WORLD ECONOMIC FORUM

Urban Transformation:
Integrated Energy Solutions

BRIEFING PAPER

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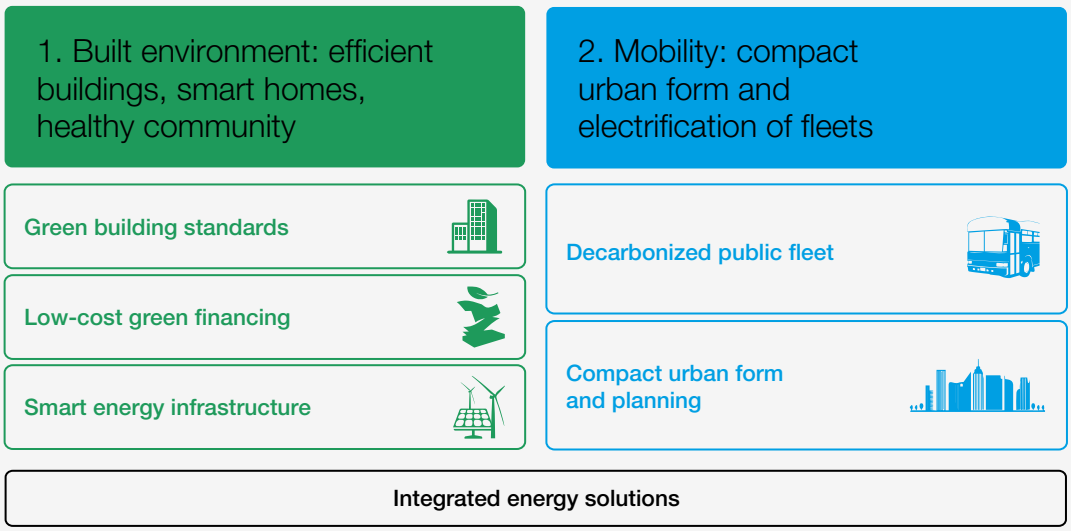
Introduction

The contribution of cities to global CO2 emissions, compounded by the growing urbanization trend, positions urban ecosystems as a critical proving ground to address environmental challenges.

Accelerating urban transformation to meet climate targets is imperative. But where to start? While there is growing momentum around net zero carbon targets for cities, there is no single path to achieving this. The World Economic Forum's Net Zero Carbon Cities (NZCC) programme aims to demonstrate the value of integrated energy solutions to deliver decarbonized, sustainable and resilient urban ecosystems across the world.

This paper shows how the built environment and mobility can serve as the foundations to kickstart urban transformation anywhere in the world, and do not necessarily require government investment.

FIGURE 1 **Foundations for an integrated urban ecosystem**



> **If you are reading this, you know that cities, because they concentrate people and infrastructure, represent the most pivotal opportunity for all of us to contribute to a more climate-resilient future.**
>
> Lauren Sorkin, Executive Director, Resilient Cities Network

The World Economic Forum has curated the Toolbox of Solutions, a digital clearing house of best practices and case studies for integrated energy solutions in urban ecosystems. In addition, the Forum and its partners are scaling a process that creates a community of local stakeholders to help cities identify and implement solutions that are the best fit for them.

1

Foundation 1: The built environment – efficient buildings, smarter homes and healthier communities

Buildings account for roughly 40% of global energy-related carbon emissions.[1]

To meet the demands of a growing population, the world building stock is expected to double in size by 2050.[2] Reducing emissions requires targeted interventions at every stage of a building's life cycle – from planning and construction to operation and refurbishment.

Advances in construction materials and digital technologies such as the internet of things (IoT) and smart appliances have paved the way. This offers economic and environmental benefits, in addition to proven improvements in occupants' health and well-being.[3]

Below: @onurdongel/ Gettyimages

A Adopt green building standards for new and existing buildings

Green building standards are a critical tool to get to net zero carbon cities and healthier communities. Local governments can adopt building standards to codify minimum performance standards, and national governments can lead by example by implementing green standards at scale in public buildings.[4]

When evaluating a building standard, it is important to ensure that it addresses the decarbonizing goal, aligning climate priorities with the requirements of an integrated urban ecosystem. This is because while there are several green building standards, only some of these take into consideration sustainability and affordability – which encompass broad factors including occupants' health, social and financial considerations.

