



IKEM

COP WORKING PAPER

Sustainable Cities

November 2021

Institute for Climate Protection, Energy and Mobility

Sustainable Cities

Working Paper for COP26 in Glasgow (2021).

Authors

Friederike Allolio
Judith Kärn
Michael Kalis
Kate Miller
Roman Weidinger

Imprint

IKEM – Institut für Klimaschutz,
Energie und Mobilität e.V.

Magazinstraße 15-16
10179 Berlin, Germany

+49 (0) 30 408 18 70-10
info@ikem.de

For more information on IKEM's projects
and publications see www.ikem.de

Contents

Sustainable Cities	2
Introduction	4
What is a sustainable city?	5
The sustainable city on the international agenda	5
The sustainable city on the 2030 Agenda	5
The sustainable city as a multi-layer concept	6
Policy approaches for the sustainable city	7
Urban systems in need of transformation	7
Cross-cutting trajectories	8
Good-practice examples	10
Energy: Adelaide	10
Buildings: Washington, D.C.	11
Transportation: Copenhagen	11
Waste: eThekweni (Durban)	12
Water management: Wuhan	12
Sustainable City under the UNFCCC and the PA	14
Transnational coordination	14
International coordination	14
Resume	18

Introduction

Cities can be seen as standing on the frontline of a necessary global transition towards sustainability. At the beginning of this millennium the global urban population exceeded the rural population for the first time in history, while the landmass covered by cities merely amounts to 3%. Notably, the striking trend towards urbanisation shows no sign of slowing down: nearly seven out of every ten people are expected to live in urban areas by 2050.¹ With 80% of the global GDP generated here, cities are a major driver of the global economy.²

Rapid urbanisation leads to the greatest demand for food, energy, water, buildings, waste management and other services to be concentrated in and around cities. Accordingly, cities are responsible for the largest proportion of environmental impacts. Currently up to 80% of global CO₂ emissions are accounted for by cities, if indirect emissions are included.³ Cities also produce 50% of global waste and consume 75% of natural resources.⁴

These factors suggest that the urban system is inherently unsustainable. Based on other factors, however, urban areas appear to present the most suitable playing field for a sustainable transition. For example, cities offer a unique concentration of collective, economic, social and technological capacities for sustainability innovations. Although cities are confronted with the impacts of unsustainability, they also offer a proper context for experimenting with innovative solutions. As agents, cities are often best positioned to push policy towards promoting sustainability on a street level, along with restructuring a city's infrastructure and facilitating larger-scale environmental, social and economic innovations throughout the world. Cities can even potentially bypass barriers within

national level policy and decision making. In their dual role as both agent and location of change, cities have the potential to become major drivers for sustainable development.⁵

Meeting this potential soon is crucial: the issue of sustainable urban development cannot be separated from the global threat of climate change. During a speech at the C40 World Mayors Summit in Copenhagen in 2019, UN secretary-General António Guterres stated that cities were 'where the climate battle will largely be won or lost'.⁶ It is time for cities to unlock their potential to initiate change – and for countries and the international community to effectively support this effort.

This analysis takes an in-depth look at what makes a city sustainable, focussing especially on those elements of transition that are deeply intertwined with the impacts of climate change. Through this prism, we will identify three cross-cutting fields of action that will allow cities to move towards a sustainable transformation. We will show that many cities are already taking the lead by implementing comprehensive and effective policies towards a sustainable transition. This paper then aims at analysing how the international community in general, and the Paris Agreement (PA) in particular, can support the pivotal role that cities must play in a sustainable transformation to fight climate change. Here, the focus is on the three trajectories we deem pivotal for sustainable urban development: creating frameworks for comprehensive urban planning, successfully financing transformative action, and promoting the coordination, cooperation and participation of different stakeholders.

