NOVEMBER 2017

CITIES

THE NEW POLICY SHAPERS IN THE ENERGY TRANSITION

DISCUSSION PAPER

friends of europe

This publication is part of Friends of Europe's Climate and Energy programme. It brings together the views of a large number of cities from five continents, represented by scholars, local authorities, entrepreneurs, business professionals and mayors. It is the first of a series dedicated to inform and share knowledge on innovative and impactful solutions to tackle climate and energy issues within cities.

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INTRODUCTION

Cities are increasingly becoming the real game changers when it comes to addressing climate change and energy issues, and are now leading the transition to a low-carbon future. By acting at the local level to solve unsustainable energy crises and climate change causes, cities can bypass national political discord to create partnerships full of opportunities that accelerate climate action as well as facilitate access to climate finance for mitigation and resilience. Cities are teaming up, creating coalitions and sharing knowledge on the most advanced and innovative solutions to tackle climate-related risks. These strategic partnerships are rooted in strong projects and initiatives that reflect cities' ambitions, priorities and interests.

This Friends of Europe publication acknowledges cities' evolving and prominent role within the energy transition. It is released at a critical time as city representatives are meeting during COP23 in Bonn at the Covenant of Mayors' Climate Summit of Local and Regional Leaders to show their growing leadership in climate action. By demonstrating that non-state actors from across the world can come together to share best practice and promote the transition to low-emission and climate-resilient economies, cities are being globally transformative.

Articles in this discussion paper are written by a wide range of experts in the field of climate and energy –from mayors and other local leaders to entrepreneurs and academics – and is intended to reveal an array of urban experiences that have proven successful. Representing views from around twenty cities split over five continents, the objective is to highlight real actions currently being implemented which if replicated and scaled up could accelerate the energy transition in compliance with the Paris Agreement.

This publication is divided into three distinct parts. Each section informs on a variety of experiences that cities are dealing with, whether it is their vulnerability to climate change, smart thinking in the context of a rapidly evolving energy system and the use of new technologies, or green solutions to boost economic growth as a result of innovative financial tools, the sustainable development goals and new business opportunities.

The first part reveals issues related to cities' vulnerability, and shows how the local level is coping with the adverse effects of climate change while ensuring the wellbeing of citizens. With examples from cities in Central America, South East Asia, the United States and Africa, this section explains actions implemented by cities against issues such as air pollution, extreme weather, urban sprawl and crop failure.

The second section explores how smart cities are paving the way towards a low-carbon future. By presenting projects from cities such as Dublin, Paris, Ludwigshafen, Rotterdam, Kochi and Singapore, we can better understand the increasingly important role urban societies are playing in addressing climate change. Initiatives include energy efficiency, citizens' enrolment, data collection, building renovations, transport decarbonisation and sustainable housing.

Existing green solutions are described in the final part of the paper. Cities such as Florence, Santiago, Warsaw and Brussels as well as regions such as Liège, Rhodope and Murcia showcase that green solutions often come with innovative financial tools and technological innovations that can boost investments and foster opportunities for growth. From smart grids to smart charging, from financing for energy efficiency to electric bikes easing congestion; there are myriad solutions at work today that will bring a greener future.

Happy reading!

PART 1
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Mexico City: Linking air quality policy and green growth

> ***By linking air quality and climate change, there will be a better chance of implementing cost-effective actions with both local and global benefits***

Beatriz Cárdenas-González, Director-General for Air Quality Management at the Secretariat of Environment of Mexico City, Mexico

Andrés Flores-Montalvo, Director for Climate and Energy at the World Resources Institute (WRI), Mexico

After reaching a recurring state of emergency during the mid and late 1980s, Mexico City has achieved significant improvements in its air quality, in particular in reducing the concentration of ozone (O_3), the most persistent atmospheric pollutant in the region.

Several policies have helped. The elimination of leaded gasoline significantly decreased the concentration of lead, a hazardous atmospheric pollutant. A refinery in the middle of the city was converted into a public park. And the widespread use of catalytic converters in vehicles has mitigated emissions of ozone precursors and other pollutants.

Other measures have also contributed, but with mixed results. The vehicle restriction policy “Hoy No Circula (HNC)” put in place one of the first efforts by any major city in the world to limit the circulation of a portion of the private vehicle fleet every day – as much as 40% of the fleet in emergencies – through a system using license plate numbers and colour-coded stickers. Its sister programme, the "Tail Pipe Mandatory Emissions Testing Programme" (Programa de Verificación Vehicular Obligatorio, PVVO), has been operating since the beginning of the 1990s.

Air quality policies worldwide are still far from being integrated with green growth and climate change policies

There has been a lot of controversy around these policies. Very few people would dispute their significant contribution to air quality, since they have incentivized the use of public transport and motivated regular car maintenance and fleet renewal, but they may have also had the unintended consequence of increasing motorization. This happened especially with the 'Day Without a Car Programme' during its first years of operation, when all vehicles, regardless of age or mechanical conditions, had to be kept off the streets one day per week. In response, some vehicle owners bought a second car, which in many cases was an older one, in order to cover for that day. Nowadays the programme is more restrictive for older or dirtier vehicles, so this perverse incentive has disappeared. Tail pipe emission testing, on the other hand, is resented by the general population, who feel that vehicle ownership carries a heavy burden in the fight against atmospheric pollution: tail pipe testing is required twice a year. Other important sources of pollution are not nearly as well controlled. The public also perceives still corruption in the testing system, despite controls and the use of state-of-the-art technology to improve the reliability, functioning and surveillance of the system.

Initially, back in the 1980s, air quality policy in Mexico City was largely driven by the need to solve the emergency. So several measures to protect the health of vulnerable groups were immediately put in place, and specific short-term actions were taken to tackle the most prominent sources of pollutant emissions. A document called “21 actions to abate air pollution” was published in 1986, and a subsequent version with “100 necessary measures” came out the following year.

At the time, there was neither a systematic response nor a thorough assessment or prioritisation of the potential measures. These would come later, once it was evident that although the measures had reduced emissions, the problem was far from solved. It soon became clear that long-term actions on several fronts were required, and that coordination among sectors and levels of government was essential to implement them successfully. That´s when air quality programmes (ProAires) were first introduced. The one for the Metropolitan Area of Mexico City was the first in Mexico, and has since been replicated in other large cities in the country. Updated versions were prepared and implemented in the periods 1995-2000 and 2002-2010. The latest Mexico City

Metropolitan Area ProAire 2011-2020 differs from previous ones, as it uses an ecosystem-based and an air-basin approach. However, the goals set are still general and there are no clear indicators linking them with Mexico City's or the country's green growth and climate change programmes. Figure 1 links the improvement of air quality with programmes and specific measures implemented over the years.

Mexico City Metropolitan Area ProAires have, nevertheless, improved significantly over time. They have specific policies and measures with general goals, implementation timeframes, responsible entities and an estimated budget. They include monitoring and contingency actions. Some of these measures may also help mitigate the emission of greenhouse gases, create economic growth and support the clean-energy transition. They may also promote employment, equality and social wellbeing. For example, they have promoted public transportation and non-motorized mobility, energy efficiency measures, the modernization of industrial facilities and more-stringent standards for ambient air quality and emissions.

Air quality policies worldwide are still far from being integrated with green growth and climate change policies, but the Mexico City Environment Programme 2012-2018 made a conscious attempt to link air quality goals with the Mexico City Climate Action Plan and its Resiliency Programme. The intentions were to identify and take advantage of synergies and to speed up implementation, for instance by increasing funding options. One example is public transportation. By linking climate-change, green-growth and air-quality policies, cleaner and more-efficient buses were put in operation in the newest line (Línea 7) of the Bus Rapid Transit (BRT, Metrobus) system. These buses have state-of-the-art emission control technology (Euro VI), which will reduce particulate matter emissions – the air-quality goal – and black carbon – the climate-change goal – as well as improve fuel efficiency and social well-being – the green-growth goal. If these policies had not been integrated, older technology such as Euro IV or Euro V would have been selected based on current federal regulations. So, linking local initiatives to global issues helped access financial resources.

Other good examples are regional coordination bodies, such as the Megalopolis Environmental Commission, which includes Mexico City and five surrounding states, and is slowly broadening its membership. Very recently, the Federal Ministry of Health and the Communication and Transport Ministry joined. The Federal Government published its National Strategy for Clean Air a few months ago, and this highlighted the need to improve coordination and strengthen links with existing climate change policy instruments.

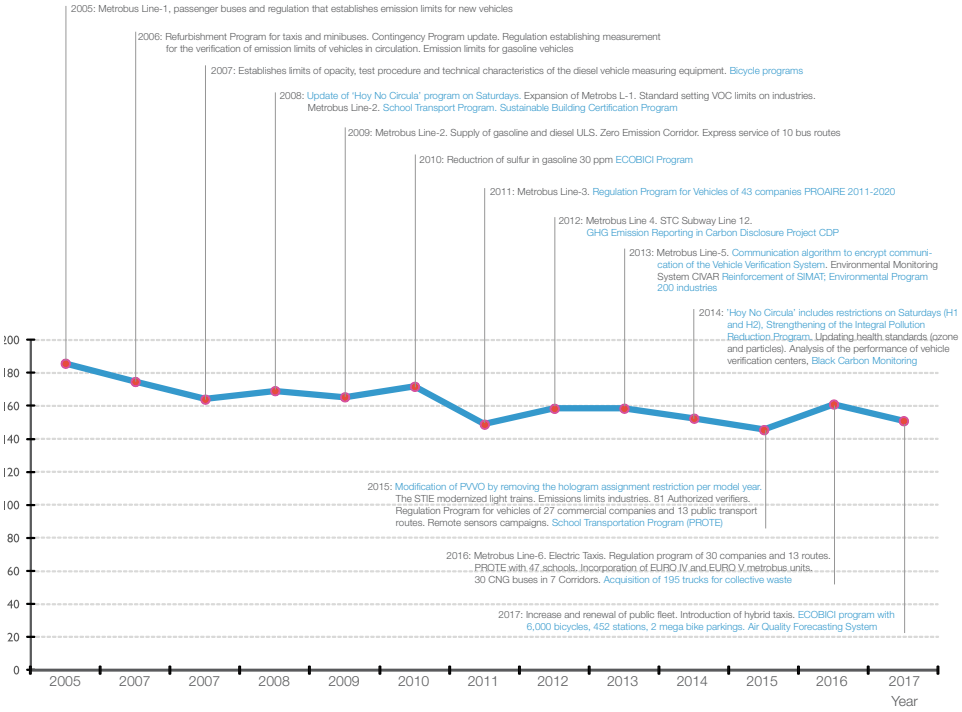


Figure 1: Link between air quality programmes and pollutant concentration improvements in Mexico City (Maximum hourly ozone concentrations, 2005-2017) Source: Adapted from Jaimes. SEDEMA, 2017

Mexico City is one of the world's leading cities in terms of climate change responses, and is also recognized for its improvement in air quality. By linking air quality and climate change, there will be a better chance of implementing cost-effective actions with both local and global benefits, at the same time as promoting social and economic improvements. This will help increase the city´s resilience.

Innovations in Urban Resilience: Examples from the US

> ***While cities are assessing their vulnerabilities and developing plans, more needs to be done to turn those plans into action and increase the scale, scope and ambition of adaptation activities on the ground***

Jessica Grannis, Adaptation Programme Manager at the Georgetown Climate Center and adjunct professor at the Harrison Institute for Public Law, at Georgetown University Law Center, United States of America
Melissa Deas, Institute Associate at the Georgetown Climate Center, Georgetown, United States of America

The importance of urban resilience initiatives was brought into sharp focus in August 2017 when two of the world's largest cities – Houston, Texas and Mumbai, India – endured catastrophic flooding, while cities in Europe experienced a heat wave so severe it earned the name "Lucifer". The disruption, devastation and loss of life remind us that these types of extreme weather events will occur with greater frequency and severity in the future as the climate warms. Rising sea levels, more-intense downpours and more-severe and prolonged heat waves will threaten the health and well-being of growing urban populations and interconnected city economies. Aging infrastructure in many cities will be unable to withstand these impacts, and rapid urbanisation and changing technologies will further strain the ability of city leaders to protect people and property.

Cities will be critical to societies' success or failure in addressing climate change. City officials are our first responders in disaster events and cities have the primary spending and regulatory powers to take measures

Aging infrastructure in many cities will be unable to withstand these impacts, and rapid urbanization and changing technologies will further strain the ability of city leaders to protect people and property

to reduce risks. In the United States, cities contribute 85% of the nation's GDP and 80% of Americans live in cities. Thus, urban efforts to both reduce greenhouse gas emissions and manage these impacts will be critical to ensuring a robust response to climate change, as well as our future ability to safeguard lives and economies.

This article showcases efforts underway in many US cities that have recognized that climate change poses life-and-death threats to their residents, businesses and economies, and are taking action to prepare. 40 local governments (municipalities and counties) have adopted stand-alone adaptation plans, and more than 100 have incorporated considerations of resilience or climate preparedness into other city plans, such as local land-use and hazard-mitigation plans. All 10 of the largest metro regions in the US have adaptation plans or have started thinking about climate resilience.

Still, progress on adaptation within US cities is piecemeal and insufficient. Most planning activities are happening within larger, coastal cities, where there is strong political support for climate action. While cities are assessing their vulnerabilities and developing plans, more needs to be done to turn those plans into action and increase the scale, scope and ambition of adaptation activities on the ground.

