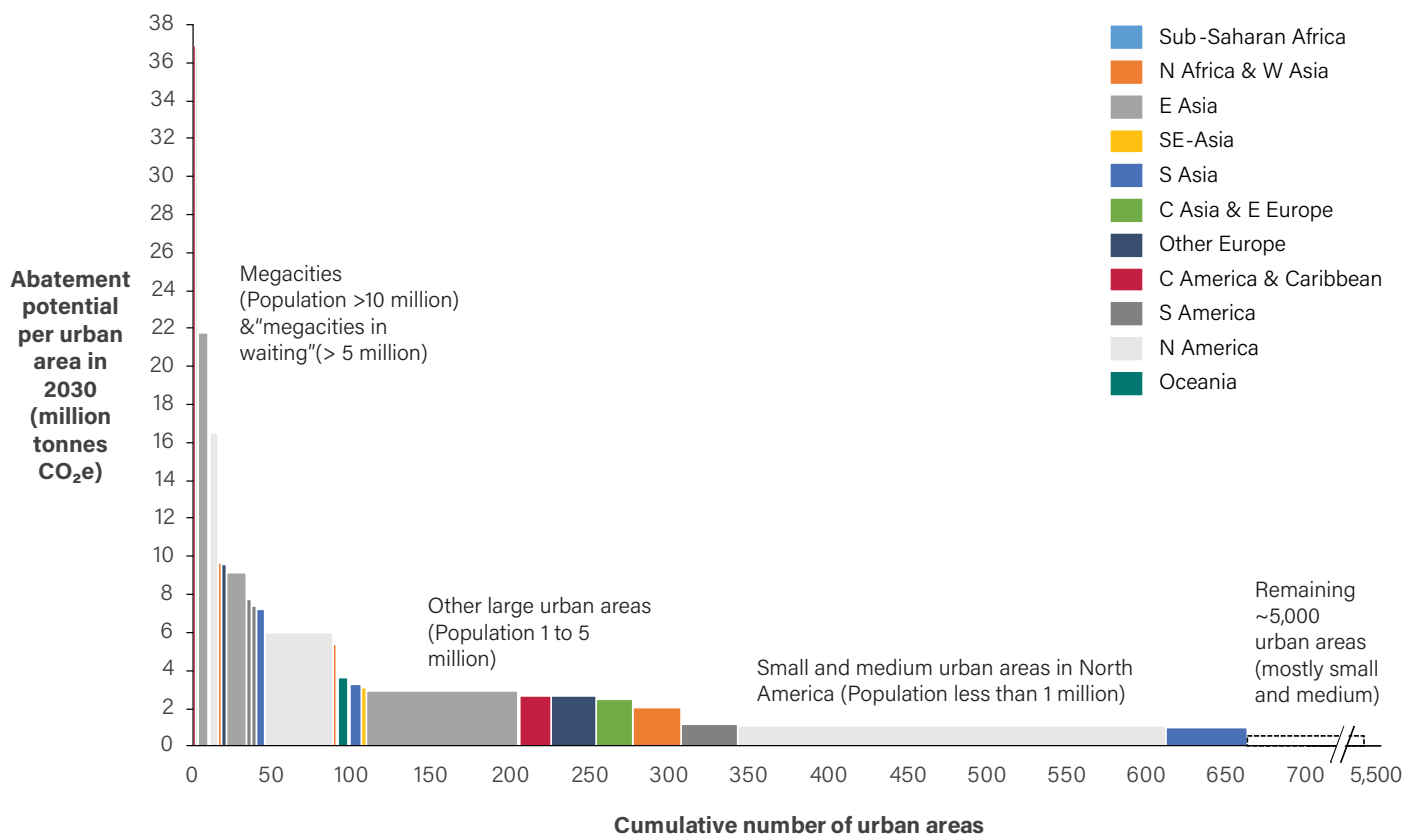
Urban development is typically seen as the responsibility of municipal governments. Indeed, many cities have done a great deal to advance low-carbon urban development. However, key aspects of urban life are defined by higher-level policies, which can help or hinder the achievement of sustainability goals. National energy efficiency standards can help reduce urban energy needs, for example, whereas transportation fuel subsidies, or tax policies that favour single-family detached homes, can frustrate efforts to achieve compact development. This means that fully unlocking the benefits of low-carbon urban development requires coherent policy-making and coordinated governance at multiple levels.

National policies are also critical for addressing shortcomings in local resources and capacity. Globally, opportunities for GHG abatement and other benefits in urban areas are highly dispersed, with the vast majority occurring in small- and medium-sized cities (Figure ES-1).ⁱ These are precisely the jurisdictions that have the fewest resources and capacity. In most countries, national leadership is needed to enable local action.

ⁱ About half of global abatement potential is in the 660 largest urban areas (area of bars in visible portion of Figure ES-1), the remainder is spread across approximately 5,000 smaller urban areas.

Figure ES-1

Global low-carbon urban development potential is spread across thousands of urban areas



Source: Authors' analysis and classification of data from Erickson and Tempest (2014). The height of each bar represents GHG abatement potential per urban area in 2030, the width indicates number of urban areas within different population classes and world regions (as indicated by labels and shading, respectively). Nearly half of all 2030 urban abatement potential is in the approximately 5,000 small and medium urban areas that lie to the right edge of the graph.

WHAT CAN NATIONAL GOVERNMENTS DO?

Governments around the world are increasingly aware of the importance of well-managed cities, and are thus formulating and implementing national urban policies. The goal is to create a coherent, cross-cutting vision of how different sectors and levels of government can shape the growth of towns and cities.

National urban policies have two key roles to play in driving low-carbon urban development. First, they can establish policies and incentives that directly or indirectly affect urban growth, mobility, energy use and waste management. Second, they can create frameworks for other levels of government to develop and implement urban policies, by providing policy direction and incentive structures, building local capacities and resources, and aligning policies at different levels.

This report lays out the range of policy options available to national governments pursuing low-carbon urban development. It is a comprehensive review and analysis, and thus an invaluable resource as policy-makers seek to design and implement low-carbon national urban policies. The report summarizes a variety of *policy approaches* –

often involving multiple levels of government – needed to achieve low-carbon urban development goals, and identifies *specific kinds of national policies* needed to pursue these approaches. National policies can include *regulatory* interventions, *fiscal* instruments (both direct spending and financial incentive tools), *informational* measures and *governance* reforms. National policies can also be applied as part of *cross-cutting* approaches that can help advance multiple aspects of low-carbon development, in many cases by enhancing local government capacities. Table ES-1 provides an overview.

Table ES-1

National low-carbon urban development policies

Development goal	Policy approaches	National policies	Measure type	
Compact urban form	Spatial planning	<ul style="list-style-type: none"> Establish national urban spatial planning frameworks that promote “smart growth” Promote compact form through public service, housing, and infrastructure provision 	R* F	
	Reform urban development tax and regulatory incentives	<ul style="list-style-type: none"> Implement national property tax reforms and development charges Revise national tax or regulatory incentives favouring less dense development 	F F	
Low-carbon urban transportation	Multi-modal mobility planning and infrastructure development	<ul style="list-style-type: none"> Establish national urban mobility policies Fund low-carbon transportation infrastructure Align national infrastructure spending priorities with multi-modal transport goals 	R* F F	
	Align pricing incentives with multi-modal transportation goals	<ul style="list-style-type: none"> Tax or restrict private vehicle ownership Incentivize efficient use of transportation modes 	F/R F	
	Promote vehicle efficiency and clean energy alternatives	<ul style="list-style-type: none"> Enact fuel efficiency and alternative vehicle standards Provide fuel efficiency and alternative vehicle incentives Enact low-carbon fuel standards Fund infrastructure for cleaner vehicles and fuels Implement fuel economy labelling for vehicles Provide national driver training programmes 	R F R F I I	
	Optimize freight transport efficiency		<ul style="list-style-type: none"> Establish national freight transport planning and logistics policies 	R*
			<ul style="list-style-type: none"> Provide tax incentives or requirements for freight transport mode shifting and optimization Fund alternative freight infrastructure (e.g. rail) 	F/R F

Efficient building energy use and local clean energy supply	Promote energy-efficient design of new buildings	<ul style="list-style-type: none"> Establish national building energy codes Establish building energy certification and labelling programmes Provide incentives for efficient building design and construction 	R I F
	Promote energy-efficient renovations and retrofits of existing buildings	<ul style="list-style-type: none"> Ensure building retrofit measures are included in national building energy codes, building energy certification and labelling programmes, and incentives for efficient building design and construction Establish energy efficiency funding programmes Adopt utility sector regulations and reforms to promote energy efficiency 	R F R/G
	Encourage the use of energy-efficient appliances, equipment and lighting	<ul style="list-style-type: none"> Set minimum energy performance standards (MEPS) for appliances, equipment and lighting Establish appliance energy efficiency labelling programmes Provide incentives for the purchase of energy-efficient technologies 	R I F
	Foster local, low-carbon energy sources	<ul style="list-style-type: none"> Ensure low-carbon energy sources are included in national building energy codes Provide incentives for the purchase of distributed energy resource technologies Adopt utility sector regulations and reforms to enable local energy systems Fund local energy supply projects 	R F G F
Efficient waste management	Promote integrated sustainable waste management	<ul style="list-style-type: none"> Establish a national waste policy Fund waste management infrastructure 	R* F
	Encourage waste prevention	<ul style="list-style-type: none"> Enact extended producer responsibility policies Enact policies to discourage or limit unnecessary waste 	R R
	Increase waste collection and recycling	<ul style="list-style-type: none"> Establish national waste collection and recycling goals Provide funding, subsidies and incentives for waste management and recycling facilities Implement taxes or levies on products to cover recycling and safe disposal 	R F F
	Promote recovery of landfill gases and energy from waste	<ul style="list-style-type: none"> Create landfill gas capture and utilization standards Fund landfill gas energy and waste-to-energy infrastructure Modify utility sector regulations to enable feed-in from landfill energy sources 	R F G

Cross-cutting <i>Direct interventions:</i>	Institute carbon pricing and fuel price reform	<ul style="list-style-type: none"> Remove fossil fuel subsidies Establish carbon pricing 	F F
	Mobilize private capital for low-carbon infrastructure investment	<ul style="list-style-type: none"> Establish a national sustainable infrastructure investment platform Facilitate green bond markets and international low-carbon investment 	R/F R/F
	Drive research, development and demonstration of low-carbon technologies	<ul style="list-style-type: none"> Support research, development and demonstration of low-carbon technologies 	F/I
<i>Enabling measures:</i>	Enhance local government financial capacities	<ul style="list-style-type: none"> Expand city fiscal powers Boost municipal creditworthiness Alleviate revenue losses associated with reforms Revise fiscal transfer rules Build local government capacities on finance and revenue generation 	G R F G I
	Empower local governments with appropriate legal authority	<ul style="list-style-type: none"> Devolve authority to local governments to manage low-carbon initiatives 	G
	Enhance metropolitan coordination	<ul style="list-style-type: none"> Legally require metropolitan governance and coordination Provide incentives for metropolitan governance and coordination 	G F/G
	Provide data, information and benchmarking	<ul style="list-style-type: none"> Establish low-carbon development data programmes Implement low-carbon city benchmarking programmes 	I I
	Build local administrative and technical capacity for low-carbon development	<ul style="list-style-type: none"> Provide low-carbon planning tools for cities Facilitate training opportunities relating to low-carbon development Facilitate peer learning opportunities 	I I I
	Enhance public education, stakeholder engagement, and government leadership	<ul style="list-style-type: none"> Build capacity in public and stakeholder engagement Build capacity in promoting sustainable behaviours Exemplify best practice through government procurement 	I I I/F

Key: R = Regulatory tools; F = Fiscal tools; G = Governance reforms; I = Information & capacity-building
R* = National frameworks are primarily regulatory tools, but typically address all four factors above

As shown in Table ES-1, national policies can play a key role in advancing all four of the major goals identified in the introduction, each of which is associated with both GHG emission reductions and broader benefits:

Compact, accessible cities: Denser urban forms combined with enhanced accessibility (often referred to as “smart growth”) can lead to a range of benefits, including lower energy demand for buildings and transport, fewer GHG and air pollutant emissions, and improved public health.

National governments can establish legal requirements or general, non-binding guidelines for urban spatial planning. Austria, for example, has adopted a “Spatial Development Concept” that sets general priorities for urban development, including compact and mixed-use development. Denmark’s Planning Act, meanwhile, sets binding guidelines on urban-rural boundaries and the provision of transport infrastructure. National governments can also affect urban form by providing public services, housing and infrastructure. Brazil, for example, has encouraged transit-oriented development through its *Minha Casa, Minha Vida* social housing programme. Another key policy tool is tax incentives. Denmark, Finland and France, for example, have all adopted property taxation policies designed to encourage greater density.

Low-carbon transportation: Achieving compact form relies heavily on having effective low-carbon transportation options. Improving accessibility, reducing urban transportation energy demand, and promoting alternative fuels can yield significant GHG reductions and improve energy security, local air quality, public health and economic growth.

Strategies for achieving low-carbon urban transportation generally consist of a mix of measures designed to *avoid*, *shift* and *improve* transportation activity. *Avoid* strategies aim to reduce the need for travel and the length of trips; for example, land use planning that creates compact cities brings people closer to their work and leisure activities, so they need to drive less or not at all. *Shift* strategies encourage people to use public transit, walk or bike instead of driving, and make it easy and convenient to do so. *Improve* strategies aim to optimize vehicle efficiency within a particular mode (e.g. cars or buses) and make transportation infrastructure more efficient; for example, clean vehicle incentives and mandates can encourage consumers to buy hybrid or electric cars, particularly if charging stations are easily accessible.

Urban transportation policies are most successful when they are designed and implemented in a coordinated fashion, in particular when they are aligned with policies designed to achieve compact form. The Republic of Korea, for example, has adopted a mix of national policies to encourage compact city planning and sustainable transportations, including investments in multi-modal transfer centres, which concentrate public transportation and new housing and commercial developments together. Korea also runs an Infrastructure Credit Guarantee Fund that supports public-private partnerships for transportation infrastructure.

Efficient building energy use and local clean energy supply: Buildings can account for a large share of urban energy use and GHG emissions, especially in high- and middle-income countries with significant heating or cooling requirements. Numerous technologies exist for reducing building energy consumption, and for supplying energy to buildings more efficiently or with lower fuel and carbon intensity using local sources. Investments in these technologies can yield important benefits, including CO₂ emission reductions, improved energy security, urban air quality improvements, local job creation, lower energy costs for consumers, higher living standards (e.g. through improved heating and cooling), and improved economic productivity.

Often policies can be designed to address multiple aspects of building energy use and supply (e.g. building energy performance codes, incentive programmes, and utility regulatory reforms). In the United States, for example, the Property-Assessed Clean Energy (PACE) programme finances a variety of energy upgrades to existing buildings – including both energy efficiency improvements and rooftop solar installations – by amortizing costs through property tax assessments.

Efficient waste management: Waste is a relatively small contributor to global GHG emissions, but it is a growing challenge for many cities. Efficient waste management represents an important opportunity to reduce emissions, improve public health, and achieve economic gains. Resource recovery creates employment opportunities, reduces costs associated purchasing raw materials, and provides security against resource price volatility. Better waste management can also reduce health risks, improve local environmental conditions, and make cities more attractive and appealing to businesses and investors. In most nations, municipal solid waste is managed locally, but there is still much that national governments can do to guide and coordinate waste management and to reduce waste generation.

Finally, national governments can adopt a range of **cross-cutting policies** that simultaneously support multiple aspects of low-carbon urban development. Such policies are often essential elements of a low-carbon national urban policy. Some cross-cutting measures involve direct interventions that drive low-carbon development across a range of sectors, including in urban areas, while others involve ways to enable local governments (and other actors) to pursue low-carbon development objectives. Successful strategies often combine both kinds of approaches. In China, for example, a key measure to achieve low-carbon development goals is the pending establishment of a national emissions trading scheme. At the same time, the Chinese national government is supporting multiple low-carbon city pilot initiatives, and providing cities with the authority to design ways to meet energy and climate goals.

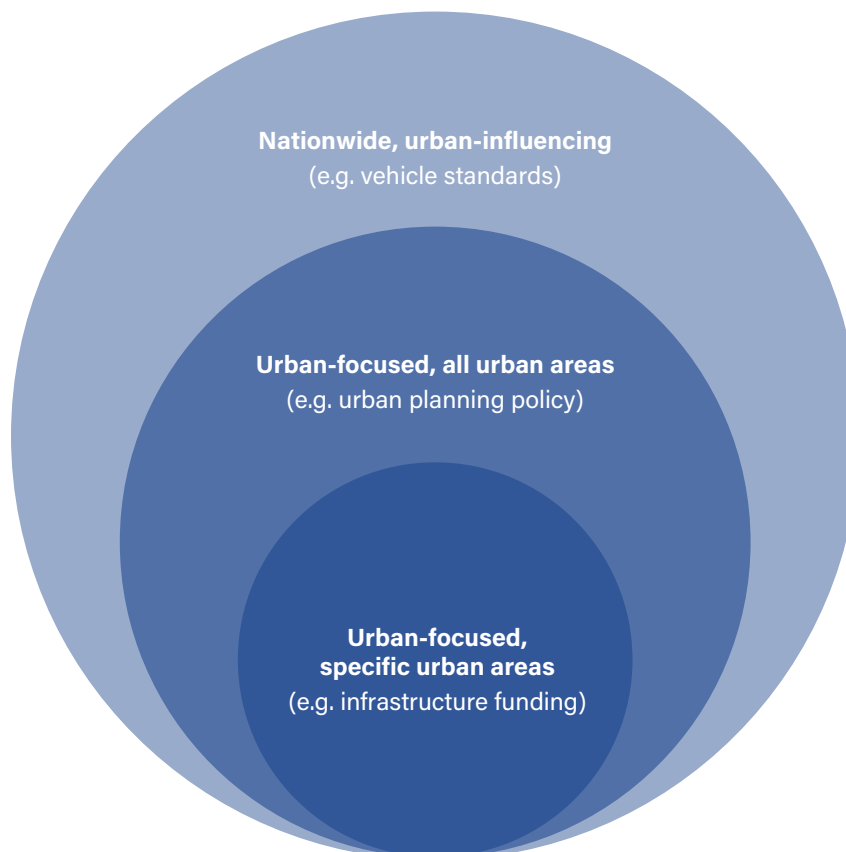
GENERAL STRATEGIES

No single set of policies is appropriate for all countries and contexts, but experience in a variety of contexts suggests some common strategies for designing a low-carbon national urban policy:

Think broadly about the scope of measures relevant to urban development. National governments can influence urban development directly and indirectly, through a wide range of measures. Designing a truly comprehensive and coherent national strategy often requires consideration of policies that can affect urban development, even if those policies are not explicitly “urban.” Three tiers of policies should be considered: nationwide policies that can significantly affect urban areas, urban-focused policies that affect all urban areas, and policies targeting specific urban areas (Figure ES-2).

Figure ES-2

Scope of measures to consider for a national low-carbon urban development strategy



Combine national policies that directly influence urban development with measures that empower effective local government action. Successful policies will require coordinated action at all levels of government, but this can only be achieved if subnational governments have sufficient capacities and resources – and motivation – to pursue low-carbon development policies. A well-designed national policy will thus combine *direct policy interventions* with initiatives that *enable and encourage* local governments to carry out national policies, complement national actions, and devise local solutions. As indicated in Table ES-1, enabling measures can take the form of governance reforms, financial support, or various types of information provision and capacity-building.

Seek a coherent package of policies. Different aspects of urban development interact with one another, so there can be substantial benefits to coordinating policies. For example, the success of planning efforts focused on compact, accessible urban forms often depends on concurrent investments in public transit and other improvements to urban mobility. Conversely, national transportation fuel subsidies and tax policies that favour single-family detached homes and/or favour greenfield development can all frustrate efforts to achieve compact development. Recognizing these kinds of synergies and conflicts can help governments unlock greater benefits by coordinating policies targeting urban form, transportation, building energy use and waste management.

Consider the political context when choosing policies. Some low-carbon development policies, such as carbon taxes and subsidy reforms, have proven challenging to enact in many political regimes. There is no simple recipe for overcoming these challenges. However, some strategies can be used to overcome short-term thinking and political resistance, such as setting mid-term targets for long-range goals, and reinforcing the gains to society from given policies, to build public support. Policy-makers can also take advantage of various windows of opportunity for enacting policy reforms, such as periodic national policy planning exercises, changes in government, opportunities for international cooperation or investment, public concern over urban development issues, or other external economic or development challenges. They should also be conscious of how both domestic and international politics might influence the policy-making process, from agenda-setting to implementation, and try to design processes to minimize potential difficulties.

CHOOSING THE RIGHT POLICIES

Urban areas face many common challenges and can draw on a common set of tools for solutions, but the optimal mix of policy tools depends on several factors. First it is important to consider the feasibility of adopting and implementing a given policy. That may depend on factors such as the potential impact on the national budget; the administrative burdens imposed; the technical expertise needed to develop and implement a policy; the potential impact on local government resources and capacities; the social equity implications; and the need for coordination between national and local governments. Different policy measures pose different challenges and opportunities related to each of these factors; we discuss the trade-offs in depth in the main report. It is important for national decision-makers to consider these factors as they choose what measures to pursue.

The second set of considerations relates to what mix of policies is most appropriate given a country's circumstances. Here, key considerations include:

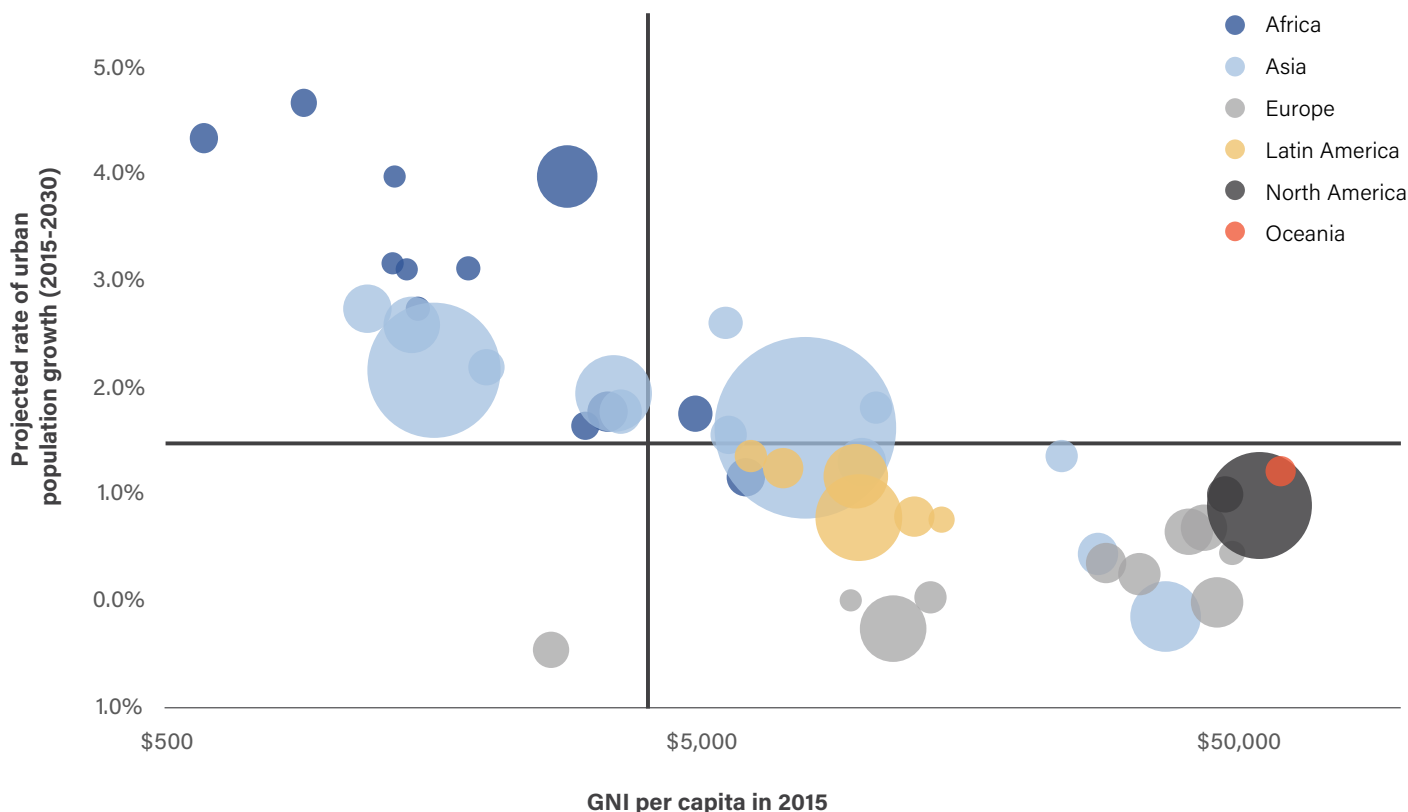
- *Domestic opportunities for urban economic growth, energy savings, and GHG reductions:* Countries may need to emphasize different approaches based on where they see the greatest potential for energy savings, GHG emission reductions, and economic growth. Factors that can drive the choice of policies include urbanization rates, the types and distribution of urban areas, existing urban form and infrastructure, and available energy resources.

- *Political and policy priorities:* One way to increase the political viability of low-carbon urban development policies is to choose policies that complement and reinforce existing policy priorities, such as reducing poverty, expanding employment opportunities, promoting accessibility and inclusion, improving urban sanitation, or reducing road congestion. It is also helpful to build on existing programmes. If utility energy efficiency programmes are already in place, for example, it can be easier to further expand efficiency incentives, or to adopt reforms that support local, distributed energy solutions. One particular area where low-carbon national urban policies can be important is in helping to advance climate policy goals.
- *Governance structures, institutional arrangements, and legal authorities:* Successful achievement of low-carbon objectives requires effective coordination at all levels of government: among different national agencies; between national, higher-level subnational, and local governments; and with non-governmental actors. Each country's governance structures will make certain policy approaches easier or harder to adopt and implement. Coordination challenges and opportunities are another factor that can drive the selection of appropriate national policies.
- *National and local governmental capacities and resources:* Policies can only succeed if national and local authorities have the financial, administrative and technical capacity to implement them. National governments may wish to focus on policies for which capacity constraints do not pose significant challenges. At the local level, it is important to remember that small and medium-sized cities may not have the same financial resources and capacities as larger cities; all else being equal, national governments may therefore want to avoid policies that place significant burdens on these municipalities, or pursue a range of enabling policies to help improve their capacities.

Another way to distinguish priorities is to consider countries' relative income and rates of urban population growth. As Figure ES-3 indicates, countries with higher incomes tend to have lower urban population growth rates, while countries with lower national incomes tend to have higher urban population growth. Low urban population growth countries with higher incomes include most Organisation for Economic Co-operation and Development (OECD) countries and others with relatively advanced economies, mature cities, and well-functioning land markets. These countries tend to already be highly urbanized. High urban population growth countries with lower incomes are mainly in South and Southeast Asia (including India, Pakistan, Indonesia, Bangladesh, the Philippines and Vietnam) and in Africa. In many of these countries, high rates of urbanization are leading to the rapid growth of informal settlements around major cities.

Figure ES-3

Distribution of countries by rate of urbanization and gross national income per capita



Source: Derived from UN-DESA (2014) and the World Bank’s World Development Indicators. Size of circles denotes relative urban population size. Only the top 50 countries in terms of urban population are displayed. The bold vertical and horizontal lines indicate the thresholds for classifying countries as higher or lower income, and higher or lower urban population growth rate, respectively.

Table ES-2 summarizes general policy priorities and associated national urban policy strategies for countries in these different categories. as a group, for example, our analysis suggests higher-income countries will find a majority (over 60%) of potential energy savings and GHG reductions in the buildings sector. Higher-income countries are also likelier to have the capacity and resources to pursue a broad range of policy approaches. For these countries, the choice of specific policy measures may therefore depend on tailoring solutions to a country’s particular political and institutional context.

For lower-income countries, urban development challenges are both quantitatively and qualitatively different. The challenges are particularly acute for lower-income countries with high urban growth rates. Cities in these countries often have limited public services, poor infrastructure, and rapid growth in informal settlements, and governments must manage these challenges with limited resources and comparatively weak urban governance capacities. In those contexts, national governments may need to combine direct policy interventions with efforts to build capacities at multiple levels of government. An effective strategy, for example, might focus on policies that national authorities can immediately implement to influence urban growth – focusing on those with lesser budgetary, administrative and technical requirements – along with measures to devolve authority and enable local governments. In the global South, it is particularly important that low-carbon development options make a substantial contribution towards other development priorities, such as access to basic services, livelihoods, mobility and durable housing.

Table ES-2

Priorities and low-carbon national urban policy strategies for different country contexts

Country grouping	Low-carbon development opportunities and challenges	General strategies
Higher income, low urban population growth	<ul style="list-style-type: none"> Well-developed private sectors, relatively wealthy citizens and large public budgets Majority of energy saving and GHG reduction opportunity in the buildings sector Need to address urban air pollution and traffic congestion Need to avoid energy and carbon “lock-in” in established infrastructure 	<ul style="list-style-type: none"> <i>Pursue an “all of the above” strategy, tailored to domestic policy and political priorities.</i> Higher-income countries have the capacity to deploy sophisticated policy instruments in tandem – including regulatory tools and fiscal incentives – to promote low-carbon infrastructure and retrofit existing urban forms and buildings. <i>Enhance policy coherence.</i> Generally strong governance means that higher-income countries can focus on streamlining or enhancing institutional arrangements, and building multi-level governance capacities where needed.
Higher income, high urban population growth	<ul style="list-style-type: none"> Well-developed private sectors, relatively wealthy citizens and large public budgets Higher opportunity for energy savings in <i>new</i> buildings Need to address urban air pollution and traffic congestion High demand for new housing; possible housing shortages High risk for – and opportunity to avoid – urban sprawl 	<ul style="list-style-type: none"> <i>“All of the above” approach, focused on managing new housing and transportation demand.</i> Greater fiscal and regulatory capacities mean that these countries can pursue a range of policy instruments to avoid urban sprawl and prevent the “lock-in” of high energy use in new buildings. <i>Enhance policy coherence.</i> As with low urban population growth countries, these countries can focus on aligning policies with existing institutional arrangements, and building multi-level governance capacities.
Lower income, high urban population growth	<ul style="list-style-type: none"> Comparatively weak urban governance capacities Less fiscal maturity, shallow domestic capital markets Rapid growth in poor urban neighbourhoods and in peri-urban areas; housing shortages and informal settlements Majority of potential energy savings and GHG reductions in the transportation and waste sectors 	<ul style="list-style-type: none"> <i>Adopt direct regulatory and fiscal measures requiring less budgetary and technical capacity, and less multi-level coordination.</i> Such policies could include national property and vehicle tax reforms; appliance efficiency standards or incentives; and some kind of utility reforms. <i>Bolster fiscal capacities,</i> e.g. through carbon pricing and fuel price reforms (removal of subsidies). <i>Provide strategic public service and infrastructure investment.</i> Strategic deployment of public services, transportation infrastructure, and transit systems can help anchor development and shape settlement patterns, and ensure greater accessibility. <i>Strengthen urban governance and institutional capacity.</i> This can be achieved through a variety of measures, including better information provision, policies to promote local government technical and financial capacities, and promoting metropolitan coordination (see Table ES-1).
Lower income, low urban population growth	<ul style="list-style-type: none"> Comparatively weak urban governance capacities Less fiscal maturity, shallow domestic capital markets Relatively greater opportunities in the buildings and waste sectors 	<ul style="list-style-type: none"> Same strategies as for lower income, high urban population growth countries, with emphasis on improving fiscal and governance capacities.

LESSONS FROM NATIONAL URBAN POLICIES AROUND THE WORLD

A look at specific countries highlights some of the differences in approach identified in Table ES-2. Germany, for example, is a “higher income, low urban population growth” country that has prioritized low-carbon urban development. Germany has enacted a range of policies, focusing especially on making buildings more energy-efficient. Under Germany’s federal system of government, states and cities have a fair degree of autonomy and are active partners in implementing low-carbon development strategies. Key challenges going forward include further addressing urban transportation, and ensuring that urban development progresses equitably both within and between cities.

China, which has a relatively high rate of urban population growth, has made low-carbon development a central goal of its National New Urbanization Plan. China’s vertically integrated governance structure helps to ensure a coherent and consistent approach to achieving the plan’s goals. Nonetheless, China is grappling with the significant challenges of building local capacity and financing low-carbon infrastructure in the face of rapid urbanization. One strategy has been to adopt a series of low-carbon city pilot initiatives, which are generating knowledge and expertise useful for building up additional local capacity. Participating cities have implemented a range of measures, including energy efficiency, distributed energy, and public transit systems. Pilot initiatives are also being used to inform national policy. Five Chinese municipalities, for example – Beijing, Chongqing, Shanghai, Shenzhen and Tianjin – have been piloting emissions trading systems (ETSs) that helped set the stage for China’s national ETS.

In Mexico – which is situated near the centre of Figure ES-3 – past policies have led to significant urban sprawl. Mexico has adopted a National Climate Change Strategy, one focus of which is to “shift towards models of sustainable cities with mobility systems, integrated waste management, and low-carbon footprint buildings.” Mexico’s National Urban Development Programme recognizes sprawl as one of the largest challenges faced by city planners. A key contributor to sprawl was the widespread availability of federal financing for mass-produced homes on peri-urban land. This helped improve housing access for citizens, but came at the price of depopulating city centres, increased transport costs, environmental impacts, and reduced liveability. National policies are being adjusted to address these issues and increase infill development. A second major challenge is the uneven, sometimes weak, capacity at a municipal level, which has made national government officials reluctant at times to devolve responsibilities to municipal governments. The National Urban Development Programme seeks to improve local government capacities and provide training and technical tools to enable quality urban planning at a local level.

South Africa is another “middle income, moderate urban population growth” and, like Mexico, has had to grapple with past policies that encouraged urban sprawl. Cities tend to be dispersed, with poorer communities located on the periphery of cities away from services and employment. This leads to a very resource-intensive and inefficient form of settlement characterized by sprawl, unequal provision of infrastructure, and high transport emissions. South Africa’s National Climate Change Response White Paper calls for urban densification, climate resilient infrastructure, low-cost housing, and provision of affordable low carbon public transport to help reverse the consequences of past planning. Ensuring more equitable development remains a central goal for both the national and local governments. Another challenge is lack of clarity about local government responsibilities for national renewable energy and energy efficiency imperatives. The national government has recognized this and called for relevant ministries to review local government functions, powers, fiscal measures, incentives and capacity-building with respect to energy and climate change.

Our final case study is Kenya, which faces rapid urban population growth with comparatively limited national capacities and resources. Kenya is pursuing low-carbon development through a mix of direct intervention-style policy levers, combined with urban governance reforms. Under its National Urban Development Policy, for example, Kenya has established a comprehensive national framework and is pursuing a range of policies to address compact urban form, transportation planning, and waste management. At the same time, it has begun substantial urban governance reforms designed to give greater authority and responsibility to local governments. Going forward, the challenge will be to further boost local capacities and adopt more policy levers to address urban poverty and promote equitable development.