An effective green building standard should address the following guidelines:

- Setting an all-electric target and/or roadmap
- Supporting ultra-efficiency and grid interactivity
- Encouraging the use of reclaimed circular materials or materials with low-embodied carbon
- Encouraging the use of local renewables

Furthermore, the World Green Building Council recommends that effective standards are designed to be:

- Science-based: their results and decisions must be reproducible by others using the same standard
- Transparent: the standards and processes for awarding certification should be transparent and open for examination
- Objective: certification bodies should be free of conflict of interest
- Progressive: standards should advance industry practices and not simply reward business as usual

CASE STUDY 1

Ha Noi

Viettel's corporate headquarters is the first commercial building in Ha Noi, Viet Nam, to meet the US Green Building Association standard, with stringent criteria for emissions, energy and water efficiency, material and resource use, and indoor environmental quality. Viettel HQ partnered with ABB to deploy smart building technology, which incorporates a digitally connected drive system that allows precise control of lighting, heating, security and energy management; this minimizes energy use, saving up to 20% in energy costs.

CASE STUDY 2

New York City

New York City's "Climate Mobilization Act"[5] requires existing buildings taller than 25,000 feet to cut their greenhouse gas emissions by 40% by 2030 and by 80% by 2050. The law added emission caps, with different limits depending on building type and distributional effects: rent-stabilized apartments and public housing projects are exempt from these caps.

CASE STUDY 3

Singapore

The Green Mark Scheme was launched by the Building and Construction Authority in Singapore to promote environmental awareness in construction and real estate. The scheme rates buildings according to five criteria: 1) energy efficiency; 2) water efficiency; 3) environmental protection; 4) indoor environmental quality; and 5) innovation that contributes to better building performance. It also offers cash incentives to developers that encourage improvements to existing construction sites in terms of energy use reduction and materials conservation.

B Promote low-cost green financing

To reduce upfront costs that may pose barriers to investment, governments at the national and local levels can work with business partners to promote green finance products that can increase demand for low-carbon solutions and aid compliance with green building standards. This is especially applicable to retrofit programmes, where the burden of investment would fall on households and individual property owners.

CASE STUDY 4 **Italy**

The Italian government issued a 110% Superbonus scheme for both apartment buildings and individual homes, allowing owners to claim up to 110% tax credit for any renovations. These expenses must be related to energy efficiency or anti-seismic improvements (e.g. thermal insulation, rooftop solar, shock absorbers, EV charging infrastructures). This tax credit can be set against the property owner's tax liabilities over five years in five equal annual instalments. The "Superbonus" can also be traded by entitled property owners, allowing them to effectively sell it to third parties or credit it against their own suppliers' invoices.[6]

C Embed smart energy infrastructure

Smart energy infrastructure is the backbone of a sustainable and resilient urban ecosystem. Government at the municipal or national levels can enter public-private partnerships to integrate a broad range of smart, distributed energy solutions and technologies in buildings and facilities, from smart meters and distributed solar and storage to EV charging networks and energy management systems.

Smart metering is a vital tool in mitigating consumer demand for energy, reshaping behaviour through transparency of user consumption data (e.g. live usage monitoring), as well as hardware such as in-home displays (IHDs) and programmable communicating thermostats (PCTs). It also provides the data insights required for a range of optimization initiatives, such as time-of-use tariffs and automated load-shifting appliances. In addition, it can support the development of localized energy communities. Residential solar energy systems or other renewable resources can be connected to smart meters to help to measure and analyse generation and consumption data and its impact in terms of avoided emissions and savings.