Despite these challenges, many promising practices are being developed and implemented in cities across the US and can serve as models for others.

Mainstreaming Adaptation – Rather than develop stand-alone plans, many cities are beginning to incorporate adaptation into existing planning processes. This is important in order to ensure that policies are embedded in city decision making and that they cut across city agencies. For example, in Baltimore, Maryland, the city integrated adaptation planning into its 'All Hazards Mitigation Plan' through Baltimore's Disaster Preparedness and Planning Project (DP3). In Austin, Texas, the city integrated climate considerations into its local land-use plan and involved a wide range of city agencies responsible for transportation, health, disaster preparedness and emergency response, as well as the city's electric and water utilities.

Prioritizing Equity – Cities are increasingly integrating social justice into climate priorities, recognizing that climate change will not affect

all people equally. For example, Cleveland, Ohio's Tree Plan addressed disparities in the city's urban tree canopy by prioritizing tree planting sites using socioeconomic, public health and neighbourhood revitalization criteria. In Seattle, Washington, the city facilitated a community-led planning process to ensure that residents who are most vulnerable to the heat impacts of climate change (for example low-income communities and communities of colour) could determine the city's response. This process emphasized the importance of addressing gaps in trust between city residents and government agencies through honest dialogue and transparency. It also promoted a continuous engagement process with city residents rather than one-time transactional interactions around particular plans or initiatives.

Moving into Implementation – Cities are finding creative ways to use existing authorities to encourage resilience in private development and to fund adaptation initiatives. Portland, Oregon, adopted an Ecoroof Incentive in 2008 to create financial incentives for

property owners to install green roofs as a method for managing storm water. Boston, Massachusetts, adopted a zoning checklist to prompt developers to consider the long-term effects of climate change on large-scale new development projects and to design projects to reduce future impacts from climate change. In Washington, DC, new storm-water regulations encourage the use of green infrastructure to reduce flooding and manage storm water, and a storm-water credit trading system gives developers flexible, market-based mechanisms to help them comply.

Linking Adaptation and Mitigation – Cities are considering the synergies and trade-offs between policies designed to enhance resilience to climate change and those designed to reduce emissions. For example, after Hurricane Sandy, New York City is assessing the feasibility of deploying renewable-energy-powered microgrids that will 'island' to stay online during wider power outages, thus providing both mitigation and adaptation benefits.

Collaborating Regionally – Local governments across the country are increasingly banding together to create regional climate collaboratives to pool resources and build capacity to address the impacts of climate change across jurisdictional lines. For example, four counties in Southeast Florida created a regional compact to work together to collectively tackle climate goals; and similar initiatives are being pursued in many other metropolitan and even rural regions throughout the US.

Although many cities are showing incredible leadership, they cannot do this work alone. To accomplish the transformational changes that are needed, national and state governments also play a critical role. The Obama administration sought to spur adaptation and support local action by providing new tools (U.S. Climate Resilience Toolkit), financial resources (National Oceanic and Atmospheric Administration Regional Coastal Resilience Grants and the Center for Disease Controls' Building Resilience Against Climate Effects (BRACE) grants to city health departments) and technical services (The Partnership for Energy Sector Climate Resilience). Many of these programmes, however, face budget cuts and shifting priorities under the Trump administration. In the short term, this will make it much more difficult for leading cities to find the funding and technical assistance they need. It will also leave other cities with fewer incentives to take on the challenge.

This means that new ways to build local capacity will also be needed. In particular, state governments can serve as a resource for local governments, as can be seen in California's Cal-Adapt tool and Climate Ready Grant Programme, among other programmes. States can also leverage their university systems to support research and local pilot projects, as Connecticut is doing through its Connecticut Institute for Resilience & Climate Adaptation

(CIRCA). Finally, some urban areas are working with the private sector to promote resilience. For example, Prince George's County created a public-private partnership to finance green infrastructure and improve water quality.

These promising examples show how cities can begin to take action to address the grave and mounting threats they face because of climate change. But much more work will be needed over the coming decades to ramp up efforts both to reduce greenhouse gas emissions and to prepare for climate-related impacts that are already unavoidable. Cities are already leading and must continue to lead. However, a proactive response at the scale and scope needed will require all levels of government, non-profit organisations, universities, and the private sector to work together to prepare our communities for the coming changes.

EXTEND YOUR KNOWLEDGE

SUMMER AND FALL 2017 SAW AN UNUSUAL STRING OF RECORD-BREAKING HURRICANES IN THE ATLANTIC

Hurricane Harvey: Aug. 25-31

- Deaths: 84
- Estimated damage: $190 billion (source: AccuWeather)
- Location: US Gulf Coast

Hurricane Maria: Sept. 19-27

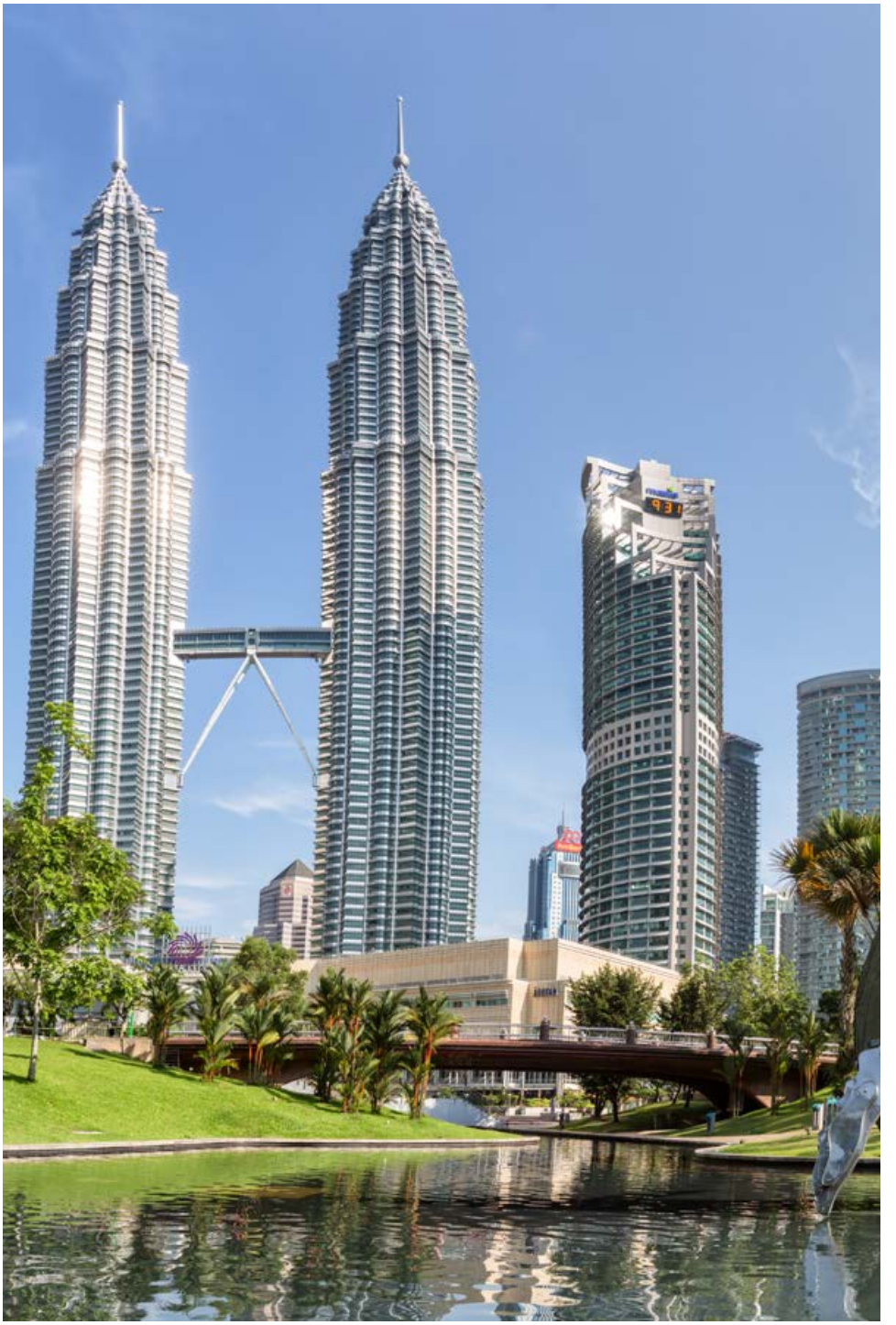
- Deaths: 38
- Estimated damage: $40-$80 billion (source: AIR Worldwide)
- Location: Puerto Rico and the Virgin Islands

Hurricane Irma: Sept. 6-12

- Deaths: 95
- Estimated damage: $64 - $92 billion (source: Moody's Analytics)
- Location: Florida and Caribbean Islands

Hurricane Ophelia: October 9-20

- Deaths: 3
- Estimated damage: €1 billion (source: Enki Research Centre)
- Location: Ireland and United Kingdom



South-south learning prospects and the Malaysia Sustainable Cities Program

> ***Energy efficiency and carbon intensity reduction strategies that work in one country require substantial modification to fit the legal, cultural and political realities in others***

Lawrence Susskind, Ford Professor of Urban and Environmental Planning at the Massachusetts Institute of Technology (MIT), United States of America

Selmah Goldberg, Programme Manager at the MIT-UTM Malaysia Sustainable Cities Programme, United States of America

The MIT-UTM 'Malaysia Sustainable Cities Program' (MSCP) is a five-year collaboration between MIT and Universiti Teknologi Malaysia. It brings eight to ten scholars a year from universities in the developing world to Malaysia for four months to document efforts in one of five Malaysian cities to reduce their carbon intensity and promote sustainable city development. The scholars then spend four months at MIT organizing their findings in working papers and educational videos for global distribution. The 27 scholars who have participated thus far have focused on disaster preparedness, flood protection, sustainable tourism, ecosystem conservation, water management, community engagement, socially responsible real estate development, the status of migrant workers, sustainable transportation, protecting cultural heritage, promoting renewable energy, greening the building process and urban regeneration. Since our primary objective is south-south learning, that's what we will focus on in this short paper.

The obstacles to north-south learning are well documented. They include (a) barriers created by cultural, legal and other fundamental differences that make solutions developed in the north inappropriate in the south; (b) economic and financial constraints that put

Malaysia has taken steps to import and adapt low-carbon development strategies used in other parts of the world

technological solutions developed in the north out of reach in the south; and (c) the lack of appropriate professional manpower in the south needed to maintain solutions or strategies 'borrowed' from the north.

It is a little less obvious why solutions generated in one part of the developing world don't necessarily fit in other parts of the global south. It may be that political and institutional differences across the global south are just as substantial as differences between countries in the south and north, so that cultural and legal differences create insurmountable obstacles to south-south technology transfer. When cross-cultural learning works and lessons from one country are applicable elsewhere, it is usually because of close interpersonal connections, rather than connections between organisations or countries. Unfortunately, experts from the global south rarely have the time or resources to build the intense interpersonal connections that can facilitate the effective transfer of social technology, software, hardware and organisational designs. It also appears that energy efficiency and carbon intensity reduction strategies that work in one country require substantial modification to fit the legal, cultural and political realities in others. This can require a sustained effort over an extended period of time. Experts from one developing country often do not have the resources needed to support this kind of adaptation process. We will illustrate each of these dynamics with examples from the work of the MSCP scholars.

Political and cultural differences can only be bridged by drawing on deep knowledge of institutional dynamics on both sides. Malaysia has taken steps to import and adapt low-carbon development strategies used in other parts of the world, particularly Japan. But the work of some MSCP scholars suggests that strategies that now work in Malaysia may not transfer easily to other countries in the global south. The idea for a green building index (GBI) - a rating tool for assessing the energy efficiency of proposed new buildings - is one example. Malaysia, drawing on similar indexes in other parts of the world, has developed a GBI that uses a number of metrics to assess the likely short-term and long-term energy efficiency contributions of proposed buildings.

The GBI in Malaysia, tailored to the operation of local construction, financing and energy supply factors, appears to do a good job of addressing short-term energy and resource

efficiency considerations, but does not put an equal emphasis on long-term considerations. To other developing countries, Malaysia's GBI may appear to be a good model to emulate. It appears to be spurring more-energy-efficient design. However, it fails to reach its full potential because long-term considerations are being undervalued in the way the points system is applied. So, in some ways it might be appealing to other countries that are not currently using a green building index. However, if other countries try to import it, they may find that it falls short in similar ways.

A study to identify the causes of urban sprawl in the Greater Kuala Lumpur region explored weaknesses in the policies and planning initiatives intended to encourage more compact patterns of development. The study showed that a focus on transit-oriented development needed to be complemented by the creation of greenbelts or other urban grown limits. Also, coordination between federal, state and local planning agencies (since Kuala Lumpur is the national capital), along with sustained political prioritisation and funding, were required to achieve compact development. It's unclear whether the goal in Kuala Lumpur is to discourage growth or merely to encourage more-efficient development patterns. The emphasis does not seem to be consistent. Without a greater commitment to growth limits and sustained intergovernmental efforts all moving in the same direction, Malaysia's attempt to reduce sprawl might appeal to capital cities in other countries, but not really help them achieve more-sustainable city development.