All of these countries have designed national policies reflecting the general recommendations in this report: thinking broadly about the scope of urban policy; deploying a mix of direct interventions and enabling measures; pursuing policy coherence, and considering political context. At the same time, they still face a variety of challenges. Further experience and research are needed to provide better guidance to policy-makers in designing national strategies, on questions such as:

- What policy levers to prioritize given specific urban conditions;
- How best to design individual policy levers;
- How to effectively design holistic low-carbon national urban policies (e.g. improving policy coherence and taking into account interactions between different elements of low-carbon urban development);
- What institutional arrangements and governance structures can most effectively achieve low-carbon urban development;
- How to promote low-carbon development that is equitable.

Many of these questions do not have generic, one-size-fits-all answers, and will need to be explored in detail on case-by-case basis in individual countries. However, experience already gained across a wide range of countries suggests ample justification – and a clear pathway – for national governments to pursue low-carbon national urban policies.

1. Introduction

Urbanization is a defining feature of human societies in this century. Over half the world's population now lives in urban areas, a proportion that will grow to two-thirds by mid-century. Over the next several decades, efforts to improve human welfare, achieve economic growth, reduce poverty and mitigate human impacts on the environment must increasingly focus on managing urbanization and its associated opportunities and risks. Accordingly, there is a growing international awareness of the need for effective national urban policies addressing a range of development priorities.¹

Urbanization is also a major focus of efforts to address climate change. As social and economic hubs, cities account for a large share of global energy consumption and resulting greenhouse gas (GHG) emissions.² Alternative modes of urban development could conserve energy and substantially reduce emissions – in particular, by focusing on.

- Compact, accessible urban forms;
- Clean and efficient urban transportation options;
- Efficient building energy use and a local clean energy supply; and
- Efficient urban waste management.³

These four traits are not only important for addressing climate change – they are also linked to benefits such as improved public health, enhanced employment opportunities, greater economic productivity, and reduced local pollution.⁴ “Low-carbon” urban development is therefore highly aligned with broader social and economic urban development goals, and can provide a strong foundation for sustainable national growth as part of a “new climate economy.”

Despite the potential benefits of low-carbon urban development, few countries have made it an organizing focus of national policy, though many have pursued elements at both the national and local scale. As a result, there is now a rich literature on effective policies to advance specific kinds of low-carbon development strategies. This report provides an overview for national policy-makers, as well as guidance on how to design national urban policies explicitly around low-carbon development goals. Our aim is to clarify the critical role of national governments in driving urban development outcomes, and provide a framework for designing “low-carbon” national urban policies appropriate to different contexts.

We begin by outlining the case for government action to achieve low-carbon urban development and the respective roles of national and subnational governments. We also explain key terms used throughout the report.

Section 2 provides an overview of national urban policies around the world, and the extent to which countries are already integrating urban and climate policy goals. Though there is a growing awareness of the benefits of such integration, most countries have not made low-carbon development a central element of their urban policies.

Section 3 explores what a comprehensive low-carbon national urban policy might look like, and how governments can approach the design process. Studies suggest that countries should think broadly about the scope of relevant policy tools, combine direct measures with efforts to empower local governments, and build a coherent package appropriate to the national context.

Section 4 delves into the different options available for achieving each of the four key elements of low-carbon urban development, as well as “cross-cutting” approaches that can advance multiple goals. It then provides comprehensive lists of measures that national governments can use, and broadly evaluates them against criteria that may be important for national decision-makers.

Finally, Section 5 examines strategies for developing a low-carbon national urban policy appropriate to each country's physical, political and economic circumstances. It illustrates potential options and challenges based on the experiences of five countries that have actively worked to incorporate low-carbon development strategies in their national urban policies: Germany, Kenya, Mexico, South Africa and China.

1.1 WHY THE SHAPE OF URBAN DEVELOPMENT IS SO CRUCIAL

Urban areas are hubs of both economic activity and energy consumption in most countries.⁵ The physical form of cities, along with the make-up and management of urban buildings, infrastructure, transportation and waste, will strongly influence a country's economic, social and environmental potential. Fostering the right kinds of urban development can thus be crucial to a country's social and economic success.

A growing body of evidence shows that development that produces compact, connected and energy-efficient cities has multiple benefits. Compact, accessible urban forms and efficient transportation systems can reduce energy demand, GHG emissions and air pollution while enhancing economic productivity.⁶ Similar benefits arise from energy-efficient buildings and local clean energy sources, which can lower energy costs and improve the well-being of urban residents.⁷ Efficient waste management can create employment opportunities, reduce raw material costs, reduce health risks, and make cities more attractive.⁸

Still, low-carbon urban development seldom happens organically. Around the world, cities are becoming less dense,⁹ and if current trends continue, sprawling urban forms will predominate over the next two decades.¹⁰ Investments in building energy efficiency also continue to lag,¹¹ as does sustainable waste management, which generally depends on government support and intervention.¹²

A key obstacle is economics. Although low-carbon urban development has multiple benefits, it is often seen as relatively costly, because the benefits are externalized, as are the costs of conventional, sprawling development.¹³ The private and public actors who invest in conventional urban development do not directly bear the societal costs imposed by urban air pollution, traffic congestion, inefficient energy use or waste, nor do they realize direct benefits from avoiding these costs or contributing to the improved health and productivity of urban residents.

On top of this, many other “market failures” further discourage low-carbon urban development.¹⁴ Economies of scale in urban infrastructure can lead to costly and inefficient monopolies in the absence of government regulation. Uncertainties and lack of information about low-carbon technologies and policies can discourage investment. Finally, many of the benefits of low-carbon options are essentially “public goods” that are difficult for investors to monetize.

Therefore, if governments want to realize the huge potential benefits of low-carbon urban development, they need to actively engage in addressing the needs of urban residents, and work to overcome barriers to investment in low-carbon technologies, practices and infrastructure. This report focuses on the role that *national* governments in particular can play.

1.2 WHY URBAN DEVELOPMENT IS A NATIONAL CONCERN

It is easy to see urban development as mainly a matter for municipal governments, given that they have the most direct authority over urban areas. Indeed, many cities have set out to become low-carbon development leaders, and they have the potential to make a real impact. One detailed analysis found that cities could cut GHG gas emissions by up to 15% of the reductions needed to avoid the most serious effects of climate change.¹⁵ However, cities cannot achieve all this on their own; we have estimated that the actions that city governments are best positioned to lead can only achieve about one-fifth of the total GHG reduction potential.¹⁶ For the remainder, actions initiated at higher levels of government would provide a more efficient and effective policy response.

For example, although individual cities can enact building codes mandating better energy performance and the use of efficient appliances, such actions are likely to have greater impact and achieve economies of scale when enacted more comprehensively, e.g. at a national level. Free-riding can also be a problem, when some communities refrain from action in expectation that they will benefit from others' efforts.¹⁷ Similarly, actions within a single city may simply shift (or “leak”) economic activity – and associated emissions – to other jurisdictions.¹⁸

This is not to say that city governments do not have critical roles to play. Rather, fully unlocking the benefits of low-carbon urban development requires coordinated governance at multiple levels,¹⁹ with each level performing functions

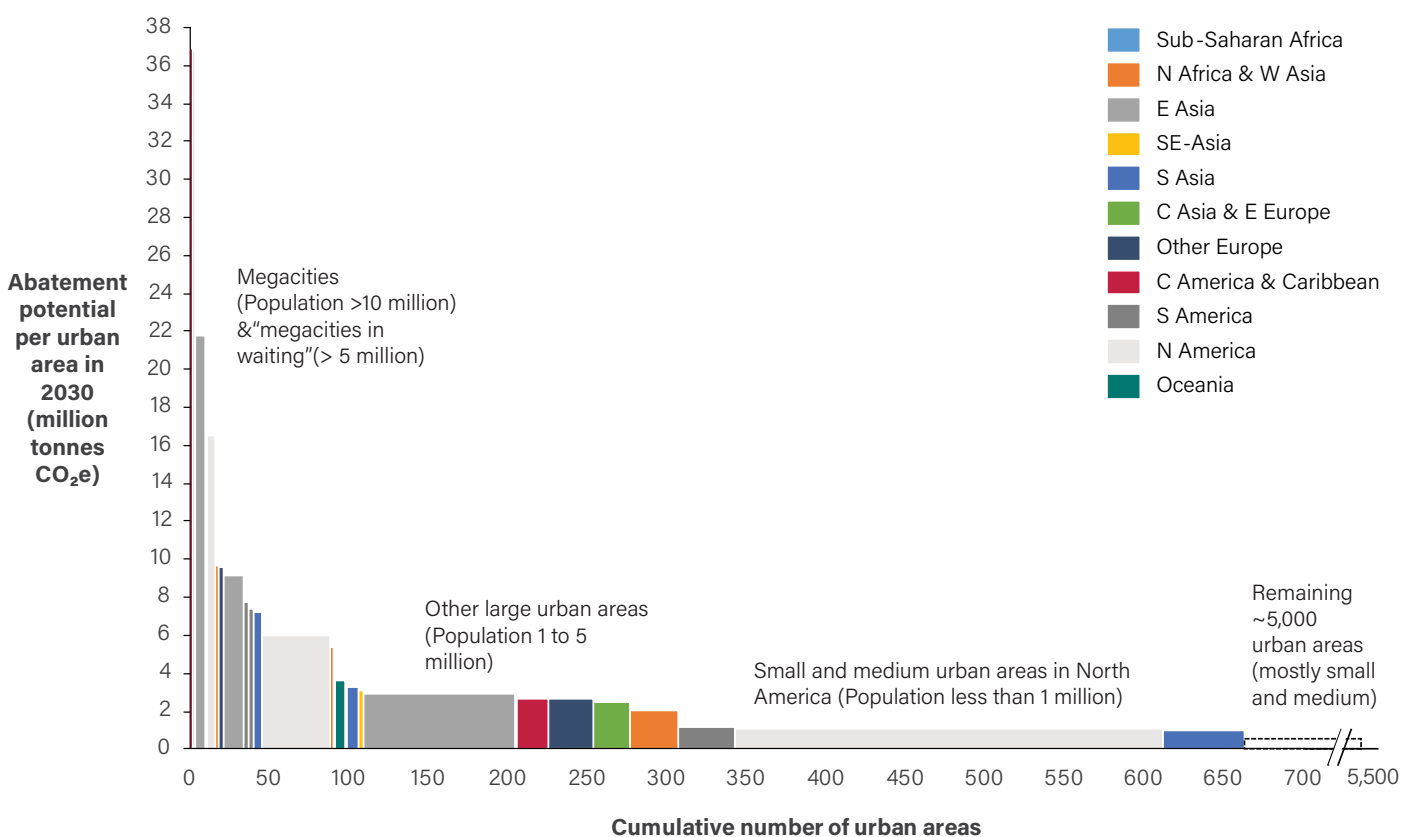
suited to its relative strengths and advantages.²⁰ In a “vertically integrated” approach, cities may lead some actions, help implement others, or act as strategic partners to enhance the effects of national policies.²¹

National governments have two key roles in promoting low-carbon urban development. First, they can establish policies and incentives that directly or indirectly affect urban growth, mobility, energy use and waste management (see Section 4). Second, they can establish a national urban policy that provides a framework for other levels of government to develop and implement urban policies. UN-Habitat and the Cities Alliance define a national urban policy (or NUP) as “a coherent set of decisions derived through a deliberate government-led process of coordinating and rallying various actors for a common vision and goal that will promote more transformative, productive, inclusive and resilient urban development for the long term.”²²

In essence, national urban policies provide a template for planning and policy coordination, meeting a significant need. Data from Erickson and Tempest (2014) suggest, for example, that global GHG abatement potential in urban areas is highly dispersed, with the vast majority of opportunity in small- and medium-sized cities (Figure 1).²³ These are precisely the jurisdictions that have the fewest resources and capacity, and are most prone to free-riding – or to leakage effects if they take action. In most countries, national leadership is needed to enlist municipal governments in low-carbon development and ensure they have the resources to pursue it.

Figure 1

Global low-carbon urban development potential is spread across thousands of urban areas



Source: Authors’ analysis and classification of data from Erickson and Tempest (2014).²⁴ The height of each bar represents GHG abatement potential per urban area in 2030, the width indicates number of urban areas within different population classes and world regions (as indicated by labels and shading, respectively). Nearly half of all 2030 urban abatement potential is in the approximately 5,000 small and medium urban areas that lie to the right edge of the graph.

Nationally led, multi-level governance is therefore highly desirable for pursuing low-carbon urban development on a broad scale. As outlined in the rest of this report, an effective approach requires national governments to establish policy frameworks and incentive structures; enhance local governments' financial capacities; strengthen local governance capacities and coordination within metropolitan areas; and align policies and eliminate conflicts at all levels of government.

1.3 WHAT ARE THE OPTIONS FOR NATIONAL URBAN POLICIES?

Governments have a range of tools at their disposal to steer urban development towards low-carbon options. In this report, we describe broad policy approaches and, within each of them, specific policy tools or measures that can be used to achieve, or aid in the achievement of, a desired outcome. In line with Hood (1983) and Howlett (2011), we identify four types of policy tools for low-carbon urban development:²⁵

- *Regulatory interventions:* National governments can use their powers to design, implement and enforce regulations that directly or indirectly affect urban development.
- *Fiscal instruments:* National governments can drive behavioural change and investment through two main types of fiscal policies. First, they can directly fund urban infrastructure and other investments needed for low-carbon development, or provide financial support to local governments for such investments. Second, they can institute taxes or subsidies that incentivize or discourage specific activities.
- *Information provision:* National governments can provide a variety of data and information relevant to urban planning and energy use, enhancing the capacities of local governments and other actors, and enhancing the effectiveness of policies at all levels.
- *Governance reforms:* National governments can organize and coordinate activities within different agencies and among different levels of government, and empower local governments with greater authority to undertake low-carbon urban development measures.

The mix of measures that a country chooses to adopt and implement will depend on the national context. Key considerations include country-specific opportunities for urban economic growth and energy savings, political and policy priorities, governance structures and legal authorities, and governmental capacities and resources. We explore these issues and their implications in Section 5.

Note that many of national measures discussed here may also be undertaken by higher-level subnational governments (e.g. state or provincial authorities). Though we refer to the measures as “national,” some countries may allocate primary responsibility for their adoption to subnational governments, depending on the nature of their governance structures and degree of federalism.

2. National urban development and climate policies today

National urban policy-making varies considerably due to differences in local development priorities, capacity and governance structures. Some countries have developed explicit national urban policies aimed at managing urban development. Others have “partial” policies that cover urban issues, such as housing, transport and land use, that are not explicitly referred to as a national urban policy but cover similar material. A survey of policies in 193 nations identified 51 countries with explicit national urban policies, and a further 100 countries with “partial” policies.²⁶ These policies are in various stages of development – 28% are in the feasibility, diagnosis or formulation stages, and 74% are in the implementation or monitoring and evaluation stages. This demonstrates that urban development is being addressed by many national governments, though there is still scope for more comprehensive planning.

Countries differ in how they manage urban affairs. UN-Habitat estimates that 40% of nations manage their policies through an agency that focuses exclusively on urban issues, while 57% manage policies through a more generalized planning authority (in the rest, planning is mainly coordinated at the subnational level, such as in Canada, where the management of cities is delegated to provincial governments). An increasing number of nations have recently developed urban agencies, suggesting growing interest in urban policy coordination through a designated agency.²⁷

The central role of urban settlements in meeting climate change mitigation goals is recognized in the United Nations' New Urban Agenda, which acknowledges "cities and human settlements, their inhabitants and all local stakeholders to be important implementers" of GHG reduction efforts.²⁸ Many cities have competencies in areas critical for climate change mitigation, such as spatial planning or transport. At the same time, these issues span beyond city borders, and often intersect with policies at higher levels of government.²⁹ National urban policies are viewed as a critical tool for linking national climate goals with urban implementation of mitigation strategies.

Climate change is discussed in many national urban policies, but often not very prominently. The UN-Habitat review found climate resilience and environmental sustainability (issues closely related to climate mitigation) received less attention than economic development, spatial structure and human development.³⁰ Only 16% of the 151 policies analysed had "moderate" or "extensive" coverage of climate resilience, and only 39% paid "moderate" or "extensive" attention to environmental sustainability. Still, this does not necessarily mean that the policies do nothing for the climate. For example, a policy may include efforts to promote more compact urban forms as a way to make cities more accessible and efficient, but they would also help reduce GHG emissions.

Indeed, many national policies incorporate elements that may directly or indirectly benefit the climate.³¹ For example, Germany's policy includes commitments on energy efficiency and renewable energy:

"Only with greater energy efficiency and the use of renewable energies can the era of cheap fossil energy be left behind. And only by doing so will an effective contribution be made to fight climate change. Being both the problem and its solution, cities are once again called upon."

Germany National Urban Development Policy (2012)³²

The Czech Republic's policy also includes energy efficiency concerns (including retrofits of existing building stock), and explicitly recognizes a climate component to these measures:

"Active measures must be directed into reducing greenhouse gas emissions, saving fuel and energy, upgrading buildings and increasing their energy efficiency, installing thermal insulation."

Czech Republic Principles of Urban Policy (2010)³³

Others have embraced urban design principles that may reduce emissions. For instance, Vietnam has committed to densification, recognizing that compact city design enables more sustainable land use:

"Underutilized sections of the inner cities may have the capacity to accommodate higher densities, but densification must be critically evaluated to ensure efficient, optimum and sustainable use of land."

Vietnam National Urban Upgrading Programme (2008)³⁴

These examples show the potential for reducing GHG emissions through national urban policies. Even greater benefits may be achieved if climate objectives are explicitly prioritized.

3. Strategies for designing a low-carbon national urban policy

Since few countries have adopted national urban policies explicitly designed to foster low-carbon development, it may not be obvious what such a policy should look like, and how best to approach its design. In this section, we draw on a review of studies and policy surveys to identify known good practices.³⁵ While no single template would be appropriate for all countries and contexts, general recommendations include:

- Think broadly about the scope of measures relevant to urban development; many policies that do not explicitly target cities or climate issues may still be very helpful.
- Combine national policies that directly influence urban development with measures that empower local governments to take effective actions.
- Build a coherent package of policies that makes the most of synergies and avoids conflicting incentives.
- Consider the political context and find windows of opportunity.

Below we expand upon each of those strategies.

3.1 THINK BROADLY ABOUT SCOPE

National governments can influence urban development directly and indirectly, through a wide range of measures. Although “traditional” urban policy has focused on issues specific to urban areas and measures that expressly target cities, aligning urban policy with larger economic development goals may require a broader approach. Often policies that are not explicitly “urban” can significantly affect urban development;³⁶ that is especially true if the goal is to foster low-carbon urban development.

National energy policies, for example, including fuel subsidies and/or taxes, can strongly influence the relative cost of different transportation modes, which in turn can affect incentives for urban growth and sprawl. Similarly, power sector regulations can affect the viability of distributed energy generation technologies, encouraging or discouraging the adoption of local clean energy alternatives such as rooftop solar.

Our analysis of national measures in Section 4 thus includes a wide spectrum of options, which can be grouped into three broad categories (Figure 2):

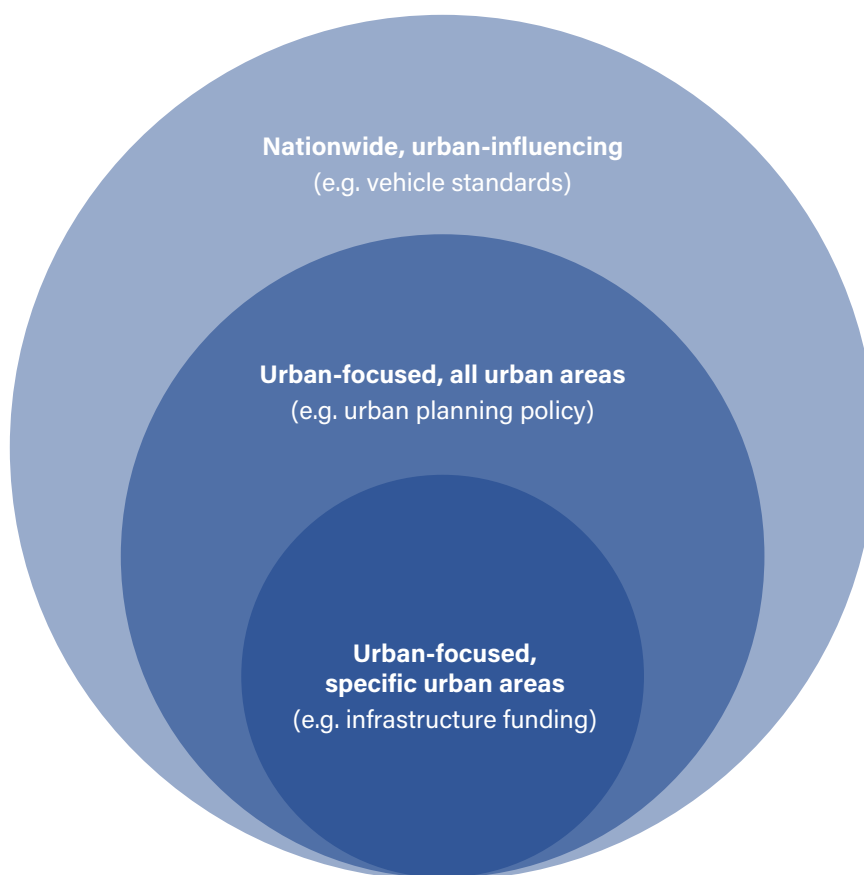
- a. *Nationwide, urban-influencing measures:* These include policies and measures designed to reduce pollution, increase energy efficiency, and lower carbon intensity throughout the economy, but with significant impacts on urban development. Often they may be pursued for reasons unrelated to urban development per se. Examples include:
 - Carbon pricing policies;
 - Fossil fuel subsidy reforms;
 - Vehicle efficiency standards;
 - National building energy performance and appliance standards;
 - Electricity sector reforms (e.g. to support energy efficiency or distributed energy resource investments);
 - Clean/electric vehicle incentives and infrastructure policies.

- b. *Urban-focused measures affecting all domestic urban areas:* These are policies that explicitly address urban development issues (and are likely be thought of as elements of “national urban policy”). Examples include:
 - National spatial planning guidelines or requirements;
 - Grant or loan programmes to support local governments (e.g. for low-carbon infrastructure development);
 - Governance reforms to empower local governments to pursue low-carbon development strategies;
 - Tax reforms to encourage compact urban development.

- c. *Measures targeting specific urban areas:* National governments can also target policies towards specific, high-priority urban areas. Examples include:
 - Efforts to facilitate metropolitan-level governance in (particular) urbanized areas;
 - Direct investments in high-value urban infrastructure;
 - Targeted local capacity-building efforts (e.g. related to data-gathering, tax administration, planning tools, etc.).

Figure 2

Scope of measures to consider for a national low-carbon urban development strategy



One implication of this analysis is that a comprehensive low-carbon national urban policy may require coordinating among multiple government agencies responsible for different policy areas. As further discussed in Section 5, the right set of policies may depend on what is feasible within a particular institutional context and a country’s national governance structure.

3.2 COMBINE DIRECT INTERVENTIONS WITH ENABLING POLICIES

As noted in Section 1.2, a successful national urban policy requires coordinated action at all levels of government. Effective multi-level governance, in turn, depends on subnational governments having sufficient capacities, resources and motivation to pursue low-carbon development policies. A well-designed policy will therefore combine direct regulatory or fiscal measures with initiatives that enable and encourage local governments to carry out national policies, complement national actions, and develop local solutions.³⁷ Accordingly, in Section 4 we identify a wide range of *direct interventions* that national government can undertake, as well as *enabling measures* to enhance the capacities of local governments.

Direct interventions are national policies that directly require, set standards for, incentivize or implement various elements of a low-carbon urban development strategy. Examples include energy pricing policies, national urban planning frameworks and requirements, infrastructure investments, and home ownership tax reforms and incentives.

Enabling measures enhance the technical, financial and staffing capacities of local governments so that they can undertake local low-carbon development actions. Enabling approaches can take the form of governance reforms, financial support, and various types of information provision and capacity-building. Many of these approaches can be used to support multiple kinds of local actions and policies, though some will be targeted to specific priorities.

To illustrate the distinction between direct and enabling measures, Table 1 provides examples for each type. A longer list of national measures is provided in Section 4, which also identifies how they can be deployed for different facets of low-carbon urban development.

Table 1
Examples of direct and enabling national policy measures

	Policy goal	Examples of policy measures
Direct interventions	Promote energy-efficient design of new buildings	<ul style="list-style-type: none"> Establish national building energy codes Provide incentives for efficient building design and construction
	Carbon pricing and fuel price reform	<ul style="list-style-type: none"> Remove fossil fuel subsidies Institute carbon pricing
Enabling measures	Enhance the financial capacities of local governments	<ul style="list-style-type: none"> Develop an enabling regulatory and legal environment for responsible sub-national borrowing Build local government capacities on finance and revenue generation
	Build local administrative and technical capacity for low-carbon development	<ul style="list-style-type: none"> Design planning tools for cities Provide training opportunities relating to low-carbon development

3.3 SEEK POLICY COHERENCE

Many governments pursue elements of low-carbon urban development in a piecemeal fashion. For example, efforts to promote transit-oriented development, improve vehicle efficiency, or encourage efficient building designs may be pursued by separate agencies, or at different levels of government, with little or no coordination. The efforts may still be successful, but there could be substantial additional benefits if the agencies worked together to maximize synergies.

For example, as discussed in Section 4, efforts to promote compact, accessible urban forms often require concurrent investments in public transit and other improvements to urban mobility.³⁸ Less obvious interactions are possible as well. Compact city policies, for example, can encourage smaller dwelling sizes and higher density, which in turn can reduce overall energy consumption in buildings.³⁹

Not all interactions may be beneficial. Increased urban density (e.g. from infill development) can increase demands on existing energy infrastructure, necessitating upgrades, new efforts to deploy local energy resources, and/or building energy efficiency improvements.⁴⁰ Higher density can also put pressure on urban waste management systems,⁴¹ and can come at the cost of green space and other amenities crucial for urban well-being.

Recognizing these kinds of synergies and conflicts can help governments coordinate and unlock greater benefits from policies targeting urban form, transportation, building energy use, and waste management.⁴² In the United States, for example, the Partnership for Sustainable Communities was set up to coordinate the efforts of transportation, housing and environmental agencies to support “smart growth” projects, aiming to achieve a range of social, economic and environmental benefits. The participating agencies modified their grant programmes with a view to ensuring that together, their investments met multiple objectives beyond each agency’s individual mandate.⁴³

Sometimes national policies can work against low-carbon urban development, even when they are not expressly concerned with urban development goals.⁴⁴ National transportation fuel subsidies, tax policies that favour single-family detached homes, or property tax structures that favour greenfield development can all frustrate efforts to achieve compact development, for example. These kinds of potential conflicts reinforce the need to think broadly about the scope of a low-carbon national urban policy, as discussed above, and to emphasize coordinated governance.⁴⁵

Policy coherence may not always be easy to achieve. The Organisation for Economic Development and Co-operation (OECD) estimates that the average government has six or seven national ministries or agencies with an explicit urban development function.⁴⁶ To prevent fragmented responses, national governments may need to clarify which agencies will lead particular low-carbon policies, and work to identify inconsistencies in national policies that could inhibit local planning and implementation efforts. Policy coherence may also entail ensuring that local governments have sufficient resources to undertake assigned elements of policy implementation, and that they do not face unfunded mandates.⁴⁷

The UN-Habitat programme recommends an approach to national urban policy development that considers three factors in tandem: urban legislation, urban economy, and urban planning and design.⁴⁸ *Urban legislation* refers to having appropriate legislative or regulatory frameworks in place to support the implementation of urban policies, and ensuring that capacity exists to enforce legislation. *Urban economy* refers to the need for policies to be attentive to local economic development and employment opportunities, and to consider the means to finance urban development. *Urban planning and design* highlights the role of planning tools to prevent sprawl and environmental degradation (including GHG emissions), and to ensure that urban infrastructure needs are met. Thinking through and incorporating all these elements in a national policy can help ensure a coherent and coordinated approach to low-carbon urban development.

3.4 CONSIDER THE POLITICAL CONTEXT

The appropriateness of any given policy option will depend on the political context. Some low-carbon development policies, such as carbon taxes and subsidy reforms, have proven particularly challenging to enact in some political regimes, for three key reasons. First, many low-carbon development policies require long-term thinking, which can be challenging in short-term political cycles. Second, domestic policy-makers are often dealing with a multitude of

stakeholders with vested interests who have influence over policy processes. Third, some low-carbon development policies work best (and are most equitable) when adopted by multiple nations simultaneously, but international cooperation may not always be immediately forthcoming.

Unfortunately, there is no simple recipe for overcoming these political challenges. However, some strategies can be used to overcome short-term thinking and political resistance. These include setting mid-term targets for long-range goals, and reinforcing the gains to society from given policies, to build public support and momentum behind low-carbon development options.⁴⁹ Additionally, policy-makers can seek to take advantage of various catalysts and opportunities for change. External or internal events, for example, can provide windows of opportunity for enacting policy reforms.⁵⁰ For low-carbon urban development policies, such events could include:

- *Periodic national policy planning exercises:* China, for example, has set goals for low-carbon urban development under its most recent five-year plan, which seeks to address a range of climate change and urban pollution challenges – see Section 5.3.4.
- *Changes in government:* Changes in political priorities often provide opportunities for policy reform.
- *Opportunities for international cooperation or investment* (e.g. related to climate change, sustainable development, or economic growth): Germany, for example, adopted its 2007 National Urban Development Policy in conjunction with EU-wide adoption of the Leipzig Charter on Sustainable European Cities – see Section 5.3.1.
- *Public concern over urban development challenges* (e.g. pollution, traffic congestion, accessibility, housing affordability, etc.): Popular attention paid to specific urban development challenges or crises can often be a catalyst for new policy reforms.
- *Other external economic or development challenges:* In Mexico, for example, many low-carbon urban development policies were enacted as part of overall structural reforms designed to improve economic competitiveness in the wake of the global financial crisis⁵¹ – see Section 5.3.2.

Policy-makers should be conscious of how both domestic and international politics might influence a national urban policy at all stages, from agenda-setting to implementation, and try to design processes with the political landscape in mind.

4. Exploring the options for low-carbon national urban policies

In this section, we provide an overview of *general policy approaches* (at all levels of government) for achieving the four core elements of low-carbon urban development:

- Compact urban form (Section 4.1);
- Low-carbon transportation (Section 4.2);
- Building energy use and delivery (Section 4.3); and
- Efficient waste management (Section 4.4).

We also identify key *national measures* that can be deployed under each approach. All of these measures involve *direct interventions* (see Section 3.2).

In addition, in Section 4.5 we identify a series of *cross-cutting policies* and associated national measures. These are policies that can have broad application and simultaneously support multiple elements of low-carbon urban development. Many of these policies involve *enabling measures* that bolster local government capacities to undertake low-carbon urban development policies, in conjunction with national policy frameworks and initiatives.

Table 3 provides a comprehensive list of all the policy approaches and measures that are described below. All of the measures presented here have been adopted in some form by multiple national governments around the world. We also classify each measure according to whether it is a regulatory intervention, fiscal instrument, governance reform, or information and capacity-building tool – as outlined in Section 1.3. For cross-cutting policies, we indicate whether they are direct interventions or enabling measures.

Although it is important to think comprehensively about designing a low-carbon national urban policy, the optimal set of policies depends on the national context. In Section 5, we explore some of the key differences in priorities and possible strategies for countries facing different urban development needs. In this section, we provide a foundation for that analysis by indicating potential implementation challenges or opportunities for each measure. In particular, we consider the following factors that could affect the feasibility of policy adoption and implementation from a national government’s perspective:

- *National budget impacts:* Different measures can have different effects on national budgets. Some (such as carbon pricing or tax reforms) may have positive budget impacts, while others will require a commitment of financial resources. We flag measures that typically require significant national fiscal appropriations, or the forgoing of revenues; we also indicate which measures have the potential to generate government revenue.
- *Administrative burdens:* Some measures are easier to implement than others. A cap-and-trade system for carbon emissions, for example, can be administratively complex. Providing land use data to local governments to aid in urban planning may be administratively easy. We assess relative administrative burdens associated with each measure, and highlight those where such burdens may be significant.
- *Technical capacity requirements:* Some types of measures require more technical knowledge and sophistication than others. Establishing building energy codes, for example, or reforming utility regulations, can be highly technical; public information campaigns may be less so. Technical demands can affect the feasibility of adopting a measure, especially where necessary expertise is lacking. However, technical demands can also influence the speed of implementation, even where sufficient government expertise is available – measures that are technically and administratively complex will often take longer to develop and implement. We discuss and highlight measures that may be particularly demanding in terms of national government technical capacity.
- *Impact on local government resources and capacities:* Many kinds of national policies directed at urban development can impose obligations on local governments to design, fund and undertake different kinds of measures (e.g. spatial planning mandates, or building code enforcement obligations). These obligations may be important to consider in assessing the feasibility of a measure, especially in areas where local governments have limited capacities and resources. Many of the enabling policies discussed in Section 4.5, on the other hand, can help local governments take on these obligations. We highlight measures that could impose significant burdens on local governments, or that could help alleviate such burdens.
- *Social equity implications:* The costs and benefits of low-carbon urban development are not always distributed evenly. Certain policies may impose regressive tax burdens, for example, or additional energy and transportation costs that disproportionately affect low-income households. Conversely, some policies may help alleviate socio-economic disparities – for instance, by providing energy and transportation subsidies for the urban poor. Although social equity impacts may not directly hinder policy implementation, they are important for social acceptance and may determine the ultimate feasibility and effectiveness of a policy.
- *Need for multi-level coordination:* As discussed in Section 1.2, successful achievement of many low-carbon urban development goals will require effective coordination between national and different levels of subnational governments. However, some kinds of policy approaches require more coordination than others. A national carbon tax, for example, can be established and enforced with little to no involvement from local governments. National urban planning policies and incentives, on the other hand, generally require close collaboration with local governments for their success. The complexity of such arrangements – and alignment with a country’s institutional structures and governing capacities – can significantly affect a policy’s feasibility. For each national measure, we indicate whether multi-level government coordination is a significant requirement for successful implementation.

We address each of these considerations, where relevant, in overviews of each measure in Sections 4.1–4.5. Our assessments are based on inferences from relevant literature related to each measure (as indicated in each subsection), and our own evaluation of relevant implementation challenges. Summary tables at the end of each subsection indicate, for each measure, which factors are likely to be most significant for assessing the measure’s feasibility, and those that are least significant:

- A (●) indicates that the factor may pose an implementation challenge, and is important to consider in assessing feasibility.
- A (○) indicates that the factor is a secondary concern, or only poses implementation challenges under certain conditions or policy designs.
- A (⊕) indicates that the factor may facilitate implementation, due to likely benefits or positive effects.
- A blank cell indicates that the factor is not applicable, or will generally pose little or no implementation challenges or benefits.