CASE STUDY 5 **Italy**

Open Meter is an Enel project that will reach more than 35 million Italian customers by 2025. This second-generation smart meter device allows the collection of 7,000 billion measurements per year, including almost real-time data use and electrical parameters to enable big data analytics for the grid. It is a digital enabler that improves customers' awareness of their electricity-consumption habits and the availability of advanced energy services. It also allows consumers to take a proactive role in monitoring and controlling appliances such as solar rooftop, home automation and electric mobility. Open Meter is also circular, using regenerated plastics for manufacturing, emitting 6% less CO2 and producing 122g less waste per unit when compared to conventional meters.

2

Foundation 2: Mobility – compact urban form and electrification of fleets

Urban form and planning, and the electrification of fleets, are crucial actions for abating transport-related emissions.[7]

To learn more about the opportunities and co-benefits enabled by compact cities and an integrated energy approach, read the World Economic Forum's "Net Zero Carbon Cities" insight report.

Below: @Scharfsinn86/ Gettyimages

A Optimize mobility through urban form and planning

Moving towards compact urban form (the physical characteristics of the built living environment, including the shape, size, density and configuration of settlements and network) is often the lowest-cost strategy to reduce mobility emissions.[8] One way to address this in fast-growing metropolitan areas is to meet housing needs through urban infill. Mixed-use developments enable people of all means to live close to jobs, essential services and recreation, while encouraging them to use active transport such as walking and cycling. Intelligent urban form can enhance economic productivity, increase a city's tax revenue and make cities more equitable by prioritizing the convenience of public transport.

CASE STUDY 6

Paris

The City of Paris developed the 15-minute city plan to embed equity in sustainable cities. The city plan is underpinned by three core principles: prioritize humans, not cars; create flexible spaces in which each square metre serves many different purposes; and establish neighbourhoods designed for inhabitants to live, work and thrive.[9] Civic participation is integral to realizing this human-centred approach; for example, through participatory engagement whereby 10% of the city's annual budget is determined at the neighbourhood level, and dedicated to community projects.[10]

B Expand and decarbonize the public transport fleet

Public and private cooperation can accelerate plans to replace diesel-powered fleets with electric vehicles (EVs). Clean electrification of buses and waste collection fleets would result in reduced emissions, better air quality and less noise.[11]

To learn more about the critical actions required to accelerate electric mobility where energy, mobility and urban transformations converge, read the World Economic Forum's "Electric Vehicles for Smarter Cities" report.

CASE STUDY 7

Brookeville

In Brookeville, Maryland, AlphaStruxure, a joint venture between Schneider Electric and the Carlyle Group, used microgrid technology to enable the electrification of the Brookeville bus fleet. It offers the county operational and dispatch flexibility of the buses as well as a way to avoid upfront capital costs. The on-site energy provided by the energy-as-a-service microgrid allows the bus fleet to charge and operate with full flexibility without overloading the distribution grid and incurring additional energy fees. It is estimated that more than 155,000 tons of GHG emissions will be avoided over the lifetime of the microgrid, which represents a 62% reduction compared to business as usual. If the fleet grows, a flexible cloud-based infrastructure can easily accommodate additional distributed energy resource and/or EV charging infrastructure.[12]

CASE STUDY 8

Santiago

In 2019, the Santiago metro area, home to more than 40% of Chile's population, had the largest fleet of electric buses outside of China. Santiago started by piloting electric bus technology on a small scale and has since moved to large-scale deployments with public transport operators. Innovative financing, with new financial actors (including utility companies) working in conjunction with e-bus suppliers and transport operators, has played a key role in Santiago's electric bus adoption. The Zero Emissions Bus Rapid-deployment Accelerator (ZEBRA) partnership has commissioned several studies to develop concrete financing and commercial models to accelerate bus electrification for different local contexts.

3

Considerations for implementation

To deliver sustainable urban transformations, city and national governments, along with businesses and civil society, must align and collaborate on a common agenda.[13] There are four additional considerations for successful urban transformation.