To learn from growth management efforts in Malaysia, scholars from other parts of the global south will need to decide what they are looking for: ideas that provide inspiration but need to be reworked, or ones can be directly applied in their own countries? They will quickly discover that adopting Malaysia's GBI is not likely to help them achieve long-term energy efficiency. And it should be clear pretty quickly that efforts to promote more compact and transit-oriented development are not likely to work in their countries unless they are accompanied by a coordinated and ongoing intergovernmental commitment to constraining market forces. Learning from Malaysia's experience will therefore require digging deeply, looking behind the obvious narrative and deciding how to take account of the unique conditions in the 'receiving' country.

Experts from the global south rarely have the time and resources needed to build and sustain long-term south-south collaboration. Malaysia offers a compelling example of a developing country seeking to promote decarbonisation of its economy. However, capitalising on the lessons of Malaysia's experience will require intensive collaboration on the part of subject-matter experts. Emission reduction helps to illustrate why this is true. One MSCP scholar, by building a sophisticated integrated carbon accounting and mitigation (INCAM) model, produced a forecast of the CO2 emissions created by biomass power plants using oil palm waste. Her research indicated that using biomass could significantly reduce CO2 emissions, in some cases by as much as 90%. Given this potential, you would

imagine the government would encourage new investment in biomass waste as a renewable energy source. However, figuring out exactly which technology to use, where to locate such plants, how to get the by-products of oil palm production to appropriate power plants, how to cover capital costs, and how to make sure that the power produced is accessible to appropriate markets, requires additional case-specific analysis. Just understanding that the energy produced from biomass can reduce CO2 emissions isn't enough. Moreover, answering these second-order questions in one country may not yield generalizable results. Building a detailed body of evidence in each country, or even just one part of the country, is time-consuming. And experts good at modelling CO2 emissions may not have the necessary expertise to answer the second-level questions.

In exploring ways to reduce CO2 emissions in Johor Bahru, Malaysia's second largest city, a MSCP scholar documented how the Malaysian University Carbon Emission Tool (MUCET) has been used to measure and monitor emissions from Johor Bahru's energy sector. It is clear that this might be a valuable tool to guide policy formulation for emissions reduction. Results showed, however, that it is also necessary to measure and monitor emissions from the electricity-generation and transportation sectors to inform policy-making. Also, the system of measurement that is used must be appropriately calibrated. Furthermore, all stakeholders must be mobilized to build support for appropriate monitoring arrangements. It turns out that adapting this existing tool to measure CO2 emissions requires extensive information collection. Someone from another country will have to work closely with scholars and officials in Malaysia to really understand how to use MUCET or some version of it. It will take time, and much trial and error, to refine the lessons learned in Malaysia to ensure they are useful in other international contexts.

Legal, cultural and political dynamics and expectations are unique to each country. Even when concerted efforts are made to encourage more-sustainable patterns of city development, legal, cultural and political norms may be resistant to change. One MSCP study examined stakeholder involvement in the development of a transportation master plan in the state of Penang. In a rather creative way, the city proposed to capture the added land value created by coastal reclamation and use it to fund city-wide mass transit improvements. The scholar involved concluded that the Penang government's efforts to involve business representatives, fishermen, environmental experts, NGOs, and activists in this unique transit planning effort fell short of generating an informed consensus on how to proceed. It is not clear at all that public engagement in Malaysia is ever meant to resolve such disagreements. Nor is it clear that the success or failure of public engagement in transit planning in Penang would be a good predictor of what the same approach to public engagement might generate in another country. The legal, cultural and political differences would probably suggest very different measures of success. So the question is: can one country learn about

public engagement methods for promoting sustainable city development in another country if its laws, culture and politics are very different? Learning from such results in one country and figuring out how to export them to cities in other parts of the world requires not only deciphering how the institutional dynamics work in the 'exporting' country, but also imagining what will happen when attempts are made to insert them into the context of the 'importing' country.

The MSCP scholars with whom we have worked have made valiant efforts to document interesting and important sustainable development experiments in Malaysia. They have brought their expertise and their cultural perspectives. They have spent time in the field, interacting with government and non-government representatives and gathering data of various kinds. Sometimes the information they wanted was not available to them. They tried hard to work from their field-based findings rather than their preconceptions. Almost all of them believe (as can be seen in their educational videos online) that they have been able to cull useful lessons relevant to their own countries. Whether they can facilitate the import of these new ideas remains to be seen.

Without a greater commitment to growth limits and sustained intergovernmental efforts all moving in the same direction, Malaysia's attempt to reduce sprawl might appeal to capital cities in other countries, but not really help them achieve more-sustainable city development

Acting local: the greenest municipality in Cameroon addresses climate change

> ***The municipality of Bangangté has understood that human waste management and the promotion of agriculture can go hand in hand***

Célestine Ketcha Courtès, Mayor of Bangangté, Cameroon

The biophysical environment of the municipality of Bangangté, an area of 800 sq km in Cameroon that is home to 200,000 people, presents numerous difficulties to its inhabitants. The soils are ferralitic, which means they are extremely sandy and contain minerals such as aluminium and iron. This, combined with a rugged relief, makes the land unsuited to agriculture – yet agriculture is a source of livelihood for 80% of the population.

A local solution means local action in this region of Africa. Using human urine to increase agricultural production helps local communities make the most of their farmland, so that they can make a living in spite of harsh climatic and soil conditions. Local communities are thus treating urine so that it can be used as natural fertiliser.

This initiative is considered to have social and environmental benefits. It prepares children for a new sort of job in a region with high unemployment and also teaches them to limit the use of chemical fertilisers that have been used by many farmers. This means the practice allows the municipality of Bangangté to address climate change at a local level.

Before this initiative officially started, people in the municipality were using chemical fertilisers, and exposing themselves to various sorts of illnesses, as well as having to pay for the fertilisers. The treatment and use of urine has the potential to solve issues related to hygiene, insalubrity and agricultural production in public spaces such as schools and markets. Using contemporary ecological toilets in such an environment has helped to modernise the population's entire approach to sanitation and to let it adapt to adverse conditions.

Despite the transfer of competencies from the state of Cameroon to decentralised regional authorities, there are still no well-defined policies or strategies for sanitation, and further political commitment is required. Of the 60 schools that have applied to construct modern ecological toilets, only 10 have so far managed to do so. Additional efforts are required to equip the remainder.

Nevertheless, these modern ecological toilets have had significant positive results in curtailing open-air defecation and environmental

These practices are easily replicable, so they are available to anyone who wants to increase soil fertility

pollution in school areas. They have also greatly encouraged the collection, storage and processing of urine and the conversion of faeces for agricultural use in Bangangté and nearby villages.

The initiative comes as the municipality pushes for the construction of modern ecological toilets in its whole territory. However, a few difficulties remain. For instance, in schools, some students' parents were unwilling to accept the new, complex practice of separating and making use of human waste. This was resolved by demonstrating both the positive sanitation outcomes and the effective results for agriculture. There were also difficulties in introducing such facilities into public markets. These were addressed by involving members of the markets' management committees and offering training in latrine management. Some religious schools lacked the funds to maintain the new structures, so the municipality stepped in and got local craftsmen to help. Finally, processed urine sometimes got stolen, so storage facilities had to be guarded – a sign of the positive impact treated urine had on farmland and its consequent value.

These practices are easily replicable, so they are available to anyone who wants to increase soil fertility and fight against the constant rises in fertiliser prices and pollution of the natural environment. The positive outcomes are as follows: post-education training for young people to address unemployment; setting up a mechanism to make use of urine as fertiliser across local communities; and promoting the practice through targeted communications campaigns. The project is being conducted within the framework of the ATPC (Total Sanitation Supported by Communities), which takes into account all elements of sustainability and contributes to climate adaptation in a region where climate change affects crops dramatically.

The municipality of Bangangté has understood that human waste management and the promotion of agriculture can go hand in hand. It has therefore decided to contribute naturally to the protection of the natural environment by transforming human waste into resources. A person produces between 25kg and 50kg of faeces per year, and this can fertilise 300 to 400 square metres of agricultural land.

The project is essentially a revival of a traditional practice. Our forefathers, in their permanent quest for yield, created cesspits in the corners of their plots of land. After filling them with

earth and leaving them for a year, they placed plantain offshoots in the resulting compost. From these they could reap an entire crop. Faeces are more effective as a fertiliser when they have a lower carbon content, and carbon is naturally released when they are left in a pit as part of an ecological sanitation process. Like this, and through the processing of urine for hygiene, potentially harmful waste products are transformed into resources that add essential nutrients – nitrogen, phosphorus and potassium – to cropland.

Momentum has been generated by the municipal executive since 2007 in the communal development plans of 24 planning units. Of these, 22 focused on water and sanitation issues using funding for the implementation of the vast 'Sustainable Management of Water and Sanitation' MODEAB Water-for-All project and its sanitation component. The municipality now has the human, financial and material means to transform and recover waste on a durable basis and also to benefit the 80% of its population who depend on agriculture.

Bangangté's compost operation is already highly successful and has received a national prize for excellence in local management and development. Today, the recycling of human waste is underway, and the result used in the production of maize, plantain and beans. The next project will involve a waste-disposal centre, where sludge will undergo biological treatment so that the percolate can be used as a humidifier for composting biodegradable waste in the dry season. This will provide further opportunities for full-time employment, as well as improving the quality of the compost. These actions to recover, transform and make use of human waste will continue to offer a substitute for chemical fertilisers. They will thus give Bangangté an effective weapon in the fight against climate change and engage the whole community in the process of sustainable development.

PART 2
SMART CITIES
PAVING THE WAY TOWARDS A LOW-CARBON FUTURE

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From Citizen Engagement to Sustainable Heat Networks

> ***Cities are playing an increasingly important role in addressing climate change***

Verena Brennan, Energy Awareness Manager at Codema, Dublin's Energy Agency, Ireland

Cities are playing an increasingly important role in addressing climate change. They shape local policy and have a significant impact on the quality and sustainability of their citizens' lives as well as on a global level.

With Ireland emerging from a deep recession, Dublin can take a lead role in advocating climate action. Governed by four municipalities – Dublin City Council, Dún Laoghaire-Rathdown County Council, Fingal County Council and South Dublin County Council – the Dublin Region works closely with its energy agency Codema to address some of the biggest challenges, and looks to Europe for some of the answers.

Codema is a not-for-profit limited company set up by Dublin City Council in 1997 under the SAVE II Programme of the EU. Spearheaded by physicist Dr Gerry Wardell, the company has grown from a two-man operation to a team of 14 staff. Despite major budget cuts, the Dublin local authorities are obliged to achieve a 33% energy reduction by 2020 under the European climate change targets, so Codema remains relevant.

As one of its core functions, Codema monitors and reports the energy use of the Dublin local authorities and the progress they are making towards this 2020 target. While

The kits give householders the chance to get involved in the energy transition by identifying simple efficiency issues and helping them improve and retrofit their homes

preliminary monitoring and reporting data for 2016 has shown that the councils have made considerable energy savings relative to the 2009 baseline year, the next four years will be crucial in tackling the remaining gap. This can only be achieved through considerable effort to improve energy efficiency in the councils' operations, as much of the low-hanging fruit has already been picked.

DUBLIN'S CLIMATE CHANGE AGENDA

Acknowledging that climate change is a transboundary challenge, the four Dublin Local Authorities came together in 2016 to collaborate closely on solutions and synchronise their methodologies for measuring and reporting. Codema prepared a strategy on behalf of the municipalities entitled 'A Strategy Towards Climate Change Action Plans for the Dublin Local Authorities'. This focused on seven main areas: citizen and stakeholder engagement, planning, energy, transport, water, waste and ecosystems and biodiversity. Codema followed up in 2017 by developing climate change action plans for the individual councils. These are due to be finalised by the end of 2017 and go to public consultation in 2018, in order to engage Irish citizens in climate change dialogue.

Ireland's Department of Communications, Climate Action and Environment emphasised the need to for people to change from passive consumers to active citizens in its White Paper "Ireland's Transition to a Low Carbon Energy Future 2015-2030". Codema has long recognised this and has been running an energy awareness programme with the Dublin local authorities. Key challenges were the intangibility of energy and getting staff members interested in implementing action in their own homes. Codema therefore developed the Home Energy Saving Kit, a toolkit containing six practical tools to help citizens save energy and at home. Launched in 2016, the kits are available to borrow free of charge from libraries across Dublin City. Initially inspired by a similar scheme in South Australia, 67 kits are now in circulation, and the scheme is due to be extended to further counties following its success at the EU Sustainable Energy Awards earlier this year. The kits give householders the chance to get involved in the energy transition by identifying simple efficiency issues and helping them improve and retrofit their homes.

ADDRESSING HIGH ENERGY BILLS FOR THE DUBLIN LOCAL AUTHORITIES

Local authorities are also facing high energy bills in their own operations. Currently 70% of their overall energy consumption is on electricity. Switching to renewable energy and improving the energy efficiency of council buildings is

therefore at the top of the agenda. Routine replacement of lighting fixtures and office appliances already takes into consideration the highest efficiency specifications. However, the key area is public lighting, which is by far the largest consumer of electricity, and LED technologies are required to meet the 2020 targets.