For example, one way that national governments can support compact, accessible urban development is by incorporating transit-oriented design principles in social housing projects or other nationally supported public services and urban infrastructure projects (Section 4.1.1). Doing so requires sufficient technical capacity at the national level to incorporate those criteria in project selection and funding decisions, so that is a key factor to consider. It may also be important to coordinate closely with local governments to ensure that prospective projects are consistent with local planning and infrastructure priorities. On balance, however, such projects can be socially beneficial by promoting greater urban accessibility for lower-income residents, and incorporating transit-oriented design criteria at the national level will usually impose few burdens on local governments (depending on circumstances). Our assessment of key considerations for determining the feasibility of this measure therefore looks like the summary in Table 2.

Table 2
Illustrative summary of key factors affecting feasibility of a national measure

	National budget	National admin. capacity	National technical capacity	Local govt. capacities	Social equity	Multi-level coordination
Promote compact form through public service, housing and infrastructure provision			●	○	⊕	●

A few caveats to these assessments are in order. First, the specific implementation challenges for a particular policy are highly context-dependent. Different governments will have different financial resources, administrative capacities, technical capacities and institutional make-ups. Thus, we can only provide a preliminary assessment here; we encourage further analysis informed by policy-makers’ knowledge of their own national context.

Other considerations are important as well. In choosing and designing any policy tool, for example, governments must balance trade-offs in effectiveness, efficiency and fairness, and must ensure that policies meet criteria for legality, legitimacy and accountability.⁵² Time is also a factor. Some measures can take longer to develop and implement than others, and governments may wish to prioritize options that can yield more immediate effects, feasibility considerations notwithstanding. In addition, the effects of different policies can vary greatly depending on pre-existing policy environments, economic and social factors, and a host of other country-specific variables that may be as important as any other consideration. Our assessment is therefore no substitute for the detailed analysis and evaluation needed to select and design policies appropriate to a country’s circumstances.

Finally, the adoption of any low-carbon urban development policy needs to be weighed against its prospective costs and benefits. At the top of each of the following subsections, we summarize findings on the economic, environmental and social benefits that are possible from different aspects of low-carbon urban development. We also highlight, where appropriate, conditions needed for effective policy design. Compact urban form, for example, may yield few economic benefits if it is not accompanied by greater accessibility, enhanced urban mobility, and other amenities. However, we do not attempt to assess the potential costs and benefits associated with individual measures, given that these will be highly context-dependent. As with any policy-making exercise, weighing costs and benefits – both in relative magnitude and with respect to their distribution among different populations – will be an important step in prioritizing policies for low-carbon urban development.

Table 3
National low-carbon urban development measures

Development goal	Policy approaches	Measures	Measure type
Compact urban form	Spatial planning	<ul style="list-style-type: none"> Establish national urban spatial planning frameworks that promote “smart growth” Promote compact form through public service, housing and infrastructure provision 	R* F
	Reform urban development tax and regulatory incentives	<ul style="list-style-type: none"> Implement national property tax reforms and development charges (where applicable) Revise national tax or regulatory incentives favouring less dense development 	F F
Low-carbon urban transportation	Multi-modal mobility planning and infrastructure development	<ul style="list-style-type: none"> Establish national urban mobility policies Fund low-carbon transportation infrastructure Align national infrastructure spending priorities with multi-modal transport goals 	R* F F
	Align pricing incentives with multi-modal transportation goals	<ul style="list-style-type: none"> Tax or restrict private vehicle ownership Incentivize efficient use of transportation modes 	F/R F
	Promote vehicle efficiency and clean energy alternatives	<ul style="list-style-type: none"> Enact fuel efficiency and alternative vehicle standards Provide fuel efficiency and alternative vehicle incentives Enact low-carbon fuel standards Fund infrastructure for cleaner vehicles and fuels Implement fuel economy labelling for vehicles Provide national driver training programmes 	R F R F I I
	Optimize freight transport efficiency	<ul style="list-style-type: none"> Establish national freight transport planning and logistics policies Provide tax incentives or requirements for freight transport mode shifting and optimization Fund alternative freight infrastructure (e.g. rail) 	R* F/R F

Efficient building energy use and delivery	Promote energy-efficient design of new buildings	<ul style="list-style-type: none"> • Establish national building energy codes • Establish building energy certification and labelling programmes • Provide incentives for efficient building design and construction 	R
			I
			F
	Promote energy-efficient renovations and retrofits of existing buildings	<ul style="list-style-type: none"> • Ensure building retrofit measures are included in national building energy codes; building energy certification and labelling programmes; and incentives for efficient building design and construction • Establish energy efficiency funding programmes • Adopt utility sector regulations and reforms to promote energy efficiency 	R
			F
		R/G	
	Encourage the use of energy-efficient appliances, equipment, and lighting	<ul style="list-style-type: none"> • Set minimum energy performance standards (MEPS) for appliances, equipment, and lighting • Establish appliance energy efficiency labelling programmes • Provide incentives for the purchase of energy-efficient technologies 	R
			I
			F
	Foster local, low-carbon energy sources	<ul style="list-style-type: none"> • Ensure low-carbon energy sources are included in national building energy codes • Provide incentives for the purchase of distributed energy resource technologies • Adopt utility sector regulations and reforms to enable local energy systems • Fund local energy supply projects 	R
			F
			G
			F
Efficient waste management	Promote integrated sustainable waste management	<ul style="list-style-type: none"> • Establish a national policy on waste • Fund waste management infrastructure 	R*
			F
	Encourage waste prevention	<ul style="list-style-type: none"> • Enact extended producer responsibility policies • Enact policies to discourage or limit unnecessary waste 	R
			R
	Increase waste collection and recycling	<ul style="list-style-type: none"> • Establish national waste collection and recycling goals • Provide funding, subsidies, and incentives for waste management and recycling facilities • Implement taxes or levies on products to cover recycling and safe disposal 	R
			F
			F
	Promote recovery of landfill gases and energy from waste	<ul style="list-style-type: none"> • Create landfill gas capture and utilization standards • Fund landfill gas energy and waste-to-energy infrastructure • Modify utility sector regulations to enable feed-in from landfill energy sources 	R
			F
			G

Cross-cutting <i>Direct interventions:</i>	Institute carbon pricing and fuel price reform	<ul style="list-style-type: none"> Remove fossil fuel subsidies Establish carbon pricing 	F F
	Mobilize private capital for low-carbon infrastructure investment	<ul style="list-style-type: none"> Establish a national sustainable infrastructure investment platform Facilitate green bond markets and international low-carbon investment 	R/F R/F
	Drive research, development and demonstration of low-carbon technologies	<ul style="list-style-type: none"> Support research, development and demonstration of low-carbon technologies 	F/I
<i>Enabling measures:</i>	Enhance the financial capacities of local governments	<ul style="list-style-type: none"> Expand city fiscal powers Boost municipal creditworthiness Alleviate revenue losses associated with reforms Revise fiscal transfer rules Build local government capacities on finance and revenue generation 	G R F G I
	Enhance the legal authority of local governments	<ul style="list-style-type: none"> Devolve authority to local governments to manage low-carbon initiatives 	G
	Foster coordination and collaboration across metropolitan areas	<ul style="list-style-type: none"> Establish governance structures that comprise entire metropolitan areas, and/or create legal requirements for coordination within metropolitan areas Provide incentives for local governments within a metropolitan area to collaborate and establish new governance structures together 	G F/G
	Provide data, information and benchmarking	<ul style="list-style-type: none"> Establish low-carbon development data programmes Implement low-carbon city benchmarking programmes 	I I
	Build local administrative and technical capacity for low-carbon development	<ul style="list-style-type: none"> Provide low-carbon planning tools for cities Provide training opportunities relating to low-carbon development Facilitate peer learning opportunities 	I I I
	Enhance public education, stakeholder engagement, and government leadership	<ul style="list-style-type: none"> Build capacity in public and stakeholder engagement Build capacity in fostering sustainable behaviours Exemplify best practices through government procurement 	I I I/F

Key: R = Regulatory tools; F = Fiscal tools; G = Governance reforms; I = Information & capacity-building
R* = National frameworks are primarily regulatory tools, but typically address all four factors above

4.1 PROMOTING COMPACT URBAN FORM

Compact, accessible cities are essential to low-carbon urban development. Compact cities provide greater density, which in turn can lead to lower travel and building energy demand, lower GHG emissions and air pollution, and other benefits.⁵³ Differences in urban form can cause urban transport and residential GHG emissions to differ by a factor of 10,⁵⁴ and reduced travel demand from improved city planning could contribute substantially to global GHG abatement.⁵⁵

Not all kinds of urban density are clearly beneficial, however. Population density without accessibility – quick and easy access to areas of employment, goods and services, recreation, etc. – can lead to traffic congestion, lower economic productivity, higher crime rates, and other social problems.⁵⁶ Urban policies designed to promote economic growth must seek to avoid these issues.⁵⁷

The policy options we discuss below aim to achieve compact urban forms that benefit the environment, promote social well-being and equity, and contribute positively to economic growth. This model of urban development has been extensively studied, and put into practice in many places.⁵⁸ It is commonly referred to as “smart growth” to distinguish it from both sprawling development and negative forms of urban densification.⁵⁹ Although there is no single definition of “smart” compact urban growth, common elements cited by researchers and practitioners include:

- Relatively dense populations;
- Intensive use of urban land, combined with agglomeration of cities into compact metropolitan areas;
- Mixed-use development that combines residential, workplace, commercial and leisure activities within a single neighbourhood;
- Preservation of green space and the associated urban ecosystem services;
- Urban development oriented around public transit, and urban areas connected by public transport options;
- “Human-scale” infrastructure that promotes accessibility and invites people to walk, bike and spend time in the city.

All these factors can work together to create vibrant, accessible cities and neighbourhoods that are attractive to urban residents. Smart growth does not necessarily mean restricted growth. In mature cities, it may mean focusing on brownfield development and infill of existing neighbourhoods; in growing cities it may involve expanding the footprint of the city, but in a deliberate, compact and accessible way.⁶⁰ “Smart” forms of compact development focus explicitly on economic growth, address multiple urban policy goals, and seek to generate economies of scale, agglomeration effects, and networking opportunities.⁶¹ Although compact, accessible city design can also help reduce GHG emissions, it is this array of other benefits that makes it particularly compelling for city leaders and stakeholders.⁶²

Successful strategies for promoting smart growth and compact urban form will depend heavily on local circumstances. No single model or set of policies will apply to all cities. Nevertheless, there are some common goals for compact development around which both local and national policy approaches can be constructed. The OECD recommends that governments focus on four goals in particular:

- Encouraging dense and proximate development;
- Retrofitting existing built-up areas (including “intensification” of existing land uses);
- Enhancing diversity and quality of life (including promotion of mixed land use);
- Minimizing adverse negative effects (such as traffic congestion, reduced housing affordability, negative aspects of perceived density, and lack of green space).⁶³

There are many specific policy tools that can be adopted to help realize these goals. The most effective approaches generally combine multiple measures, coordinated at multiple levels of government.⁶⁴ Major policy approaches for promoting compact urban form include:

- Spatial planning and land use regulation;
- Reform of urban development tax incentives;
- Complementary transportation policies and incentives.

The first two of these tools are addressed in the remainder of this section. Because of the variety of distinctly transportation-related policy tools available to both national and local governments, we address them separately in Section 4.2.

Metropolitan coordination is also essential to the success of many compact city policies, and to low-carbon urban development strategies generally. National measures related to metropolitan coordination are discussed under cross-cutting strategies, in Section 4.5.

4.1.1 Spatial planning

In most countries, an essential policy tool for encouraging compact urban form is effective spatial planning and land use management. Mixed-use urban development oriented around public transit and improved accessibility seldom happens organically. In many urban areas, for example, a combination of policy, social and economic factors can encourage less dense development with lower accessibility (i.e., urban “sprawl”), despite the relative societal costs of such development.⁶⁵ Spatial planning can help ensure that urban development proceeds in a way that allows for mixed uses and multiple modes of transportation, ensures proximity and accessibility, provides for green space, and ensures affordable housing, among other “smart growth” goals.

Urban spatial planning is implemented by deploying a wide range of local measures, including zoning, urban containment policies, regulations and tax systems. Mixed-use zoning, for example, can promote greater density and intensification of land use, and ensure accessibility to amenities and public services. Removal of maximum density requirements (such as maximum floor-area ratios and minimum per-unit parking standards), and setting minimum requirements, can be key tools for enabling compact development and achieving related policy goals. Not all of these tools will be effective or appropriate in all countries,⁶⁶ but national governments can help foster their use and adoption where appropriate, and promote compact form in other ways where they are not (see below).

NATIONAL MEASURES

The details of urban spatial planning, and plan implementation, are by necessity responsibilities of local governments. Still, national governments can do a great deal to guide and enable local government efforts. Key national measures include:

- Establishing national urban planning frameworks;
- Promoting compact form through public service, housing and infrastructure provision.

Establish national urban spatial planning frameworks that promote “smart growth”

Coordinated spatial planning has historically been a centrepiece of national urban policies,⁶⁷ and many countries have national policies designed to encourage more compact urban development.⁶⁸ National urban spatial planning policies can take many forms depending on a country’s circumstances. Many governments have adopted general, non-binding guidelines that municipalities are encouraged to adopt. Often these are developed with input from local governments themselves. Austria, for example, has adopted a “Spatial Development Concept” that sets general priorities for urban development, including compact and mixed-use development.⁶⁹ In other cases, national governments have established

legally binding rules and requirements for spatial planning that cities are obligated to follow. Denmark's Planning Act, for example, contains binding guidelines on urban-rural boundaries and provision of transport infrastructure.⁷⁰ The Republic of Korea has adopted a mix of national policies designed to encourage or require compact city planning that incorporates sustainable transportation options.⁷¹

The “right” level of prescriptiveness and legal obligation for national spatial planning guidelines will depend on a country's circumstances and the composition of its urban areas, but even general guidelines can make a significant difference in encouraging the adoption of compact city and “smart growth” concepts. As the OECD has noted: “The core value is to signal to urban developers, citizens and sub-national governments that national urban policy is heading towards compact cities.”⁷²

The national budget impacts and administrative burdens associated with a national urban planning framework can vary significantly, depending on its scope, level of specificity, and prescriptiveness. A prescriptive framework calling for national-level engagement in planning and infrastructure development (as in Korea) could entail significant budgetary and administrative commitments. A more “hands-off” advisory framework may be relatively low-impact.

Technical capacity is important to consider, especially since poorly conceived and executed urban plans can impose societal costs. Care must be taken to ensure that national planning guidelines align with smart growth principles, and do not simply promote negative forms of urban densification.

The impacts of a national urban planning framework on local government budgets and capacities must also be carefully considered. The success of any spatial planning guidelines, even advisory ones, will depend on the ability of local governments to adopt, apply and implement them.

Regardless of the approach taken, it is important to coordinate between national and subnational governments in the development of any national guidelines or requirements. Ideally, national policies should be tailored to domestic urban circumstances, and developed with input from local governments. “Hybrid” governance models where local experience and initiatives can inform national policy parameters will often be most effective.⁷³ Austria's spatial planning guidelines, for example, were developed as a joint effort between the federal government, states and municipalities.⁷⁴

Finally, several studies indicate that one of the main risks of increased urban density is the potential for negative effects on housing affordability and social equity. Greater density tends to increase housing rents, for example, leading to gains for homeowners but greater economic burdens on renters.⁷⁵ Zoning policies (and their selective application) can further increase housing costs and deepen inequality,⁷⁶ to the point of driving out longstanding residents of a community. These risks highlight the need to accompany compact-form policies with other measures that can offset social equity impacts, such investments in affordable housing, accessibility and public transit. They also suggest the need for appropriate land and property regulations to ensure low-income groups have options to live closer to jobs and services, and are not excluded from property markets.⁷⁷

Promote compact form through public service, housing and infrastructure provision

Governments can also promote compact form through the deployment of public services and infrastructure.⁷⁸ Although national governments will seldom engage directly in the details of urban planning, they do often have a role in supporting – directly and indirectly – local housing developments and other public projects. In some cases, national programmes can be explicitly tailored to promote compact city development. National affordable housing programmes, for example, can be used to encourage compact, mixed-use, transit-oriented projects. Lending criteria and other incentives can encourage alternatives to single-family homes, promoting both greater affordability and smart-growth principles.⁷⁹ In Brazil, the *Minha Casa, Minha Vida* social housing programme has provided loans for low-income neighbourhood development projects, some of which have begun to incorporate transit-oriented development principles in their design.⁸⁰ National programmes of this nature can help to complement local efforts to shape urban form through deployment of public services and infrastructure.

Promoting compact form through national affordable housing and other programmes is often a low-cost way to make an impact. It can be a particularly important tool in countries with urban areas that face barriers to effective regulation, e.g. due to governance challenges and ambiguous or insecure property rights, especially in informal settlements.⁸¹ In these areas, a primary tool for implementing a spatial plan may be the strategic deployment of public services, transportation infrastructure, and transit systems, which can help anchor development and shape settlement patterns.⁸²

For these kinds of approaches, the most significant requirement for national government agencies may be technical capacity to incorporate effective smart-growth standards and criteria into housing, public service and infrastructure support programmes. However, this kind of measure can often “piggyback” on existing programmes at both the national and local levels, and will generally impose few burdens on local governments. Close coordination with local government planning efforts may still be necessary. Promoting compact form through public service, housing and infrastructure provision can be socially beneficial by promoting greater urban accessibility for lower-income residents.

Relevant cross-cutting policies

Several cross-cutting policies can enable more effective local spatial planning, including:

- *Building local capacity:* In the context of spatial planning efforts, national governments can invest in and make available planning tools, provide training and capacity-building efforts, and build local governments’ capacity to engage with stakeholders.
- *Information provision and transparency measures:* National transportation and land use data programmes, for example, can help provide standardized geographic information and transportation statistics to inform city planning efforts.⁸³
- *Enhancing the financial capacities of local governments:* Developing and implementing spatial planning policies requires resources, and national governments can help ensure local governments have the funds they need.
- *Enhancing metropolitan coordination:* Many urban areas consist of multiple municipalities with separate jurisdictions. Efforts to promote compact urban forms usually require coordinated action across an entire metropolitan area in order to be effective.⁸⁴ This implies a need for close coordination among municipal governments – and across levels of government – on urban spatial planning, transportation planning, and provision of public services.

4.1.2 Reform urban development tax and regulatory incentives

One of the primary ways in which governments can influence urban development is through taxation and regulation of land, property and development activity. Compact development can be incentivized through a combination of (1) tax policies and development fees that encourage greater density and infill development in urban areas, and (2) tax and regulatory reforms that eliminate perverse incentives favouring larger, single-family homes and lower-density development.

Property taxes are a key source of revenue for many local governments, and in some cases are also administered by national governments.⁸⁵ Conventional property taxes are based on a combined assessment of the value of land, along with the value of buildings and improvements on the land.⁸⁶ Often the land and any built structures are taxed at the same rate with respect to their assessed value. Thus, all else being equal, developers are indifferent to the density of development and the intensity of land use – low-density development is taxed at the same rate as high-density. One frequently cited way to encourage greater density is to reform property taxes to encourage more intensive land use, e.g. through “split-rate” policies that tax land exclusively, or tax land at a higher rate than buildings and improvements.⁸⁷ Although the effects may be marginal, this can encourage developers to seek higher returns through more compact development.

Achieving compact urban form requires not only promoting denser new development, but also “infilling” and redevelopment within urban centres. However, building on new land (“greenfields”) is often more attractive to developers, because there is nothing to tear down or clean, and they typically do not have to bear the full cost of new infrastructure.⁸⁸ Split-rate property taxes can partially address this disparity. Governments can create further incentives by imposing development charges or fees on greenfield development projects. These development charges can help equalize the costs of new development and redevelopment, while also helping to pay for urban infrastructure expansion and upgrades.⁸⁹

Many types of tax and regulatory policies favour lower density development, even if not deliberately. In some countries, for example, differences in how property values are assessed can cause owners of large, single-family homes to pay a lower effective tax rate than those in multi-family dwellings.⁹⁰ Some incentives can be even less direct. In the United States, homeowners are allowed a deduction in their personal income taxes linked to the amount of interest they pay on home loans, which indirectly favours ownership of larger, more expensive homes.⁹¹ In addition, a range of national regulatory policies can have both direct and indirect effects on urban density and infill development. These can include regulations related to noise, health, safety, road construction and historic preservation, which – while well-intentioned and beneficial in many cases – nevertheless can hinder compact, mixed-use development (especially infill development). Eliminating or modifying these kinds of perverse incentives – many of which are under the control of national governments – could encourage more compact development.

NATIONAL MEASURES

As with spatial planning, local governments control many of the tax policies that affect urban development incentives. However, national governments may still have an important role to play. Potential national measures include:

- Implementing national tax incentives and charges to encourage compact and infill development (where applicable);
- Revising national tax or regulatory incentives that now favour less dense development.

Implement national tax incentives encouraging compact development

Local governments generally have primary responsibility for designing and administering urban property taxes and development charges. However, in some cases national governments may administer relevant property taxes. In these contexts, national governments can adopt land taxes (i.e., exclusively taxing land value, rather than the value of built structures), or split-rate property taxes, as Denmark and Finland have done.⁹² France has similarly experimented with other forms of property taxation designed to encourage greater density, such as imposing a higher tax rate on development deemed to be insufficiently dense.

The implementation challenges associated with direct property tax reforms (e.g. split rates) or development charges will depend greatly on national circumstances. Where national governments are involved in administering these reforms, coordination with local governments related to planning and fiscal impacts is essential.

Revise national tax or regulatory incentives that now favour less dense development

Even if they do not directly administer property or development taxes, national governments can still complement and enable local reform efforts. A key policy tool for many national governments is to eliminate national tax policies or subsidies that favour larger, detached, single-family homes, and instead incentivize smaller, multi-unit, and transit-adjacent dwellings.⁹³ Transportation-related tax incentives may also be important, as described in Section 4.2.2. National governments can also review and revise (as appropriate) noise, health, safety, historic preservation and other regulations that place disproportionate burdens on infill development.⁹⁴

From a technical and administrative standpoint, reforming tax and regulatory policies will generally present few challenges. The budgetary impacts of tax reforms will depend on the nature of existing taxes related to homeownership, but will always be important to consider. Removing tax credits or deductions that favour larger single-family homes, for example, could result in higher net revenues at the national level. Instituting tax and regulatory reforms that incentivize smaller, more compact dwellings could have mixed or negative budget impacts. Generally, these kinds of reforms can be undertaken without the need for close coordination with local governments. In conjunction with other smart growth reforms, reforming density and infill incentives can yield social benefits, but policy-makers should be cognizant of possible effects on housing markets.

Relevant cross-cutting policies

Because local governments are so often responsible for property taxes and development charges, an important part of a good national policy is to ensure that these governments are well positioned to undertake appropriate reforms. Cross-cutting national policies to promote and support such reforms may include:

- Ensuring local governments have the *appropriate authority* to implement property tax reforms or development charges. Often local powers are constrained by national or subnational policies; for instance, national government approval may be required to implement new local taxes or charges.⁹⁵ Those constraints may reflect prior decisions about the desired allocation of fiscal and regulatory authority between different levels of government. It is important to recognize that changing these arrangements could have national budgetary, administrative and technical implications, as well as significant impacts on local government budgets and capacities.
- National governments can also help *enhance local governments' capacity* to undertake tax and incentive reforms. A first step may be to raise local governments' awareness of the need for reform and some of the policy options available. National governments can also help by providing training, facilitating knowledge-sharing, and providing resources to hire new staff. Implementing development charges, for example, requires a high degree of local technical capacity, e.g. to evaluate the impacts of new development on infrastructure requirements.⁹⁶ Likewise, implementing split-rate taxes requires separate valuation of land and built structures, which can be complex and administratively costly. Most local governments, particularly in small and medium-sized cities, will need national assistance to implement such reforms.
- Improving local *information and data* can aid tax reform initiatives. Such efforts can include measures to strengthen property registries and facilitate valuation methods, especially land use data that could be used to inform valuation and taxation policies.⁹⁷
- *Enhancing the financial capacities of local governments* may also be crucial, in particular if property tax reforms would reduce revenue. Agreeing on a compensation mechanism will generally require close coordination between national and local governments, and may involve complex technical considerations related to estimating locally forgone revenues.

4.1.3 Summary of key implementation challenges and opportunities

Table 4 summarizes some of the key factors to consider in assessing the feasibility of national measures for promoting smart growth and compact urban form.

Table 4
Implementation considerations for compact urban form measures

	National budget	National admin. capacity	National technical capacity	Local govt. capacities	Social equity	Multi-level coordination
Spatial planning						
Establish national urban planning frameworks	○	○	●	●	●	●
Promote compact form through public service, housing and infrastructure provision	○	○	●		⊕	●
Reform urban development tax incentives						
Implement national tax incentives encouraging compact development (where applicable)	●	○	○	○	○	●
Revise national tax incentives favouring less dense development	●				● / ⊕	

● May pose an important implementation challenge

○ Secondary concern, or only poses implementation challenges under certain conditions or policy designs

⊕ May facilitate implementation, due to likely benefits or positive effects

4.2 PROMOTING LOW-CARBON URBAN TRANSPORTATION

Low-carbon transportation policies go hand-in-hand with urban “smart growth” (Section 4.1) and are an essential part of an effective national urban development strategy. Transportation accounts for 23% of global carbon dioxide emissions.⁹⁸ It is the fastest-growing emissions sector, due in part to a rise in personal vehicle use and freight demand in rapidly urbanizing areas. Many cities around the world are thus increasingly choked by traffic congestion, but there are proven alternatives that are more efficient and sustainable.⁹⁹

Urban transportation policies that improve accessibility, reduce transportation energy demand, and promote clean energy alternatives could yield a wide range of benefits. Low-carbon transport infrastructure can improve energy security by reducing dependence on imported oil.¹⁰⁰ Cities with modern transport infrastructure also tend to be ranked as more liveable, increasing their competitiveness for top workers and companies.¹⁰¹ Reduced traffic congestion in cities allows easier flow of people and resources, aiding economic growth.¹⁰² Limiting air pollution and noise from vehicles has health benefits for urban populations. Additionally, providing options to walk or bike can improve public health by increasing physical activity levels.¹⁰³ When well designed, low-carbon transit can also help to address social inequality, by reducing transportation costs for lower-income households,¹⁰⁴ and reduce traffic fatalities and injuries.¹⁰⁵

Low-carbon transportation strategies typically combine different measures to *avoid*, *shift* and *improve* transportation activity.¹⁰⁶ *Avoid* strategies aim to reduce the need for travel and the length of trips; for example, land use planning that creates compact cities brings people closer to their work and leisure activities, so they need to drive less or not at all¹⁰⁷ – see Section 4.1. *Shift* strategies encourage people to use public transit, walk or bike instead of driving, and make it easy and convenient to do so. *Improve* strategies aim to optimize vehicle efficiency within a particular mode (e.g. cars

or buses) and to make transportation infrastructure more efficient; for example, clean vehicle incentives and mandates can encourage consumers to buy hybrid or electric cars, particularly if charging stations are easily accessible.¹⁰⁸

As noted in Section 4.1, it is important to integrate land use and transportation planning to achieve low-carbon goals, as the two issues are deeply intertwined.¹⁰⁹ Many transportation policies are also more effective when they are bundled together.¹¹⁰ For instance, efforts to discourage private automobile use are likelier to succeed when combined with improvements in public transit, and vice versa.

Governments can help drive urban transportation towards low-carbon models through several approaches, including:

- Promoting multi-modal transport planning and infrastructure development;
- Aligning incentives with multi-modal transportation goals;
- Promoting vehicle efficiency and clean energy alternatives;
- Optimizing freight transport efficiency.

4.2.1 Multi-modal mobility planning and infrastructure development

Transportation planning is typically centred on the use of the personal automobile. New approaches, however, start from the recognition that dependency on personal vehicles has negative impacts, such as congestion, air pollution and GHG emissions, and thus aim to reduce that dependency. They emphasize transportation demand management and the use of multiple modes of transport in addition to personal cars and motorcycles, including:

- Walking and wheelchair use;
- Cycling (including e-bikes);
- Car- and bike-sharing;
- Taxis and ride-sharing;
- Fixed route public transit (e.g. buses, rail, ferries, subway, bus rapid transit);
- Paratransit (public transit aimed at enhancing mobility for people with disabilities).

These new approaches, which have been shown to yield significant social, economic and environmental benefits,¹¹¹ define personal vehicles not as the centrepiece of transportation, but as part of a broad landscape of mobility choices.¹¹² Multi-modal transport planners are also making use of information technology tools to increase efficiency, such as car-sharing and ride-hailing software, smart fare cards that make it easy for users to transition between transport modes within a city, and route planning tools.¹¹³

Multi-modal transport policies may emphasize some modes of transport over others. For example, some cities have adopted “green transportation hierarchies” that prioritize lower-emission options (such as walking, cycling or mass transit) over more carbon-intensive transportation forms when planning new projects.¹¹⁴

NATIONAL MEASURES

National governments can enhance multi-modal transportation in cities using several approaches. Key national measures include:

- Establishing national urban mobility policies;
- Funding low-carbon transportation infrastructure;
- Aligning national infrastructure spending priorities with multi-modal transport goals.

Establish national urban mobility policies

National governments can develop national urban mobility policies that direct or encourage urban transportation, public transit and mobility improvements, in order to meet energy and economic efficiency goals. One example is Brazil's National Policy on Urban Mobility, which directed cities with populations of 20,000 or more to develop sustainable urban mobility plans, and provided access to a designated transportation fund for cities completing their plans by a 2015 deadline.¹¹⁵ The United Nations Environment Programme (UNEP) has created a toolkit for the preparation of low-carbon mobility plans, which outlines the factors that should be considered during plan development and implementation.¹¹⁶

For maximum effectiveness, national mobility policies should be coordinated – or integrated – with national spatial planning policies (see Section 4.1). Transit-oriented development strategies, for example, cluster new development around mass transit hubs, so people can easily live, work or visit there without having to drive. The Republic of Korea has actively embraced these strategies at a national level, developing multi-modal transfer centres that concentrate railway stations, bus terminals, and new housing and commercial developments together.¹¹⁷ Integrating transportation and spatial plans can boost economic efficiency by reducing sprawl and improving connectivity within cities.¹¹⁸ Major transit upgrades can also be used to attract private investment to revitalize an area and promote infill development; recognizing the value added by transit, private developers often directly contribute to infrastructure upgrades.

Developing and implementing national urban mobility plans may require reorganizing the governance of transportation. For instance, Litman (2014) notes that many governments have renamed “highway” agencies as “transportation” agencies, to denote a shift away from road-building as their sole or central focus.¹¹⁹ Governments may also need to reformulate transport regulations, technical manuals and modelling tools to prioritize low-carbon modes of transportation, and to account for the added benefits of those modes – e.g. improvements to public health or the environment – in planning.¹²⁰ Guidance documents exist to help improve transportation plans, such as the National Association of City Transportation Officials' *Urban Street Design Guide*.¹²¹ This type of reorganization will require technical expertise to ensure the benefits of multi-modal planning are captured.

As with national spatial planning frameworks, the budgetary challenges associated with developing and implementing a national urban mobility plan will vary based on the scope of the plan, and its level of specificity and prescriptiveness. A prescriptive framework calling for national-level engagement in planning and infrastructure development could entail significant budgetary and administrative commitments. A more “hands-off” advisory framework is likely to cost less but may also make less of an impact.

It is important to consider local governments' capacities and resources to develop and implement transport plans. Coordination between national, regional and metropolitan mobility plans is important, both with regard to the type of policies pursued and the timing of implementation. As with spatial planning, “hybrid” governance models where local priorities and initiatives can inform national policy parameters will often be most effective.¹²²

The impact of national urban mobility plans on social equity will depend on the substance of national plans. In general, equity should be considered an overarching goal in transport planning, ensuring that decisions about new infrastructure and transportation options are made fairly, with a goal of increasing accessibility for residents.¹²³

Fund low-carbon transportation infrastructure

Low-carbon transportation infrastructure often requires large capital expenditures, which may be beyond the reach of many local governments. Furthermore, while the city-wide energy savings and economic returns from such infrastructure can be significant, they do not directly accrue to commercial investors, making it difficult to raise private investment capital.¹²⁴ National governments can help bridge this gap by helping to finance the construction and operation of low-carbon urban transportation infrastructure. Financial support can take different forms, including direct funding, grant programmes, and loan guarantees, aimed at both private developers and local governments. The Republic of Korea, for example, runs an Infrastructure Credit Guarantee Fund that provides credit guarantees to concessionaires involved in public-private partnerships for infrastructure projects.¹²⁵ Often an effective strategy is

to combine funding support for local governments with transportation planning requirements. This is the approach followed by Brazil's national urban mobility policy.¹²⁶ Likewise, in the United States, the Partnership for Sustainable Communities programme has provided challenge grants to local communities for both infrastructure investments and sustainable transportation planning.¹²⁷

One promising way to fund transportation is the use of land value capture (LVC) instruments, which recover increases in land value accrued from new infrastructure through taxes or development contributions. In most cases, cities need the support of national governments to enact LVC tools, because these large-scale developments typically invoke national policies (such as property rights and environmental regulations) in addition to local development rules.¹²⁸ National governments can support local governments in enacting LVC in a number of ways, such as by ensuring that national transit and land policies include LVC as an option, helping cities identify possible sites for LVC developments, and building technical capacity and best practices guides for LVC projects.¹²⁹

Measures to fund transportation infrastructure projects, whether directly or indirectly through local governments, can have significant budgetary implications, and depending on the mechanisms used to provide funding, may have significant administrative and technical requirements as well. In general, local governments will benefit from financial support for infrastructure, unless it comes with significant requirements that overburden municipal staff. Coordination between national and local governments is necessary to ensure that new infrastructure meets local priorities.

The social costs and benefits of infrastructure investments will depend on the specifics of each project. Generally, public transit projects and other forms of low-carbon infrastructure will have positive net economic, social and environmental benefits; however, transit projects may in some cases lead to gentrification, higher rents and social inequities.¹³⁰

Align national infrastructure spending priorities with multi-modal transport goals

National governments can ensure that national transportation (and other) spending priorities align with urban multi-modal transportation goals. National policies on infrastructure spending, for example, often prioritize road-building and maintenance.¹³¹ National gasoline tax policies sometimes stipulate that revenues be spent on roads and not on other transportation modes, causing misalignment with local compact city plans. In the U.S. state of Oregon, for example, efforts by the city of Portland to encourage the use of public transit and create walkable neighbourhoods were undermined by state and national laws requiring that gasoline tax revenues be invested in road construction. This resulted in low-density development in the suburbs, despite the city's planning efforts.¹³² Where national policies like this exist, they can be revised to align with urban multi-modal transport goals.