> **Cities are well placed to deliver on net zero solutions and the co-benefits that they can unlock for communities through public policy and private investment. This, plus their ability to bring together data, knowledge and resources across all infrastructure systems, means they have a vital role to play in developing new models for instilling long-term resilience.**
>
> Mike Haigh, Chair of the Executive Board, Mott MacDonald

CASE STUDY 9

Stockholm

Stockholm Royal Seaport, a former brownfield area, is today one of the largest urban development areas in northern Europe. The area is a test bed for innovations, with a strong focus on sustainability. It is currently in the last stage of development into a waterfront urban district with social facilities, 12,000 new homes and 35,000 workplaces. The large space offers opportunities to try out new materials and construction methods in low-energy buildings, to improve waste management and promote the use of circular resources. The target is to become a fossil fuel-free residential and business area by 2030. By keeping locals involved throughout the process, the city aims to encourage sustainable behavioural changes.

Below: @olaser/ Gettyimages

3.1 Design integrated policies and promote circularity

Integrated policies align efforts by different stakeholders to adopt the best technologies and behaviours, using public-private collaboration.

Indeed, such policies can both spur direct consumer investment in decarbonization solutions[14] and nudge choices to boost the circular economy.

CASE STUDY 10

São Paulo

São Paulo State Government has an open innovation hub, IdeaGov, which connects people and organizations with a mission to solve public challenges and generate a positive impact on society. IdeaGov will select 20 businesses that provide innovative and scalable solutions to address four challenges: 1) reduce greenhouse gas emissions; 2) increase renewables' share in the energy matrix; 3) expand the use of sustainable fuels in transport; and 4) create resilient cities. The selected start-ups will work in synergy with UK start-ups to jointly develop solutions for the State of São Paulo. The companies will also have networking opportunities with investors, governments and industry organizations and will present their solutions at the 2021 United Nations Climate Change Conference (COP26).

3.2 Collecting data and tracking co-benefits

A systemic approach can best address the complexity of a city's carbon footprint by collecting and using data to:

- Improve the integration of planning decisions across different city services/areas
- Allow for transparency and replicability of decision-making
- Measure outcomes and progress, allowing stakeholders to also identify links between carbon reduction and related economic and health co-benefits

CASE STUDY 11

Wellington

Wellington, New Zealand's capital city, has been tracking its carbon footprint since 2001, achieving a reduction in total gross emissions during this time of 7% against a 24% population and 59% GDP growth. With the data collected, the city has been able to create a plan to make Wellington a zero-carbon capital by 2050. It has also developed a gamified carbon calculator, FutureFit, to help citizens make choices to reduce their impact on climate change. FutureFit lets people work out the carbon impact of their lifestyle and choose positive changes in the way they live to help reduce it.

3.3 Public engagement for an inclusive transition

Government leaders need to design transformation to make it easy for citizens to make the right infrastructure choices. Citizen involvement[15] is essential and can be achieved using clear, transparent communication and education campaigns. From nudging consumer behaviour driven by smart metering to television programmes seeking to steer households away from heavily polluting solid fuels such as wood and charcoal,[16] a human-centred approach is vital to the design and application of decarbonizing solutions.

CASE STUDY 12

Buenos Aires

In 2019 in Buenos Aires, Argentina, the "Pasate a LED" programme distributed more than 1 million LED light bulbs, reaching almost 225,000 homes, saving an estimated 100 GWh energy and avoiding the emission of an estimated 47,432 tonnes of carbon dioxide equivalent (tCO2eq).[17] At 90 hubs in the city, residents could hand in incandescent lights bulbs (or similar lighting units, such as fluorescent lamps) and take away new LED bulbs. The hubs were strategically located, close to homes in low-income neighbourhoods. The programme also distributed information about energy efficiency and climate change. In addition, the disused incandescent light bulbs were recycled as far as possible – and their glass was used to help repave the city's streets.

3.4 Leverage district projects to mobilize actions

Integrated district-level planning provides an opportunity to pilot and scale approaches, mobilizing the targeted partnerships and commercial models required to deliver urban transformation.

CASE STUDY 13

Singapore

Jurong Lake District in Singapore, spanning 410 hectares, is seen as a leading sustainable district. It balances the needs of residents and businesses, has excellent first- and last-mile connectivity, and has developed a differentiated business hub that builds on the area's existing strengths in professional services, engineering and architecture, infrastructure and construction, as well as sustainability-related businesses including energy, water and environmental services.

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Endnotes

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