Recent successes include Dublin City Council's first Energy Performance Contract (EPC), which involved a range of energy-efficiency upgrades in the council's three largest leisure centres. An EPC is a contractual agreement by an Energy Service Company (ESCo) to guarantee energy savings over an agreed period of time, reducing the risks of energy upgrades to the local authority. Dublin City Council will therefore benefit from potential energy savings of 38% throughout the eight-year contract, saving up to 640 tonnes of CO2. Codema sees these performance-related energy upgrades as key to the Dublin Local Authorities achieving the EU targets. Through its EU cooperation on the Horizon2020-funded GuarantEE project, Codema is striving to roll out the EPC model beyond the public sector and promote the EPC self-assessment tool. The tool, developed by Dutch project partner Rijksdienst voor Ondernemend, helps building owners and facility managers take the first step towards an EPC by determining in less than five minutes whether their building might be suitable.

TRANSITIONING TO A SUSTAINABLE HEAT NETWORKS

Ireland currently imports 85% of its fossil fuels, so there is a major opportunity for Irish cities to switch to low- or zero-carbon sources. District heating is well established in other European countries, and Codema has been investigating its potential for Dublin. It provides a highly efficient heat distribution network using flexible heat sources. Evidence-based energy maps can be used as a tool for town and city planners to influence future energy use. With 75% of Dublin City considered suitable for district heating, the newly built waste-to-energy plant in its docklands provides an ideal heat source for a network. Codema is also working closely with district heating experts from the UK, Belgium, France and the Netherlands as part of the €11.5m HeatNet NWE project, which is co-funded under Interreg North-West Europe and seeks to promote the rollout across north-western Europe of fourth generation district heating, the most advanced form. A pilot project is starting in South Dublin.

Data collection for smart and sustainable cities

> ***Tech start-ups can offer services that are globally scalable, and they can develop fast enough to have a real impact in the short time frame envisioned***

Paul Moreau, Innovation Programmes Manager for DataCity at NUMA, a French start-up based in Paris, France

Many reports show that cities are the main cause of climate change. Indeed, cities account for 70% of global CO2 emissions, and this is merely the beginning: it is predicted that in 2050, 70% of the world population will live in cities. These people – us – will consume more products and services, they will have to travel and commute, eat and drink clean water and heat their houses and apartments – all of which represent sources of large-scale CO2 emissions.

On the other hand, people produce a huge amount of data every day, for example geo-localised data produced by mobility apps, or energy data from energy providers or mass-energy users such as commercial buildings. This data is often lost or misused because today's infrastructures do not allow unified data access. Moreover, one of the challenges for data usage is that public and private organisations do not yet collaborate effectively, this usually resulting in missed opportunities for urban driven data solutions. We need concrete collaborations and actions if we want our cities to have a positive impact on global climate change.

NUMA, the leading French innovation hub, fostering communities engagement through different activities (start-ups acceleration, corporate innovation, communities and education) has decided to dedicate its

strengths and expertise to bring stakeholders together to fight climate change within cities. Our goal for the next 15 years is to involve tech entrepreneurs and start-ups to provide solutions to problems that humanity will face in the coming decade. Tech start-ups can offer services that are globally scalable, and they can develop fast enough to have a real impact in the short time frame envisioned. They can thus bring concrete solutions to climate change, a common global issue.

Our open innovation Programme DataCity was initially developed in partnership with the City of Paris and five large private corporations. It aims to bring public and private stakeholders together to define the city-scale challenges that start-ups will tackle using the data sets provided by the partners. These challenges can be in fields such as energy, solid waste management, logistics, urban planning, smart buildings, mobility and transportation.

Unlike most existing smart city initiatives, DataCity's bottom-up approach to transform local issues into concrete challenges is problem-oriented and user-centric, ensuring the relevance of the solutions developed. It operates over a nine-month programme, using the most advanced innovation, design and acceleration methodologies. In a given city, experts from city departments (transport, energy, housing, etc.) with operators from the participating corporations define strategic challenges that must be tackled using the data sets provided. NUMA then selects the start-ups, which works hand-in-hand with city experts and corporate partners to develop the solutions that respond to the challenges initially defined.

One successful project concerned Paris street lighting. In Paris, as in many other cities, street lights stay at the same level of brightness throughout the whole night. However, they could be dimmed when fewer people are in the streets in order to reduce light pollution and energy usage – or they could be brightened for specific events, around stadiums for example. This intelligent street lighting system is particularly important for soft transport needs such as walking and cycling. Pilot projects with sensors and meters for individual lights have proven costly and unreliable.

French data science consultancy Quantmetry teamed up with Dataiku (a collaborative data crossing and modelling solution) to model night-time urban movement. It combined crossing anonymised and aggregated data from mobile network SFR and data on streets and movement from the City of Paris' open database. They then developed an app to visualise off-peak times when lights could be dimmed, as well as the potential cost and energy savings.

It was calculated that savings in the city's electricity bill for street lighting ranged from 3% to 10%. This solution, scaled to the whole city, would represent savings counting in the hundreds of thousands of euros as well as significant energy savings. This is scalable to the 199,000 street lights in Paris and to any street lighting system in the world where mobile data is available.

Another challenge was to predict waste collection times. In Paris, bins cluttering public areas are still a common sight.. This happens either because the trucks have not yet emptied them or because they have not been returned them to storage; waste collection often takes hours. In the end, people from Paris experience cluttered streets and nasty bins staying on the street for most of the day.

In this case, the problem was how to notify users, building caretakers and companies handling waste bins exactly when the waste collection truck would be coming by. All bins were already equipped with a microchip to record exact waste collection times, and geo-localized data from truck collectors were available thanks to SUEZ participation in the challenge. The selected start-up, Craft.ai, used its artificial intelligence models to analyse this data and forecast times for each address. SUEZ's platform Monservicedechets.com was then used to register the end user's forecasted collection times and send SMS notifications in case of delays. This method has been put in place in the 14th arrondissement of Paris and adopted by dozens of beta users. As a result, prediction intervals have been reduced to two hours instead of an average four-hour interval.

Smart data applications can also be used in electricity communities. French bylaw allows for communities to self-supply electricity from 2017 onwards, using local energy sources, such as photovoltaic panels, and local micro-grids. The bylaw is intended to make it easier for clusters of households, whether it is private or public, to source more of their power from local facilities, such as solar farms, which are connected to the same low-voltage node. Producers and consumers can give, buy or sell electricity generated within their cluster and thereby lower their energy bills and optimise their investments.

The challenge was to set up an energy exchange system within a local energy community while minimising production and distribution costs. Start-up Linc.com developed a technology to test energy exchange between electricity consumers and producers using innovative smart meters.

Building on its successes, NUMA is now expanding the DataCity programme internationally in partnership with the C40 Cities Climate Leadership Group, with the objective of scaling the impacts of the solutions developed in more than 40 cities by the end of 2020. DataCity's ambition is to become a global collaboration platform where municipalities, corporations, tech innovators and citizens can work hand in hand to design the cities of tomorrow. With DataCity, NUMA aims to accelerate the transition towards more efficient, resilient, inclusive and sustainable cities, while putting citizens at the very heart of this transformation. Once scaled in 40 cities, the solutions developed as part of DataCity will impact more than 300 million citizens, have a real impact on climate change and help stay below the 1.5°C global temperature rise specified in the 2015 Paris Agreement on climate change.

Brunck district demonstrates successful energy transition

> ***The biggest contribution to a reduction in CO_2 emissions from buildings will come from renovating the existing building stock***

Quentin de Hults, Senior Manager Construction Advocacy and Sustainability, EU Government Relations, BASF Group, Germany

Smarter construction offers the greatest opportunity to deliver cost-effective cuts in the greenhouse gas emissions that cause climate change. Buildings account for 40% of global energy consumption and are responsible for a third of the planet's carbon dioxide (CO2) emissions. So business, academia and science are together designing new urban landscapes, where cities are living and interconnected, solar energy is produced in every façade, and smart insulation regulates the internal environment.

Yet for the most part, we live in houses built decades ago, which waste energy and cause the emission of large quantities of CO2. The biggest contribution to a reduction in CO2 emissions from buildings will therefore come from renovating the existing building stock.

The Brunck residential quarter, just outside the gates of BASF in Ludwigshafen, Germany, is a striking example of how to cut energy consumption and CO2 emissions by renovating existing buildings. For the most part, the district's 500 dwellings are blocks housing multiple flats dating back to the 1950s. In the mid-1990s, the floor plans of these apartments no longer met modern needs. BASF's housing

company, the city of Ludwigshafen and the state of Rhineland-Palatinate drew up a comprehensive modernisation programme, which has reduced the amount of heating fuel needed by 80%. It consisted of projects targeted at different levels of performance. Starting from an average heating energy consumption of 21 litres of heating oil per square metre (210 kilowatt hours per square metre per year, or kWh/m² per year), renovations reduced the energy consumption to 7 litres, 5 litres and 3 litres. For the most part, the buildings were modernised in line with the low-energy house standard, and new construction was carried out following the passive house standard (1 litre – 10 kWh/m²year).

The modernisation of an older building to meet the 3-litre energy consumption target has attracted attention and acclaim well beyond Ludwigshafen. Its success is based on a cutting-edge energy strategy using innovative construction materials. The building's maximum consumption of only around 3 litres of heating oil per square meter per year puts its energy requirements between one-seventh and one-tenth of non-modernised older buildings. For an apartment measuring 100 square meters, heating costs have dropped from around €1,400 to €200 a year.

The building was insulated with panels at least 20 centimetres thick made of Neopor®, which has considerably better thermal insulation

properties than conventional materials. Like its ancestor Styropor®, the foam plastic invented by BASF in 1950, Neopor is composed of small beads of polystyrene. However, the beads in Neopor contain tiny graphite particles that reflect thermal radiation and give the material a silver-grey hue. The addition of graphite improves the insulation performance by up to 20%.

The Passive House Institute also strongly recommends avoiding thermal bridges in the building's envelope (gap or discontinuity in the insulation layer) that make it easy for heat to escape. To prevent heat from escaping via the balconies, for example, shunts were replaced by a structure not directly attached to the building.

The fresh air supply for all rooms in the building comes from a controlled ventilation system, which sucks used air out of the kitchen and bathroom and passes it through a heat exchanger. The exchanger transfers up to 85% of the heat from the used air to fresh air, which then flows at a pleasant temperature into the living room and bedrooms. It also filters out contaminants.

The windows in the 3-litres house are triple-glazed, and their synthetic frames feature a core of polyurethane insulating material. Inert gas between the panes provides additional protection against the cold. A single-glazed window allows around seven times as much heat to escape. The windows were enlarged to let more light enter.

Brunck district renovation has demonstrated the feasibility of cutting-edge energy savings in existing building stock, so it is now up to governments to take the necessary steps to increase the renovation rate and depth

These technologies have become standard practice, and BASF continues to innovate. The performance of Neopor® insulation has been further enhanced and new innovative materials, such as Slentite®, have been developed. This is a polyurethane-based aerogel insulation panel with very high insulation performance, making it suitable when there is limited space available for insulation.

The Brunck district modernisation has also accommodated new residential requirements identified through workshops held with tenants. Floor plans incorporated the identified requirements, an optimised parking scheme was implemented, and green areas were created, as well as areas for recreation and relaxation.

Ten years after the renovation, the economic, ecological and socio-cultural results were

assessed in a long-term study. This showed that energy efficiency measures are durable and equally beneficial to tenants and landlords. Besides cost savings, tenants appreciate better comfort and are positive about the renovation. More importantly, between 2000 and 2015 the BASF housing company thermally renovated around 3,500 housing units, representing 40% of its housing stock. This corresponds to an annual renovation rate of 2.6%, far above the EU average of 1%.

Each renovation project is different, but the aim is always to make it win-win. For the tenants, rent increases after renovation have to be lower than the energy cost savings. They also benefit from increased comfort and quality of living space. For the housing company, the investment has to be economically viable in terms of increased revenue and asset value. Even with these conditions, primary energy consumption is reduced by about 70% to 80% in most cases.

The current renovation rate in Europe is insufficient to meet the EU's energy and climate targets. To meet the ambitions of the Paris Agreement, the EU building stock needs to be renovated to an energy level of nearly zero by 2050. The European Commission's November 2016 Clean Energy Package supports the energy transition, and the key role of buildings was highlighted in the Energy Performance of Buildings Directive. But no clear building renovation targets have been set. The Brunck district renovation has demonstrated the feasibility of cutting-edge energy savings in existing building stock, so it is now up to governments to take the necessary steps to increase the renovation rate and depth.

EXTEND YOUR KNOWLEDGE

EUROPE CLIMATE AND ENERGY TARGETS

	2020 Climate and Energy Package	2030 Climate and Energy Framework
GHG Emissions Reduction	**20%** compared to 1990	**40%** compared to 1990
	Binding via ETS and Effort Sharing Decision (ESD)	Binding via ETS and Effort Sharing Decision methodology
Increase of Renewable Energy use	**20%** of total energy consumption	**27%** of total energy consumption
	Binding via Energy Efficiency Directive	Only binding at EU level
Increase of energy efficiency	**20%** compared to baseline scenario	**27%** compared to baseline scenario
	Binding via Energy Efficiency Directive	Only binding at EU level

2050

The climate and energy roadmap from the European Commission suggests that, by 2050, the EU should cut its emissions to 80% below 1990 levels through domestic reductions alone. This is in line with EU leaders' commitments to reducing emissions by 80-95% by 2050 in the context of similar reductions to be taken by developed countries as a group. To reach this goal, the EU must make continued progress towards a low-carbon economy. To get there, Europe's emissions should be 60% below by 2040.