Realigning national infrastructure spending and tax policies can be relatively straightforward from a technical and administrative standpoint (although it may be challenging in some circumstances to identify all instances of unintended or "perverse" incentives). Such reforms may change how national budgets are allocated, but otherwise should have few budgetary impacts. The most significant implementation issue may be coordinating with local governments to allocate infrastructure spending (and perhaps decide whether and how to delegate some decision-making to local authorities). In some cases, it may also be important to consider how reprioritizing infrastructure spending may affect mobility for specific groups of citizens, e.g. where reduced road spending could adversely affect poor and/or rural communities.

Relevant cross-cutting policies

Cross-cutting national policies and measures relevant to multi-modal transportation planning and infrastructure include:

- *Capacity-building*, for instance through transportation planning tools and training, can help improve the proficiency and effectiveness of local governments in transportation planning; in the United States, for example, the U.S. Department of Transportation has a capacity-building programme for subnational governments;¹³³
- *Information provision and transparency measures* can assist mobility planning (e.g. traffic and other transportation data) as well as citizen engagement;

- *Measures to foster metropolitan coordination*, which is as essential for effective urban mobility planning as it is for spatial planning;
- *Measures to enhance the financial capacities of local governments*, e.g. to support planning efforts and new infrastructure investments;
- *Measures to mobilize private capital* in support of transport infrastructure investments;
- *Carbon pricing and fuel price reforms* can be important cross-cutting policies for encouraging multi-modal urban mobility, to the extent that they provide a more favourable investment climate related to low-carbon transportation infrastructure investment.

4.2.2 Align pricing incentives with multi-modal transportation goals

The number of passenger cars is rising fast worldwide. There are now about 900 million light-duty passenger vehicles in the world, and by 2050, the number is expected to exceed 2 billion.¹³⁴ Current policies tend to reinforce this trend by supporting private car manufacturing and use over other forms of transport.¹³⁵ For example, many countries subsidize gasoline and diesel, and many provide incentives to buy new vehicles.¹³⁶ During the last global economic downturn, car-producing countries spent US\$10 billion subsidizing the purchase of new vehicles.¹³⁷ This under-pricing of fuel and vehicles steers people towards driving instead of using public transit or other options.¹³⁸ The availability of ample free or low-cost parking in many urban areas further exacerbates the problem. Removing these incentives to drive and introducing pricing regimes that account for the full cost of vehicle operation can help cities meet low-carbon transport goals.

One way to think about effective low-carbon transportation policy is as “push and pull” approach: incentives to use public transit or other low-carbon options need to be coupled with appropriate measures to discourage the use of private automobiles.¹³⁹ Efficiently pricing vehicle use can make transit more attractive and also provide new revenue to invest in green transport infrastructure. There are a wide variety of pricing strategies that can be employed to limit unnecessary automobile use, such as parking fees and restrictions, cordon or congestion pricing in urban cores, vehicle-kilometres travelled (VKT) fees, and pay-as-you-drive insurance.¹⁴⁰

NATIONAL MEASURES

Although many of the policies and incentives that need to be realigned are set at a local level, national governments have important tools at their disposal to influence local action. Key national measures include:

- Taxing or restricting private vehicle ownership;
- Incentivizing the efficient use of different transportation modes.

Tax or restrict private vehicle ownership

National governments have several policy tools available to discourage the purchase and ownership of private automobiles. One approach is to impose taxes on vehicle sales – though in many developing countries, very high levies already apply. Another is to limit the number of new vehicle registrations available. These approaches have been applied simultaneously in Singapore, for example, where a vehicle quota exists to limit the number of vehicles on the road, and a vehicle tax is collected to discourage private automobile ownership.¹⁴¹ Singapore has combined ownership disincentives with an electronic road pricing system to discourage unnecessary driving.¹⁴² The effect of these policies is that Singapore has relatively low car ownership rates relative to other countries with a similar GDP.¹⁴³ Taxes and incentives can also be used to steer drivers towards cleaner, more efficient cars – see Section 4.2.3.

Measures like these can be relatively easy to implement from a budgetary, administrative and technical standpoint, and can yield additional revenues at the national level.¹⁴⁴ Such measures will also have few impacts on local government capacities, and do not generally pose significant coordination challenges.

The politics around such policies can be quite challenging, however, especially when there are social equity impacts. Increasing the cost of vehicle ownership will disproportionately affect lower-income people, unless there are affordable alternatives such as public transit.¹⁴⁵ For this reason, national policies that aim to discourage automobile ownership should be coupled with measures that make low-carbon alternatives more accessible and affordable. Public acceptance may also be bolstered by efforts to highlight the health, economic and environmental benefits of low-carbon transportation.

Incentivize the efficient use of different transportation modes

National tax policies can encourage more efficient use of the different transportation modes available in urban areas. For example, tax policies related to company car use or commuting expenses sometimes encourage driving and favour personal vehicles over other transportation options; these can be revised to encourage a more efficient mix of commuting incentives.¹⁴⁶ National governments can also provide transit subsidies to encourage a shift away from driving, through mechanisms such as tax deductions for transport passes, or subsidized transit fares.¹⁴⁷ National governments can also provide financial incentives to local governments to implement efficiency-boosting measures such as parking fees and congestion pricing – for instance, by making certain fiscal transfers contingent on implementing such measures. These policies can be enacted separately from, or in conjunction with, efficient and alternative *vehicle* incentives, described in the next section.

National tax and subsidy reforms to encourage more efficient *use* of vehicles and other transportation modes will generally pose few technical challenges. Administrative burdens may be a significant consideration, depending on the nature of the specific incentives involved. Budgetary impacts will always be important to consider, but may depend on how broad-based existing tax regimes are, and the magnitude of any subsidies established for alternative transportation modes. In most cases, these kinds of reforms can be implemented without the need for close coordination with local governments, and will not adversely affect local government budgets or capacities.

As with vehicle ownership disincentives, however, the introduction of pricing mechanisms that increase the cost of automobile use has proven to be politically challenging in many jurisdictions. Social equity issues are a primary concern, and it is therefore important to implement reforms as part of a comprehensive “push and pull” strategy that enables greater access to alternative transportation modes along with policies that increase the costs of private vehicle operation. Emphasizing the economic, health and environmental benefits of this approach in public consultations may likewise be important.

Relevant cross-cutting policies

National governments can support cities’ own efforts to realign price incentives with their low-carbon transportation priorities through a number of cross-cutting measures:

- *Carbon pricing mechanisms and fuel price reforms* can have broad and significant effects, including ensuring that fuel prices reflect the full cost of their use (including “external” social and environmental impacts), incentivizing fuel-use efficiency, promoting the use of alternative fuels, and inducing changes in travel choices.¹⁴⁸
- *Ensuring that city governments have the authority* to enact local transportation pricing mechanisms and regulations (e.g. cordon or congestion pricing, VKT fees, etc.) may be essential in some national contexts.
- *Building local governments’ capacity* to design and implement pricing mechanisms can enable better local governmental action.
- *Alleviating fiscal impacts* when local transportation pricing policies adversely affect local government budgets (e.g. where local governments provide public transit ridership subsidies) can also be an important enabling policy.
- Measures to *foster metropolitan coordination* may be essential for effective policy alignment across urban areas.
- *Information provision and transparency measures* can help both with citizen engagement and the design of local transportation incentive mechanisms.

- *Public engagement and strategies to promote sustainable behaviours* are important for encouraging citizens to use low-carbon transportation options.

4.2.3 Promote vehicle efficiency and clean energy alternatives

Widespread adoption of vehicles that use fuels more efficiently, or use cleaner energy sources, can produce significant economic, social and environmental benefits in urban areas. This includes the adoption of electric vehicles (EVs), which have much lower local pollution impacts, and in most cases generate fewer GHG emissions per kilometre travelled than conventional vehicles.

There is enormous scope for improving the efficiency and environmental impact of vehicles. It is estimated that the fuel economy of passenger vehicles can be doubled by 2050 using existing cost-effective technologies.¹⁴⁹ The U.S. National Research Council has argued that with investment in technological development, the potential for improvement is even greater. The Council has identified four factors are required to achieve deep reductions in fuel use and pollutant emissions (including GHGs) in light-duty vehicles:

- Improvements in the power trains of existing vehicles;
- Reductions in the weight and load size of vehicles;
- Changes in the energy sources or fuels used to power vehicles (such as biofuels, compressed natural gas, hydrogen and electricity);
- Use of new power train systems (such as plug-in hybrid electric vehicles, battery electric vehicles, and fuel-cell electric vehicles).¹⁵⁰

National-level policies are typically needed to encourage these kinds of advancements. However, although policies supporting the development of efficient vehicles and clean fuels are typically enacted at a national level, the benefits are felt in urban areas, through reduced air pollution and emissions, lower fuel costs, and lower vehicle operation costs, making this a key element of low-carbon urban development.

In addition to vehicle technology improvements, drivers can be encouraged to adopt more efficient driving practices, such as eco-driving techniques and proper vehicle maintenance.¹⁵¹ This can be induced through driver education, smart vehicle technologies, and improved operation of traffic systems (for instance, appropriate speed limits). This is particularly relevant for cities, where fuel lost to traffic delays and inefficient driving tends to be higher than in non-urban areas.

NATIONAL MEASURES

National governments can speed the adoption of low-carbon fuels and vehicles using a number of policy instruments. Key national measures include:

- Enacting fuel efficiency and alternative vehicle standards;
- Providing fuel efficiency and alternative vehicle incentives;
- Enacting low-carbon fuel standards;
- Funding infrastructure for cleaner vehicles and fuels;
- Implementing fuel economy labelling for vehicles;
- Providing national driver training programmes.

Enact fuel-efficiency and alternative vehicle standards

A proven national policy tool for encouraging fuel efficiency in vehicles is the establishment of fuel economy standards for car producers and importers.¹⁵² These require automakers to improve the efficiency of vehicles over time, usually to meet a specified average per-kilometre fuel consumption target for vehicles sold in a given year. Such standards can also be adapted to drive greater adoption of alternative technologies, such as EVs. Alternatively, standards can be applied to existing cars – for instance, requiring scrappage of highly inefficient vehicles. The UNEP Clean Fuels and Vehicles Regulatory Toolkit provides examples of these different options to improve vehicle and fuel efficiency.¹⁵³

Fuel economy standards are a relatively inexpensive way to encourage efficiency (from a national government perspective), because the costs are borne by producers. However, they can require significant administrative and technical resources, to ensure standards are effective and appropriately enforced. In addition, they can impose costs on consumers that raise equity concerns, e.g. where clean vehicles are more costly than conventional ones. Furthermore, fuel economy standards are often criticized due to the “rebound effect”, where cost savings from increased efficiency simply encourage more driving. Combining fuel economy standards with other pricing strategies, such as fuel tax increases, can help to overcome this problem.¹⁵⁴ Fuel taxes can also be used to fund incentives for clean vehicles, and address possible equity concerns.

Provide fuel efficiency and alternative vehicle incentives

Fuel economy and clean vehicle standards can be coupled with taxes on inefficient vehicles, and “feebates” that incentivize the purchase of efficient and low-carbon vehicles by consumers, to help automakers meet fuel economy standards.¹⁵⁵ Such incentives can help new low-carbon technologies compete in the marketplace until economies of scale make those vehicles (and their associated fuels) profitable. Numerous governments, for example, have supported EVs with purchasing rebates.¹⁵⁶

Establishing and implementing clean vehicle incentives can require significant budgetary, administrative and technical resources – for instance, to define eligible vehicle classes and administer incentives. Certain kinds of tax incentives (e.g. taxes on inefficient vehicles) may be revenue-positive, but many kinds of rebate programmes or other tax incentives will require significant budgetary outlays. Social equity impacts should be considered to ensure that taxes, rebate and incentives do not lead to an accrual of “environmental goods” (such as clean vehicles) exclusively in higher income brackets.

Enact low-carbon fuel standards

To encourage the uptake of low-carbon fuels, national governments can set targets for renewable fuel content, or enact low-carbon fuel standards that reduce the carbon intensity of transport fuels. Ideally these standards should reflect both the emissions produced by burning the fuel, and all upstream emissions created in the production and delivery of fuels.¹⁵⁷ Carbon pricing and fuel price reforms – both cross-cutting measures – can also aid in the adoption of low-carbon fuels and help achieve fuel standards.

As with vehicle standards, fuel standards are a relatively inexpensive policy tool, because most of the costs are borne by fuel producers. However, creating low-carbon fuel standards can be technically and administratively complex. It is difficult to adequately account for all GHG emissions in the supply chains of different fuels, so careful design and regular review of renewable fuel content standards is necessary to ensure that new fuels are not more polluting than the fossil fuels they are designed to replace.¹⁵⁸ Economic and social equity impacts may also be a concern in cases where fuel standards effectively raise energy and transportation costs for consumers.

Fund infrastructure for cleaner vehicles and fuels

National governments can aid in the commercialization of clean energy alternatives and vehicles by investing directly in new infrastructure. A comprehensive policy strategy around EVs, for example, requires the build-out of charging station networks. Many governments are directly supporting the deployment of new public charging stations.¹⁵⁹

Governments can also set targets for infrastructure adoption, to highlight support for new technologies. For instance, France has set a target of 4 million charging stations to support 2 million EVs by 2020.¹⁶⁰

As with other forms of infrastructure investment, funding low-carbon vehicle and fuel infrastructure, directly or through local governments, may have significant budgetary implications as well as administrative and technical requirements. Effective deployment of infrastructure will require coordination with local governments. Providing financial assistance or new infrastructure should positively impact local government capacities, especially where cities are already pursuing an agenda of electrifying vehicle stocks. The social costs and benefits of infrastructure investments will depend on the specifics of each project, and on whether they are equitably distributed.

Implement fuel economy labelling for vehicles

National governments may implement information campaigns or education programmes to improve fuel efficiency. One way to inform the public about fuel economy is through vehicle labelling. Fuel economy labels provide consumers with information about vehicle fuel costs and/or CO₂ emissions, to encourage consumers to choose more efficient vehicles.¹⁶¹

Fuel economy labelling is relatively low-cost, but requires administrative and technical capacity to design and monitor vehicle labelling. Nations without labelling schemes can reduce costs by borrowing from existing models in other countries;¹⁶² however, technical expertise is still required to ensure labels are accurate for local driving conditions. Labelling may have a small positive social impact by helping consumers reduce fuel costs.

Provide national driver training programmes

A second educational approach is to provide driver training to encourage more efficient driving and reduced congestion. Drivers can reduce their fuel consumption through improved driving techniques (e.g. avoiding rapid acceleration) and proper vehicle maintenance (e.g. maintaining proper tire pressure).¹⁶³ The Netherlands and Sweden, for example, have both been running eco-driver training programmes since the 1990s to educate drivers about techniques to reduce fuel consumption.¹⁶⁴

Public education about efficient driving is a relatively low-cost strategy for improving fuel efficiency. In countries where national governments administer driver's licenses, these can be incorporated into existing programmes with relative little added administrative or budgetary burden. Efficient driving programmes may have a minor social benefit, by helping drivers reduce fuel costs with no new technology requirements.

Relevant cross-cutting policies

National governments can adopt a cross-cutting measures to directly or indirectly foster the uptake of new technologies:

- Promoting the development of new vehicle technologies and fuels, through *investment in research, development and demonstration (RD&D)*. There are a wide array of technologies that have the potential to reduce vehicle GHG emissions that are still in research and development, such as advanced hydrogen fuels, smart operating systems, and energy storage beyond lithium ion batteries, to name a few.¹⁶⁵ The development and demonstration phases of these products need support, so that they can be commercialized in the future.
- *Carbon pricing mechanisms and fuel price reforms*. As noted above, these types of policies can have broad and significant effects, including ensuring that fuel prices reflect the full cost of their use (including “external” social and environmental impacts), providing incentives for greater vehicle efficiency, and promoting the use of alternative vehicle technologies and fuels.
- Although it usually makes sense for national governments to take the lead in adopting policies and measures to drive clean vehicle and fuel adoption, local governments can play key complementary roles. *Enhancing local government access to infrastructure financing and mobilizing private investment* can assist cities with the deployment of new technologies, such as fuelling infrastructure and EV charging stations.¹⁶⁶

4.2.4 Optimize freight transport efficiency

Cities tend to be the “last leg” of freight journeys, where goods are delivered to consumers. The International Energy Agency notes that while urban freight constitutes only 1% of total tonne kilometres of freight transport, urban deliveries consume 21% of freight transport energy demand.¹⁶⁷ This is because urban deliveries tend to involve more starts and stops, slower speeds, complex routes, less efficient delivery modes, and traffic congestion.

Cambridge Systematics (2009)¹⁶⁸ notes three key intervention points for improving freight efficiency in cities (in addition to general improvements in vehicle efficiency noted above):

- *Mode diversion* – diversion of freight from trucks to rail and waterways can reduce transport emissions, and reduce traffic congestion in urban areas.¹⁶⁹
- *Mode optimization* – aiding the movement of trucks through cities, through initiatives such as designated truck routes and provision of adequate loading zones, can limit fuel waste and associated emissions. Additionally, appropriate truck size and load limit regulations in urban areas, and regular maintenance requirements can ensure that freight vehicles are optimizing performance.¹⁷⁰
- *Logistics* – freight logistic efficiency can be improved through measures such as the establishment of urban consolidation centres for the distribution of goods in cities, time-of-day delivery restrictions in central business districts, and permitting systems for less-than-truckload deliveries to encourage load consolidation.¹⁷¹

At the national level, freight transport burdens in cities can also be reduced by limiting freight demands, e.g. by introducing standards to prevent unnecessary packaging. This reduces freight in two ways: first by reducing space and weight of goods shipped, and second by reducing subsequent waste that needs to be transported.¹⁷² This issue also encompasses emissions from waste, which are discussed further in Section 4.4.2.

NATIONAL MEASURES

Many national-level measures related to freight transport will parallel those that can be used to optimize and encourage low-carbon passenger transportation. They include:

- Establishing national freight transport planning and logistics policies;
- Providing tax incentives or requirements for freight transport mode shifting and optimization;
- Funding alternative freight infrastructure (e.g. rail).

Establish national freight transport planning and logistics policies

National governments can establish nationwide freight transport planning and logistics policies, or where they already exist, can revise them to ensure they reflect urban freight considerations. At the national level, these policies can ensure that national responsibilities related to freight transport (such as infrastructure investment strategies, vehicle registrations, and driver credentialing) are designed to optimize urban freight efficiency. At the local level, national freight transport policies can direct or support local government efforts to improve freight efficiency. This may involve incentives or directives to develop urban freight plans, logistics centres, and delivery restrictions or permitting systems.

Care needs to be taken in the technical design of regulations; overly prescriptive freight regulations may lead to unintended consequences. For example, limits on truck size in urban areas can have the effect of increasing the number of vehicles and associated emissions.¹⁷³ Policies should be designed so that they support the freight industry in finding efficiencies. Freight operators are key stakeholders in urban freight planning, and policies are unlikely to succeed if they do not have buy-in from the industry. For instance, many attempts to establish urban freight consolidation centres have been unsuccessful because they have not been accepted by private sector operators.

In many cases, national governments already manage freight licensing and safety regulations, so the administrative and budgetary burdens of integrating low-carbon measures into existing freight policies will be low. Some technical

expertise is required to ensure that regulations lead to the desired emissions reductions. Where national policies call for municipalities to develop freight plans, multi-level coordination of plans is necessary, and there will be impacts on local government capacity. Freight policies will have limited social equity impacts, beyond the general health and environmental benefits associated with more efficient transport systems.

Provide tax incentives or requirements for freight transport mode shifting and optimization

Freight efficiencies can be gained by moving freight to more efficient vehicles, off congested urban streets, and/or onto alternative transport modes. A range of alternatives exist for urban freight transportation, including rail, cargo bicycle, coastal shipping, and more efficient trucks (e.g. hybrid or electric trucks).¹⁷⁴ Vehicle and modal shifts typically require infrastructure investment (described further below), as well as subsidies, tax incentives or requirements to get freight companies to shift freight to alternative modes. One interesting example for encouraging improvements in urban freight is the use of vehicle labels in China, where efficient vehicles receive green labels, while inefficient vehicles (mostly freight) receive yellow labels; only green labelled vehicles are allowed within certain urban boundaries, providing a strong push towards more efficient vehicles.¹⁷⁵

These approaches can require significant budgetary, administrative and technical resources, depending on the nature of the initiative; budgetary implications are particularly important to consider if financial incentives are provided for mode shifting. In most cases, reforms can be implemented without the need for close coordination with local governments, and will not adversely impact local government budgets or capacities. Taxation and regulatory requirements may have adverse impacts on particular freight industry actors, which may be an important consideration in assessing overall costs and benefits.

Fund alternative freight infrastructure (e.g. rail)

Shifting freight transport to more efficient modes requires investment in infrastructure, such as electric truck charging facilities, cycle cargo lanes, railway lines, ports, consolidation and offloading facilities. Significant infrastructure improvements may be costly, and involve some administrative burdens. However, freight plays a critical role in national economies, so expenditures may align with economic development goals: the costs of infrastructure spending are often recouped through economic growth associated with well-functioning freight systems.¹⁷⁶ In general, providing new freight infrastructure will have a minimal impact on local government capacities, though some coordination with cities will be required to ensure infrastructure fits in with existing city development plans.

Relevant cross-cutting policies

National governments can help improve the proficiency and effectiveness of local freight transportation planning and regulation through a number of cross-cutting measures:

- *Capacity-building efforts* can help ensure that local governments have good freight transportation planning tools, and facilitate the training needed to improving freight efficiency.
- *National carbon pricing policies and fuel price reforms* can help incentivize shifts to less carbon-intensive modes of freight transport.
- Measures to improve *access to transportation data* can aid local freight planning.
- *Building local financial capacity* can enable local freight infrastructure investments.
- *Improving metropolitan governance* may also be important for reducing freight emissions, as freight issues typically extend across municipal boundaries.

4.25 Summary of key implementation challenges and opportunities

Table 5 summarizes some of the key factors to consider in assessing the feasibility of national measures for promoting low-carbon urban transportation.

Table 5
Implementation considerations for urban transportation measures

	National budget	National admin. capacity	National technical capacity	Local govt. capacities	Social equity	Multi-level coordination
Multi-modal mobility planning and infrastructure development						
Establish national urban mobility policies	○	●	●	●	○/⊕	●
Fund low-carbon transportation infrastructure	●	○	○	⊕	⊕	●
Align national infrastructure spending priorities with multi-modal transport goals	○	○	○	○	○	●
Align pricing incentives with multi-modal transportation goals						
Tax or restrict private vehicle ownership	⊕	○	○		●	
Incentivize efficient use of transportation modes	●	○	○		●/⊕	
Promote vehicle efficiency and clean energy alternatives						
Enact fuel-efficiency and alternative vehicle standards	○	●	●		○	
Provide fuel-efficiency and alternative vehicle incentives	●	●	●		○	
Enact low-carbon fuel standards	○	●	●		○	
Fund infrastructure for cleaner vehicles and fuels	●	●	●	⊕	○	●
Implement fuel economy labelling for vehicles	○	●	●		⊕	
Provide national driver training programmes	○	○	○		⊕	
Optimize freight transport efficiency						
Establish national freight transport planning and logistics policies	○	○	●	○		○
Provide tax incentives or requirements for freight transport mode shifting and optimization	●	○	○			
Fund alternative freight infrastructure (e.g. rail)	●	○	○	○		●

● May pose an important implementation challenge

○ Secondary concern, or only poses implementation challenges under certain conditions or policy designs

⊕ May facilitate implementation, due to likely benefits or positive effects

4.3 PROMOTING EFFICIENT BUILDING ENERGY USE AND LOCAL CLEAN ENERGY SOURCES

For most countries, making buildings more energy-efficient will be a key pillar of any low-carbon development strategy. Buildings account for around 30% of global energy consumption,¹⁷⁷ a proportion that is closer to 40% in many developed countries.¹⁷⁸ Half of global electricity consumption occurs in buildings, and such consumption is growing steeply in rapidly urbanizing regions.¹⁷⁹ Globally, building energy consumption (including electricity) is responsible for close to a third of human-caused CO₂ emissions.¹⁸⁰

Despite steady reductions in the intensity of building energy use globally, total energy consumption has increased by 35% since 1990 due to rapid growth in floor space, especially in residential buildings.¹⁸¹ Growth in building construction is itself a significant source of energy consumption and GHG emissions,¹⁸² with much of this growth occurring in developing nations. Improving the energy performance of buildings thus presents a major opportunity for enhancing energy security in most countries, and should be a central component of low-carbon national urban policies.

Many technologies are already available to reduce building energy consumption and provide energy more efficiently or with lower fuel- and carbon intensity. Energy conservation measures include advanced building envelope materials;¹⁸³ energy-efficient building designs;¹⁸⁴ advanced lighting technologies (e.g. light-emitting diodes); efficient heating, cooling and ventilation systems, including energy and heat recovery equipment;¹⁸⁵ energy-efficient appliances and equipment;¹⁸⁶ efficient water heating technologies; and technologies for reducing water consumption (which reduces the energy needed to supply water).¹⁸⁷ Localized building energy delivery technologies include district energy systems (including those that utilize waste heat or heat from renewable sources, and/or cogenerate heat and electricity); and distributed energy technologies, including rooftop solar photovoltaics.¹⁸⁸ Other low-carbon energy technologies available primarily in urban areas include municipal solid waste-to-energy facilities, and sewage- or landfill-gas capture and utilization technologies.¹⁸⁹

As with other elements of low-carbon urban development, investments in these technologies can yield important social, economic and environmental benefits beyond CO₂ reductions and energy security. Energy-efficient technologies and low-carbon energy delivery systems can produce significant urban air quality benefits; create local jobs; lower energy costs for consumers; improve human well-being (e.g. through improved heating and cooling); and boost economic productivity both locally and nationally.¹⁹⁰ In a study of energy efficiency standards and labelling programmes encompassing 20 nations, the IEA found that national benefits of these programmes outweighed costs by a ratio of at least 3 to 1.¹⁹¹

Despite these potential economic and social benefits, investments in advanced building energy technologies often fall short of what would be economically efficient, even in well-functioning economies. This is due to a range of market failures and barriers, including externalities and the under-pricing of public benefits, information gaps and split incentives, and imperfect competition.¹⁹² Government intervention is generally needed to correct these misalignments and overcome investment barriers. Interventions can take many forms; common types of policies include:

- Energy pricing reforms that internalize externalities (e.g. associated with air pollution and carbon emissions from fossil fuel combustion);
- Energy efficiency or performance standards (e.g. minimum energy performance standards – MEPS – for appliances, equipment and buildings);
- Incentives and rebates for energy-efficient technologies and advanced energy delivery systems;
- Power sector regulatory reforms that encourage efficient investment by electric utilities in end-use energy efficiency and distributed energy technologies;
- Government-led or -supported energy efficiency funding programmes;
- Information, labelling, and awareness programmes that inform consumers about the energy performance of buildings and technologies.

Frequently these types of policy interventions are enacted and coordinated by higher levels of government, especially national governments.¹⁹³ However, local and metropolitan governments often play key in helping to implement national policies (e.g. building codes or renovation programmes), adapt national policies or guidelines to local circumstances, and supplement national policies with local information campaigns, enforcement activities, and local regulations and incentives.¹⁹⁴ An important role for national governments is thus to help address potential barriers to local government action, including jurisdictional authority, financial constraints, and other capacity-related issues.

Broadly speaking, policies to improve the energy performance of urban buildings can target four different priorities:ⁱⁱ

- Promoting energy-efficient design of new buildings;
- Promoting energy-efficient renovations and retrofits of existing buildings;
- Encouraging the use of energy-efficient appliances, equipment, and lighting;
- Fostering local, low-carbon building energy delivery systems

Although we discuss each objective separately below, the four are – like other aspects of low-carbon urban development – highly interrelated. The overall energy performance of a building will depend both on design and materials as well as the types of technologies used for heating, cooling, water heating and use, lighting and appliances. Effective strategies thus need to encompass both demand- and supply-side measures. National policies to encourage greater building efficiency should consider relative costs, benefits and opportunities for both new and existing buildings. Because of these interrelationships, many of the measures appropriate to one priority will also be relevant for others, and it will often make sense to design a single policy approach (e.g. building energy performance codes) to encompass multiple aspects of building energy use and delivery.¹⁹⁵

4.3.1 Promote energy-efficient design of new buildings

Globally, urban housing has been increasing rapidly and will likely continue to increase at unprecedented rates over the next few decades. If those new urban buildings are made with conventional materials and designs, they could lock in high levels of energy demand for heating and cooling, and lead to substantially higher carbon emissions.¹⁹⁶ Therefore, some of the options for reducing urban carbon emissions with the greatest potential worldwide are those to reduce heating and cooling energy demand in new buildings.¹⁹⁷ That potential, in turn, is greatest in areas that are rapidly urbanizing, which could enjoy significant energy savings and economic benefits from promoting energy-efficient buildings.

NATIONAL MEASURES

For economic and regulatory efficiency, policies on building design are often set at higher levels of government. National-level policies can help harmonize standards and even the playing field among cities or regions. At the same time, local governments can be key implementers and enforcers of national policies, and can often supplement national policies with local measures, including local codes, information programmes and incentives. An effective approach for national governments, therefore, is to adopt a comprehensive framework that both sets national standards and goals, and enables local governments to be strong partners and implementers. Key national measures include:

- Establish national building energy codes;
- Establishing building energy certification and labelling programmes;
- Providing incentives for efficient building design and construction.

ⁱⁱ A fifth related priority may be to improve the energy performance of infrastructure used to service buildings and urban areas, including water distribution systems and street lighting. Many of the national enabling policies discussed in Section 4.5 can also enable local government action on these systems. Because the impacts of such action will in most cases be small relative to interventions in building energy use and delivery, we have not assessed this as a separate objective.

Establishing national building energy codes

Building codes, a key tool for promoting energy efficiency, can be formulated in different ways, but generally set mandatory minimum standards for building energy use. A key distinction is between “prescriptive” codes that seek to regulate individual building components, and “performance” codes that set overall building energy performance requirements and allow architects and engineers to meet these requirements through different combinations of design features, internal equipment and appliances, and energy delivery systems.¹⁹⁸ Even prescriptive codes, however, often cover more than just requirements for building design.

National governments generally bear primary responsibility for establishing these codes, although their content and the nature of the obligations they impose can vary considerably. Some countries, such as the United States, establish general guidelines, which help to harmonize and inform the development of standards at a subnational level. Alternatively, building codes may be prescriptive, but place different requirements on different jurisdictions, e.g. requiring codes as part of mandatory sustainable energy plans for cities above a certain size.¹⁹⁹ Building code policies may also differ in how they are monitored and enforced, and which levels of government are obligated to undertake monitoring and enforcement.

The national budgetary and administrative impacts of establishing building energy code policies can vary, depending on the nature of the codes, how prescriptive they are, and whether they are mandatory or advisory. Still, even basic building energy codes will generally require significant technical capacity. Building codes can also impose significant budgetary, administrative, and technical burdens on local governments, which often play the lead role in implementing and enforcing them. Coordination with and among subnational and local governments is essential, in both the design of building codes and their enforcement.

Efficient building design and construction standards can significantly reduce heating and cooling energy demand, but they can also impose additional upfront costs on building owners. In contexts with high informality, rigid building codes are sometimes selectively enforced against low-income households, causing disparities and forcing them to the urban periphery.²⁰⁰ In any context, upfront cost impacts on low-income households may be especially important to consider and ameliorate, in order to ensure an equitable distribution of energy cost savings over time.

Establish building energy certification and labelling programmes

Building energy codes are often supplemented with building certification, labelling or information disclosure programmes. Certification can be employed to ensure compliance with building codes, but can also inform consumers, helping prospective purchasers or renters to anticipate energy costs,²⁰¹ and increasing demand for energy-efficient buildings. As with building codes, certification and disclosure programmes can cover a range of energy use components beyond building form and materials.

Certification and labelling programmes can take different forms depending on their primary objective. Mandatory certification programmes, for example, can be used in conjunction with building energy codes to enable better enforcement. Voluntary certification programmes can serve demand from consumers for energy-efficient homes or commercial buildings, and can be used in conjunction with tax exemptions or other incentives for efficient new buildings. The voluntary ENERGY STAR programme in the United States, for example, certifies buildings with energy performance at least 15% better than established codes, and has been used in conjunction with efficient home incentive programmes.²⁰²

Implementations challenges and considerations related to building energy certification and labelling will largely mirror those for setting national building energy codes. One key difference is that national programmes (especially voluntary ones) are often implemented by national authorities, avoiding implementation burdens for local governments. In these cases, coordination with local governments may be less of a priority. Certification programmes by themselves will generally not significantly affect upfront building costs; they can, however, aid consumers in choosing more energy-efficient buildings and houses.

Provide incentives for efficient building design and construction

National governments can also play a key role in establishing incentive programmes and innovative financing mechanisms. National home lending programmes can subsidize purchases of energy-efficient houses, which in turn can incentivize efficient new construction. In Mexico, the National Workers' Housing Fund, for example, provides “green mortgage” subsidies to low-income households for the purchase of energy-efficient systems and building insulation, among other environment-friendly and health-related technologies.²⁰³ National governments can also provide tax exemptions (e.g. for developers or new building owners) and other incentives to encourage energy-efficient new construction.

National building efficiency incentives can take many forms, with varying budgetary, administrative and technical implications, but in most cases, budgetary impacts will be an important consideration. Administrative burdens can generally be low to the extent incentives are provided through existing programmes (e.g. home lending programmes, or property tax collection). Technical expertise is necessary to ensure that incentives achieve the efficient building outcomes they are designed to encourage. Generally, these kinds of incentives can be provided without the need for close coordination with local governments (although local governments may in some cases be involved with implementation). Incentives can yield a range of broader economic, social and environmental benefits associated with energy conservation, and when designed properly, can contribute to social equity.

Relevant cross-cutting policies

Several cross-cutting measures are important for encouraging building efficiency:

- *Building local capacity* in enforcing building energy codes is a critical part of policy delivery. Local governments will often have a primary role in enforcing new building energy codes, because such enforcement can be done most efficiently in conjunction with enforcing building health and safety codes, for example. The same may be true for certification programmes, especially mandatory ones. However, local governments need to both technical knowledge and financial resources to enforce building energy codes. A survey of U.S. municipalities found that lack of resources was commonly cited as a reason for failing to enforce energy codes, and that energy code enforcement was often the first thing to be dropped when resources are limited.²⁰⁴ However, an equally important goal is to ensure that local government staff have the technical knowledge to approve code-compliant building designs and to inspect buildings to ensure compliance. National governments can help by providing information and training programmes to help build this capacity.²⁰⁵
- *Enhancing the financial capacities of local governments* can play a key role in the success of building energy code enforcement. These can range from direct fiscal support by national governments for enforcement purposes, to general policies that expand local government fiscal authority.
- *Giving ambitious cities the legal authority* to adopt stringent new building codes, certification programmes, or local incentives for energy-efficient new buildings (including special zoning requirements, e.g.) can help improve building standards. National governments can help these cities by easing legal restrictions on the introduction of ambitious local policies, including fiscal authority where necessary to implement incentive programmes.
- *Carbon pricing and fuel price reforms* can help drive greater demand for higher efficiency.
- *Information and transparency measures* can help create a broader enabling environment for efficiency, including public education programmes, providing data on the social and economic benefits of energy efficiency, and incorporating building efficiency into urban development benchmarking programmes.
- *Government procurement policies* can be updated to support efficiency labelling and certification programmes (for instance, preferentially building or renting space to a certain standard) – this can signal commitment to policies, and provide support green building industries.