-
- 1 Hanna Ritchie, Max Roser, Urbanization (2018), available at: <https://ourworldindata.org/urbanization>
 - 2 Richard Dobbs et al, Mapping the economic power of cities (2011), 1, available at: https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Urbanization/Urban%20world/MGI_urban_world_mapping_economic_power_of_cities_full_report.pdf (last accessed 30/10/21).
 - 3 UN Habitat, Energy – Overview (n.d.), <https://unhabitat.org/topic/energy> (last accessed on 27/10/2021).
 - 4 UNEP-DTIE, Cities and Buildings (2013), 1, available at: http://energies2050.org/wp-content/uploads/2013/09/2013-06-UNEP-Cities-and-buildings-activities_16-pages-GB.pdf, (last accessed 30/10/21).
 - 5 Derk Loorbach et al, Governance of Urban Sustainability Transitions, Theories of Urban Sustainability Transitions, Springer Japan (2016), 5.
 - 6 „Secretary-General’s remarks at C40 World Mayors Summit | United Nations Secretary-General“, available at <https://www.un.org/sg/en/content/sg/statement/2019-10-11/secretary-generals-remarks-c40-world-mayors-summit> (last accessed 30/10/21).

What is a sustainable city?

The concept of sustainable development itself is not new. The Brundtland Report famously defined sustainable development as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’.⁷ Derived from this concept, different definitions of the sustainable city have emerged in literature as well as in formal statements issued by international bodies. In 1991, the United Nations Centre for Human Settlements (UNCHS) Sustainable Cities Programme defined a sustainable city as a city ‘where achievements in social, economic and physical development are made to last’.⁸ In a report issued in 2013, the four pillars of social development, economic development, environmental management and urban governance were integrated in the previously found definition by the UNCHS.⁹ The World Bank defines the concept as ‘resilient cities that are able to adapt to, mitigate and promote economic, social and environmental change’,¹⁰ while a later definition by the German Advisory Council on Global Change (WBGU) sets out three dimensions of a normative compass that must be addressed when transforming into a ‘sustainable’ urban society: (1.) sustaining natural life support system by complying with planetary guard rails and protecting the local environment, including the ceasing of CO2 emissions, (2.) ensuring substantive, political and economic inclusion for city dwellers and (3.), the city must seek ‘its own way’ to a sustainable future due to socio-cultural and spatial diversity.¹¹

The sustainable city on the international agenda

The attempts by international bodies to find a definition point to the fact that the growing significance of cities as a place of sustainable transformation has become a focus on the international agenda. An early programme of action arose from the 1992 UN Conference on Environment and Development (UNCED) with Agenda 21. This Agenda addressed sustainable human settlement and appealed directly to cities and other local authorities, urging strategies and

measures from them. It was under the guidance of established transnational networks such as ICLEI and supported by key international institutions such as UN-Habitat and UNEP, that cities embraced the LA 21 mandate in the years to follow, which resulted in numerous urban sustainability strategies.¹² Another, more recent milestone includes the new urban agenda, which was adopted in 2016 at Habitat III in Quito, Ecuador. Through this third iteration of its housing and shelter convention, the UN recognises urbanisation as a permanent driver of development with potentially positive impacts on people and the planet.¹³ However, it is the adoption of the Agenda 2030 one year prior that can be seen as marking a shift at the international level from a reactive approach to one that is ambitiously proactive.¹⁴ The 2030 Agenda framework shall therefore serve as a starting point for the definition of a sustainable city in this discussion.

The sustainable city on the 2030 Agenda

In 2015, 193 nations of the UN unanimously adopted the 2030 Agenda for Sustainable Development. The agenda serves as the successor to the ‘Millennium Goals’. Its core message consists of 17 sustainable development goals (SDGs) as well as their 169 targets and 247 indicators, the latter of which help to signal whether a policy or programme is serving the respective target.

The SDGs represent a novelty, as the agenda does not focus on the challenges of low and middle-income countries but addresses the world in its entirety. The inclusion of SDG 11, ‘Sustainable Cities and Communities’, means that world leaders commit to ‘make cities and human settlements inclusive, safe, resilient and sustainable’.¹⁵ It represents the international consensus that sustainable urban development is a transformational driver of human development.¹⁶

While countries are expected to take ownership of the SDGs and implement them accordingly, the SDGs are not legally binding.