Heat transition in the urban environment: a call for greatness

> ***The city should be a smart orchestrator of the transition. It can encourage a focus on the most economical combination of energy-saving measures for buildings and changes in energy systems***

Astrid Madsen, Programme Manager for energy transition in the city of Rotterdam, The Netherlands

In the Dutch city of Rotterdam, 80% of buildings are currently heated by domestic gas boilers, while many houses do not have optimal insulation. So the city recently started a 'Heat Transition Programme' to reduce heat consumption and replace fossil-based heating with sustainable alternatives such as heat pumps, using electricity or district heating, using waste heat from the industry and geothermal heat.

This is a huge and very complex challenge because the heat transition impacts not only the owners and end-users of buildings but also the urban and regional environment. In order to contribute effectively to the Paris Agreement goal by 2050, reduce CO_2 emissions by 80-95% from all energy use, the transition from natural gas to free from fossil fuel heating is essential. To achieve this, Rotterdam needs to change the heating of 8,000 buildings and replace 40 km of gas grid every year, starting now.

We do not exactly know how the transformation will take place and what is needed. Clearly, significant cooperation is needed, not just between the local and national governments

but also between grid owners, heating companies, home owners – both housing corporations and privately-owned properties – and all citizens.

The transition will require extensive investment and provoke upheaval and challenges. But it brings manifold opportunities to the city and its citizens, such as cleaner air, new jobs and a more comfortable living environment.

Only when we can benefit from these opportunities will the transition change from slow and almost arbitrary to a larger, more coherent transformation of districts that has great and far-reaching impact.

One of the main issues is balancing the costs and benefits. In the short term an optimal solution can only be executed when the costs and benefits are divided fairly. For the long term it is important to value early adopters, who are badly needed during the transition, to ensure that they continue to reap the benefits of their investments. In a sense, we are in a prisoners' dilemma, where people make decisions for their individual benefit rather than the combined benefit of all involved.

To make the challenge even more complex, the current low price of natural gas in the Netherlands impacts the cost-benefit equation, as it is cheaper to take no action than to make the transition away from gas. Furthermore, most additional benefits, such as air quality, are not accounted for in business terms. In short, the transition is currently being hindered by inadequate rules and regulations and insufficient financial arrangements.

Another dilemma concerns the extent to which the local government can and should coordinate the transition. On the one hand, local initiatives are crucial in building political support for the transition and encouraging new innovation, so it is essential to nurture these bottom-up initiatives. On the other, a more district-oriented coordination will make possible wider opportunities such as economies of scale by involving all parties, not just those at the grassroots, in the transition. This top-down approach can prevent the accumulation of unnecessarily high total costs. The downside is its potential to stifle local initiatives and inhibit innovation.

I believe the city should be a smart orchestrator of the transition. It can encourage a focus on the most economical combination of energy-saving measures for buildings and changes in energy systems, and also benefit from opportunities and facilitate grassroots initiatives and innovations.

Heating pipes used in the city of Rotterdam

Local initiatives are currently supported wherever possible. On top of this a new approach is being developed in collaboration with stakeholders towards a district-oriented agreement. In this approach the city is the conductor, aiming to realise economies of scale by combining operations, while also using the transition as a driver for improvements to the city. The district in transition is scanned for improvement opportunities arising from local concerns, for example parking problems or social cohesion, while initiatives in these districts are also supported. This approach will not only result in lower emissions, cleaner air, more jobs and a call for innovation, but will also have a valuable and positive social and environmental impact. The district-oriented agreement should be between all local players, laying out how stakeholders will reach the end goal and detailing the planning, actions, responsibilities, timing and financial conditions.

However, this is easier said than done. Moreover, the coming decades, during which the city will be in transition, are likely to witness great changes. A flexible approach towards the transition is therefore essential. At the same time, it is important not to simply wait for innovations to happen. We need to start now by creating confidence in the chosen direction and be flexible enough to adapt to changes. As well as the city, the grid owners, building owners and citizens need to be flexible and agile.

To cash in on local opportunities, all stakeholders need to participate and be willing to share both costs and benefits. This

Rotterdam needs to change the heating of 8,000 buildings and replace 40 km of gas grid every year, starting now

sounds easy but history tells us it is not. Breaking the prisoners' dilemma is difficult, although the currently established approach of transparency, open dialogue and a common goal is an excellent starting point.

The main paradox in this transition is the apparent conflict of approaches. Bottom-up action is needed to build momentum and awareness as well as to create an environment that enables new and badly needed innovations. A top-down approach will ensure optimisation of the transition, resulting in the lowest total costs and highest benefits for all citizens, both within and outside of the energy domain, and speeding up the transition.

Rather than debating which is the better approach, we need to embrace the uncertainty a transition brings. We also need to learn to value all progress, including initiatives that perhaps do not match the initial vision, and be willing to sacrifice personal preferences and individual benefits for a better overall result. This – the sharing of all costs and benefits – might be the biggest challenge of all, as well as an opportunity to show greatness.

Kochi leads mobility in a sustainable way

> ***To be successful, the metro needs to be accessible to pedestrians and cyclists and be well-integrated with the urban landscape and other modes of transport***

Rajnish Ahuja, Project Coordinator for Urban Transport at the French Develpment Agency (AFD), New Delhi, India

Marion Hoyez, Project Manager at CODATU, a French public transport organisation, France

Kochi is the commercial capital of Kerala as well as the largest and most vibrant agglomeration in the state, and it has the highest Human Development Index in India. In the past decade, the city has witnessed increased economic growth. As with other major Indian cities, its population growth and the rising living standards of its middle class have led to a large increase in personal vehicles. The modal share of public transport fell from 73% in 2005 to 49% in 2015.

Kochi therefore decided to build a metro system to relieve the city of congestion and pollution. This took form with a special purpose vehicle called Kochi Metro Rail Limited (KMRL). The project is financed by the Government of India, the Government of Kerala and the Agence Française de Développement (AFD). The eighth metro system in India, it has been backed by a comprehensive vision and been completed remarkably fast and at little cost. The metro began operations on 17 June 2017 and is projected to be used by 360,000 passengers a day from 2018 and 550,000 in 2033.

As they designed and implemented the Kochi Metro, the French-Kerala cooperation team discovered five core values that were keys to its success: integration, innovation, inspiration, communication and cooperation.

INTEGRATION

KMRL made a public statement that 'the metro alone will not solve the congestion problems in the city'. To be successful, it said, the metro needs to be accessible to pedestrians and cyclists and be well-integrated with the urban landscape and other modes of transport. KMRL has evolved from a metro company into an urban planning and mobility agency of the city of Kochi. Ultimately, KRML will work jointly with the Metropolitan Transport Authority, a unique organisation overseeing and regulating all public transport in the city.

KMRL has designed a seamless integrated public transport system combining metro, bus corridors, water ferries, feeder routes, shared bicycles and walkways to the railway network. An early initiative was to revamp the water transport system to improve accessibility to the mainland for thousands of islanders, and to develop this as a feeder service for the metro. In total, the network will be composed of 16 routes, 78 modern ferries and around 38 jetties. It will serve 10 islands and should be in place by 2018.

KMRL prepared a bus route plan for the Greater Kochi Region (GKR) with three clear objectives: avoidance of competition with the metro, better coverage of the territory and efficient integration with other modes of public transport.

KMRL's ambition expanded to all mobility-related planning. It placed importance on the development of open spaces, walkways and cycle paths to ensure an equitable sharing of public space among Kochi citizens. The space given to traffic has been reduced, and comfortable sidewalks and bicycle lanes have been built.

The first pilot project was inaugurated in July 2016 in Panampilly Nagar, a residential area whose vacant land was transformed into a 750-meter-long walkway and cycle path. This project intended to show how, with a limited budget, an urban area can be transformed and revamped with good lighting, greenery, proper stops at each intersection and universal accessibility. Open-street days or 'street festivals' were organised to show everybody how good it would be to live in a car-free city, with less noise and less pollution.

INNOVATION

KMRL also acquired a good reputation through innovative projects using intelligent transport systems, a critical component of every transport project. KMRL used a public-private partnership with AXIS Bank to introduce a cobranded debit card that can also be used as a mobility card to access all modes of public transport. Another enterprise has been the development of the 'Kochi One' mobile app,

which acts as a journey planner and generates QR code tickets for travel. In addition, it can be used to pay public utility bills and access other city information.

KMRL also took into consideration the people working on the project, and it is the first metro company in the world to have balanced recruitment of men and women in departments. It signed an agreement with Kudumbashree, a poverty eradication and female empowerment programme run by the Government of Kerala. Its crew of 774 women is the largest of any metro in India, and is a significant step towards making the metro system more female-friendly. KMRL has also decided to hire transgenders as part of the crew, a first for a government-owned company in India.

INSPIRATION

Kerala's territory and culture were a major source of inspiration for the Kochi Metro and were reflected in specific themes given to the main stations.

KMRL has also invested a lot of time and energy in developing a flat organisation that promotes collaboration and creates internal dynamism. The result is a common vision of urban transport challenges.

COMMUNICATION

Kochi Metro has extensively used social networks to inform and involve citizens. It made a special effort on branding, working with a specialist company, as well as on the aesthetics of the stations and rolling stock. Before the official opening of the metro, a special preview ride was given to differently-abled children, elderly people and migrant workers.

Open-street days or 'street festivals' were organised to show everybody how good it would be to live in a car-free city, with less noise and less pollution

COOPERATION

Kochi Metro has benefited from first-hand experience from major French metro authorities, designers and operators. In 2015, AFD, KMRL and French public transport organisations CODATU and SYTRAL signed a two-year agreement to cooperate and accompany the metro project. Lyon in France became a partner city because of it has similar numbers of inhabitants and mobility challenges. CODATU and SYTRAL organised eight interactive workshops in Kochi, three study tours in Lyon and one preliminary study. It also coordinated an open-street day. This results of this partnership can be seen in the various initiatives towards intermodal integration.

KMRL has set an example for other metro companies in India and around the world. From the start, it has been 'more than just a metro', and has earned an excellent reputation in the city, the country and worldwide.

CASE STUDY

SINGAPORE'S PUBLIC HOUSING: green, sustainable and liveable homes

The HDB is the public housing authority in Singapore. It was born in a crisis in 1960 to address an acute housing shortage situation. HDB places importance on the building of communities, and has earned much international acclaim, including the 2010 United Nations Habitat Scroll of Honour Award.

Over 80% of Singapore's residents live in close to a million apartments run by the Housing & Development Board (HDB), making it Singapore's largest planner and housing developer.

In line with Singapore's efforts to promote sustainable development, HDB seeks to create a high-quality living environment that is green, liveable and sustainable. New public housing projects are planned with greenery and sustainable features, while older estates are continually enhanced with green features.

DESIGNING COOL AND SUSTAINABLE HOMES

From the outset, every HDB precinct is designed to embrace local climatic conditions, so as to conserve energy and optimise its use. This is done by adopting

passive design strategies that improve ventilation, reduce heat gain and minimise the reliance on mechanical cooling. These include the following:

Building Orientation: The majority of HDB apartments are oriented on the north-south axis to reduce heat gain and glare from the sun into the units, and take advantage of the direction of prevailing winds. Insulated gable end-walls are also provided on the eastern and western sides as heat barriers.

Cross ventilation: To promote cross ventilation, façade openings such as windows are maximised on the north and south sides of buildings to capitalise on prevailing winds and maximise air flow. More window areas have also been incorporated into the design of the apartments for better natural lighting and ventilation. Today, some of our apartments come with living-room windows that are nearly full-height, and bedroom windows that are three-quarters height.

Utilising void spaces: In a typical HDB block design, part of the ground-floor space is kept open, or 'void'. Besides serving as community space for a wide variety of uses, these void decks also help to draw wind onto the ground plane and improve wind flow within the precincts, making the living environment breezier. In addition, the porosity allows more-direct and convenient pedestrian movement through the blocks, as pedestrians do not have to skirt around them.

In our planning and design process, we also make use of new technologies to optimise the elements of nature to create the best possible homes. For instance, we employ smart town-planning tools such as “urban environmental modelling”, which allows us to analyse the wind flow, solar irradiance and shaded areas within a town. We can then determine how best to design and site apartments and community facilities, or we can plant more greenery to mitigate heat in hot spots to provide maximum thermal comfort for residents.

EVERY APARTMENT IS AN ECO-FRIENDLY HOME

In 2014, HDB took another significant step towards sustainable development: it made every new HDB apartment an eco-friendly home. All new HDB apartments launched for sale from January 2014 come with a standard suite of eco-features to help build a greener, cleaner and healthier environment for Singaporeans.

The suite of eco-features in HDB apartments helps to manage water, waste and energy more efficiently. They include centralised chutes for recyclables (CCR) to promote

CASE STUDY

recycling; eco-pedestals in bathrooms, which recycle water so it can be used for toilet flushing; LED lighting with motion sensor controls in common areas; and regenerative lifts that help to lower energy consumption by up to 20% through the harnessing of renewable energy.

TAPPING THE SUN

Given Singapore's geographical size, lack of natural resources and tropical weather with lots of sunshine, solar energy is the most feasible source of renewable energy. In 2009, HDB embarked on a solar capability building programme to enable Singapore to harness solar energy on a scale that would have an impact in spite of our limited land space.

Solar photovoltaic (PV) systems installed on the rooftops of HDB apartment blocks can generate clean energy for common services such as lighting, lifts and water pumps. This also contributes to the reduction of our carbon footprint in the long run. With about 10,000 HDB blocks located on the island, HDB is currently the largest stakeholder in the installation of solar PV systems in Singapore.