4.3.2 Promote energy-efficient renovations and retrofits of existing buildings

Although efficiency improvements to new buildings offer the greatest potential for building-related energy conservation globally, for many countries there is equal or greater potential in upgrading existing buildings. Especially for developed countries in colder climates, renovations to improve the energy performance of existing buildings will be a critical component of efforts to achieve low-carbon development.²⁰⁶

As with new building energy efficiency measures, efforts to renovate existing buildings often cover more than just the building envelope, and include heating, cooling and ventilation systems along with water heating equipment. Thus, policies to address building renovation and policies focused on energy-efficient appliances and equipment may be highly complementary (Section 4.3.3 below).

A key difference with renovations and retrofits, however, is that they typically cost much more than implementing energy-saving measures in new buildings, and they are often done in a more piecemeal fashion. Individual measures typically focus on low-cost options with short payback periods, and fail to address whole-building “deep renovations” that can achieve much greater energy savings and economic efficiencies in the long run.²⁰⁷ Building energy codes can help address this barrier, but may have the effect of delaying renovation efforts due to higher required costs. This may be especially true for low-income households, who not only lack resources, but also tend to live in lower-quality housing with costlier retrofitting needs.²⁰⁸ Fully realizing renovation potential may therefore require policy tools that help push investment towards comprehensive “whole-building” approaches.

NATIONAL MEASURES

Several policies for encouraging the energy efficiency of new buildings can also be applied to building renovations. As with policies targeting new buildings, policies to promote energy-efficient building renovations are frequently set at the national level, in close coordination with local governments. Key national measures include:

- Ensuring building retrofit measures are included in national building energy codes; building energy certification and labelling programmes; and incentives for efficient building design and construction;
- Establishing energy efficiency funding programmes;
- Adopting utility sector regulations and reforms to promote energy efficiency.

Ensure building retrofit measures are included in key national codes and programmes

As with new buildings, a primary national measure for promoting energy-efficient retrofits and renovations is the establishment of building energy codes, which can include mandatory energy performance standards (MEPS) for existing buildings when they undergo renovations. In fact, MEPS for existing building renovations will often be part of the same body of law or regulation applied to new buildings, and can be formulated in similar ways – i.e., as “prescriptive” or whole-building “performance” standards.²⁰⁹

National governments can likewise establish building certification, labelling and information disclosure programmes aimed at both new and existing buildings. In conjunction with these programmes, monitoring and evaluation of projects at existing buildings can yield data to inform private investment decisions, aid in the development of innovative financing models,²¹⁰ and help both national and local decision-makers prioritize energy efficiency efforts, engage with stakeholders, and increase adoption of efficient building designs and technologies.²¹¹

Many national building energy efficiency tax incentives and subsidies are applicable to existing buildings. For example, Mexico’s “green mortgage” programme, mentioned in Section 4.3.1, supports a range of energy-saving building renovations. In the United States, the Property-Assessed Clean Energy (PACE) programme finances energy upgrades to existing buildings by amortizing costs through property tax assessments.²¹²

Establish energy efficiency funding programmes

Government-funded programmes for investing in energy efficiency can target whole-building renovation opportunities, including weatherization and efficiency upgrades for low-income households. Such programmes can take many forms, and are often designed to leverage private capital (e.g. through revolving loan funds or other financing structures).²¹³ Energy efficiency programmes can also be administered by electric utilities, as directed by regulation and using utility-specific funding mechanisms.

National governments (or higher-level subnational governments) will generally bear the primary responsibility for establishing energy efficiency funding programmes, though they may be implemented at a regional or local level.

Though they can be configured in different ways, energy efficiency funding programmes may require significant national budgetary resources, and significant government technical capacity, to ensure they achieve intended efficiency goals. The national administrative burdens will depend on the design and scope of programmes. Efficiency funding programmes may or may not require close coordination with – or impose obligations on – subnational governments, depending on how the programmes are administered. One possible use of energy efficiency programmes is to address social equity concerns by directly supporting otherwise unaffordable “deep” energy renovations for low-income households.²¹⁴

Adopt utility sector regulations and reforms to promote energy efficiency

Regulatory reforms in the energy utility sector can promote energy conservation and encourage greater investment in building renovation. “Rate decoupling” policies, for example, can encourage utilities to invest in an optimal mix of both new capacity and energy conservation to meet growing demand,²¹⁵ including building renovation programmes. Government-directed utility “demand-side management” and efficiency programmes can target a range of investments, incentives, labelling and consumer education efforts, including funding of deep building renovation. “Smart grid” regulatory reforms – combined with advanced metering technologies – can allow time-of-use pricing for electricity that encourages customers to conserve energy and invest in energy-saving measures, including building renovation.

National or higher-level subnational governments are typically responsible for enacting utility sector regulations. Utility sector reforms will generally not require significant government financial resources, but may entail some administrative burdens (depending on their requirements), and may require significant technical capacity and understanding. Local government resources will not generally be affected, although depending on a country’s regulatory structure, coordination with other subnational governments may be required to implement nationwide reforms.

Although greater investment in building energy efficiency will generally benefit residents by reducing their net energy costs, certain regulatory reforms may increase retail energy prices. These price implications may need to be managed, especially if utility efficiency investments and programmes are not evenly targeted across households and building owners.²¹⁶

Relevant cross-cutting policies

The same cross-cutting policies applicable to new buildings can be applied to energy-efficient renovations and retrofits of existing buildings:

- *Enhancing the technical and financial capacities of local governments* may be important not just for building code and certification implementation and enforcement, but also for administering nationally funded energy efficiency programmes.
- Where relevant, it may also make sense to give *local governments legal authority* to implement locally ambitious or supplementary standards, certification programmes, zoning requirements, and incentive/investment programmes related to existing building renovations.

- Finally, national governments can *encourage private-sector investment* in building energy upgrades, through appropriate regulatory reforms and utility pricing policies. With the right incentives, businesses can play a significant role in channelling investment into energy-efficient building renovations. Third-party energy performance contracting companies, for example, can undertake such investments in exchange for a share of the energy cost savings that accrue to building owners, but may need enabling pricing systems or regulations for them to pursue this business model.²¹⁷

4.3.3 Encourage the use of energy-efficient appliances, equipment and lighting

Energy use in buildings is determined not only by building design, but also by the energy demands of internal appliances, equipment and lighting. Lighting alone, for example, accounts for almost 20% of global building electricity use.²¹⁸ Many nations have introduced policies to improve appliance, equipment and lighting efficiency. The most mature policies have reduced energy use from these sources by up to 25%.²¹⁹

NATIONAL MEASURES

The major types of policy tools for promoting energy-efficient appliances, equipment and lighting parallel those for improving building designs and promoting energy-efficient renovations and retrofits. Unlike national building energy codes, which may take the form of general guidelines or model rules that are then adopted and/or implemented at lower levels of government, technology performance standards are generally set and enforced at the national level, e.g. by establishing performance benchmarks for different classes of equipment and appliances at the point of manufacture. Coordination at a national level helps ensure an economically efficient, harmonized approach and avoids discrepancies in standards and incentives among subnational jurisdictions. Key national measures include:

- Setting minimum energy performance standards (MEPS) for appliances, equipment and lighting;
- Establishing appliance energy efficiency labelling programmes;
- Providing incentives for the purchase of energy-efficient technologies.

Set minimum energy performance standards for appliances, equipment and lighting

Governments can introduce minimum energy performance standards (MEPS) for appliances and other technologies, limiting the amount of energy that a given appliance may use for a set task. MEPS allow manufacturers to innovate and provide a variety of products for consumers, while also setting a base level of performance that removes inefficient products from the market. The introduction of MEPS can have a strong impact on product efficiency – Korea, for instance, tracked a 59% improvement in efficiency of products covered by MEPS between 1996 and 2010.²²⁰ MEPS may need to be updated on a regular basis, to ensure they keep pace with technology developments and international standards.

The creation of MEPS for appliances, equipment and lighting may require significant administrative resources, and will require good technical expertise in order to effectively design and enforce standards. Budgetary commitments may be relatively moderate, involving only financial resources needed to administer and enforce a MEPS program. In general, national MEPS programmes will have little impact on local governments, and require minimal coordination with them – although horizontal coordination between agencies at the national level may be important. Well-designed standards can bring a variety of social benefits, although care may be needed to ensure equitable access to advanced technologies.²²¹

Establish appliance energy efficiency labelling programmes

National governments can help consumers identify efficient products with standardized energy labels. Labelling systems can give consumers information about the relative performance of an appliance (for example, through a rating system), or can signify best-in-class products (through awards or special labels).²²² In addition to informing consumers, labels can push manufacturers to innovate to improve efficiency. For example, the U.S. ENERGY STAR

labelling programme created an “Emerging Technology Award” with an ambitious target of improving clothes dryer performance by 40%, which encouraged two companies to design new heat pump dryer models.²²³

While energy labelling is a relatively inexpensive policy option, it requires technical expertise – and administrative and enforcement capacity – to ensure that labels are accurate and manufacturers are applying them appropriately. Labelling programmes are best delivered at a national level, so that standards can be consistently applied across jurisdictions, and this means impacts on local governments (and needs for coordination) will generally be minimal. Labelling programmes will generally have a small positive social impact, by providing consumers with information about efficient appliances, enabling them to reduce energy costs.

Provide incentives for the purchase of energy-efficient technologies

National governments can also incentivize the purchase of energy-efficient products and technologies. As with new building design and renovation incentives, product efficiency incentives can take a variety of forms, including subsidies, rebates or tax breaks, depending on the type of equipment and efficiency goals. For example, Mexico’s National Programme for Home Appliance Replacement (PNSEE) offers energy bill rebates for replacing refrigerators and air conditioners with energy-efficient models;²²⁴ Korea offers a “Carbon Cashbag” programme that provides consumers with retail discounts when they buy efficient appliances or electronics.²²⁵ These programmes are often most effective when they incentivize the purchase of highly efficient products.²²⁶

Providing these kinds of incentives will require budgetary commitments and may impose administrative burdens, the nature of which will depend upon the size and reach of the programme. Technical capacity may also be an important consideration, since there may be challenges in identifying how incentives should be configured and applied to best achieve efficiency gains.²²⁷ Incentives can be targeted to address economic and social equity concerns, e.g. by targeting low-income households in order to reduce health and social impacts associated with energy poverty. Demands on local governments and needs for vertical coordination will depend on decisions about how incentives are administered (e.g. through national agencies or local government offices).

Relevant cross-cutting policies

National governments can drive efficiency in appliances, equipment and lighting through a number of additional cross-cutting measures:

- *Supporting research, development and demonstration* of energy-efficient appliances, equipment, and lighting. There are many kinds of nascent energy-efficient appliance technology options that require further research and development in order to reach commercialization.
- *Carbon pricing and fuel price reforms* can help drive greater demand for energy-efficient technologies.
- *Building local capacity in public engagement* can help cities encourage uptake of more efficient products. Municipalities are well-positioned to deliver information and incentives to encourage the purchase of energy-efficient products. Local governments can offer a single point of contact for citizens, and combine information and incentives from across various government bodies (including those for other forms of efficiency, such as water conservation). National governments can also support local governments in this role by providing *capacity-building and training on energy efficiency*, as well as *enhancing access to financial resources*.

4.3.4 Foster local, low-carbon energy sources

Low-carbon local energy sources – including rooftop solar photovoltaics (PV), small-scale solar thermal technologies, and district heating systems combined with low-carbon fuels or waste heat recovery – can often deliver energy to buildings cost-effectively. They can provide economic, social and environmental benefits relative to traditional energy supply.²²⁸ Local and distributed energy resources often increase the efficiency and resilience of urban energy systems, and are a key way to address energy poverty among the urban poor and in informal settlements.²²⁹ National benefits include increased energy security, reduced investment needs, and lower carbon emissions.

The viability and cost-effectiveness of local energy sources depends on local circumstances and urban form. Solar thermal and PV systems, for example, may be more viable in less densely settled urban areas than in cities with very little available space and many high-rise buildings.²³⁰ District heating systems, on the other hand, are often more economically viable in cold and temperate climates, and the benefits may diminish once aggressive heating efficiency (building shell) measures are implemented. Effectively deploying and utilizing local, low-carbon energy sources often requires an integrated approach.

NATIONAL MEASURES

Integrated planning related to urban energy systems – needed to accommodate district energy systems and other local energy supply options – is almost always the responsibility of local governments. However, there is much that national governments can do to support integration of local energy sources generally, particularly with respect to distributed energy options. General policies to promote the use of local energy delivery systems are similar to those used to promote building energy efficiency. Key national policy tools include:

- Ensuring that low-carbon energy sources are included in national building energy codes;
- Providing incentives for the purchase of distributed energy resource technologies;
- Adopting utility sector regulations and reforms to enable local energy systems;
- Funding local energy supply projects.

Ensure low-carbon energy sources are included in national building energy codes

National building energy codes can be tailored to support local energy delivery options, including onsite solar water-heating and PV technologies. The most effective way to accommodate these technologies will often be to apply a whole-building energy performance approach, as described in Section 4.3.1. These “performance”-style codes accommodate a mixture of both conservation and onsite energy supply to meet whole-building performance goals. Implementation challenges and considerations will be largely identical to those identified for national building energy codes.

Provide incentives for the purchase of distributed energy resource technologies

National governments can provide subsidies, tax incentives and innovative financing mechanisms to encourage the purchase and installation of distributed energy systems (e.g. solar thermal and PV systems). For instance, the PACE programme in the United States (discussed in Section 4.3.2) has been used to expand the adoption of rooftop solar PV systems.²³¹ Implementation challenges and considerations will be largely identical to those for energy-efficient technology incentive programmes. Some types of incentives may have negative social equity implications depending on how they are structured; for instance, feed-in tariffs for distributed renewables can be regressive to the extent they increase costs for all electricity customers, but only benefit wealthier households able to afford those technologies.²³² Successful adoption and integration of distributed low-carbon energy systems may require utility sector reforms (see below).

Adopt utility sector regulations and reforms to enable local energy systems

Utility sector reforms needed to accommodate and promote local energy sources generally involve revisions to pricing policies and tariffs, along with policies to enable investments in “smart grid” technologies.²³³ “Net metering” tariffs allow building owners to sell excess electricity from rooftop solar panels to their local utility, for example, providing added financial incentive for their adoption. Grid-based digital communications technologies (i.e., “smart grids”) can facilitate these kinds of metering arrangements.²³⁴ Utility sector reforms can encourage feed in of excess heat as well as electricity, as is currently the case in Germany, where the waste heat recovery is incentivized through the Combined Heat and Power Act (KWKG) and Renewable Energy Heat Act.²³⁵ National governments (and/or higher-level subnational governments) are often best positioned to direct these reforms and technology investments. Although the substance of the reforms will differ, implementation challenges and considerations are largely the same as those identified for utility reforms related to promoting energy efficiency.

Fund local energy supply projects

As with other types of urban infrastructure investments, national governments can also provide financial support to major local energy supply projects, including district energy systems, waste-to-energy facilities, and sewage- or landfill-gas capture and utilization projects. Financial support can take different forms, including direct funding, grant programmes and loan guarantees, aimed at both private developers and local governments.

As with national financial support for other kinds of urban infrastructure, this approach will have significant budgetary implications, and depending on the mechanisms used, may have significant administrative requirements as well. Sufficient technical expertise is necessary to identify appropriate and effective projects to fund. Local government impacts will generally be small, although coordination with local planning efforts, for example, may be important.

The social equity impacts of local energy projects will depend on the specifics of each project. Certain projects (e.g. district heating, waste-to-energy, and waste gas capture projects) may have environmental, social and economic impacts that need to be addressed and mitigated.

Relevant cross-cutting policies

Several cross-cutting policies are relevant for promoting local, low-carbon energy sources; also see the measures described in Section 4.5.

- *Research, development and demonstration priorities* can be expanded to include distributed low-carbon energy sources and other types of local urban energy technologies and solutions (e.g. battery storage), many of which require further development to improve efficiencies and lower costs.²³⁶
- *Carbon pricing and fuel price reform* can help drive greater demand for local, low-carbon energy delivery systems.
- *Building local governments' technical, financial and public engagement capacities* can help them implement and enforce building energy codes, administer incentive programmes, and provide the public with information on building energy solutions.
- As with energy efficiency measures, it may make sense to *give local governments the legal authority* to implement locally ambitious or supplementary standards, certification programmes, zoning requirements, and incentive/investment programmes that promote local, low-carbon building energy systems.
- *Metropolitan coordination* may be needed to facilitate planning efforts for integrating local energy sources into broader urban energy delivery systems.²³⁷
- Finally, as with renovations and appliance efficiency options, national governments can *facilitate private-sector investment* in building energy upgrades, which may include low-carbon energy systems.

4.3.5 Summary of key implementation challenges and opportunities

Table 6 summarizes some of the key factors to consider in assessing the feasibility of national measures for promoting efficient building energy use and delivery.

Table 6
Implementation considerations for building energy measures

	National budget	National admin. capacity	National technical capacity	Local govt. capacities	Social equity	Multi-level coordination
Promote energy-efficient design of new buildings						
Establish national building energy codes	○	○	●	●	○	●
Establish building energy certification and labelling programmes	○	○	●	○	○	○
Provide incentives for efficient building design and construction	●	○	●	○	⊕	○
Promote energy-efficient renovations and retrofits of existing buildings						
Ensure building retrofit measures are included in national building energy codes; building energy certification and labelling programmes; and incentives for efficient building design and construction	See “Promoting energy-efficient design of new buildings” (listed above)					
Establish energy efficiency funding programmes	●	○	●	○	⊕	○
Adopt utility sector regulations and reforms to promote energy efficiency	○	●	●	○	●	○
Encourage the use of energy-efficient appliances, equipment and lighting						
Set minimum energy performance standards (MEPS) for appliances, equipment, and lighting	○	●	●		○/⊕	
Establish appliance energy efficiency labelling programmes	○	●	●		⊕	
Provide incentives for the purchase of energy-efficient technologies	●	●	●	○	⊕	○
Foster local, low-carbon energy sources						
Ensure low-carbon energy sources are included in national building energy codes	See “Establishing national building energy codes” (listed above)					
Provide incentives for the purchase of distributed energy resource technologies	●	○	●	○	⊕	○
Adopt utility sector regulations and reforms to enable local energy systems	○	●	●	○	●	○
Fund local energy supply projects	●	○	●	○	○	○

● May pose an important implementation challenge

○ Secondary concern, or only poses implementation challenges under certain conditions or policy designs

⊕ May facilitate implementation, due to likely benefits or positive effects

4.4 PROMOTING EFFICIENT WASTE MANAGEMENT

Waste management is a growing challenge for urban areas in many countries. Globally, municipal solid waste generation is outpacing population growth, and it is expected to increase to 2 billion tonnes per year by 2025.²³⁸ Increasing waste volumes will place an enormous strain on urban areas. Solid waste management is often the largest budget item for cities, particularly in low- and middle-income countries.²³⁹ Waste also poses public health risks, as it can be a source of disease, air and water pollution, and even create flood hazards.²⁴⁰

Waste is a relatively small contributor to global GHG emissions, but efficient waste management represents an important opportunity to both reduce emissions and achieve economic gains. Solid waste accounts for 3% of GHG emissions worldwide, predominantly methane emissions from landfills.²⁴¹ However, concerted waste prevention and management efforts could potentially reduce global GHG emissions by 15–20%.²⁴² This is due to avoided emissions in other sectors (such as building, transportation and manufacturing) associated with reducing, reusing and recycling materials.

Efficient waste management can bring numerous benefits. Resource recovery creates employment opportunities, reduces costs associated purchasing raw materials, and provides security against resource price volatility.²⁴³ From a political perspective, efficient waste management can signal good governance to citizens.²⁴⁴ Improving waste collection can help reduce associated health risks and improve local environmental conditions.²⁴⁵ Furthermore, cleaner cities are more appealing for residents and tourists, and can be more attractive for businesses and investors.²⁴⁶

Governments face different challenges with waste production and disposal, and therefore, a variety of policies may be appropriate depending on local circumstances. Where no organized waste collection exists, developing infrastructure is a critical first step. This is necessary to limit public health hazards and localized environmental issues arising from uncontained waste. Once collection is established, the emphasis can shift to reducing, reusing and recycling materials, and managing the remaining waste. This approach is encapsulated in the “waste hierarchy,” which prioritizes reducing and reusing goods over recycling or disposing of materials.²⁴⁷ Several regions have gone further and set goals of “zero waste.”²⁴⁸ This approach places heavy emphasis on waste prevention and resource management in order to limit waste output. A similar model is that of a “circular economy,” whereby goods and raw materials are recirculated within the economy rather than wasted.²⁴⁹

In most nations, municipal solid waste is managed at a local level. However, national governments can help guide and coordinate waste management, and reduce waste generation, through measures to:

- Promote integrated sustainable waste management;
- Encourage waste prevention;
- Increase waste collection and recycling;
- Promote recovery of landfill gases and energy from waste.

Promote integrated sustainable waste management

Modern waste management systems tend to be complex, involving a range of strategies to prevent and manage waste, and a variety of stakeholders. Integrated sustainable waste management (ISWM) refers to the need to plan in an integrated fashion to address this complexity. Specifically, ISWM refers to the three areas that need to be considered simultaneously when developing a waste management strategy:

- The physical infrastructure of the system, including technologies to reduce waste, collect, transport, sort, recover, recycle, and safely dispose of materials;
- Strategic aspects, such as financing, health, social, environmental and economic impacts; and
- The stakeholders involved, including government actors, service providers, waste pickers and collectors, and waste generators.²⁵⁰

There is no “one-size-fits-all” approach to waste planning. The right mix of policies and approaches will depend on a range of factors, such as the composition of the waste stream, existing waste infrastructure, local consumption and waste habits, financial capacity, and institutional arrangements.²⁵¹ An ISWM framework provides the key areas that should be considered in waste planning, but the effectiveness of a plan will depend on how well strategies are tailored to local circumstances.

An effective ISWM plan can dramatically cut GHG emissions from waste. For instance, the introduction of an integrated solid waste management programme in Muangklang municipality, Thailand, reduced emissions by 60% relative to a baseline scenario of sanitary landfilling, and further emissions cuts are still possible through system improvements.²⁵²

NATIONAL MEASURES

Local governments are typically responsible for many aspects of urban waste management. An important role for national governments is to support local governments in their waste planning and management efforts, by providing guidance, coordination, funding and capacity-building opportunities. Key national measures for encouraging ISWM include:

- Establishing a national waste policy;
- Funding waste management infrastructure.

Establish a national waste policy

National governments can bolster urban ISWM planning by creating a national policy on waste. The policy can address a range of issues, including goals and priorities for waste management; delineation of authority over elements of waste management; enforcement mechanisms; and monitoring and evaluation protocols.²⁵³ Numerous governments have already developed national waste plans, and their experiences have informed useful guidance documents for national ISWM policy development.²⁵⁴

The budgetary and administrative impacts of a national waste policy will vary based on the scope and ambition of the policy. Technical understanding of the existing national waste system, and opportunities for improvement, is critical when designing national policies. In most cases, the largest challenges will be faced by local governments, which have to implement waste policies. As with other forms of national policy, attention must be paid to ensuring local governments have the necessary resources, and that local and national policies are appropriately coordinated to meet waste management goals. National ISWM policies should be designed with environmental justice in mind, to ensure that the burdens and benefits of waste management are equitably shared by all urban citizens.²⁵⁵

Fund waste management infrastructure

National ISWM planning should include consideration of infrastructure funding, as many jurisdictions suffer from a chronic lack of infrastructure to manage waste safely and effectively.²⁵⁶ Funding can cover a range of waste management infrastructure, including facilities for source segregation and collection, landfills (with gas capture), hazardous waste disposal sites, and recycling facilities.

Providing funding for waste management infrastructure can be costly; however, these costs may be justified by reduced spending elsewhere. Many nations have discovered that the cost of inaction on waste is more expensive than waste management infrastructure, due to the health and environmental effects associated with unmanaged or poorly managed waste.²⁵⁷ The technical and administrative challenges will vary depending on the types of infrastructure developed, but in most cases, some technical expertise is necessary to ensure that new infrastructure is safe and efficient. The provision of waste infrastructure funding will typically positively impact the capacities of local governments, which currently bear much of the cost of waste management. Coordination between national and municipal governments is necessary to ensure infrastructure meets local needs.

While waste infrastructure provision generally has a positive social impact, governments should be conscious of the impact of new infrastructure on neighbouring communities. In particular, both local and national governments should work to ensure that waste facilities (especially hazardous facilities) are not disproportionately sited in low-income or minority communities.²⁵⁸ It is also helpful to recognize that some very low-income people depend on waste-picking for their livelihoods; some waste management programmes have successfully engaged former waste-pickers in their operations (see Section 4.4.3).

Relevant cross-cutting policies

Many of the cross-cutting policies discussed in Section 4.5 are relevant for ISWM planning. The following measures are particularly relevant:

- *Enhancing the financial capacity* of local governments and facilitating funding for municipal waste initiatives is a necessary part of waste planning. As previously mentioned, waste management can be one of the largest expenses for city governments, so ensuring that municipalities have the financial capacity to enact ISWM goals is important.
- The establishment of *data and monitoring programmes* is a key part of ISWM planning. Many waste management strategies rely upon accurate information about the composition of waste streams, so quality data collection is needed to inform planning. Good information can also support enforcement and compliance, and help the public and stakeholders track progress.²⁵⁹ National-level information systems are a valuable complement to local waste monitoring, because dispersed systems typically suffer from a lack of standardized measurement and reporting, making it difficult to aggregate and track data.²⁶⁰
- Capacity-building for waste management at a municipal level is critical, as most waste policies are ultimately implemented at a local scale. Costa Rica provides a model for incorporating local capacity-building into national waste policy – the Law on Integrated Waste Management (No. 8839) is accompanied by a guide for the development of municipal ISWM.²⁶¹ Capacity-building can enable municipal waste managers to make strategic decisions about the best ways to achieve national goals.
- *Building local capacity in public and stakeholder engagement* can help ensure waste policies and infrastructure decisions are made in an equitable manner, in consultation with local communities.

4.4.2 ENCOURAGE WASTE PREVENTION

The most effective way to minimize waste impacts is to prevent waste from being generated in the first place. Waste prevention efforts may focus on both the quantity and the composition of waste generated – for instance, reducing the amount of hazardous substances in waste streams as well as the total quantity of waste.²⁶² Waste prevention reduces GHG emissions in two ways: by avoiding emissions from the production of goods, and by limiting emissions associated with disposal of goods.²⁶³ These savings have real economic value.

Waste can be prevented through the whole life cycle of product manufacturing and use, from the extraction of raw materials through to end-of-life disposal. Three key intervention points are through manufacturers, retailers and consumers:²⁶⁴

- Manufacturers can reduce waste through initiatives such as waste-conscious packaging, replacing hazardous materials with more benign substances, and designing products so that materials can easily be remanufactured or reused.
- Retailers can improve packaging at point-of-sale (for example, by not providing plastic bags in addition to product packaging), and labelling products to help consumers to make conscious product choices.
- Consumers can reduce waste by purchasing only what is needed, preferentially choosing products that can be recycled, and reusing and repairing items.

Policies may be designed to directly prevent waste; for example, numerous cities have enacted plastic bag charges to limit unnecessary use. Alternatively, policies may incentivize reuse and repair in order to avoid waste, such as in Sweden, where tax breaks were recently announced for costs associated with repairing goods.²⁶⁵

NATIONAL MEASURES

National governments can play a critical role in waste prevention. As with energy efficiency standards, it makes sense to set waste minimization policies at the national level (and even at an international scale where coordination is possible), to reduce regulatory inconsistencies for retailers and manufacturers. Key national measures include:

- Enacting extended producer responsibility (EPR) policies;
- Enacting policies to discourage or limit unnecessary waste.

Enact extended producer responsibility (EPR) policies

The introduction of national extended producer responsibility (EPR) standards can push manufacturers to minimize waste and design products with reuse and recycling in mind. Extended producer responsibility shifts the burden of waste management from the public to the private sector, by requiring producers to take responsibility for products at the end of their life cycle. This can be accomplished through mechanisms such as “take-back” schemes, whereby producers recycle products, or by charging a fee to cover end-of-life costs. National EPR standards help to incentivize eco-design, internalize waste costs, and push manufacturers to find recycling options.²⁶⁶

The development of EPR policies may alleviate budget constraints for both local and national governments, as these policies shift many costs of waste management from the public sector back to producers. These policies tend to involve technical expertise and administrative burdens in the development phase, and require ongoing administration for enforcement to ensure standards are upheld. Establishing national EPR standards will generally require little coordination with local governments, but will require close collaboration with producers. Overall, EPR standards should have a positive social impact, as they reduce the social burdens associated with excess waste; however, care must be taken to ensure EPR standards do not lead to significant price increases on essential goods and services.

Enact policies to discourage or limit unnecessary waste

National governments can also enact policies to discourage or limit generation of unnecessary waste. Several nations have enacted landfill or incineration taxes, to discourage waste generation and inappropriate disposal.²⁶⁷ Policies can also be sector-specific, tailored to problematic waste streams in a given country. An illustrative example is France’s legislation to restrict food waste, which requires supermarkets to donate rather than dispose of unsold food.²⁶⁸ In some cases international cooperation may be required, to ensure that limiting waste in one region doesn’t lead to displacement to other parts of the world, following the example of the Basel Convention, which limits transboundary flow of hazardous waste.²⁶⁹

As with EPR standards, policies that discourage or limit waste may alleviate national and local budgets by reducing costs associated with handling waste. Pricing strategies, e.g. landfill or incineration taxes, may also generate national revenues. The administrative and technical requirements of such policies will depend on the specific waste streams being tackled. Likewise, the impacts on social equity and on local governments (and associated needs for multi-level coordination) will depend on the types of policies applied. To maximize benefits, national governments may target particular waste streams for the purpose of improving social or environmental conditions – as is the case in the French food waste legislation, which redistributes food to the poor, or with plastic bag bans in many developing nations, which are enacted to prevent localized flooding.²⁷⁰

Relevant cross-cutting policies

Several cross-cutting policies are particularly relevant for waste minimization.

- It is important to ensure that *local governments have the legal authority* to pursue innovative, locally appropriate waste initiatives. Some policies to limit waste are best enacted at a local scale, such as variable waste pricing where citizens pay for waste produced (sometimes referred to as “pay-as-you-throw” pricing).²⁷¹ National governments can support city governments by ensuring that they have appropriate authority to introduce such policies.
- *Public engagement* is a key part of waste minimization, as ultimately policies are aiming to change people’s attitudes and behaviour concerning the production of waste.
- *Government procurement* can support waste minimization programmes – for instance, by preferentially purchasing products with a higher recycled content.
- *Carbon pricing and fuel price reforms* can encourage waste prevention, as reuse and minimization of materials becomes more attractive when life-cycle carbon costs are taken into account.
- Fostering good *metropolitan governance and cross-boundary coordination* helps reduce the perverse side effects of waste minimization policies, such as dumping in areas with more lax waste standards.

4.4.3 Increase waste collection and recycling

Providing reliable waste collection is important, both to reduce environmental risks and to improve public health issues associated with uncontained or unmanaged waste. Regular waste collection provides an opportunity to recycle materials. Recycling can save energy and raw material use, which in turn reduces emissions.²⁷²

A wide range of materials can be diverted from landfills and recycled or disposed of safely, including dry materials (such as paper, plastics, metals, glass and textiles), organics, hazardous wastes, and construction materials. Dry materials and construction wastes can be repurposed or recycled into new products, reducing virgin material requirements and the associated energy embodied in producing those materials. Organic matter can be broken down through composting or anaerobic digestion, decreasing the need for fertilizers, and potentially providing a source of heat or energy (see the next section). Materials can be segregated for recycling at the source (where producers and consumers sort materials before they are sent to waste managers), or recovered at waste management facilities (using sorting technologies, or manual waste-pickers). At-source recycling is preferable when possible, as it can prevent cross-contamination of materials and is safer to handle for waste workers.²⁷³

As noted above, it is important to remember that in many nations, an informal recycling economy exists in lieu of, or alongside, formal systems. Often waste-pickers sort through uncollected waste and landfills to gather and sell resources. New recycling programmes should include these workers to ensure that their livelihoods are not adversely affected. Creating dedicated spaces for waste sorting and formalizing these jobs can improve health and economic conditions for waste workers, and may also bring benefits to the national economy, such as the ability to tax profits from these waste streams.²⁷⁴

NATIONAL MEASURES

Some of the policies discussed in the preceding section on waste prevention would help increase recycling rates, such as waste pricing, and extended producer responsibility policies. Additional national measures include:

- Establishing national waste collection and recycling goals;
- Providing funding, subsidies and incentives for waste management and recycling facilities;
- Implementing taxes or levies on products to cover recycling and safe disposal.

Establish national waste collection and recycling goals

As an overarching policy, governments can set national goals or requirements for waste collection, diversion and recycling. Targets are most effective when they include designated time frames and measurable indicators of success, such as “achieve 100% controlled disposal by 2020” or “80% of newspapers recovered and recycled by 2020”.²⁷⁵ Targets must be coupled with good data to track progress. In some cases, recycling targets may provide a perverse incentive not to focus on elements higher in the waste hierarchy, such as minimization and reuse; including targets within a broader ISWM strategy that emphasizes waste prevention can help overcome this problem.

National waste targets have limited national budgetary impacts, but will require administrative and technical capacity to track and monitor. Most of the burden from national targets will be felt by local governments that need to increase recycling or collection to meet goals. Coordination between national and local governments will be necessary to ensure municipalities have the capacity to meet national targets. Assuming that target-setting leads to improvements in waste management, such policies would have a minor positive impact on social equity, through improvements in living conditions for those in areas with uncollected waste.

Provide funding, subsidies and incentives for waste management and recycling facilities

National governments can encourage the establishment of collection and recycling facilities, either by directly funding infrastructure (see Section 4.4.1), or through subsidies and incentives. To optimize waste collection and recycling, a range of infrastructure is necessary, such as sanitary landfills (with gas capture, see Section 4.4.4), waste sorting facilities, and composting and waste digestion facilities. National governments can encourage the development of this infrastructure by providing direct subsidies, as well as tax breaks for equipment and other related costs. Implementation challenges and considerations for subsidies and incentives are broadly the same as those identified for waste infrastructure funding.

Implement taxes or levies on products to cover recycling and safe disposal

National governments can attach taxes or levies to products at time of sale to encourage recycling, e.g. bottle deposits or e-waste recycling fees. Revenue from such charges can be used to cover disposal and recycling costs.²⁷⁶ In addition to covering waste management expenses, these charges make producers and consumers more aware of the costs of waste disposal, which may drive changes in behaviour towards more responsible packaging and production.