Today, solar panels have been installed in more than 900 blocks, generating enough electricity to power around 10,000 HDB apartments. HDB has also committed to install solar panels in about 5,500 HDB blocks by 2020, contributing strongly to Singapore's plan to raise solar power production to 350 Mega Watts peak (MWp) by 2020. With solar PV capacity of 220MWp, 265 Giga Watt hours (GWh) of clean energy can be generated annually, reducing annual carbon emissions by 132,500 tonnes.

KEY ECO-FEATURES IN HDB DEVELOPMENTS

Living environment	HDB estates have been designed to embrace local climatic conditions, thereby reducing dependence on fans and air-conditioning.
	Bicycle parking lots and wheel ramps encourage cycling.
Waste and water management	A centralised chute encourages recycling
	Eco-pedestals allow water used for hand-washing to be re-directed for toilet flushing, saving up to 1.25 litres per flush
	Compost bins in community gardens collect leaf litter, grass clippings and other organic matter. The compost is used to fertilise landscape shrubs and plants.
	Recycled materials – such as concrete and water – and sustainable products are used in construction.
Energy-efficiency	LED lighting with motion sensor control is used in common areas such as staircases.
	Regenerative lifts convert the braking and motions of lifts into energy for other uses. Lifts use a green fuel-cell system for backup power instead of conventional battery-operated sources.
Rainwater use in Punggol Town	Rainwater is collected to wash common areas.
	Active, beautiful and clean (ABC) features use rainwater to beautify the landscape.

PART 3

GREEN SOLUTIONS

BOOSTING CITIES' ECONOMIC GROWTH

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E-mobility and smart grids: the building blocks of clean, efficient cities

> ***E-mobility technology is ready for the mass market and the benefits are many***

Massimiliano Calamea, Head of European Affairs at ENEL

Just as cities can be the source of a plethora of environmental issues, they also offer tremendous opportunities for improvement and can lead the transition to cleaner and more-efficient ways of living.

One of the main sources of pollution in cities is vehicles. By focusing on transportation we can significantly and quickly improve people's lives. Electrifying transportation improves air quality, enhances energy efficiency and makes a significant contribution to fighting climate change.

The "tank-to-wheel" efficiency of electric motors is between 80% and 90%, which is much higher than the 20% to 30% achieved by internal combustion engines (ICEs). At the local level, electric vehicles (EVs) do not produce pollutants such as thin powders, organic volatile compounds, CO2 and Sox. So they improve air quality dramatically and also reduce noise pollution.

Light commercial vehicles have a particular impact on mobility in town centres, and their number is expected to increase in coming years.

The replacement of ICE vehicles with lightweight, electrically-driven vans will reduce noise pollution in town centres and contain polluting emissions, as these vehicles are suited to short-to-medium range journeys in an urban setting.

E-mobility technology is ready for the mass market and the benefits are many. But smart grids are also crucial. They support the development of e-mobility as well as playing a structural role in smart cities by providing part of the infrastructure needed to activate new approaches to urban ecosystems.

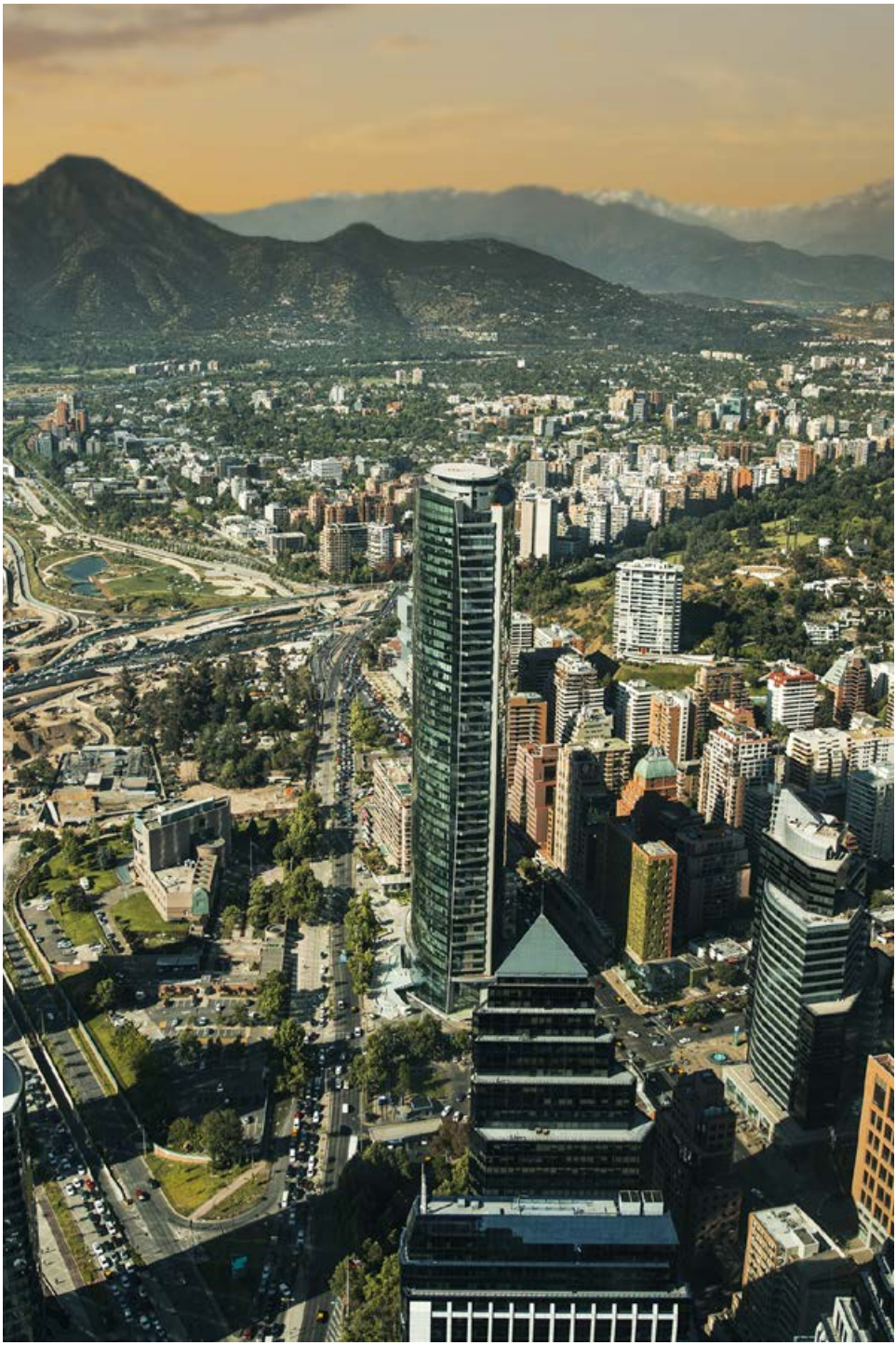
Smart grids and their basic building blocks, smart meters, enable consumers to actively manage their own energy demand and adopt energy-efficient patterns of behaviour. As most of a vehicle's lifetime is spent idle, demand-side management and behind-the-meter services provided through electric vehicle batteries and their "smart charging" can empower consumers. Ultimately, this will save energy, improve customers' total cost of ownership and accelerate mass market rollout.

We can derive benefits from EV batteries through uni-directional solutions, or simply "smart charging": charging more during periods of lower demand and less at times of high demand, or charging through a photo-voltaic panel. Bi-directionality, in the form of vehicle-to-grid (V2G) technology, allows plug-in electric vehicles to communicate and provide a reverse power flow to the power grid. This helps provide critical balancing services to the entire grid system. V2G is already being commercially exploited by Enel in Copenhagen, Denmark. V2G technology turns electric cars from a means to get from one point to another into batteries on wheels. When cars are plugged in, they become a fully integrated part of the electricity grid, helping to stabilize it and unlocking new revenue streams.

Our work in Copenhagen provides grid services through a business fleet of electric vans. The vans can be plugged into the V2G units and receive energy from the grid and then supply energy back from it through bidirectional power flow. The vans are effectively turned into mobile energy solutions. The platform that operates the V2G units ensures that the customers' preferences and comfort requirements are always met, while demand-side management services are optimized for the grid. Through bidirectional V2G chargers, the fleet has become an active participant in Denmark's energy management system.

The significance of this intelligent interaction between EVs and the grid is huge. Not only can users receive compensation for intelligently managing their charging processes, but the stability of the grid is enhanced, further enabling the integration of renewables into the generation mix. This objective is the core of Enel's overall energy strategy.

Elsewhere in Europe, Enel is playing an integral role in the development of the Florence Smart City, a lab for public and private electric mobility and energy efficiency. The project is be carried out in collaboration with the Municipality of Florence and is a best practice in Italy.



Florence currently has 179 Enel recharge stations for public use, giving the capital of Tuscany more recharge stations than any other Italian city. The Enel infrastructure consists of pole stations offering smart and interoperable recharges, which can deliver electricity to the new generation of vehicles, as well as to those already in circulation.

Over the next five years, €10 million will be invested by Enel to improve energy efficiency through smart grids and smart lighting, sustainable mobility and an urban control centre.

Florence is also the Italian municipality with the highest number of all-electric taxis. A hundred additional taxis will be converted to electric power, while fast-recharge stations will allow them to recharge in about 20 minutes.

Additionally, the FURBA (Florence Urban Rapid Bus Transport) project plans to activate a public transport corridor using four all-electric buses to guarantee service every five minutes. As part of this project, Enel will be installing a fast-recharge station capable of delivering a full recharge to an electric bus battery in 10 minutes. Enel will also provide a set of smart-charging stations using energy generated by photovoltaic panels.

The partnership is also active on the ultra-broadband front with Open Fiber, a joint venture between Enel and Cassa Depositi e Prestiti (Cdp) to create infrastructure using FTTH (Fiber to the home) technology. After an investment of some €50 million, about 80% of premises in Florence will be connected by 2019.

These solutions are not just relevant in Europe. Urban transportation is evolving around the world and another interesting project is taking place in Santiago de Chile. Until a few years ago, using electricity for transport around the city was not considered a viable possibility. Today, Santiago boasts an impressive number of electric-vehicle charging stations and clean

mobility initiatives. A network of 130 charging stations has been installed by Enel Distribution in 64 districts of the capital. Electric taxis circulate in the city, demonstrating their applicability and potential for other cities.

Enel also inaugurated the city's first 100%-electric bus route in conjunction with the Municipality of Santiago. A pilot programme in conjunction with the Municipality of Lo Barnechea aims to incorporate electric bicycles into the inter-district network of Bike Santiago, the public bike system of the capital of Chile.

Cities can and are serving as launchpads for clean and efficient technologies. As we work to find new ways to apply these technologies in our cities and beyond, our future looks bright.

EXTEND YOUR KNOWLEDGE

PARIS AGREEMENT

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

On 5 October 2016, the threshold for entry into force of the Paris Agreement was achieved. The Paris Agreement entered into force on 4 November 2016 and is currently ratified by 169 Parties out of the 197 to the Convention.

The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts.

In 2018, Parties will take stock of the collective efforts in relation to progress towards the goal set in the Paris Agreement and to inform the preparation of NDCs.

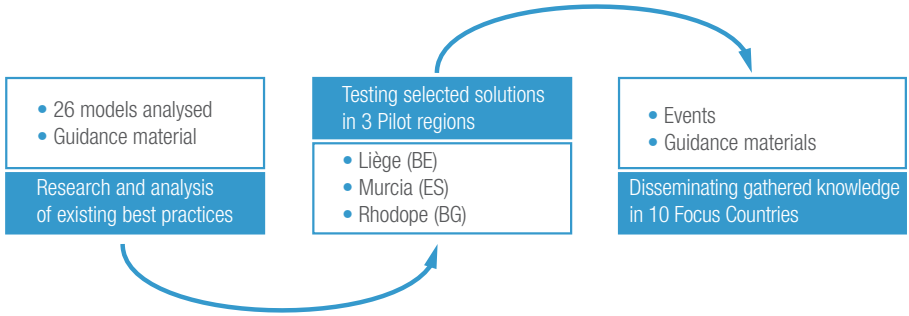
It is expected that more and more local and regional governments will step up to help the world reach the goal of the Paris Agreement. International frameworks such as the New Urban Agenda and the Sustainable Development Goals in addition of the Paris Agreement as well as leading coalitions for cities and regions such as the Covenant of Mayors and the C40, who have been designed to shape global development in an increasingly urban world.

CASE STUDY

CITYnvest: innovative financing for energy efficiency in building renovation

Maria Giovanna Zamburlini, CITYnvest Project Officer at the Council of European Regions and Municipalities (CERM)
Giustino Piccolo, CITYnvest Project Coordinator at Climate Alliance

Cities are places where people move and consume, and where most economy activity takes place. With more than half the world population living in cities, urban areas are becoming massive consumers of energy and the primary source of greenhouse gas (GHG) emissions. A constellation of cities, acting as pioneers of the low-carbon transition, have committed to a more-sustainable use of energy, putting the building sector at the core of their strategies. Buildings are responsible for 36% of CO2 emissions in the EU and 40% of energy consumption, so it is clearly vital to boost investment in sustainable building renovations in cities in order to achieve



a clean energy transition in Europe. Yet, municipalities find accessing finance one of the main hurdles to moving from plans to action.

CITYnvest acts a source of practical information on innovative financing models. In three pilot regions in Europe, it has been supporting the implementation of different models, such as energy-performance contracting, third-party financing, revolving funds and cooperative models. In parallel, it has provided training sessions for local authorities in 10 European countries with the aim of accelerating the energy transition and putting cities at the forefront of this transformation.

WHERE IS CITYnvest ACTIVE?

Key results

A participatory approach has been put in place in three EU regions. Regional actors have engaged local governments and investors, and these are now directly involved in the set-up and implementation of ambitious investment plans for renovation.

Capacity-building programme

- Over 650 local authorities and 300 other stakeholders trained in 10 focus countries

CASE STUDY

Murcia region

- Development of a business plan for the energy-efficiency renovation of some 400 public buildings
- €1.8 m of investments triggered to implement the energy-efficiency plan for the renovation of the Murcia building stock
- 17 m kilowatt hours (kWh) expected energy savings in the 392 buildings included in the Public Buildings Energy Efficiency Plan

Liège region

- Five energy performance contracts of nearly €60 m implemented; 134 buildings to be renovated from 2017 onwards; and a reduction in energy consumption of 34%
- Up-scaling of the one-stop shop RenoWatt to RenoWatt+ with a planned investment volume of €120 m
- Over 45 municipalities in Liège and other provinces in Wallonia involved in the one-stop shop

Rhodope region

- Set up a one-stop shop involving six municipalities, the Association of Rhodope Municipalities and the Sofia Energy Centre
- Two project pipelines with expected total investments of €11.5 m to refurbish 42 public buildings and €1.7 m to improve street lighting in 46 settlements
- Expected energy savings of 8.8 gigawatt hours per year

CITYnvest provides the following types of documents to guide local governments:

- Benchmarking of 26 innovative financing models
- Recommendations matrix: a self-assessment tool for local authorities to choose the most suitable project development unit (PDU) models to carry out large-scale energy retrofitting projects in their territory. The matrix is organised around a set of questions addressing three different macro areas:

Macro areas	Recommended models
Operational model – including questions on the type of services offered by the PDU	Facilitation or integration
Aggregation model – an add-on to the operational model including questions on project aggregation	Bundling and/or pooling of projects and/or beneficiaries
Financing model – including questions on possible financing sources	Private fund, financial institutions, Energy Sevice Company (ESCO), PDU Financing, investment fund, citizens financing

- Guide for the launch of a one-stop shop on energy retrofitting: a practical, step-by-step guide to starting a project.

- Action template: a structured overview of steps needed to develop a financing model for energy efficiency. This includes decision mapping showing the steps to launch the process: for example, analysis of the level of ambition in terms of energy saving and emissions reduction, winning political commitment and choosing the operational and financial models. For each element of the decision mapping, strategic questions are addressed and a set of practical actions are identified.

- Tools to overcome barriers to the development or implementation of projects: Barriers can be related to the implementation model, operating service, level of ambition and type of funding vehicle. For instance, some CITYnvest regions experienced a barrier related to the operating service. The projects' potentials were too small in terms of energy consumption, energy savings or investment to be viable in terms of things such as transaction costs and energy savings. Or else they were too small to be attractive for the supply market or for EU funding. Using the tool, the regions have been able to take action such as project bundling, which allows both private and public funds to be unlocked.

Sustainable development of Cities amid the energy transition

> ***Cities and municipalities are important because of their increased engagement in the fight against climate change and the acknowledgement of their role by national governments***

Hanna Gronkiewicz-Waltz, Mayor of Warsaw, Poland

We are living in the era of cities. Key international documents, such as the United Nations 2030 Agenda for Sustainable Development and the EU Urban Agenda, acknowledge cities' growing role in facilitating sustainable global development. This is not surprising: in 1950, just 30% of the world's population lived in cities, but today 55% do. By 2050, that will reach 66%, meaning 6 billion people will live in urban agglomerations.

This change brings risks but also an opportunity to improve global welfare by shaping cities in accordance with the principles of sustainable development. These ideas appear under different names, such as green cities, smart cities and sustainable cities. However, their meaning is largely the same. They all assume a holistic approach to cities based on the commitments of decision makers; improvements of an organisational and institutional nature; capacity building; and municipal planning in cooperation with citizens and other stakeholders. They also imply a gradual transformation towards cities that are efficient, environmentally friendly and open to their citizens – so they might use innovative pilot projects and initiatives to test possible large-scale solutions.

Human-induced climate change interferes with all the other goals of sustainable global development: without climate protection development in other fields will be slowed. The 2016 Paris Agreement at the COP21 conference, as well as other agreements over the past two years, have made important commitments to tackle climate change. The world's biggest economies have also made joint efforts to reduce greenhouse gas emission. Nevertheless, crucial issues still need to be addressed – especially after the recent, unfortunate policy change by the US administration. These topics include adaptation to climate change, the transfer of innovative and energy-efficient technologies and a comprehensive financing of actions, which are of particular importance to developing countries. Cities and municipalities are important because of their increased engagement in the fight against climate change and the acknowledgement of their role by national governments.

Key elements include changes in consumers' energy behaviour, a shift towards electric mobility and an efficient transition of energy-producing sectors. The energy transition is also important because of its implications for energy access and security. Goal 7 of the UN

Sustainable Development Goals says: “Ensure access to affordable, reliable, sustainable and modern energy for all”.

In the 2016 Pact of Amsterdam, the European Union emphasized challenges at the level of local governments and also their partners – as the scope of the issues reaches beyond the borders of municipalities. Consequently, the EU Urban Agenda provides for the establishment of partnerships in 12 fields, one of which is the Energy Transition Partnership. It is coordinated by a team from Gdańsk in Poland, London in England and Roeselare in Belgium. Warsaw is one of the partners.

The opportunity for direct and organised influence by cities on both EU and national policies, for example on energy, is invaluable. Warsaw is a dedicated advocate of such possibilities. We joined the Energy Transition Partnership after cooperation with the network EUROCITIES. However, the current Polish government is reluctant to acknowledge the essential role of municipalities.

Energy transformation is relevant for cities because they consume 80% of Europe’s energy and generate 70% of its greenhouse gas (GHG) emissions. The energy transition requires a long-term structural change in energy systems. Only then will it be possible to create a more-integrated and smarter energy system to balance supply and demand at the EU, national and urban levels. The proposed approach focuses on minimizing energy demand and simultaneously diversifying energy sources by increasing the use of renewables, waste heat

and power-to-gas solutions. Cost-effective combinations of energy storage should also be maximized and smart-grid solutions should be deployed to decentralize the energy system.

Over the last 10 years, Warsaw has realized a number of large, sustainable projects, and more are planned for the near future. They include the modernization and extension of the Czajka treatment plant, which can treat all the wastewater released to the Vistula River and provide a source of clean energy from the incineration of biogas originating from sludge fermentation.

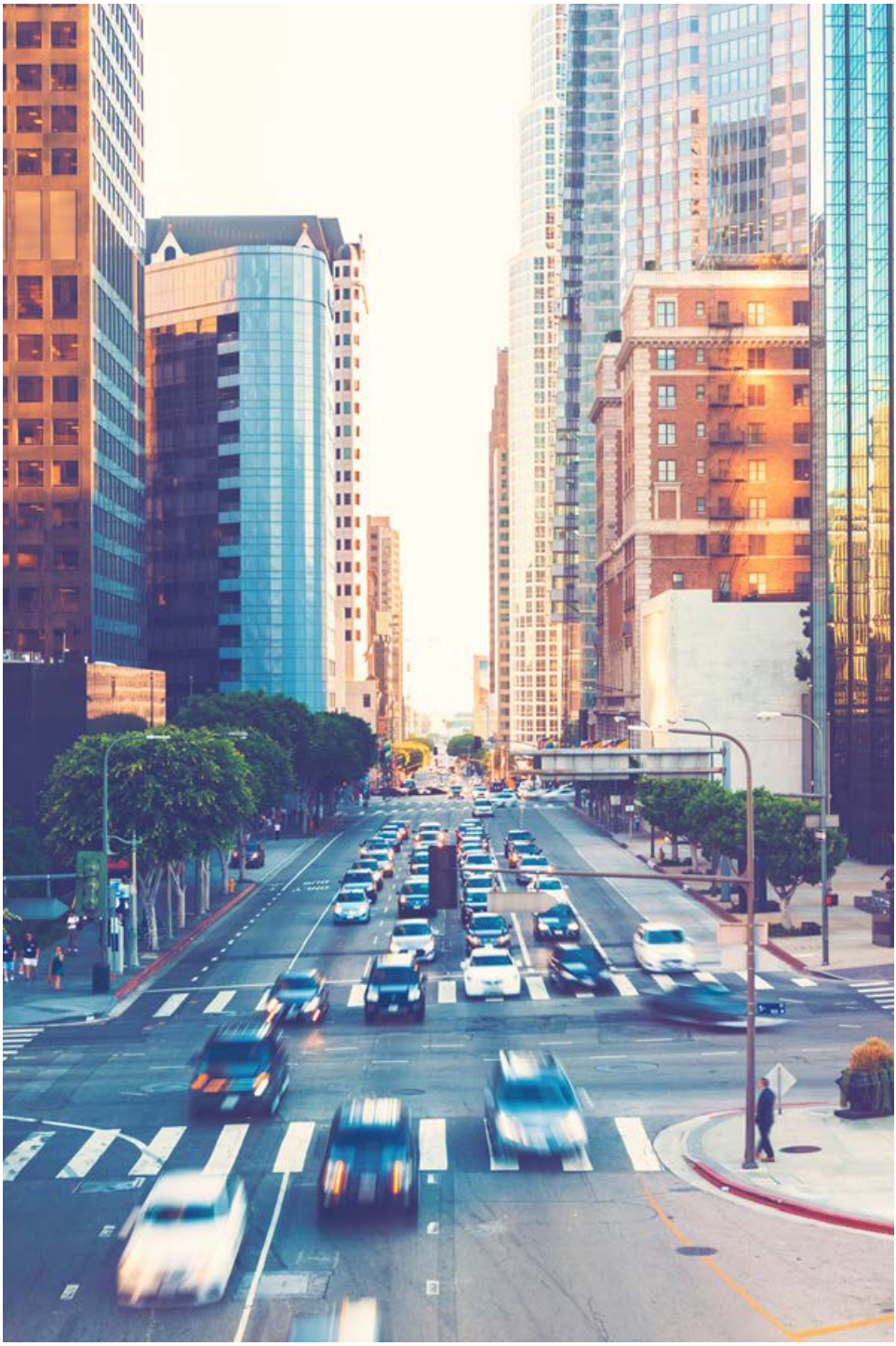
Over the last 10 years, Warsaw has realized a number of large, sustainable projects, and more are planned for the near future

In addition, public transport is being electrified. A second metro line is being constructed. New tramways are being built, and more than 200 trams equipped with regenerative brakes are being bought. The municipal bus operator will be in possession of 160 electric buses by 2020. The successful city bike system, Veturilo, has introduced electric bikes, while a car-sharing system will be launched in the near future and later be supplemented with electric vehicles.

The city and its partners are also differentiating the energy mix and improving energy efficiency. A massive biomass block was launched recently in the Warsaw heat and power plants system, and it will be supplemented before 2020 with a block that combusts natural gas. On a smaller scale, the city is supporting dispersed, renewable energy installations by establishing these as standard in new municipal buildings. The city is also investing in smart grid solutions and smart metering, both for municipal buildings and private households.

Warsaw is already a role model for energy transition in district heating: its system, the largest in the EU, satisfies the needs of 80% of residents. The municipal solid waste incineration plant will soon provide the system with an additional source of renewable electricity and heat. Finally, the city is continually promoting energy efficiency and climate awareness among citizens, companies and municipal staff.

To become more sustainable and energy-efficient, cities need increasing external support. More legal competences should be transferred to local governments, which should receive greater financial support, including EU funds. The city level is optimal for planning, implementing and financing urban innovations. European cities, including Warsaw, are willing to cooperate with both European and national administrations. Only through such cooperation will it be possible to achieve the EU climate and energy goals and successfully deliver the energy transition.



Cities are the nexus for climate action

> ***Cities will account for 70% of the demand for infrastructure over the next 15 years***

Victor Gancel, Programme Manager at Climate-KIC, the Low Carbon City Lab (LoCaL)

The 'New Climate Economy 2014 Report' estimated the global investment needs for a low carbon economy at $93 tn between 2015 and 2030, not taking into account funding for adaptation to the impacts of climate change. But worldwide climate finance in 2014 was estimated to be in the range of $340 bn to $650 bn. Out of the total infrastructure investments made each year, a small fraction could be labelled as green, estimated at between 7% and 13% in 2013.

An initial study by the IPCC put global climate adaptation needs at between $70 bn and $100 bn for the 2010-2050 period, but a recent 2016 UNEP report put the costs in the range of $140 bn to $300 bn per annum by 2030 – compared with adaptation-related finance of about $25 bn in 2014.

As recognized by the EU High-Level Expert Group on Sustainable Finance, current EU investments are not at the scale necessary to achieve its energy policy targets: the investment gap is €1.7 tn.

SIGNIFICANT OPPORTUNITIES TO UNLOCK CLIMATE FINANCE

A convergence of global factors creates significant opportunities to direct the necessary funding towards a global low-carbon and resilient economy.