As with waste prevention policies, adding charges to products to cover recycling and disposal would likely have a positive impact on national and local government budgets, by alleviating some of the expenses associated with waste management. The technical and administrative requirements of such charges will vary based on the waste stream; for example, some products (such as e-waste) are complex to dispose of safely, because they are composed of multiple materials that require specialized recycling, so charges will likewise be challenging to calculate and administer. Coordination between national and local governments will be required to arrange transfer of revenues, and to ensure that the charges collected are used for associated waste streams. Social equity must be considered when applying charges to essential items (such as food packaging), to avoid disproportionate impacts on lower-income households.

Relevant cross-cutting policies

All of the cross-cutting policies discussed under waste prevention are relevant for meeting recycling goals. In addition:

- *Public engagement and strategies to promote sustainable behaviours* are necessary for ensuring effective waste collection and recycling. Recycling and collection efforts are most successful in areas where the public is committed to improving waste management. Policies that build local government capacity for public engagement can therefore enhance recycling rates.
- As mentioned in the previous section on promoting integrated sustainable waste management, it is critical for governments to *facilitate funding and build local financial capacity* for waste management and associated infrastructure.

4.4.4 Promote recovery of landfill gases and energy from waste

Landfills are a source of methane, which is both a potent greenhouse gas, and a potential fire hazard on landfill sites. Methane builds up from decomposing matter under anaerobic conditions. Modern landfill design typically incorporates the recovery of methane, which can be captured using pipe networks within landfills, and then either flared or – preferably, as discussed below – used as a source of energy.²⁷⁷

Methane captured from landfills can be directly piped to nearby facilities for use as a heating or electricity source. It can be turned into electricity and fed into the grid, or can be purified and used as a replacement for other forms of natural gas.

In addition to generating energy from landfill methane emissions, the waste itself can be used as a source of energy. Several options exist for generating energy from waste, including incineration, refuse-based fuels, pyrolysis and gasification.²⁷⁸ Turning waste into energy not only reduces methane emissions from landfills, but can also reduce emissions by displacing fossil fuels that might otherwise have been burned.²⁷⁹ Investing in energy-to-waste infrastructure typically makes good economic sense, as the sale of heat and electricity can generate a financial return, particularly where there are favourable pricing regimes (e.g. feed-in tariffs or a carbon price).²⁸⁰

NATIONAL MEASURES

National governments can play an important role in setting standards for landfill development and in ensuring that providing funding and regulatory frameworks to support landfill gas recovery and energy generation from waste. Key national policy options include:

- Creating landfill gas capture and utilization standards;
- Funding landfill gas energy and waste-to-energy infrastructure;
- Modifying utility sector regulations to enable feed-in from landfill energy sources.

Create landfill gas capture and utilization standards

National governments can encourage landfill gas capture and utilization by enacting standards for landfill construction that require methane capture, flaring and/or energy generation. Many nations already have policies or guidelines for solid waste landfill design; where necessary, they can be revised to include landfill gas capture and energy utilization.²⁸¹

A number of factors need to be considered when developing landfill gas and landfill energy standards, including environmental impacts (in particular, management of harmful pollutants such as dioxins), costs associated with establishment and operation of systems, and the potential to produce energy from different waste streams.²⁸² Given that landfill energy technology is a rapidly developing field, nations may want to consider enacting performance-based rather than prescriptive standards to allow new technologies to be adopted as they are developed.²⁸³

The creation of landfill gas capture and utilization standards should have a relatively low impact on national budgets and administration, especially where national governments already have solid waste landfill policies and enforcement capabilities. Some specialized technical expertise is required, to ensure that standards will effectively reduce emissions and work within local waste management systems. Most of the burden of this policy will be borne by local governments, which have to ensure landfills meet these standards. Some coordination between national policy-makers and local waste managers will be required to ensure capacity exists to enact and enforce standards. There are limited social equity implications, beyond localized improvements in health and safety for landfill workers and neighbouring communities.

Fund landfill gas energy and waste-to-energy infrastructure

National governments can directly fund landfill energy infrastructure and associated operating costs, or support cities aiming to acquire funding by facilitating partnerships with funding bodies (see Section 4.5.2). For instance, the Clean Development Mechanism (CDM) has provided additional funding for a large number of landfill gas capture projects in developing nations.²⁸⁴ When funding projects, care must be taken to ensure that incentives do not have the perverse impact of encouraging landfilling over more sustainable waste management practices, such as reuse and recycling.²⁸⁵

The costs, burdens and impacts of funding landfill gas energy and waste energy projects largely mirror those for waste management infrastructure more broadly. However, if governments can demonstrate that they have reduced methane emissions or displaced polluting energy sources, some costs may be offset through funding streams for reducing GHG emissions (such as credits from the CDM or other carbon trading programmes).

Modify utility sector regulations to enable feed-in from landfill energy sources

Finally, governments can modify energy distribution grids and pricing policies to enable feed-in from landfill energy sources. This may require reforming electricity tariffs so that landfill energy operators are compensated for electricity generation – for instance, through feed-in tariffs or net energy metering.²⁸⁶ It may also entail upgrading distribution grids so that landfill energy can reach existing infrastructure. See Sections 4.3.2 and 4.3.4 for a general discussion of utility sector reforms.

In some cases, governments are already reforming grids and pricing policies to allow for other forms of distributed energy (such as rooftop solar), so accommodating landfill energy sources may not add significant financial or administrative burdens beyond what is already planned. Some technical expertise will be necessary to identify the best ways to reform tariffs and grid infrastructure to encourage the use of landfill energy. Coordination and support from national governments can help local governments identify opportunities for connecting landfill waste facilities to national grids. The social impacts of utility reform will depend on how feed-in from landfill sources influences net energy costs.

Relevant cross-cutting policies

Several cross-cutting policies are applicable to landfill energy programmes.

- *Enhancing the financial capacities of local governments and facilitating private investment* can aid local governments in meeting the costs associated with landfill gas and energy infrastructure.
- *Carbon pricing and fuel price reform* can help ensure that landfill energy can compete with fossil fuel sources.
- *Technical capacity-building* for local waste managers can help ensure they have adequate technical knowledge and financial support to design and safely operate landfill gas utilization and waste-to-energy systems.
- *Public and stakeholder engagement* is also crucial, because landfill siting decisions, and by virtue landfill energy projects, often tend to be a source of community conflict.²⁸⁷

4.4.5 Summary of key implementation challenges and opportunities

Table 7 summarizes some of the key factors to consider in assessing the feasibility of national measures for promoting efficient waste management.

Table 7
Implementation considerations for waste management measures

	National budget	National admin. capacity	National technical capacity	Local govt. capacities	Social equity	Multi-level coordination
Promote integrated sustainable waste management						
Establish a national waste policy	○	○	●	●	○	●
Fund waste management infrastructure	●	○	●	⊕	○/⊕	●
Encourage waste prevention						
Enact extended producer responsibility (EPR) policies	⊕	●	●	⊕	○	
Enact policies to discourage or limit unnecessary waste	⊕	○	○	○/⊕	○/⊕	○
Increase waste collection and recycling						
Establish national waste collection and recycling goals	○	○	○	●	⊕	●
Provide funding, subsidies, and incentives for waste management and recycling facilities	●	○	●	⊕	○/⊕	●
Implement taxes or levies on products to cover recycling and safe disposal	⊕	○	○	⊕	○	●
Promote recovery of landfill gases and energy from waste						
Create landfill gas capture and utilization standards	○	○	●	●	⊕	●
Fund landfill gas energy and waste-to-energy infrastructure	●	○	●	⊕	○/⊕	●
Modify utility sector regulations to enable feed-in from landfill energy sources	○	○	●	○	○	○

● May pose an important implementation challenge

○ Secondary concern, or only poses implementation challenges under certain conditions or policy designs

⊕ May facilitate implementation, due to likely benefits or positive effects

4.5 CROSS-CUTTING POLICY APPROACHES

Throughout the discussion in this section, we have identified not only targeted measures, but broader “cross-cutting” measures that can help advance low-carbon urban development goals. In this final subsection, we look more closely at those cross-cutting policy options, which can be critically important.

Some cross-cutting measures involve direct policy interventions that drive low-carbon development across a range of sectors, including in urban areas. These include policies that:

- Institute carbon pricing and fuel price reforms;
- Mobilize private capital for low-carbon infrastructure investment;
- Drive research, development and demonstration of low-carbon technologies.

As discussed in Section 3.2, however, a wide range of cross-cutting measures involve mechanisms that enable local governments to undertake relevant city-level actions. These include policies that:

- Enhance the financial capacities of local governments;
- Enhance the legal authority of local governments;
- Foster coordination and collaboration across metropolitan areas;
- Provide data, information and benchmarking;
- Build local administrative and technical capacities;
- Enhance public education, stakeholder engagement and government leadership.

We address each of these categories below, and evaluate possible measures under each.

DIRECT INTERVENTIONS

4.5.1 Institute carbon pricing and fuel price reform

A central objective of low-carbon urban development strategies is to help move national economies away from an overreliance on fossil fuels, and towards cleaner and more sustainable energy sources. Efficient pricing of energy – and of fossil fuels in particular – can help drive greater investment in a whole range of technologies and infrastructure needed to realize this model of urban development.

REMOVE FOSSIL FUEL SUBSIDIES

Many countries subsidize fossil fuels, artificially lowering their price relative to other sources of energy. Subsidies take a variety of forms, and may be implemented at different points in fossil fuel supply chains.²⁸⁸ These subsidies are often well-intended – aiming to make transportation, household energy use, and sometimes commercial and industrial energy use more affordable – but they can also lead to inefficient overconsumption of fossil fuels relative to cleaner, healthier and environmentally friendly alternatives. Removing such subsidies can send a more efficient price signal, and help improve the economics of a range of low-carbon urban development investments.

ESTABLISH CARBON PRICING

Carbon pricing is based on the recognition that GHG emissions impose global social costs by contributing to climate change. By imposing a price on carbon, governments can shift some of those costs back to emitters, instead of having the full cost borne by society. Carbon pricing can take different forms, such as carbon taxes (per tonne of CO₂ emitted, or as a tax on fossil fuels, irrespective of carbon content), and emissions trading schemes that cap carbon emissions.²⁸⁹

Carbon pricing policies can help drive low-carbon urban development investments by better aligning energy prices with the social costs of different fuels.

The challenges of pricing carbon and/or removing fossil fuel subsidies will depend on national circumstances, and may be affected by their intersection with a range of other policy goals. Local governments are unlikely to be involved or affected. Both can have significant positive effects on national budgets, by reducing expenditures and forgone tax revenues, or by generating new revenues. The technical and administrative burdens associated with removing fossil fuel subsidies will generally be minimal. For carbon pricing policies, however, these burdens may be substantial – especially for emissions trading schemes, which tend to involve complex carbon accounting requirements.²⁹⁰

Social equity impacts are a crucial consideration. Although fossil fuel subsidies typically benefit higher-income households more than the poor, because they consume more fuel,²⁹¹ the removal of subsidies, without other measures to help low-income households, can still cause a real price shock. Thus, the political challenges can be substantial.²⁹² Carbon pricing programmes have not generated quite the same level of controversy in countries that have adopted them, but the energy price increases that they tend to trigger can disproportionately affect lower-income households, necessitating mechanisms to compensate for such impacts.²⁹³

4.5.2 Mobilize private capital for low-carbon infrastructure investment

Globally, development of low-carbon urban infrastructure (including transportation, energy, and waste management infrastructure) will require large capital expenditures, on the order of US\$1 trillion per year through 2050.²⁹⁴ This scale of investment is largely beyond public-sector capacities, especially in lower-income countries.²⁹⁵ Channelling private capital into low-carbon infrastructure is therefore essential, but commercial investors often lack sufficient incentive to make such investments.

A range of actions are needed to help overcome private investment barriers. In some cases, regulatory interventions (primarily local) are needed to overcome “principal-agent”²⁹⁶ problems and allow private investors to recover costs.²⁹⁷ Other times the key is to reduce transaction costs and facilitate a conducive investment climate. There are numerous ways national governments can enhance the investment climate for low-carbon infrastructure, including establishing strong property rights and land tenure systems, adequately pricing carbon and removing fossil fuel subsidies, reforming government procurement, and enhancing the financial capacities of local governments.²⁹⁸ In addition, national governments can attract private and international capital by directly reducing the transaction costs associated with low-carbon investments.

Two measures stand out in particular:

- Establishing a national sustainable investment platform to match private investors to public projects;
- Facilitating green bond markets and institutions to attract international climate finance.

ESTABLISH A NATIONAL SUSTAINABLE INFRASTRUCTURE INVESTMENT PLATFORM

One way to reduce transaction costs is to establish a national sustainable infrastructure bank or investment platform, to help match private investors to public projects. This platform can be used to identify and develop projects, and to group together smaller projects into larger initiatives. By pooling together different projects, investment platforms can reduce investment risks and transaction costs, and attract financing for projects that might otherwise go unfunded.²⁹⁹

FACILITATE GREEN BOND MARKETS AND INTERNATIONAL LOW-CARBON INVESTMENT

National governments can also attract infrastructure investment by setting up institutional offices to facilitate green bonds, or to attract multinational climate finance (e.g. through international carbon trading schemes). National governments can explicitly package their own climate-friendly urban infrastructure projects in order to sell green

bonds to finance them or to attract international finance. They can also support local government infrastructure plans by bundling local initiatives into national programmes, or providing the technical expertise required to certify and verify local projects. This would help cities tap into the significant amount of international financing and private capital that exists globally for low-carbon infrastructure.³⁰⁰

Establishing national investment platforms and green bond markets may bring some upfront costs, but the overall impact on national budgets should be positive, because infrastructure costs would be shifted from the public to the private sector. Both of these measures will require technical and administrative resources (e.g. to establish local standards, or undertake required GHG measurement, reporting, and verification mechanisms). Otherwise, these measures pose few challenges for implementation. Increased investment in infrastructure should aid local government capacity to deliver low-carbon initiatives. It should also have a positive impact on social equity, as previous research has found that income inequality declines with higher infrastructure quantity and quality.³⁰¹

4.5.3 Drive RD&D of low-carbon technologies

An important role for national governments can be to promote the development of new low-carbon technologies.³⁰² Many technologies with potential to reduce GHG emissions, such as low-emissions fuels, low-carbon vehicles, or energy-efficient appliances, are still in the research and development phases. Public support for the development and demonstration of these products can accelerate their commercialization.

Governments can support new technologies by investing directly in research, development and demonstration (RD&D), and by creating favourable market conditions for low-carbon technologies, so that private industry invests more in RD&D. Complementary measures such as carbon pricing and government procurement can also spur research and development, by shifting market conditions so that they favour low-carbon technologies.

SUPPORT RESEARCH, DEVELOPMENT AND DEMONSTRATION (RD&D) OF LOW-CARBON TECHNOLOGIES

National governments may want to consider funding for RD&D through mechanisms such as tax incentives, grants and awards. National plans may also identify areas where skills gaps exist, and include provision for training opportunities to fill these gaps.

RD&D plans should include consideration of deployment of newly developed technologies, to prevent products from getting stuck in the “valley of death” between proof of concept and commercialization.³⁰³ In many cases, private industry may be better placed than government to deploy new technologies. However, some government oversight is recommended to ensure that new technologies are safe and ready for consumer markets, and that necessary infrastructure is in place to support deployment.

In the early stages of research and development, it can be difficult to predict which nascent technologies will be commercially successful. For this reason, governments may wish to provide support for a portfolio of different technologies.

Although RD&D is often considered a “key pillar” of low carbon development,³⁰⁴ RD&D efforts may involve significant budgetary, administrative and technical burdens for national governments. For many countries, these costs can be justified by the contributions RD&D makes to economic growth.³⁰⁵ For countries with limited capacity, RD&D strategies may emphasize technology transfer from other nations, rather than new development.

In most nations, RD&D is primarily managed at a national level, so burdens for local government will be limited; however, encouraging coordination between researchers and municipalities can help ensure that new technologies meet local needs. The impacts of RD&D on social equity will depend on the specific types of technologies being researched and deployed. In general, national RD&D strategies should include provisions to ensure the risks and benefits of new technological developments are equitably distributed.³⁰⁶

ENABLING MEASURES

4.5.4 Enhance the financial capacities of local governments

Most low-carbon urban development strategies require action and implementation by local governments – which, in turn, requires local resources both for staff and to invest in urban infrastructure. However, local governments are often financially constrained, and may in some cases lack the authority and capacity to increase their financial resources, or to undertake innovative approaches for financing low-carbon infrastructure construction and operation.³⁰⁷ Key cross-cutting measures that national governments should consider in this context include:

- Expanding the fiscal powers of local governments;
- Boosting the creditworthiness of municipalities;
- Alleviating any revenue losses associated with nationally driven reforms;
- Revising fiscal transfer rules to ensure they are not overly restrictive;
- Building local governments' capacities on finance and revenue generation.

EXPAND THE FISCAL POWERS OF LOCAL GOVERNMENTS

Deficiencies in the legal and regulatory environments related to local government financing can be a major impediment to urban infrastructure development. The regulatory frameworks established by national (or higher-level subnational) governments can directly determine cities' abilities to borrow money and to engage in innovative financing arrangements such as public-private partnerships (PPPs) and land-value capture (LVC) mechanisms. National rules can also affect how much cities (and/or utilities) can borrow and under what terms (e.g. borrowing procedures, what currencies may be used, types of collateral they may pledge, events in cases of default, etc.) National legal frameworks can also determine the ability of cities to enter into PPP arrangements, the corporate framework for entities that may be established under PPPs, the way in which tariffs are set, and regulatory oversight processes and agencies.³⁰⁸ With respect to LVC mechanisms, national rules may determine whether cities can sell and trade development rights, land leasing systems, the rules governing rights exchanges, and so on. Without appropriate municipal fiscal authority, the financing capabilities of cities (and local utilities) can be highly constrained.

National governments can help address these issues in several ways. First, where relevant, they can expand municipalities' fiscal authority to allow them to undertake a range of strategies to boost local revenues, ease financial obligations, and support investment in low-carbon infrastructure. Such measures can include authorization of simple charges and fees, e.g. to enable traffic congestion pricing or impose local development charges or betterment levies. However, they can also allow cities to undertake a range of more complex financing strategies, such as LVC, tax-increment financing and PPPs.³⁰⁹

BOOST MUNICIPAL CREDITWORTHINESS

Many local governments, particularly in small and medium-size cities, find it difficult to borrow money. National governments can help to improve their creditworthiness and thus expand their access to debt financing from bonds, private bank loans, and other sources (e.g. multilateral development banks). Only a small percentage of cities in developing countries, for example, are considered creditworthy by international lenders, mainly due to weak revenue bases, and most cities have poorer credit ratings than their respective national governments.³¹⁰ The appropriate tools for addressing municipal creditworthiness or lending risk may vary depending on national and local circumstances. National grants, loans or guarantees to bolster local finances may be particularly relevant in lower-income countries. National standardized rating systems for municipal payment capacity and creditworthiness can also be useful in many contexts.³¹¹ Various mechanisms to facilitate and attract private capital (e.g. green bonds and infrastructure investment platforms – see next section) can enhance local creditworthiness as well.

ALLEVIATE REVENUE LOSSES ASSOCIATED WITH REFORMS

Some national policies may reduce local government revenues. For example, reduced automobile ownership might lead to lower excise tax collections. Likewise, depending on their property tax structure local governments might lose revenue due to reforms that shift private investment away from large-scale greenfield developments and towards infill and redevelopment (Section 4.1.2). National governments can help compensate for some of this loss; for example, some countries have revised grant allocation formulas to account for the opportunity costs of implementing socially and environmentally beneficial policies.³¹²

REVISE FISCAL TRANSFER RULES

National governments may impose conditions on the use of funds allocated to local governments, which in some cases may impede investment in low-carbon development options. Where relevant, national governments can revise terms related to fiscal transfer to local governments, e.g. to ensure that they do not unnecessarily restrict the use of funds from different sources and impede cross-cutting local development strategies (e.g. housing and public transit).³¹³

BUILD LOCAL GOVERNMENT CAPACITIES ON FINANCE AND REVENUE GENERATION

Many financing strategies related to low-carbon urban development require high-level institutional and technical capacities.³¹⁴ National governments can provide programmes and training to local governments to help them develop the know-how to implement a range of revenue and financing strategies, and to increase their access to financial capital. Measures can include programmes to review and improve municipal revenue management, including institutional accounting and budgeting systems; investment in human resources; support for cities to design and implement debt-financed urban projects, to build local government experience and credit history; and facilitation of peer-to-peer exchanges among cities, to support knowledge transfer on revenue generation and management, expenditure control, and asset maintenance.

All of these measures will have positive effects on local government capacities. Implementation challenges vary by approach. Measures to expand city fiscal authority will generally place few direct budgetary, administrative or technical burdens on national governments (depending on circumstances), but do need to carefully consider impacts on local governments and vertical coordination of fiscal responsibilities. Revising fiscal transfer rules can face similar challenges, and may have implications for national budgets as well.

Measures to boost the creditworthiness of local governments may face varying implementation challenges depending on which tools are used, but will generally require close multi-level coordination. Capacity-building programmes can likewise face different implementation burdens depending on their content, and require direct engagement with local governments.

Finally, alleviating revenue losses may have significant national budgetary implications, depending on the context. Agreeing on a compensation mechanism will generally require close coordination between national and local governments, and may involve complex technical considerations related to estimating locally forgone revenues.

4.5.5 Enhance the legal authority of local governments

In some cases, city governments (especially larger municipalities) may have the capacity, resources and political motivation to adopt more stringent policies and programmes than those that exist at the national level. Moreover, municipalities are closest to the people they serve, and can apply both their local knowledge and their ability to engage residents to design effective programmes and policies that directly address local needs. Devolving authority to local governments can create local ownership of low-carbon initiatives, both within the government and in the community. National governments can help cities by easing legal restrictions on the introduction of local, low-carbon policies.

Where national governments are already pursuing a decentralization agenda, low-carbon development can be included as an explicit goal of the devolution process.³¹⁵ For instance, some municipalities in the United Kingdom are making “devolution deals” with the national government to pursue more ambitious low-carbon policies.³¹⁶

Granting cities more power to manage low-carbon policies can encourage innovation, local leadership, and more tailored local initiatives.³¹⁷ However, successful devolution of authority depends on a number of contextual factors, including local governance and technical capacity. For this reason, pilot projects may be an appropriate first step to gauge the benefits and challenges of devolving authority for a given low-carbon strategy. This approach was adopted in the Jiha Tinou programme in Morocco, where three municipalities were chosen to test a devolution of authority for renewable energy and energy efficiency initiatives, helping to set explicit targets and foster greater municipal interaction.

Reforming policy arrangements will often go hand-in-hand with rebalancing fiscal authority, which could have national budgetary, administrative and technical implications, as well as significant impacts on local government budgets and capacities. Coordination of responsibilities between national and local governments is critical, to ensure that any devolution of authority leads to more stringent or ambitious local outcomes, and not an exemption from minimum national standards. Simply delegating authority to cities without establishing national policy frameworks and standards can lead to “free-riding” behaviour and lack of comprehensive, effective action.³¹⁸

At the same time, allowing local governments to pursue greater stringency can provide valuable information for national governments when considering strengthening national policy measures. Devolution processes should be attentive to issues of social equity, to ensure that devolution does not lead to an inequitable distribution of resources among cities.

4.5.6 Foster coordination and collaboration across metropolitan areas

Nearly all major urban areas consist of multiple municipalities with separate jurisdictions. In some cases, urban areas extend across larger jurisdictional boundaries, such as states or regions. Efforts to promote many aspects of low-carbon urban development often require coordinated action across an entire urban area in order to be effective. For example, transportation and urban mobility are often best addressed at a regional scale, rather than city-by-city.³¹⁹ The same is true for other forms of public infrastructure and public services (e.g. water supply, waste management, and sanitation).

This implies a need for close coordination among municipal governments – and across different levels of government – related to urban spatial planning, transportation planning, and provision of public services. However, local governments tend to have limited capacity or incentive to coordinate across borders.³²⁰ Metropolitan governance arrangements are therefore essential in most cases for successfully achieving low-carbon development goals.³²¹

Effective metropolitan governance can take many forms, and often will build on existing institutions.³²² However, the effort and transaction costs involved in forming cooperative arrangements among local jurisdictions, often involving multiple agencies and authorities, can be prohibitive. National governments have two broad options for motivating better metropolitan cooperation: imposing it by law or by establishing new governance structures, or creating incentives for municipalities to coordinate and collaborate.

ESTABLISH METROPOLITAN-LEVEL GOVERNANCE STRUCTURES AND/OR REQUIRE COORDINATION

National governments can establish legal frameworks for metropolitan coordination. These can be built from the bottom up, where municipalities working together request a national framework to institutionalize governance, or through a top-down process driven by national government.³²³ France has taken the latter approach in Paris, where national legislation mandates cooperation between the city of Paris and 130 surrounding communes on transboundary issues, such as transportation.³²⁴

PROVIDE INCENTIVES FOR METROPOLITAN-LEVEL GOVERNANCE AND COORDINATION

Alternatively, governments can encourage metropolitan governance by providing contractual and financial incentives for coordination. Such incentives can take the form of financial support for metropolitan governing institutions, or for cooperative planning processes among municipalities. For instance, in the United States, cities have to designate a Metropolitan Planning Organization to receive federal transportation funds.³²⁵

Challenges for establishing metropolitan governance arrangements will vary greatly depending on national circumstances and the specifics of the urban areas requiring coordination. Contractual and financial incentives will require a national financial commitment, although the budgetary impacts may depend on the specific nature of these commitments and individual circumstances. Administrative and technical requirements will depend on the governance arrangements. Even with financial support, inducements to metropolitan coordination may impose significant burdens on local governments. As with other mechanisms for promoting smart growth, close coordination between national and local authorities is essential. National government policies designed to encourage metropolitan coordination will have positive social equity implications; in some cases, there may be concerns about inclusive participation of different urban communities, but coordinating bodies can generally help to alleviate these concerns.

4.5.7 Provide data, information and benchmarking

The successful implementation of many aspects of low-carbon urban development often relies on the availability various kinds of data and information. Data on the performance of low-carbon development measures – as well as the benefits they provide – are useful to both stakeholders and decision-makers and can facilitate appropriate adjustments going forward. In many contexts, however, such data are lacking, especially on a metropolitan-wide basis.³²⁶ National governments can help to efficiently provide a variety of data and information relevant to urban planning and development that would otherwise difficult or costly for local planners to obtain. They can also institute benchmarking programmes that encourage local action based on the data.

ESTABLISH LOW-CARBON DEVELOPMENT DATA PROGRAMMES

National governments can establish programmes to guide the process of gathering and managing data relevant to low-carbon urban initiatives. Data can be collected on a range of environmental and land use indicators, such as GHG emissions, transportation mode share, waste generation, and energy use. Data can also be gathered to track co-benefits of low-carbon policies, such as health outcomes or economic growth. Decisions about the type of data that will be collected should be made collaboratively with the stakeholders who will use the data, particularly local governments. The Cities LEAP programme in the United States, for example, was developed with cities to provide standardized city-level data and analysis for facilitating better urban planning and local energy policies.³²⁷ Data programmes may need to include provision for capacity-building at a local level; the World Bank has suggested just 20% of the 150 largest cities have the analytical capabilities needed for low-carbon planning.³²⁸

IMPLEMENT LOW-CARBON CITY BENCHMARKING PROGRAMMES

National governments can also actively use data to advance low-carbon development goals. Benchmarking programmes can be used both to track progress nationally and to incentivize greater action among cities.³²⁹ For progress tracking, the benchmarks should be designed to be achievable;³³⁰ to incentivize action, benchmarks may be aspirational to drive innovation. Benchmark metrics may include, for example, per capita GHG or energy intensity; various urban density metrics (e.g. floor-area ratios); transit-to-urban resident ratios and final energy demand in buildings and transport. Ideally, benchmarks should rely on established accounting frameworks, developed specifically for the purpose of tracking city progress towards low-carbon goals.

Benchmarks can be combined with national award programmes or other incentives to encourage cities to improve performance. Some illustrative examples include China's "Eco and Low-carbon Indicator Tool for Evaluating Cities" (ELITE Cities) which tracks cities progress against 33 indicators of low-carbon development,³³¹ and the European Union's "Green Capital Award," which recognizes one city each year as the best performer against 12 indicators.³³²

Information and benchmarking programmes can be a relatively low-cost way to help build capacity and enable local government action related to compact development; however, details will vary by program. City-level benchmarking efforts may be particularly data-intensive and complex, requiring greater technical capacity at a national level – and also greater involvement of, and coordination with, local governments to generate required data.³³³ Depending on their design, benchmarking programmes can also impose new obligations on local governments, in order to meet

benchmarking goals. Data and information programmes will have limited impact on social equity, but the collection of data may enable cities to more easily identify inequitable distribution of resources (e.g. gaps in transport access).

4.5.8 Build local administrative and technical capacity for low-carbon development

Local governments require a range of technical skills to manage low-carbon programmes. Many of the measures discussed in Sections 4.1–4.4 require specialized knowledge about issues such as spatial and transport planning, building design, energy efficiency and waste management techniques. However, the requisite skills may often be lacking at the local level, especially in developing nations.³³⁴ National governments can take steps to improve the proficiency and effectiveness of local government efforts by building local capacities in low-carbon development policy design and implementation. National governments can invest in and make available planning tools, and facilitate training and capacity-building for urban planners. Capacity-building efforts should also consider funding for appropriate staffing at the local level; measures to build local financial capacity are discussed in Section 4.5.4.

PROVIDE LOW-CARBON PLANNING TOOLS FOR CITIES

Recognizing that local governments may need technical support to deliver low-carbon policies, national governments may develop planning tools to aid cities' efforts. Examples of such tools include best practice guides, searchable resource lists, funding databases, and analytical instruments.³³⁵ For instance, the U.S. government developed an open-source Standard Energy Efficiency Data Platform (SEED) for local agencies to simplify the process of gathering and analysing building energy data.³³⁶

PROVIDE TRAINING OPPORTUNITIES RELATING TO LOW-CARBON DEVELOPMENT

To ensure that local governments have the skills necessary to deliver policies, national governments can provide training opportunities. For example, in Bangladesh, a national training centre was established to support subnational government staff in developing waste management skills.³³⁷ Governments may provide training and capacity-building themselves, or work with training providers to set up learning opportunities.

FACILITATE PEER LEARNING OPPORTUNITIES

Peer learning networks provide cities with the space to share experiences and best practices.³³⁸ National governments can establish new networks to support cities, and/or provide support to existing networks. A number of networks exist to support cities pursuing low carbon goals, such as ICLEI – Local Governments for Sustainability, United Cities and Local Governments (UCLG), and the C40 Cities Climate Leadership Group.³³⁹

Investment in these capacity-building efforts can pose varying budgetary, administrative and technical challenges depending on their scope, but can yield significant dividends in ensuring the success of national policies. Coordination with local governments is important, as they are the key beneficiaries of capacity-building efforts. Tools and training options should generally be developed in consultation with municipal governments, to ensure that programmes fill critical skill gaps. Capacity-building may advance social equity to the extent that residents of communities with limited resources benefit from newly acquired skills and expertise.

4.5.9 Enhance public education, stakeholder engagement, and government leadership

The success of urban planning, regulation and infrastructure development often depends on having an open, collaborative, participatory process with community stakeholders.³⁴⁰ Many measures discussed in this report require close collaboration with a range of stakeholders, and the mobilization of the public to adopt new behaviours, such as recycling, or transport mode shifts. National governments can encourage such engagement through their policies. For instance, the Brazilian government's guidelines for developing municipal plans under its National Policy on Urban Mobility emphasize citizen engagement, to ensure cities are tailoring mobility options to resident's needs.³⁴¹ National governments can help ensure the success of such efforts by building capacity around effective public and stakeholder engagement, and designing programmes to promote sustainable behaviours. Governments can also lead by example, adopting low-carbon options in their own procurement of goods and services.

BUILD CAPACITY IN PUBLIC AND STAKEHOLDER ENGAGEMENT

National and local governments can secure greater support for low-carbon policies and reduce opposition if they engage relevant stakeholders in planning processes.³⁴² Public engagement can also build local ownership of low-carbon initiatives. A variety of innovative approaches exist for engaging the public in urban planning, such as the use of “participatory budgeting,” where residents help determine priorities for local government budgets;³⁴³ or the use of “citizen scorecards,” where residents develop indicators of urban development, and score performance against these indicators on a regular basis.³⁴⁴ While engagement initiatives are best delivered at a local level, national governments can support local governments by providing funding and capacity-building for public and stakeholder engagement.

BUILD CAPACITY IN PROMOTING SUSTAINABLE BEHAVIOURS

Meeting low-carbon goals requires promoting sustainable behaviour patterns. A common assumption is that public education programmes can be used to drive more sustainable behaviour; however, research shows that information provision is rarely sufficient to shift or maintain behavioural changes.³⁴⁵ Well-designed programmes tend to be created at a local level with community members, and focus on addressing the barriers and opportunities that influence the uptake of sustainable practices.³⁴⁶ Building local capacity to design behaviour change programmes should be included alongside capacity-building for technical elements of a low-carbon strategy.

EXEMPLIFY BEST PRACTICE THROUGH GOVERNMENT PROCUREMENT

Governments can demonstrate their commitment to low-carbon policies by modelling best practices in their own procurement of goods, services and works. This provides a visible symbol to the public about the government’s commitment to reducing emissions, giving credence to public engagement efforts. Government procurement can also catalyse market transformation. Public procurement often accounts for a significant proportion of government spending,³⁴⁷ and shifts by government towards greener procurement practices can push producers to offer low-carbon products and services.³⁴⁸

Capacity-building programmes will generally place moderate burdens on national budgets and administrative capacities. These programmes do not necessarily have high technical requirements, though some specialist expertise in public engagement and behaviour change will be required to design programmes. Investments in capacity-building may be recouped by helping local governments operate more efficiently; for example, research has found that programmes delivered through participatory budgeting with citizens are often more cost-effective and better maintained than those delivered by local governments alone, due to higher levels of local ownership and oversight.³⁴⁹ Intragovernmental coordination is essential, to ensure capacity-building programmes meet local government needs. Capacity-building around public engagement can make strong positive contributions to social equity, by ensuring that low-carbon development planning is undertaken in an inclusive manner.

National government procurement strategies can have varying budgetary and administrative requirements depending on their scope. Some technical capacity will generally be required to define sustainable procurement standards and successfully manage supply chains. National government procurement will have little direct impact on local government capacity or social equity, but may have indirect impacts at the local level by creating new economic opportunities for those who provide low-carbon products. Changes in national procurement standards should not require coordination with other levels of government, however, other jurisdictions may wish to piggyback on national efforts to increase their purchasing power.

4.5.10 Summary of key implementation challenges and opportunities

Table 8 summarizes some of the key factors to consider in assessing the feasibility of national cross-cutting measures.