Worldwide monetary stimulus since the financial crisis has not produced a return to pre-crisis investment levels, and long-term investors have expressed a high demand for infrastructure investment opportunities.

Institutional investment in infrastructure is around $500 bn, and it might be plausible to double or triple these investments in the next 15 years.

Cities will account for 70% of the demand for infrastructure over the next 15 years. Urban infrastructure investments made over the next five years will determine up to one-third of the remaining carbon budget under a 2°C scenario. Over the 2010-2025 period, cities are estimated to grow by 65 million inhabitants per year, and they are expected to host two-thirds of the world population by 2050.

SCALING UP CITY ACTION

	Barrier	Effects
Macro	Uncertainty over regulatory and tax policy	Prevents prospective investors, increases risk sensitivity & lack of integration
	Lack of proven funding models for low-emission & resilient projects	Unfamiliarity of investors with climate & resilient projects, increases risk sensitivity
	Lack of transparent project pipilines & agreed best practices	Missed opportunities, infrastructure investments still seen as „exotic“
	Difficulty in integrating climate goals in urban planning	Climate action given a lower priority, no climate action performance metrics
	High transaction costs for low-emission & resilient projects	Deters investments from cities and investors, hinders project development past design phase
	Insufficient city control over infrastructure planning	Lack of control of direct investments, cities cannot capture revenues & cashflows
Micro	Lack of city expertise in developing low-emission & resilient projects	Cities develop fewer projects, absence of investment opportunities for investors

Urban growth will drive demand for transport, water, housing and energy infrastructure, but past investment levels have not been high enough. Since 2015, the Climate-KIC has been managing the Low Carbon City Lab (LoCaL), a programme aiming to unlock climate finance for cities.

LoCaL aims to do so by influencing public and industry policy to ensure alignment between investment plans and environmental outcomes. As such, LoCaL the programme supports the development of standards for urban climate action, enabling result-based finance. Given the gap between investors and cities, LoCaL aims to mobilize a community of investors and public sector officials, to accelerate matchmaking and knowledge exchange. Through its online platform, LoCaL is building a large community of practice around sustainable infrastructure finance. Finally, LoCaLThe programme also enables the integration of the climate dimension in the decision making process by supporting the development of greenhouse gas monitoring and data systems relevant at city scale.

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To diversify their sources of funding, cities need new skills, such as infrastructure finance, knowledge of climate finance mechanisms, project structuring and climate solutions

finance. Finally, LoCaL enables the integration of the climate dimension in the decision making process by supporting the development of greenhouse gas monitoring and data systems relevant at city scale.

More than 30 EU organisations are involved in LoCaL, delivering Training & Capacity building, project preparation, investment mechanisms and impact assessment tools.

EMPOWERING EU CITIES IN TAKING ACTION

LoCaL aims to foster collaborations between research, education and innovation. It gives cities the opportunity to lead in innovative funding mechanisms. LoCaL is supporting innovative solutions around four main pillars:

Training and capacity building: To diversify their sources of funding, cities need new skills, such as infrastructure finance, knowledge of climate finance mechanisms, project structuring and climate solutions. Leveraging the Climate-KIC online training platform, LoCaL is creating a

knowledge hub combining physical workshops with massive open online courses (MOOCs). LoCaL's first courses comprise training in green bonds, results-based finance and cost-benefit analysis for adaptation.

Project acceleration: In a macroeconomic environment that should support infrastructure investments, it is puzzling to see how few cities are implementing transformational projects. LoCaL and Climate-KIC are dedicated to helping cities identify and design climate action. Together with CDP and the Matchmaker project, LoCaL is creating a database of climate projects within cities, to be made available to investors.

Investment mechanisms: Cities do not always know the right financial mechanisms to use for climate action, so LoCaL is launching a city finance lab to support the uptake of novel financing mechanisms. It is being implemented with the South Pole Group, Imperial College, FMDV and CDP. In parallel, LoCaL supports innovations by looking at sector-specific approaches such as funds to retrofit private buildings.

Impact assessment: The current methodologies and standards used by cities to assess their emissions often lack accuracy or are not meant to be used to track progress against climate ambitions. But accurate emission monitoring is often costly. So LoCaL is supporting sector-specific innovations in transport, using mobile-phone signal data to track traffic emissions; and in the waste sector, using atmospheric monitoring, with Telefonica Germany, Teralytics and the South Pole Group.

WAY FORWARD

The investment decisions made in cities over the next three to five years will likely determine whether or not we limit the global rise in temperature to 2°C. Most of the infrastructure investment to combat climate change will take place in European cities, and the EU has pioneering investment banks, structural and investment funds and leading city networks and innovators. So it would be a shame if European cities did not demonstrate global leadership in the global fight against climate change.

Introducing e-bikes within cities to decarbonise transportation

> ***Maintaining traditional urban means of transportation will not suffice to avoid gridlocked cities***

Guillaume Verhaeghe, Founder of Billy Bike, Brussels, Belgium

Cities are home to more than 70% of the European population. This leads to an increased concentration of motorised vehicles. With time, it is estimated that things will get worse. Moreover, the dominant mean of transportation is still private combustion engine vehicles, which emit large amount of greenhouse gases as observed with the recent car emissions scandal.

Consequently, one may define present mobility within cities as being difficult, inefficient and a source of unsustainability to be illustrated by repetitive and severe congestion, poor air quality, accidents, noise pollution and high CO_2 emissions. Recent studies have demonstrated that current transport systems in urban areas produce high external costs of about €230 billion annually, thus jeopardizing the European goals for a competitive and resource-efficient transport system as stated by the 2011 Transport White Paper, and the newly released Mobility Package from the Commission.

Maintaining traditional urban means of transportation will not suffice to avoid gridlocked cities and reach the Commission's target for clean mobility. Looking at the recent lower asset-mobility trends, new means of transportation such as shared mobility,

Billy

for instance car sharing and carpooling, can alleviate problems regarding urban transportation and solve current and future transportation challenges.

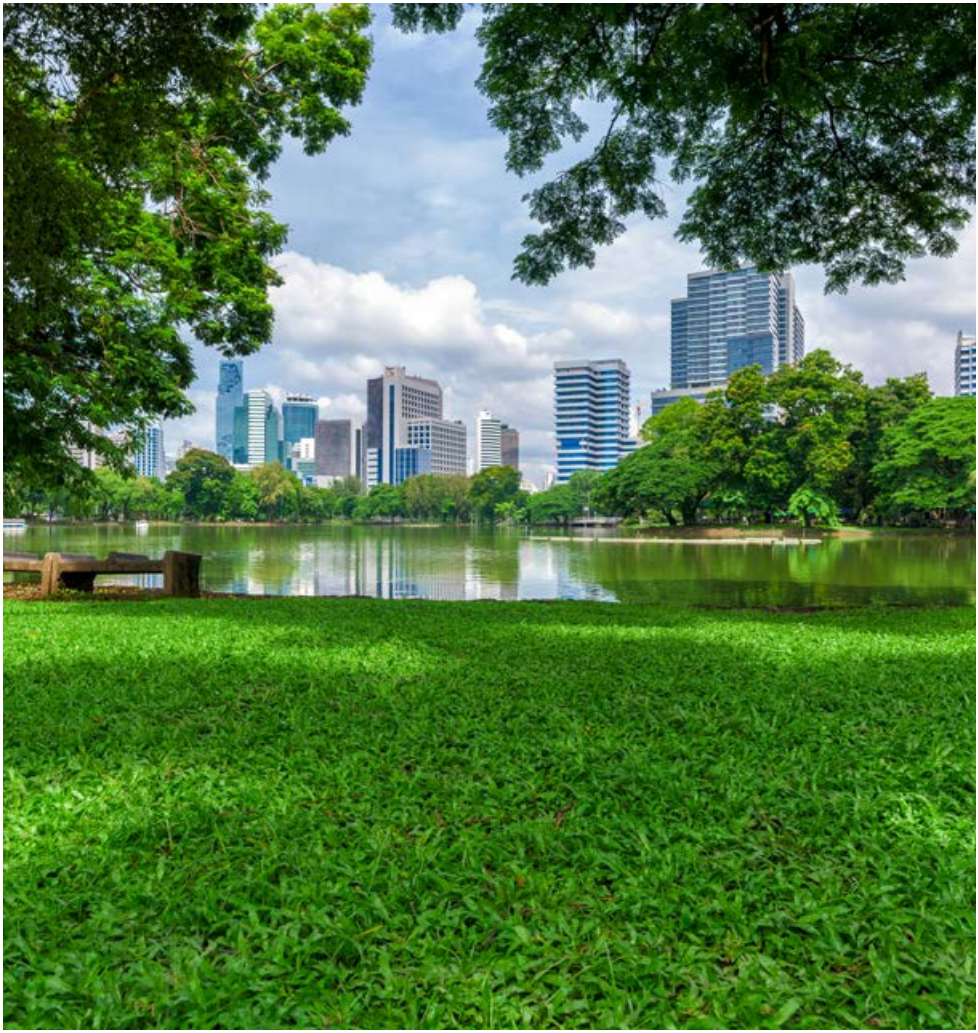
In this regard, bike sharing models have developed as a valuable instrument to considerably reduce negative externalities and foster sustainable, clean and energy efficient methods of mobility in urban areas. Bike sharing also comes with benefits: it encourages more active lifestyle and improves health. Bike sharing programmes have existed for 50 years. Nevertheless, major challenges resulting from increased motorised urban mobility (i.e. severe congestion, noise, and CO_2 emissions) and trends in personal mobility (i.e. lower asset-intensity mobility, enhanced interconnectedness and altered consumer behaviour) have made them a globally applicable, highly technological and integrated mode of transport. Low-priced and covering short-to-medium distances, bike sharing has filled the niche for inexpensive transportation in urban areas.

Recently, dockless free-floating bike systems have emerged due to trends in personal mobility and innovative technologies as response to the high implementation and operation costs of the docking stations, longer average walking distances and shortage of vacant spots to facilitate the embracing of these schemes by some cities.

Closely linked to the flourishing bike use, e-bike's market boom (i.e. 1.64 million unit sales in 2016) has been supported by 1) The user's desire of avoiding sweating during commuting trips to work (the most common use) and, 2) The growing use from elderly or people with health problems of this vehicle for long and/or difficult journeys.

In Brussels, free-to-download application Billy Bike was developed to help decarbonising transportation, as well as easing the day-to-day journeys of many. Billy shared e-bike's project aim to introduce one of the first dockless electric bicycle sharing system in the world which will boost bicycle as a real mainstream alternative to car, accessible to a larger group of people and for longer distances. The system is managed through an intuitive and simple-to-use free app allowing Billy e-bikes to be picked up and dropped off everywhere in a city. Through our internally developed procedure, we detect the e-bike batteries with low charge and a dynamic maintenance team switch them for new ones while supervising the e-bike maintenance. Hence, no docking stations are needed. We have performed over 500 beta testing rides this summer and now we are live since early September in the streets of Brussels with 150 e-bikes demonstrating our solution in a relevant environment.

PART 4
CONCLUSIONS



Friends of Europe identified key conclusions, drawn from the viewpoints and ideas presented in the articles of this publication. They reflect on the different opportunities and challenges cities and regions have encountered when addressing climate change and underline key solutions implemented for effective change.

DRIVE
THE CHANGE

Cities are smart orchestrators of the energy transition. They must lead by example to encourage the most economic combination of energy-saving measures for buildings and change in the energy systems. But adaptive action must increase in speed and scale on the ground. Increased momentum from cities can only lead to more robust policies more generally. To keep driving the transition, cities should show their leadership and act as champions of change.

INVEST
IN SUSTAINABILITY

Investing in green solutions and resilience is costly but results are highly valuable, not only for citizens' health but also for businesses and the international community. Significant financial capital will need to be mobilised, often despite a barrage of political challenges. One of the main issues is learning how to demonstrate a balance of costs and benefits. Finding the right trade-offs to ensure investment is profitable is extremely relevant.

COOPERATE
LEARNING BY DOING

National governments and the international community are finally acknowledging cities' critical role in the energy transition, but collaboration must go further still. Grid owners, heating companies, housing corporations and private home owners critically need to work with each other to accelerate change. For cities' investments to work, citizens and local businesses need to understand how they benefit from becoming part of the solution, such as through the creation of new jobs and improved air quality.

REPLICATE
AND SCALE UP

Some best practices are easily reproduced and should be broadly disseminated for adoption by all. Effective measures such as the decarbonisation of transport can thus become a feature of cities worldwide. Local energy agencies as well as city tech start-ups can offer services that are then globally scalable, and can be developed fast enough to have a real impact in the short term. What's more, cities are hubs of innovation. Each city must use its native talents to continually improve upon policies.

UPDATE
DISTRICT RENOVATION

Renovating older buildings has led to significant energy savings. Urban infrastructure investments made over the next five years will determine up to a third of the remaining carbon budget under the 2°C scenario. Renovation is therefore one of the most impactful ways to comply with the Paris Agreement, but also one that ensures cities are really stepping up a gear in the energy transition.

ENGAGE
CITIZENS

To ensure the transition is socially fair and inclusive, it is significant to engage citizens. Local authorities have a huge responsibility to encourage their citizens, help them understand the implemented actions and better explain how these initiatives can be directly beneficial to each individual. The more they understand the measures in place, the more they become part of the solution. When it comes to fighting climate change, citizen engagement matters and can help accelerate ambition to achieve bold climate and energy-saving actions.

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