Table 8
Implementation considerations for cross-cutting measures

	National budget	National admin. capacity	National technical capacity	Local govt. capacities	Social equity	Multi-level coordination
DIRECT INTERVENTIONS						
Institute carbon pricing and fuel price reform						
Remove fossil fuel subsidies	⊕	○	○		⊕	
Establish carbon pricing	⊕	●	●		●	
Mobilize private capital for low-carbon infrastructure investment						
Establish a national sustainable infrastructure investment platform	⊕	●	●	⊕	⊕	○
Facilitate green bond markets and international low-carbon investment	⊕	●	●	⊕	⊕	○
Drive research, development and demonstration (RD&D) of low-carbon technologies						
Support research, development and demonstration (RD&D) of low-carbon technologies	●	●	●	○	○	○
ENABLING POLICIES						
Enhance the financial capacities of local governments						
Expand city fiscal powers	○	○	○	⊕		●
Boost municipal creditworthiness	○	○	○	⊕		●
Alleviate revenue losses associated with reforms	●	○	●	⊕		●
Revise fiscal transfer rules	●	○	○	⊕		●
Build local government capacities on finance and revenue generation	○	○	○	⊕		●
Enhance the legal authority of local governments						
Devolve authority to local government to manage low-carbon initiatives	●	○	○	○	●/⊕	●

	National budget	National admin. capacity	National technical capacity	Local govt. capacities	Social equity	Multi-level coordination
Foster coordination and collaboration across metropolitan areas						
Legally require metropolitan governance and coordination	○	○	○	●	○	●
Provide incentives for metropolitan governance and coordination	●	○	○	●/⊕	○	●
Provide data, information and benchmarking						
Establish low-carbon development data programmes	○	○	●	●/⊕		●
Implement low-carbon city benchmarking programmes	○	○	●	●		●
Build local administrative and technical capacity for low-carbon development						
Provide low-carbon planning tools for cities	○	○	●	⊕		●
Provide training opportunities relating to low-carbon development	○	○	●	⊕		●
Facilitate peer-learning opportunities	○	○	○	⊕		●
Enhance public education, stakeholder engagement, and government leadership						
Build capacity in public and stakeholder engagement	○	○	●	⊕	⊕	●
Build capacity in promoting sustainable behaviours	○	○	●	⊕	⊕	●
Exemplify best practices through government procurement	○	○	●	○		○

● May pose an important implementation challenge

○ Secondary concern, or only poses implementation challenges under certain conditions or policy designs

⊕ May facilitate implementation, due to likely benefits or positive effects

5. Choosing the right measures

Most studies of low-carbon urban development emphasize the advantages of comprehensive policy approaches that simultaneously address urban form, low-carbon transportation, building energy use, and waste management.³⁵⁰ However, each country faces its own particular set of urban policy challenges, and must also address those challenges within its own political and policy context. Countries also have different governance structures, capacities and resources. Thus, governments will need to tailor their national urban policies – and select from the menu of options discussed in Section 4 – with close attention to their country’s physical, institutional and economic circumstances, and set priorities to reflect their urban areas’ greatest needs.

In Section 5.1, we discuss in general terms how to select the most relevant policy approaches and measures. In Section 5.2, we provide an assessment of low-carbon urban development opportunities and challenges in different types of countries, based on their income level and the speed at which they are urbanizing. In particular, we highlight useful approaches for countries facing rapid urbanization with limited resources and governance capacities. In Section 5.3, we provide illustrative examples from Germany, Mexico, South Africa, China and Kenya.

5.1 KEY CONSIDERATIONS

Building an effective national urban policy requires political commitment, strong coordination among government agencies and with external groups (including the private sector and civil society), and the establishment of legal foundations, institutional capabilities, administrative procedures, and appropriate financial instruments.³⁵¹ However, the precise combination of policy approaches and measures that a country adopts – or can adopt – will depend on a range of physical, demographic, economic and political considerations, as well as the country’s existing policy context, including:

- Domestic opportunities for urban economic growth, energy savings and GHG reductions;
- Political and policy priorities beyond GHG reduction and urban development;
- Governance structures, institutional arrangements and legal authorities;
- National and local governmental capacities and resources.

5.1.1 Where are the biggest opportunities?

Although there are common features to effective low-carbon urban development strategies, each country will need to emphasize a different set of elements, based on where it sees the greatest potential for urban energy savings, GHG emission reductions, and economic growth. All else being equal, key factors to consider include:

Urbanization rates: The rate at which countries are urbanizing is a key factor shaping opportunities for low-carbon development. As noted earlier, globally, much of the potential for avoiding future urban-area GHG emissions comes from improving the energy performance of *new* urban development, including buildings and urban transportation systems.³⁵² Promoting compact urban forms will be essential. Countries with high urbanization rates may seek to emphasize policy approaches that influence new development, such as strong spatial planning requirements and incentives for compact development (Section 4.1), along with multi-modal mobility planning, incentives and infrastructure investment (Sections 4.2.1 and 4.2.2). Policies to optimize energy use in new buildings could also be a high priority, including building energy codes, labelling programmes and incentives, as well as policies to encourage energy-efficient appliances and deployment of local energy systems (Sections 4.3.1, 4.3.3, and 4.3.4).

Countries with lower urbanization rates and more mature cities, by contrast, could emphasize policies aimed at promoting more infill development in urban areas (e.g. emphasizing appropriate tax incentives – Section 4.1.2). They can also work to improve the efficiency of existing transportation systems (e.g. through improved multi-modal transportation planning, but also through policies and incentives aimed at improving vehicle efficiencies – Sections 4.2.3 and 4.2.4).

Types and distribution of urban areas: One important variable to consider is the make-up of a country's cities. Countries whose urban populations are concentrated in a handful of large cities, for example, may seek to focus much of their effort on those specific cities (see Section 3.1). National governments in these countries may emphasize more direct spending on urban infrastructure, for example (Sections 4.2.1, 4.2.3, 4.2.4, 4.3.4, 4.4.1, and 4.4.4), or adopt enabling policies more easily targeted at individual municipalities (e.g. Sections 4.5.4, 4.5.5, and 4.5.6). Countries with large urban areas consisting of multiple municipal jurisdictions may need to encourage metropolitan governance (Section 4.5.6), and emphasize policies that influence urban development across all jurisdictions.

Countries with many small- and medium-size cities may need to adopt broader national fiscal, regulatory and enabling policies affecting all urban areas.³⁵³ Since smaller cities generally have less capacity to undertake low-carbon development policies (see Section 5.1.4), capacity-building measures may be particularly important (e.g. Sections 4.5.4, 4.5.7, 4.5.8, and 4.5.9).

Existing urban form and infrastructure: Urban form and infrastructure can influence where and how energy is consumed in urban areas, which urban activities give rise to the most GHG emissions, and what development alternatives are viable.³⁵⁴ Countries with relatively compact cities, for example, may wish to focus more on improving vehicle and building energy performance. Countries with more sprawl may need to combine measures for vehicle efficiency with those that promote greater density in existing urban areas (e.g. through tax reform and other policies to encourage transit-oriented redevelopment), and encourage distributed energy solutions such as rooftop solar (Section 4.3.4). The relative efficiency of a country's vehicles and extent of public transit systems can likewise determine whether to emphasize “avoid”, “shift” or “improve” strategies in transportation (Section 4.2). The presence or absence of urban energy infrastructure can affect the feasibility of different local energy solutions (Section 4.3.4).

Natural environment: A country's geography and climate can be major drivers of urban energy use – most notably demand for heating and cooling in buildings. Countries with significant heating or cooling needs may benefit from a greater emphasis on building energy efficiency measures;³⁵⁵ countries with high solar potential may benefit from rooftop and community solar investments. Similarly, urban topography can determine what kinds of alternative transportation modes are viable (e.g. walking or cycling vs. rail, bus and other modes). Topography can vary significantly from city to city, but prevailing conditions in a country's major urban areas can help inform both the focus of national multi-modal urban transportation planning, and the choice of measures (Section 4.2).

Available energy resources: The availability and cost of energy resources within a country (fossil fuels and biofuels; production and refining capacity; electrical generation capacity; wind, water and sunlight availability, etc.) will affect the relative cost-effectiveness of different low-carbon urban development strategies. Higher electricity costs may favour greater investment in building energy efficiency and localized energy production. Higher relative costs for transportation fuels may yield greater dividends for low-carbon urban transportation policies and investments. From a GHG perspective, countries with abundant renewable energy resources may be able to focus more on decarbonizing their energy supply (e.g. using renewable electricity and biofuels) and less on urban energy efficiency measures – although low-carbon urban development strategies could still make decarbonization more cost-effective. Abundant clean energy can also increase the attractiveness of promoting EV adoption.

5.1.2 Domestic political and policy priorities

A country's broader policy context will be a key determinant of the approaches that make sense for a low-carbon national urban policy. Options for (politically feasible) policies may look very different, for example, depending on whether a country already has – or is contemplating – carbon pricing policies (e.g. as part of an overall climate policy strategy). At a sector level, the feasibility of different policy approaches may depend on what policies and institutions are already in place. The presence of utility energy efficiency programmes, for instance, can make it easier to further expand efficiency incentives, or to adopt reforms that support local, distributed energy solutions (Section 4.3.4). Similarly, existing national urban planning goals can make it easier to adopt new kinds of incentives related to housing development and transportation options. The generic ratings in Section 4 for national budget impacts, administrative burdens, and technical requirements should thus be carefully considered and interpreted with respect to existing domestic policies, institutional structures and capacities.

Broader political constraints may also shape the design of any national policy framework (see Section 3.4). Political factors, for example, may constrain the ability or willingness of national governments to devolve fiscal and legal authorities, or to promote metropolitan coordination strategies.³⁵⁶ A general strategy for overcoming political obstacles may be to pursue policy approaches that help build supportive constituencies for (or reduce opposition to) low-carbon urban development goals. In particular, national policy-makers can choose to adopt measures that are likely to have positive social equity outcomes, and pay particular attention to ameliorating equity impacts where they are a significant concern. For example, pursuing new waste management infrastructure (Section 4.4.1) can generate positive general effects on public health and urban social welfare, and the proper design and siting of such infrastructure can help avoid negative effects that would engender local political opposition.

One particular area where low-carbon national urban policies can be important is in helping to advance climate goals. Nearly all countries have now pledged their “nationally determined contributions” (NDCs) under the Paris Agreement. However, many are still elaborating policy approaches for meeting their NDC goals. National urban policies can help countries meet or exceed NDCs, particularly for the energy and transportation sectors. Policies to promote efficient building energy use and delivery can help lower the cost of decarbonizing electricity, for example – or help maintain an already low-carbon resource mix.³⁵⁷

5.1.3 Governance structures, institutional arrangements and legal authorities

As noted in Section 1.2, coordination at all levels of government is highly desirable for achieving low-carbon development outcomes. This includes coordination both among different national agencies and between national and subnational governments – and in some cases non-governmental actors. Different countries may have governing structures that make certain policy approaches more or less difficult to adopt and implement. Coordination challenges and opportunities can affect the feasibility of different national measures.

One basic consideration is how hard or easy it might be to implement a particular measure. As noted in Section 3.3, an average national government may have six or seven agencies in charge of various aspects of urban development. Promoting compact form through public service, housing and infrastructure provision (Section 4.1.2), for example, may be difficult to coordinate if different ministries are in charge of different public service and infrastructure programmes. Although an effective national urban policy may ultimately require improving coordination among these ministries, it may be easier to start with measures that require less coordination, or for which existing institutional arrangements are already conducive.

A country's multi-level governance structure is also important to consider. Where national governments have a strong, direct influence on municipalities, for example, regulatory measures can be relatively efficient.³⁵⁸ Under federal systems with greater subnational authority, national governments may need to employ a wider variety of measures, and put greater emphasis on fiscal measures and informational tools (see Table 3), depending on the specific policy goal. One strategy is to focus first on policies that require less direct cooperation between national and local authorities, and in parallel work to establish new institutional structures for fostering greater multi-level coordination. In most African countries, for example, authority for energy, infrastructure, transport and environmental protection is vested in national agencies.³⁵⁹ In these countries, the question is how to proceed with (largely) nationally led low-carbon urban development in the near term, while building more effective multi-level governance structures for urban development over the longer term.³⁶⁰

5.1.4 Governmental capacities and resources

A final, but often determinative, consideration in the selection of measures is the capacity – financial, administrative and technical – of national and local authorities to implement them. Higher-income countries are likeliest to be able to pursue an “all of the above” approach; indeed, much of the literature on low-carbon urban development is based on the experiences of those countries. They are most able to afford, for example, significant investments in RD&D, infrastructure, capacity-building and technical know-how. National governments facing budgetary, administrative or technical capacity constraints may wish to focus on measures for which these constraints do not pose significant implementation challenges.

Local government capacity is also an important consideration. Even in wealthier countries, small and medium-sized cities may not have the same financial resources and capacities as larger cities to undertake low-carbon development measures. National governments may therefore want to avoid measures that place immediate burdens on these municipalities, and start by pursuing a range of enabling policies to help improve their capacities over time.

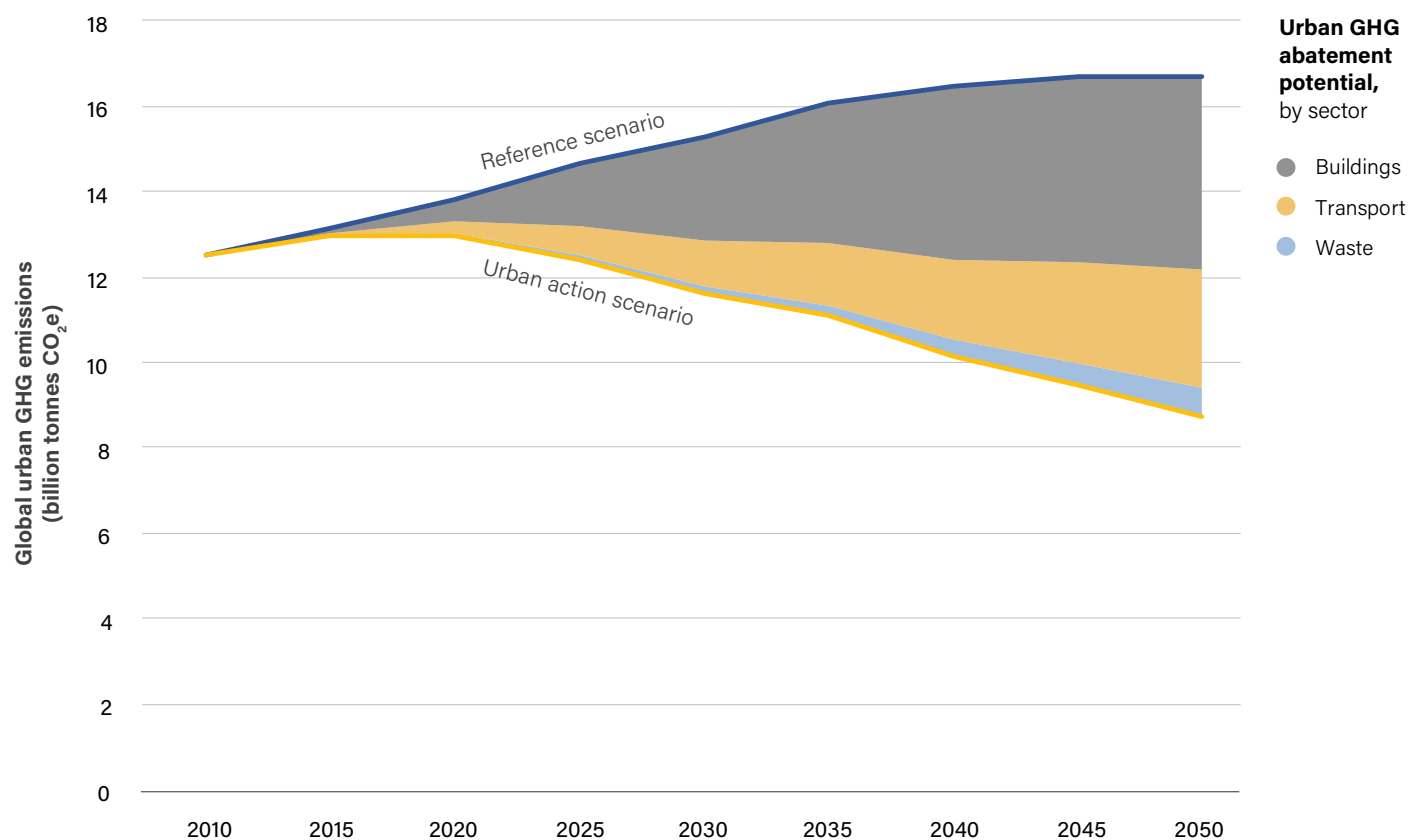
Capacity and governance challenges often go hand-in-hand. For example, although there has been a policy emphasis on improved urban planning and stronger governance in many African cities (based on experience in developed-world economies), governance structures in many African countries make these reforms difficult or inappropriate.³⁶¹ In particular, few African cities are governed by a single jurisdictional authority with responsibility for urban planning, infrastructure development and public services within clearly defined boundaries. Cartwright et al. (2017) argue that weaker capacities and fractionated urban governance in many African countries point to a need for a stronger national role in urban development. At the same time, weaker local governance structures may limit the kinds of national measures that are feasible or effective. For instance, those relying on secure tenure and strong local technical capacity may face significant implementation challenges.³⁶²

5.2 A GLOBAL ASSESSMENT OF PRIORITIES AND STRATEGIES FOR NATIONAL URBAN POLICIES

As noted throughout this report, most studies of low-carbon urban development suggest that benefits are maximized when different elements – related to urban form, transportation, building energy and waste management – are pursued comprehensively and concurrently. Still, it is important to ask which of those elements offer the greatest relative potential for benefits, including economic benefits, reduced pollution, energy savings and GHG reductions. Different national development priorities can lead to different choices about what to emphasize. Improving urban waste management and sanitation, for example, may produce relatively few GHG reductions, but can yield significant health and economic benefits.

As a general guide to the areas of greatest potential, a look at GHG emissions can be instructive. In a 2014 study, Erickson and Tempest estimated the global potential for urban GHG abatement, based on an assessment of emission sources that city governments could (in principle) influence through policy actions.³⁶³ Here we present the results of that analysis broken down by the three primary sectors associated with low-carbon urban development: buildings, transportation (influenced both by urban form and transportation policies), and waste (Figure 3). The analysis shows the greatest potential for GHG reductions globally is in the buildings sector (around 60% of total abatement potential), followed by transportation (at around 30%), and waste (less than 10%). Note that these estimates are based on outcomes (e.g. achievement of “passive house” energy consumption in new buildings, increased public transit, more compact forms, expanded recycling, etc.), not on modelling the effects of specific policy approaches or tools described in Section 4. However, they give a sense of where policies could be usefully targeted to achieve GHG reductions and energy savings, and indicate at a broad level where the relative opportunities are for steering urban development towards low-carbon outcomes.

Figure 3
Global urban GHG abatement potential, by sector



Source: Authors' analysis and representation of data from Erickson and Tempest (2014)

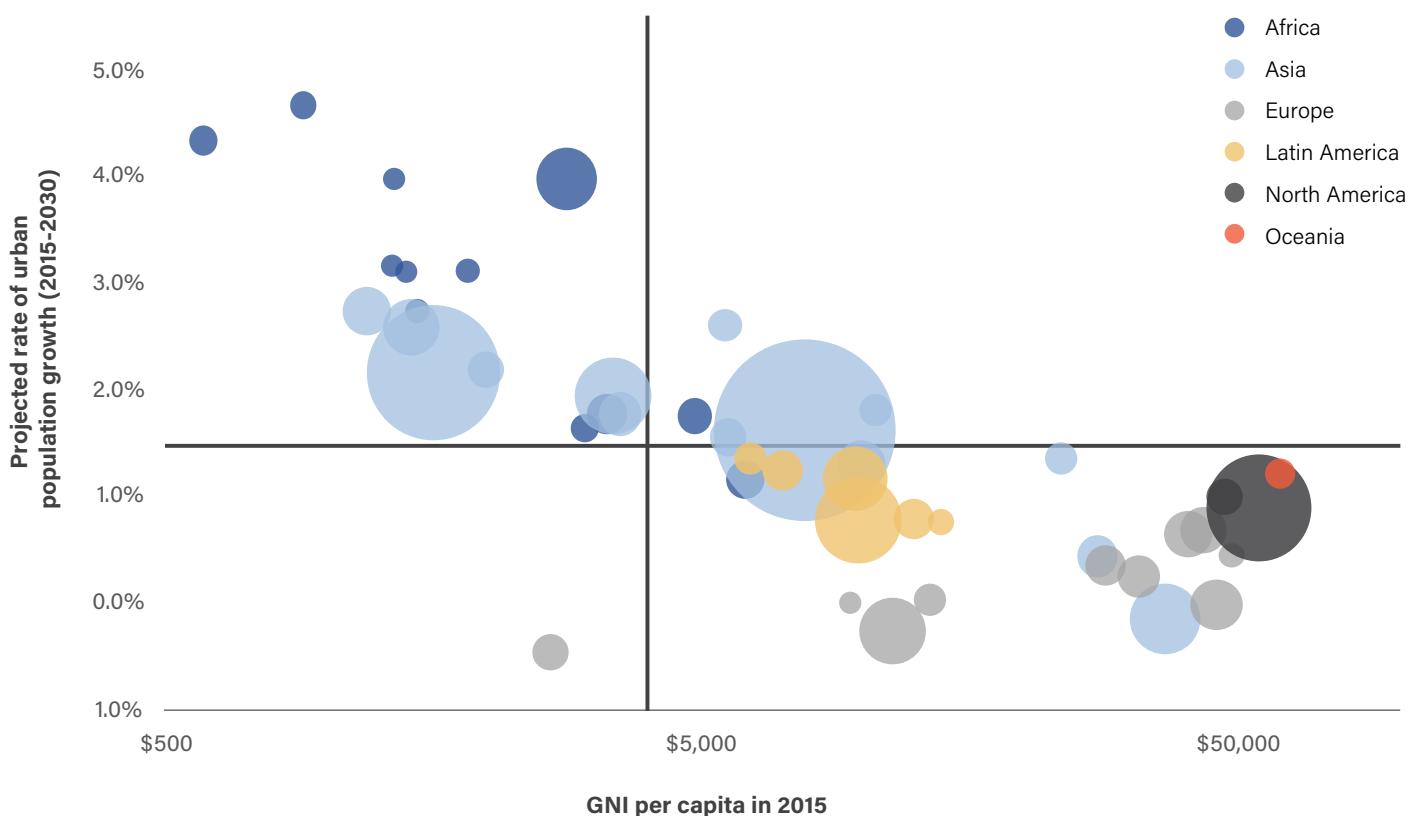
These are technical potential estimates, and as such do not indicate which types of actions or investments would be most cost-effective or would achieve the greatest social and economic net benefits. In many cases, low-carbon development options that look costly from a GHG reduction perspective – e.g. mass transit systems – may generate substantial returns in terms of public health, pollution reduction and productivity gains.³⁶⁴ Further country-specific assessments are needed to determine how to prioritize and design nationally appropriate policies.

With these caveats in mind, we examined whether we could identify general strategies for countries with similar resources, and facing similar urban development challenges. As a first step, we grouped countries into four categories: upper and lower per capita income, and high and low urban population growth rates (Figure 4). Specifically, based on groupings used by the World Bank, we categorized “upper-middle” and “high-income” countries as “higher” income, and “low-” and “lower-middle” income countries as “lower” income.³⁶⁵ We similarly categorized countries with projected annual urban population growth rates higher than 1.5% as having “high” urban population growth, and those with projected rates below 1.5% as having “low” urban population growth, using data from the United Nations.³⁶⁶

As Figure 4 indicates, countries with higher incomes tend to have lower urban population growth rates, while countries with lower national incomes tend to have higher urban population growth. Most OECD countries, as well as other nations with relatively advanced economies, mature cities, and well-functioning land markets, fall into the category of high income and low urban population growth. All these countries tend to already be highly urbanized. Countries with low incomes and high urban population growth are mainly in South and Southeast Asia (including India, Pakistan, Indonesia, Bangladesh, the Philippines, and Vietnam) and in Africa. In many of these countries, high rates of urbanization are leading to the rapid growth of informal settlements around major cities.

Figure 4

Distribution of countries by rate of urbanization and gross national income per capita

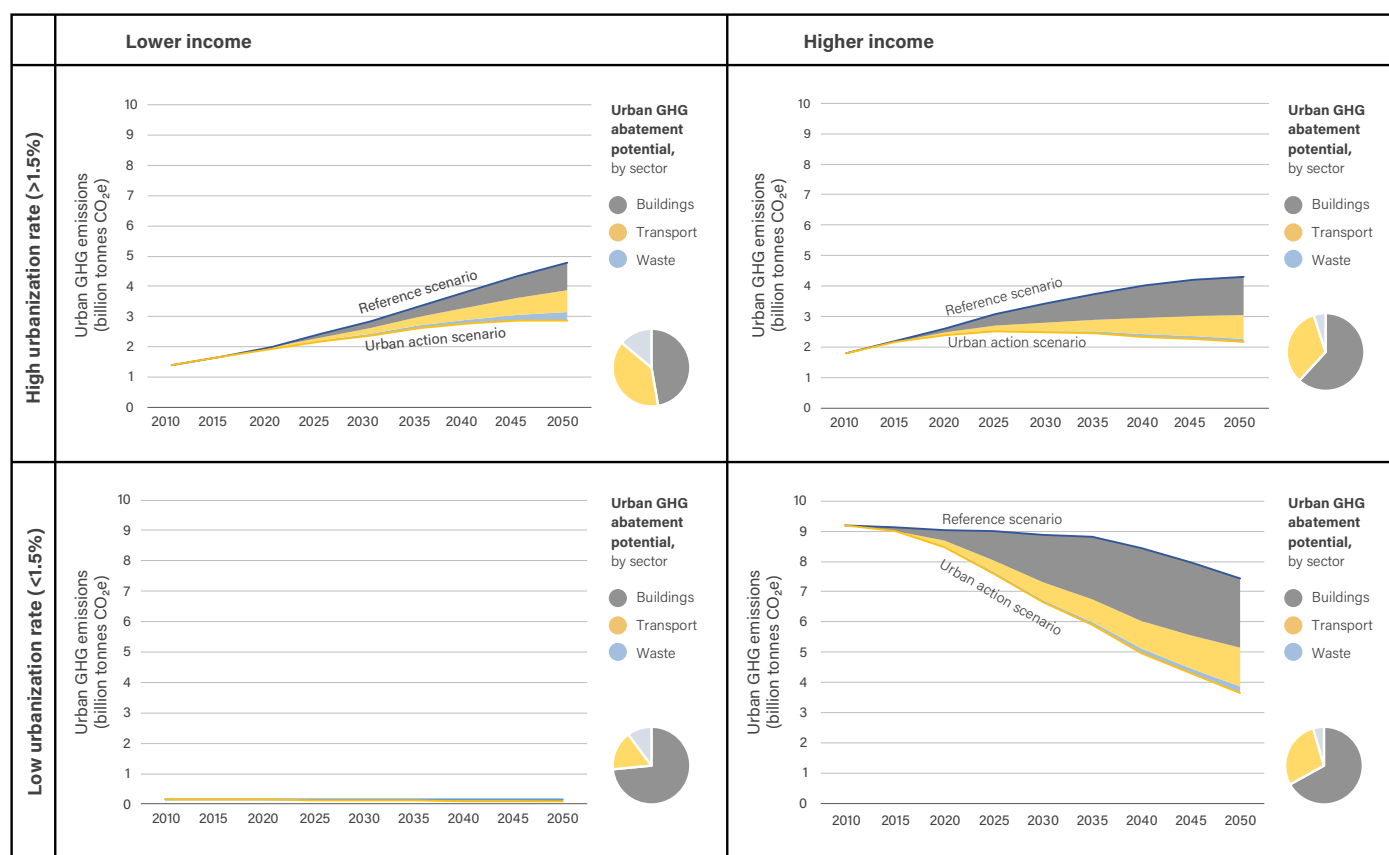


Source: Derived from UN-DESA (2014) and the World Bank’s World Development Indicators.³⁶⁷ Size of circles denotes relative urban population size. Only the top 50 countries in terms of urban population are displayed. The bold vertical and horizontal lines indicate the thresholds for classifying countries as higher or lower income, and higher or lower urban population growth rate, respectively.

Next, we used the model from Erickson and Tempest (2014) to estimate urban GHG abatement potential for each of the four country groupings (Figure 5).³⁶⁸ Two inferences stand out. First, differences in the distribution of abatement potential among different urban sectors are more a function of income than of urbanization rates. The relative proportions of potential GHG reductions in buildings, transportation and waste are roughly the same in higher-income countries, regardless of urbanization rate (see pie chart inserts in Figure 5). Thus, while a major focus for China (whose urban population dominates the upper-right quadrant in Figure 4) may be managing rapid urban *growth*, using measures tailored to this purpose, the distribution of opportunities for reducing emissions looks very similar to those in countries in the lower-right quadrant, whose focus may be (relatively) more on *existing* urban buildings and infrastructure. In lower-income countries, there is relatively greater potential for GHG reductions in the urban waste sector than in buildings and transport. This may largely be a reflection of the smaller existing base of urban buildings and infrastructure, and suggests a comparatively greater need for addressing urban waste management.³⁶⁹

Second, the distribution of GHG abatement opportunities in lower-income, high-urban-growth-rate countries differs noticeably from that in other groups. In this group, a significantly greater proportion of potential GHG reductions is in transportation. This may reflect the potential for sprawl-driven increases in transportation emissions, without government intervention to promote more compact urban form, combined with a comparatively lower base of urban buildings.

Figure 5
GHG mitigation potential in different country groups



Source: Authors own analysis, based on Erickson and Tempest (2014). Pie chart insets show relative proportions of GHG abatement potential over the entire period of analysis, 2010–2050. Note that only six countries fall in the lower-income, low-urban-growth-rate quadrant: Armenia, El Salvador, Ukraine, Guyana, Moldova and Sri Lanka.

These findings – along with the general considerations discussed in Section 5.1 – offer some insights into how countries in different circumstances might approach low-carbon national urban policies. While individual countries' circumstances will vary, as a group, higher-income countries will find a majority (over 60%) of potential energy savings and GHG reductions in the buildings sector. This suggests, all else being equal, a strong focus on building efficiency and local energy systems in these countries' national urban policies.

As noted in Section 5.1.4, higher-income countries are likelier to have sufficient capacities and resources to pursue a broad range of policy approaches and tools related to low-carbon urban development. For these countries, the choice of specific measures may thus depend more on the political and institutional context than on capacity constraints.

For lower-income countries, urban development challenges are both quantitatively and qualitatively different. The challenges are particularly acute for lower-income countries with high urban growth rates. Cities in these countries often face limited public services, poor infrastructure, and rapid growth in informal settlements, and governments in these countries must manage those challenges with limited resources and comparatively weak urban governance capacities.³⁷⁰ These kinds of circumstances differ strongly from those in higher-income countries with the strongest track record of pursuing low-carbon urban development options to date. Across the global South, it is also particularly important that low-carbon measures make a substantial contribution towards other development priorities, such as access to basic services, livelihoods, mobility and durable housing.

For example, as noted above, there is relatively large potential in these countries for urban energy savings and GHG reductions in the transportation sector. Possibly the quickest approach to achieving transportation energy savings is through vehicle efficiency measures (Sections 4.2.3 and 4.2.4), along with carbon pricing and fuel price reforms (Section 4.5.1). However, by themselves these policies could have negative social equity outcomes, by imposing higher mobility costs on lower-income households, and so they might conflict with broader development goals. Policies to promote compact, mixed-use, accessible urban forms (Sections 4.1.1 and 4.1.2) and investments in public transit and other alternative transportation modes (Sections 4.2.1 and 4.2.2) may thus be preferable, even if they are costlier and more logistically challenging, and take longer to implement.

National governments in these countries may also find it valuable to combine direct policy interventions with efforts to build capacities at multiple levels of government. An effective strategy might start by establishing policies that national authorities can immediately implement to influence urban growth – focusing on those with lesser budgetary, administrative and technical requirements – along with measures (where appropriate and applicable) to devolve authority and enable local governments. Near-term options might include:

- Establishing national policy frameworks for spatial planning and urban mobility (Sections 4.1.1 and 4.2.1). Such frameworks could consist of guidelines and principles for urban planning, and establish a long-term vision for urban development that municipalities can tailor to local circumstances.
- Providing strategic investments in public services and infrastructure. As discussed in Section 4.1.1, this can be an effective way for national governments to encourage compact, mixed-use, transit-oriented development, especially in urban areas that face governance challenges or barriers to effective regulation.
- Mobilizing private capital for low-carbon infrastructure investment (Section 4.5.2), domestic or international. This can be an effective way to compensate for limited public-sector budgets. However, solutions would need to be commensurate with national technical and administrative capacities (e.g. related to establishing green investment platforms and designing infrastructure projects to meet green investment criteria).

- Implementing direct regulatory measures at the national level that do not require extensive coordination with subnational governments. These could include carbon pricing, fuel price reforms, national property and vehicle tax reforms, appliance efficiency standards or incentives, utility reforms, etc.
- Implementing selected information provision, capacity-building, and public engagement measures, including strategic national-level public procurement policies (e.g. Sections 4.2.3, 4.3.1, 4.3.3, 4.5.7, 4.5.8, and 4.5.9).

At the same time, the national government could focus on strengthening urban governance capacity. This would enable policy-makers to focus on long term goals such as:

- Empowering local governments with legal authority (Section 4.5.5);
- Enhancing the financial capacities of local governments (Section 4.5.4);
- Fostering metropolitan coordination (Section 4.5.6);
- Implementing a range of other policies that require greater multi-level coordination (various measures throughout Section 4).

Among the case studies in the next section, Kenya perhaps best exemplifies a country in these circumstances. The Kenyan government is indeed pursuing many of these same approaches, including steps to reform urban governance and enable more effective local action.

Table 9 summarizes some of the general guidance provided here on strategies for different country contexts.

Table 9
Priorities and low-carbon national urban policy strategies for different country contexts

Country grouping	Low-carbon development opportunities and challenges	General strategies
Higher income, low urban population growth	<ul style="list-style-type: none"> Well-developed private sectors, relatively wealthy citizens and large public budgets Majority of energy saving and GHG reduction opportunity in the buildings sector Need to address urban air pollution and traffic congestion Need to avoid energy and carbon “lock in” in established infrastructure 	<ul style="list-style-type: none"> <i>Pursue an “all of the above” strategy, tailored to domestic policy and political priorities.</i> Higher income countries have the capacity to deploy sophisticated policy instruments in tandem – including regulatory tools and fiscal incentives – to promote low-carbon infrastructure and retrofit existing urban forms and buildings. <i>Enhance policy coherence.</i> Generally strong governance means that higher income countries can focus on streamlining or enhancing institutional arrangements, and building multi-level governance capacities where needed.
Higher income, high urban population growth	<ul style="list-style-type: none"> Well-developed private sectors, relatively wealthy citizens and large public budgets Higher opportunity for energy savings in new buildings Need to address urban air pollution and traffic congestion High demand for new housing; possible housing shortages High risk for – and opportunity to avoid – urban sprawl 	<ul style="list-style-type: none"> <i>“All of the above” approach, focused on managing new housing and transportation demand.</i> Greater fiscal and regulatory capacities mean that these countries can pursue a range of policy instruments to avoid urban sprawl and prevent the “lock-in” of high energy use in new buildings. <i>Enhance policy coherence.</i> As with low urban population growth countries, these countries can focus on aligning policies with existing institutional arrangements, and building multi-level governance capacities.
Lower income, high urban population growth	<ul style="list-style-type: none"> Comparatively weak urban governance capacities Less fiscal maturity, shallow domestic capital markets Rapid growth in poor urban neighbourhoods and in peri-urban areas; housing shortages and informal settlements Majority of potential energy savings and GHG reductions in the transportation and waste sectors 	<ul style="list-style-type: none"> <i>Adopt direct regulatory and fiscal measures requiring less budgetary and technical capacity, and less multi-level coordination.</i> Such policies could include national property and vehicle tax reforms; appliance efficiency standards or incentives; and some kinds of utility reforms. <i>Bolster fiscal capacities,</i> e.g. through carbon pricing and fuel price reforms (removal of subsidies). <i>Provide strategic public service and infrastructure investment.</i> Strategic deployment of public services, transportation infrastructure, and transit systems can help anchor development and shape settlement patterns, and ensure greater accessibility. <i>Strengthen urban governance and institutional capacity.</i> This can be achieved through a variety of measures, including better information provision, policies to promote local government technical and financial capacities, and promoting metropolitan coordination (see Section 4.5).
Lower income, low urban population growth	<ul style="list-style-type: none"> Comparatively weak urban governance capacities Less fiscal maturity, shallow domestic capital markets Relatively greater opportunities in the buildings and waste sectors 	<ul style="list-style-type: none"> Same strategies as for lower income, high urban population growth countries, with emphasis on improving fiscal and governance capacities.

5.3 NATIONAL CASE STUDIES

In this section we discuss low-carbon urban development in the context of five countries: Germany, Mexico, South Africa, China, and Kenya. These countries stand out because each has some form of both national urban policy and climate policy, and has sought to incorporate low-carbon principles in urban policy measures. They represent a mix of per capita income levels and urban growth rates. Germany is most solidly in the “higher income, low urban growth” category. Mexico, South Africa and China are all near the middle for both income and urban population growth. Kenya represents a country with both relatively low income and high urban population growth.

Table 10

Urban population, gross national income per capita, and urban population growth for case study countries

Case study country	2015 urban population	2015 GNI per capita	Urban pop. growth rate (2015-2030)
Germany	62 million	45,790	0.0%
Mexico	99 million	9,710	1.2%
South Africa	35 million	6,050	1.2%
China	779 million	7,820	1.7%
Kenya	12 million	1,340	4.0%

Sources: UN-DESA (2014) and World Development Indicators; population growth rate calculated using UN-DESA projections. GNI per capita in current \$US, Atlas method.³⁷¹

Through these case studies, we aim to illustrate how urban development priorities can differ based on low-carbon opportunities, policy context, governance structures and governmental capabilities and resources – and also point the way towards what a truly comprehensive, low-carbon national urban policy might look like.

5.3.1 Germany: Integrating national urban and climate policy

Germany is a highly urbanized country, with about three-quarters of its population in urban areas.³⁷² The urban landscape is heterogeneous – in 2014, there were 22 cities with more than 300,000 residents each, including four with over 1 million residents (Berlin, Hamburg, Cologne and Munich).³⁷³ The current urban growth rate is relatively low, at 0.2% per year (and is expected to decline).³⁷⁴ However, growth is not distributed evenly: some cities, particularly in the East, are losing population, while others continue to expand.³⁷⁵

GOVERNANCE AND NATIONAL POLICY CONTEXT

Urban development is governed at multiple levels in Germany, with decisions made in the European Union (EU), the federal government (Bund), 16 regional governments (Länder), district authorities (Kreis), and local authorities (Gemeinden).³⁷⁶ While this multi-level governance may seem relatively complex, the constitution delineates responsibilities for each level of government, and cooperation between different administration levels tends to be strong.³⁷⁷ In general, German cities enjoy relatively high levels of autonomy, as the constitution enshrines the principle of local self-administration, and confers the right to charge local taxes.³⁷⁸

Germany has a National Urban Development Policy (*Nationale Stadtentwicklungspolitik*), which was developed in 2007 following the adoption of the Leipzig Charter on Sustainable European Cities.³⁷⁹ This policy was jointly prepared by representatives from federal, regional and local governments, and is managed by the Federal Ministry of Transport, Building and Urban Development (BMVBS). The key focus of this policy was to establish a national framework for better governance of urban issues. Significant outputs included the creation of dedicated funding streams for innovative urban projects, the development of an online portal for sharing best practices, and the establishment of a board with a diverse group of representatives to advise ministers on the implementation of national urban development policy.³⁸⁰

A FOCUS ON URBAN ENERGY EFFICIENCY

The 2007 National Urban Development Policy addressed the need for low-carbon development in urban areas. In the accompanying Papenberg Declaration on National Urban Policy, climate change mitigation was included as one of the priority areas for urban policy:

“Currently, there is great importance placed on sustainable climate protection as part of the Urban Development Strategy. The priority is on developing sustainable urban structures by concentrating on inner urban sites, conversion of uses, energy-efficient buildings, utilization of existing infrastructure resources, avoidance of traffic and environmentally friendly urban transport systems. Health risks associated with climate change need to be counteracted.”³⁸¹

In 2012, an updated memorandum for the national urban policy was released, titled *Urban Energies – Urban Challenges*. It placed climate change at the centre of national urban policy, noting that since 2007, “climate change has become more serious and its impacts more significant, the era of cheap fossil energy is nearing its end.”³⁸²

Neither the 2007 nor the 2012 document is very prescriptive about how low-carbon urban development should be managed, as this is covered in more depth in other related national policies. Germany has a national climate change framework that includes a short-term climate action plan, *Aktionsprogramm Klimaschutz 2020*,³⁸³ and a long term climate strategy, *Klimaschutzplan 2050*.³⁸⁴ These policies are designed to make Germany “largely GHG emissions-neutral” by 2050, with a near-term goal of reducing emissions by 40% by 2020. Targets have been set for emissions reductions in key sectors, particularly energy, buildings, industry and transport.

Germany has already enacted many of the measures outlined in Section 4 to help drive low-carbon urban development. Significant policies include a national building code that emphasizes energy-efficient buildings and brownfield development;³⁸⁵ a programme for refurbishing existing building stocks; targets for renewable energy generation; a national energy tax; and sectoral energy policies that contribute to Germany having the highest levels of energy efficiency in the world.³⁸⁶ Germany has made significant progress in reducing emissions from waste and generating renewable energy. Future efforts are focused on reducing reliance on coal for energy, reducing the need for heating oil, limiting transportation emissions, and improving industrial efficiency.³⁸⁷

FUTURE CHALLENGES: TRANSPORTATION AND EQUITY

Germany’s transport emissions are rising, due to increases in car ownership and increased freight transport.³⁸⁸ The government faces challenges in transitioning a country known for its auto industry towards more efficient forms of transportation.

A second challenge is ensuring that low-carbon development occurs evenly within and between cities. A key focus of Germany’s national urban policy is redeveloping declining urban areas.³⁸⁹ Ensuring that the benefits of low-carbon development are realized by all parts of society, and that measures to reduce emissions (such as the transition away from coal) are managed in a way that reduces social impact, remain key concerns. Relatedly, as growing urban areas face issues of housing affordability,³⁹⁰ coordination is required at the national level to ensure building standards and development plans meet the dual goals of energy efficiency and cost-effectiveness for urban residents.

5.3.2 Mexico: Pursuing a coherent vision for urban development

Mexico has urbanized rapidly over the past half-century. By 2015, almost 80% of the people lived in urban areas, and the urban population is still growing at a rate of 1.6% per year.³⁹¹ Mexico's urban residents are dispersed over a large number of cities – in 2014 there were more than 50 cities with over 300,000 residents, including 14 with more than 1 million residents. Mexico City is by far the largest, with a population of over 20 million.³⁹²

GOVERNANCE AND NATIONAL POLICY CONTEXT

Mexico's cities are governed by municipal governments, which fall under the jurisdiction of 31 federal states (the one exception is Mexico City, which is in the process of becoming the 32nd state, following a federal constitutional reform in 2016). Municipal governments are responsible for public services such as urban planning, water distribution, waste management, roads and transit, and public spaces. Municipal governments collect property taxes, but rates are set by state governments and vary widely. In practice, cities tend to be heavily reliant on federal funding.³⁹³ Two further challenges for cities are the relatively short (three-year) terms for elected officials at a municipal level, which inhibit long-term planning, and the lack of legal requirement for metropolitan coordination.³⁹⁴

Until recently, Mexico lacked a coherent policy on urban development at the national level. The creation of a new ministry for urban policy in 2013 (the Ministry of Agrarian, Territorial and Urban Development – SEDATU) was an important first step in rectifying this gap.³⁹⁵ This was followed shortly after by the introduction of a national urban policy, the National Urban Development Programme (*Programa Nacional de Desarrollo Urbano*) 2014–2018.³⁹⁶

Mexico's policy focuses on six objectives:³⁹⁷

1. Controlling urban sprawl and consolidating existing cities;
2. Creating an urban development model that creates well-being for city dwellers and guarantees social, economic and environmental sustainability;
3. Designing and implementing normative, fiscal, administrative and regulatory instruments for land use management;
4. Promoting a sustainable mobility policy that ensures the quality, availability, connectivity and accessibility of urban trips;
5. Avoiding human settlements in risk zones and reducing the vulnerability of urban populations to natural disasters;
6. Consolidating the National Regional Development Policy based on local economies' capabilities and potential.

URBAN DEVELOPMENT AS A PILLAR OF CLIMATE POLICY

Mexico has a well-developed policy framework for addressing climate change. Mexico enacted a General Law on Climate Change in 2012, the 10-20-40 National Climate Change Strategy in 2013, and a longer-term Climate Change Mid-Century Strategy in 2016. The government also established the National System on Climate Change, which brings together federal, state and municipal representatives, along with private- and social sector actors to coordinate climate action. The national policies set out goals of reducing emissions 22% below business-as-usual by 2030, and 50% below 2000 levels by 2050 relative to business-as-usual.³⁹⁸

Urban development is one of the eight pillars of the National Climate Change Strategy, which calls for a “shift towards models of sustainable cities with mobility systems, integrated waste management, and low-carbon footprint buildings”.³⁹⁹ The strategy also directs state governments to develop climate action programmes linked to local municipal climate planning and action.⁴⁰⁰ In addition, a number of related national policies have been enacted that will help drive low-carbon urban development, including the introduction of a carbon tax, an energy efficiency programme, and renewable energy targets.⁴⁰¹

In line with Mexico's overall climate change strategy, the National Urban Development Programme calls for climate adaptation and mitigation criteria to be incorporated into urban development planning.⁴⁰² It also calls for actions that would contribute to low-carbon development, such as sustainable urban mobility planning, improved waste management, and compact urban form. The policy includes provisions for improving local government capacity, which would aid the implementation of these strategies.

FUTURE CHALLENGES: SPRAWL, URBAN GOVERNANCE, AND POLICY COHERENCE

Mexico's National Urban Development Programme recognizes sprawl as one of the largest challenges faced by city planners. Analysts suggest a key contributor to sprawl was the widespread availability of federal financing for mass-produced homes on peri-urban land.⁴⁰³ This helped improve housing access, but came at the price of depopulating city centres, increased transport costs, environmental impacts, and reduced liveability. National policies are being adjusted to address these issues and increase infill development; however, planners must still deal with the legacy of sprawling development.⁴⁰⁴

A second major challenge for low-carbon urban development is the uneven, sometimes weak capacities of municipal governments.⁴⁰⁵ The national government acknowledges that there has historically been a lack of training, continuity and technical tools to enable quality urban planning at a local level, and is seeking to rectify this gap.⁴⁰⁶ However, the perception that local governments have weak institutional capacities means that national government officials are reluctant to devolve responsibilities to them.⁴⁰⁷

A final challenge is addressing policy fragmentation at the national level. Because Mexico lacked a coherent national urban policy framework and dedicated agency prior to the establishment of SEDATU in 2013, urban policy development was done by multiple agencies at different levels for many years, without adequate coordination. This created policy incoherence on urban issues. Consolidating SEDATU as a key agency for policy coordination on urban development was a critical first step to overcoming fragmentation.⁴⁰⁸ The establishment of coordination mechanisms through the National System on Climate Change will also help improve policy coherence.⁴⁰⁹

5.3.3 South Africa: Enhancing multi-level governance and policy coordination

About 65% of South Africa's residents are in urban areas, and the urban population has been growing at a rate of 1.6% per year.⁴¹⁰ South Africa has six major cities with more than 1 million residents, and another six cities with more than 300,000 residents.⁴¹¹ Larger cities are growing at a faster pace than secondary cities, due to a concentration of employment opportunities in the larger metropolitan areas.⁴¹²

GOVERNANCE AND NATIONAL POLICY CONTEXT

Urban development is managed by three levels of government in South Africa: national, provincial and municipal. Each level is autonomous, but is required by the Constitution to undertake cooperative governance. The eight largest cities are governed by metropolitan municipalities, while smaller cities fall under the jurisdiction of local and district governments. Metropolitan municipalities are responsible for providing all local services (such as urban planning, electricity delivery, water, waste management, roads and public transport), whereas local governments share these responsibilities with district governments.⁴¹³

In 2016, the government released a national urban plan, the Integrated Urban Development Framework. It was developed by the national Ministry of Cooperative Governance and Traditional Affairs (COGTA), with support from several other national ministries, representatives from the South African Local Government Association (SALGA) and the South African Cities Network (SACN), and a panel of urban development experts. The framework sets a central goal of spatial transformation, aiming to "steer urban growth towards a sustainable growth model of compact, connected and coordinated cities and towns".⁴¹⁴ The framework outlines nine policy priorities to achieve this goal:

- Integrated urban planning and management;
- Integrated transport and mobility;
- Integrated sustainable human settlements;
- Integrated urban infrastructure;
- Efficient land governance and management;
- Inclusive economic development;
- Empowered active communities;
- Effective urban governance;
- Sustainable finances.

MANAGING AN EMISSIONS-INTENSIVE ECONOMY

South Africa has a national climate policy, the National Climate Change Response White Paper, and has pledged to peak and then reduce its GHG emissions between 2025 and 2030. South Africa has relatively high carbon emissions, due to a reliance on coal for energy as well as the presence of energy-intensive industries such as mining and manufacturing. Policies to tackle emissions include a renewable energy procurement programme, an energy efficiency strategy, and an emissions tax on passenger vehicles. South Africa has proposed a carbon tax; however, the implementation of this tax has been delayed several times.⁴¹⁵

The National Climate Change Response White Paper discusses the need for municipal climate action, noting that “local government plays a crucial role in building climate resilience through planning human settlements and urban development; the provision of municipal infrastructure and services; water and energy demand management; and local disaster response, amongst others.”⁴¹⁶ Accordingly, the Integrated Urban Development Framework includes several low-carbon measures. The policy recognizes that South African cities have suffered from poor spatial planning, dependency on cars, and reliance on a pollution-heavy energy system. It calls to fix these issues through compact city planning, green infrastructure, and public transit.⁴¹⁷

FUTURE CHALLENGES: ADDRESSING A LEGACY OF SPRAWL AND FIXING URBAN ENERGY GOVERNANCE

The legacy of Apartheid-era planning looms over efforts to reduce urban emissions. As a result of race- and class-based spatial segregation, cities tend to be dispersed, with poorer communities on the periphery of cities, away from services and employment.⁴¹⁸ This leads to “an extremely resource-intensive and inefficient form of settlement,” characterized by sprawl, unequal provision of infrastructure, and high transport emissions.⁴¹⁹ The National Climate Change Response White Paper calls for urban densification, climate-resilient infrastructure, low-cost housing, and provision of affordable low-carbon public transit to help reverse the damage of past planning.⁴²⁰ Ensuring more equitable development remains a central goal for both national and local governments.

South African cities have been proactively pursuing climate change mitigation, for example, through the Local Government Association’s Energy Efficiency and Renewable Energy Strategy.⁴²¹ However, there are still roadblocks to low-carbon urban development that need to be addressed at the national level. One issue is lack of clarity about local government responsibilities for renewable energy and energy efficiency imperatives in national policies. A second challenge relates to the configuration of the electricity system in South Africa. City governments are responsible for local electricity distribution grids, and currently generate significant revenues from utility billing. This provides a disincentive for cities to pursue energy efficiency and distributed energy (such as rooftop solar), as it would undercut municipal revenues.⁴²² The national government has recognized that there is a lack of clarity and coherence around local mitigation responsibilities, and the National Climate Change Response White Paper calls for relevant national ministries to review local government functions, powers, fiscal measures, incentives, and capacity-building with respect to climate change.⁴²³

5.3.4 China: Vertically integrated policies enabling city-level initiatives

Since the 1950s, China has undergone a major transition from a rural to an urbanized country. By 2015, 56% of China's population lived in urban areas, and between 2010 and 2015, urban populations grew at a pace of 3% per year.⁴²⁴ China contains almost 400 cities with over 300,000 residents, including 105 cities with over 1 million residents.⁴²⁵ The Chinese government has been actively pursuing a policy of urbanization, and has set a target of 60% urbanization by 2020.⁴²⁶

GOVERNANCE AND NATIONAL POLICY CONTEXT

The Chinese administrative structure has five levels: national, provincial, prefectures, counties and local governments. Cities fall into different levels of this hierarchy. The largest cities (Beijing, Shanghai, Tianjin and Chongqing) retain a status equivalent to a provincial government. Prefecture-level cities typically have a non-farming population of more than 250,000, and county-level cities have a non-farming population over 80,000 (though many other factors, such as economic development, feature into decision-making about city status). All levels of government are subordinate to the central government. The system works as a nested hierarchy where each level interacts with the level directly above and below it. In general, higher-level cities tend to enjoy more autonomy and resources.⁴²⁷

All development in China is guided by five-year plans, the 13th of which was released in 2016. It sets high-level goals for urbanization and carbon emissions reduction. In terms of urban development, the 13th Five-Year Plan aims to increase the urban population, build more affordable housing, and create more urban jobs. The plan suggests that there will need to be greater coordination of policies, resources and plans between levels of government to achieve these goals.⁴²⁸

NATIONAL GOALS AND LOCAL PILOTS

The 13th Five-Year Plan recognizes that China's rapid urbanization has come at the price of severe environmental degradation, and seeks to rectify this problem. It sets a number of binding targets for environmental improvement, including climate change mitigation. The government aims to reduce the carbon intensity of the economy (CO₂ emitted per unit of GDP) by 18%, and energy intensity (energy consumption per unit of GDP) by 15% over the five-year period to 2020.⁴²⁹ A key measure to achieve this goal is the establishment of a national emissions trading scheme (ETS). This will help China meet its Paris Agreement goal of peaking carbon emissions by 2030, and in the same timeframe reducing the carbon intensity of its economy by 60–65% from 2005 levels. Five Chinese municipalities – Beijing, Chongqing, Shanghai, Shenzhen, and Tianjin – have been piloting ETSs to help inform the development of China's national ETS.

Feeding into the 13th Five-Year Plan is China's national urban policy, the National New Urbanization Plan 2014–2020. The comprehensive document covers rural population resettlement, spatial layout and form, sustainable development, land management, planning and implementation. The urbanization plan is managed by the National Development and Reform Commission (NDRC). Low-carbon development is a central aim of the plan; one of the guiding visions is of an “ecological civilization” characterized by low-carbon development.⁴³⁰

In addition to these national policies, the Chinese government has been pursuing low-carbon urban development through low-carbon city pilots. The NDRC piloted emissions reduction programmes in 36 cities, who together represented 33% of China's GDP and 18% of the population. Participating cities created low-carbon development strategies, established GHG inventories, and implemented a range of low-carbon initiatives including energy efficiency, distributed energy, and public transit systems.⁴³¹ The Chinese government has also been investing heavily in low-carbon infrastructure, such as renewable energy, public transport facilities, and green buildings.⁴³²

FUTURE CHALLENGES: INFRASTRUCTURE FUNDING AND MORE COMPACT AND EQUITABLE URBAN PLANNING

The scale of the transition required in Chinese cities to meet urban development goals poses numerous challenges, including building local capacity and financing low-carbon infrastructure. It is estimated that more than US\$1 trillion of investment is required for low-carbon buildings, green transportation, and clean energy over the term of the 13th

Five-Year Plan. Government financing is expected to cover about 10–15% of this goal, so private capital is necessary to fill the gap. To attract private capital, the government needs to adopt clear standards and monitoring instruments for green initiatives, leverage public funding, and design suitable financing mechanisms.⁴³³

A second major challenge involves moving away from past urban development patterns, which involved pursuing economic development at the price of environmental degradation and social inequality. For instance, municipal governments financed a large share of urban development through land conversion and development (often achieved by manipulating ambiguous property rights in rural collectives), leading to displacement of rural residents, unnecessary sprawl and loss of arable land. The National New Urbanization Plan 2014–2020 recognized this problem, calling for a land management system to improve property rights in rural collectives, and investment in infill development.⁴³⁴ Continued attention to balancing social and environmental issues with growth imperatives will be necessary for China to achieve its dual objectives of economic development and decarbonization.

5.3.5 Kenya: Reforming urban governance to support low-carbon outcomes

Kenya is rapidly urbanizing. At present, only a quarter of residents are in urban areas, but the urban population is currently growing by 4.3% per year.⁴³⁵ Much of the urban population lives in two major cities, Nairobi and Mombassa,⁴³⁶ though there are numerous towns with populations larger than 100,000 residents.⁴³⁷

GOVERNANCE AND NATIONAL POLICY CONTEXT

Historically, urban settlements in Kenya have suffered from fragmented governance and poor planning.⁴³⁸ This has resulted in a large number of informal settlements with limited infrastructure. However, urban issues are receiving more attention at a national scale. Kenya's guiding development strategy, Vision 2030, recognized the urbanization trend, and highlighted the need to plan for "high quality urban livelihoods."⁴³⁹

In line with this vision, Kenya is undergoing profound changes in urban governance. In 2010, a new Constitution was approved that devolved significant responsibility to 47 elected county governments. These counties include wholly urban areas (such as Nairobi City County), counties with a mix of rural and urban areas, and rural regions. The new county governments have responsibility for a range of urban development functions, including planning, roads, public transport, housing, electricity delivery, water, sanitation, and environmental conservation.⁴⁴⁰ Additionally, in 2011, the Urban Areas and Cities Act was adopted, requiring cities to create integrated development plans, to enable more organized urban growth.⁴⁴¹

Kenya has been crafting a National Urban Development Policy since 2008, and a draft was endorsed by the cabinet in 2016.⁴⁴² The main focus of this policy is improving housing, physical infrastructure and municipal services.⁴⁴³ The policy is managed by the Ministry of Lands, Housing and Urban Development.

A COMPREHENSIVE FRAMEWORK

Kenya has set a goal of reducing GHG emissions 30% by 2030 relative to "business-as-usual."⁴⁴⁴ In aid of this goal, Kenya has been actively developing renewable energy sources, which now provide about three quarters of the energy supply. However, energy demand and transportation fuel use are increasing, as GDP and consumption levels rise.⁴⁴⁵

The National Urban Development Policy addresses climate change directly, calling for national and county governments to promote efficient technologies, develop integrated urban transport systems, and educate the public about greenhouse gases. The policy employs many of the measures outlined in Section 4, calling for a more compact urban form, improved waste management, green construction, and transportation planning. It also acknowledges the need for more integrated urban planning, and for capacity-building to meet these goals.⁴⁴⁶

Kenya has a number of guiding climate policies as well that cover low-carbon development. The National Climate Change Response Strategy (NCCRS) launched in 2010, laid the framework for a Climate Change Bill, the draft National Climate Change Policy Framework, and the development of five-year National Climate Change Plans.⁴⁴⁷

The NCCRS focuses on integrating climate mitigation and adaptation into government planning, and creating a conducive environment for green development.

FUTURE CHALLENGES – REALIZING NATIONAL GOALS AT THE LOCAL LEVEL

Kenya has a good policy framework for low-carbon urban development at the national level, and a national commitment to reducing emissions. The key challenge will be to realize these goals at the local level. UN-Habitat notes that implementation of Kenya's National Urban Development Policy will be difficult, due to limitations in the human, technical and financial resources required to achieve objectives.⁴⁴⁸ The Kenyan government has worked to address these concerns, including an implementation matrix in the latest version of the policy.⁴⁴⁹ Ongoing attention to building local capacity will be critical to the success of Kenya's low-carbon urban development goals.

A second limitation relates to financing of low-carbon urban initiatives. Kenya relies on development funding to pursue improvements in infrastructure. The government has estimated that US\$40 billion is needed to meet its climate change goals.⁴⁵⁰ The national government has an important role to play in facilitating financing for local infrastructure (see Section 4.5). The national government can also help cities design low-cost solutions. For instance, UNEP's "Share the Road" programme in Nairobi worked with local commuters and community members to paint signs and road markings to improve pedestrian and bicycle safety.⁴⁵¹

Finally, Kenya has the challenge of balancing low-carbon imperatives and development needs. Goals to improve efficiency and reduce emissions need to consider the circumstances of urban residents in order to succeed. For example, by some estimates, more than 70% of developments in low-income areas are proceeding without permits,⁴⁵² so improvements in policies such as building or planning codes alone are unlikely to be sufficient to drive low-carbon development. Efforts to reduce poverty and improve local governance must go hand-in-hand with climate change mitigation strategies.

6. Conclusion

Countries around the world are confronting a range of economic development challenges at the same time that populations are rapidly urbanizing and climate change poses ever-growing threats. Steering urban development towards a low-carbon approach can help to simultaneously address all these challenges and achieve multiple benefits. As noted throughout this report, low-carbon urban development can lead to lower energy and raw material demands, reduced GHG emissions, better air quality, and enhanced economic productivity. It can also make cities more accessible and attractive and improve the well-being of urban residents.

However, this model of urban development is unlikely to take hold without deliberate policy action. Cities around the world are actually becoming less dense, and if current trends continue, sprawling urban forms are expected to predominate. Governments must therefore adopt and deploy a range of policies to achieve low-carbon outcomes. National governments in particular can both directly influence urban development, and provide a framework within which other levels of government develop and implement urban policies.

As the case studies in Section 5.3 indicate, countries facing a wide range of national circumstances are already pursuing low-carbon urban development. These examples show many of the hallmarks of a successful approach, including:

- *Think broadly about the scope of low-carbon national urban policy.* Germany, for example, has largely integrated its urban and climate policies, and deployed a wide range of measures to promote compact form and urban energy efficiency. National carbon pricing and renewable energy policies help to complement urban development goals. Mexico has likewise taken a comprehensive view of urban and climate policy, making urban development a pillar of its national climate change strategy. National policies promoting better urban mobility planning, improved waste management, and compact urban form are complemented by a national carbon tax, energy efficiency programmes, and renewable energy targets. China, too, is deploying multiple measures, from broad national and provincial carbon pricing programmes, to low-carbon infrastructure investments in specific cities.

- *Combine direct interventions with policies to enable local-governments to take action.* China's 13th Five-Year Plan addresses urban development goals and sets binding targets for environmental improvement, including climate change mitigation. A key measure to achieve overall low-carbon development goals is the establishment of a national emissions trading scheme. At the same time, the Chinese government is supporting low-carbon pilots in a number of cities, and empowering city leaders to design ways to meet energy and climate goals. Kenya has adopted a comprehensive National Urban Development Policy calling for national and county governments to promote compact urban form, improved waste management, green construction, and transportation planning, as well as to educate the public about greenhouse gases. The national government is also pursuing various means to build local capacities, steer more investment to low-carbon infrastructure and public services, and help cities with low-cost urban development solutions. Similarly, both Mexico and South Africa have adopted comprehensive national policy frameworks supporting low-carbon urban development, and are exploring ways to both build local capacities and empower local jurisdictions to help carry out these frameworks.
- *Work to ensure that policies governing urban development are coherent.* In Mexico, the creation of the Ministry of Agrarian, Territorial and Urban Development (SEDATU) in 2013 was a direct effort to address urban policy fragmentation both among national ministries and between federal, state and local governments. South Africa's Integrated Urban Development Framework seeks to coherently address a range of urban development priorities. National ministries are also reviewing local government functions, powers, fiscal measures, incentives and capacity-building to ensure more coherent and effective low-carbon policy implementation. In China, low-carbon development is a central aim of the National New Urbanization Plan 2014–2020, which provides overall direction to subnational urban development policies. In Germany, policy coherence is being pursued through both short- and long-term national climate policies, and a national urban policy framework that incorporates low-carbon development principles as a central aim. Finally, Kenya has undertaken wholesale reforms to urban policy, focusing on housing, infrastructure, and public services along with low-carbon development. A coherent national framework has been combined with governance reforms to better achieve urban development goals, even while building up local capacities is still a priority.
- *Tailor national urban policies to the political context.* Each country in these case studies has pursued policy approaches appropriate to its domestic context, including both long-term development objectives and short-term political cycles. Germany, for instance, has established both long-term climate goals and shorter-term targets around which various low-carbon urban policies are designed. The government has also prioritized building energy efficiency, in order to complement national policies promoting renewable energy generation. National urban policies are mostly high-level and not very prescriptive with respect to low-carbon measures, reflecting the existence of more detailed climate policies and the autonomy given to subnational governments by the federal system of government. In Kenya, meanwhile, national low-carbon urban policies reflect the imperative to balance low-carbon objectives with broader development needs: strategies must also address poverty alleviation and improve local governance.

The case studies also show the challenges of realigning urban development after decades of rapid, sprawling and often poorly managed growth. In Mexico and South Africa, past policies have led to significant urban sprawl. National policies in both countries are seeking to address this by promoting greater infill development and investing in affordable public transit. However, both countries are also grappling with how to implement policies effectively at the local level, given limited capacities and resources, and unclear or conflicting local authority.

China has made low-carbon urban development a centrepiece of its National New Urbanization Plan, and its vertically integrated governance structure helps to ensure a coherent and consistent approach achieving the plan's goals. Nonetheless, China is grappling with the significant challenges of building local capacity and financing low-carbon infrastructure in the face of a rapidly urbanizing population. China's low-carbon city pilots provide an innovative model for building up local experience and technical capacity, which can be replicated in other jurisdictions. China will now need to focus on measures for correcting land conversion incentives and promoting infill development, and policies to attract more private financing for low-carbon infrastructure.

Kenya is also seeking to manage rapid urban population growth, but with comparatively limited national capacities and resources. Kenya's priorities reflect the mix of opportunities in most countries with lower incomes and high urban growth rates, and its approach to pursuing low-carbon national urban policies mirrors the general approach suggested in Section 5.2. Under its National Urban Development Policy, for example, Kenya has established a comprehensive national framework and is undertaking a range of direct interventions to address priorities such as compact urban form, transportation planning, and waste management. At the same time, it has begun substantial urban governance reforms designed to give greater authority and responsibility to local governments. Going forward, the challenge will be to further boost local capacities and adopt more measures to address urban poverty and promote equitable development.

As the challenges still faced by these countries illustrate, there is quite a bit more to learn about how best to develop and implement a low-carbon national urban policy to maximize economic, social and environmental benefits. Further research is needed to clarify issues such as:

- *What measures to prioritize given specific urban conditions:* More knowledge is needed to help governments identify and prioritize the most relevant low-carbon development strategies. Finding the right mix of policies, taking into account multiple development objectives, is a key task at both the local and national levels.
- *How best to design individual measures:* This report has explored a broad array of possible national measures for achieving different aspects of low-carbon urban development. In many cases, however, “the devil is in the details,” and different ways of designing and implementing measures can yield big differences in outcomes. Much of the literature surveyed in Section 4 provides examples of effective, and less effective, policy designs. But building the knowledge base on effective policy design is still essential, especially for lower-income, rapidly urbanizing countries.
- *How to effectively design holistic low-carbon national urban policies:* As noted in Section 3.3, there are many possible interactions between different elements of low-carbon urban development. Although the need for policy coherence is generally recognized, further research is needed to understand how different measures can reinforce, or detract, from one another – even where they are designed and implemented in a coordinated fashion.
- *What institutional arrangements and governance structures are most effective for achieving low-carbon urban development:* An essential condition for policy coherence is having effective coordination of policies at a national level, and between national and subnational governments. At the national level, this may mean broadening the scope and responsibilities of agencies responsible for urban policy, and strengthening coordination between ministries in charge of finance, energy, transportation, environment, and health policies. At the subnational level, metropolitan governance is often essential, necessitating the creation of effective institutions for coordinating local government actions on transportation, housing, waste management, and infrastructure. Further work is needed to better understand the most effective governance models for integrating urban spatial planning, transport, building energy, and waste management policies.⁴⁵³
- *How to promote equitable low-carbon urban development:* As indicated in Section 1.1 and throughout this report, low-carbon urban development has the potential to deliver multiple economic, social and environmental benefits. Much of the literature on low-carbon urban development, however, focuses only tangentially on the distributional implications of different measures. In this report, we have indicated where social equity issues may present a concern for, or help to facilitate, implementation of different measures. Further research could help to illuminate how to design low-carbon development policies to better achieve equitable outcomes.

Many of these questions will need to be explored in detail on a case-by-case basis for individual countries. As indicated in the body of this report, however, experience already gained across a wide range of countries suggests ample justification and a clear path forward for national governments to pursue low-carbon national urban policies.

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ABOUT THE COALITION FOR URBAN TRANSITIONS

The Coalition for Urban Transitions - launched in 2016 at the Climate Leaders' Summit in New York - is a major new international initiative to support decision makers to unlock the power of cities for enhanced national economic, social, and environmental performance, including reducing the risk of climate change. The Coalition will provide an independent, evidence based approach for thinking about 'well managed' urban transitions to ensure that the growth of urban areas, and the accompanying process of economic, social, and environmental transformation, maximises benefits for people and the planet.

The initiative is jointly managed by the **C40 Cities Climate Leadership Group (C40)** and **World Resources Institute (WRI) Ross Center for Sustainable Cities**, with a Steering Group comprising of 20 major institutions spanning five continents including leaders from thinktanks, research institutions, city networks, international organizations, infrastructure providers, and strategic advisory companies. The initiative will be overseen by a Global Urban Leadership Group to champion the work, drawing on members of the Global Commission on the Economy and Climate, as well as other prominent individuals as Ambassadors.

ABOUT SEI

The Stockholm Environment Institute is an international not-for-profit research organization that has been engaged in environment and development issues at local, national, regional and global policy levels for 25 years. Our goal is to bring about change for sustainable development by bridging science and policy. We do this by conducting integrated analysis that supports decision-makers. SEI's work is interdisciplinary in nature, drawing upon engineering, economics, ecology, ethics, operations research, international relations and software design. We work around the world, building capacity for integrated sustainability planning through training and collaboration on projects.

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