-
- 7 United Nations World Commission on Environment and Development, Report of the World Commission on Environment and Development: Our Common Future, 1.
 - 8 United Nations Human Settlements Programme – UN Habitat (2002), 6.
 - 9 UN-DESA Policy Brief, An Integrated Strategy for Sustainable Cities, available at: https://www.un.org/en/development/desa/policy/publications/policy_briefs/policybrief40.pdf (last accessed 30/10/21).
 - 10 The World Bank, Sustainable Cities Initiative, available at: <https://www.worldbank.org/en/region/eca/brief/sustainable-cities-initiative> (last accessed 30/20/21).
 - 11 Rauke Kraas et al (WBGU), Der Umzug der Menschheit: die transformative Kraft der Städte (2015),137-159.
 - 12 Riccardo Pavoni, Sustainable Development as a Cornerstone of Cities’ Engagement with International Law,(2021), available at: 8.
 - 13 United Nations, New Urban Agenda, Habitat III (2016).
 - 14 Andrew Rudd et al., „The UN, the Urban Sustainable Development Goal, and the New Urban Agenda“, 183, available at <https://doi.org/10.1017/9781316647554.011> (last accessed 30/10/21).
 - 15 United Nations, Transforming our world: The 2030 agenda for sustainable development (2015), Goal 11.
 - 16 Andrew Rudd et. al., “The UN, the Urban Sustainable Development Goals, and the New Urban Agenda, 184 available at <https://doi.org/10.1017/9781316647554.011> (last accessed 30/10/21).

They are also in need of contextualisation, especially given the wide variety between urban environments. Cities are heterogeneous, and transition pathways towards sustainability must be tailored to local contexts. In addition, it must be noted that, like any other goal, SDG 11 cannot be considered in isolation from the other SDGs. The SDGs represent a networked understanding of sustainable development that includes various aspects, such as the reduction of poverty, health, environmental degradation, and gender inequalities. There are numerous interconnections between SDGs, forming both synergies and trade-offs. According to UN Habitat, SDG 11 has strong interconnection with at least 11 other SDGs and more than a third of indicators can be assessed against an urban threshold.

The 2030 Agenda must be credited with acknowledging the city as a specific site for global governance, as well as with the ability to serve as a basic model for cities to help define the scope and context of sustainable development.¹⁷ Yet, while the targets are useful for providing a basic understanding of urban sustainable development, they are too broad and ambiguous to point to a general definition of the ‘sustainable city’.

To find a definition of the ‘sustainable city’ for the purpose of this analysis, we will take the context of the adoption of the 2030 Agenda as a starting point. While not formally or institutionally connected, the parallel adoption of the PA in 2015 – and the explicit acknowledgement of the 2030 Agenda in its text – show the immediate link between sustainable development and the fight against climate change. When adopting the PA, Parties to the UNFCCC explicitly acknowledged the significance of cities, as it calls for the promotion and mobilisation of climate action by non-state actors, including cities and other subnational authorities. The strong interrelationship can further be illustrated by taking a closer look at the connections between SDGs. While the connections between SDG 11 and other NDCs are numerous, e.g. to SDG 3 (health) and SDG 6 (water and sanitation), SDG 13 on climate action and SDG 11 have been found to be the most interconnected pair of SDGs overall.¹⁸ To ‘[t]ake urgent action to combat climate change and its impacts’ (SDG 13) is crucial for achieving the targets of SDG 11. At the same time, this goal offers many opportunities to develop mitigation and adaptation strategies to address climate change, especially through environmentally sustainable and resilient urban

development (Targets 11.2, 11.5, 11.b, 11.c.) as well as ensuring responsible urban context development plans through target 11.a.¹⁹

Effective mitigation and adaptation action in an urban context also includes action to protect, sustainably manage and restore natural or modified ecosystems, harvesting also the benefits of heightened human wellbeing and biodiversity benefits.²⁰ Here, a strong connection to SDG 15 (life on land) can be identified, which calls for the conservation and restoration of the use of terrestrial ecosystems such as forests, wetlands, drylands and mountains. SDG 15 contributes to SDG 11 by advocating for nature-based solutions and disaster risk adaptation.²¹ In light of the fact that cities account for more than 70% of global GHG emissions and 70% of natural resource consumption, the sustainable city therefore also contributes to the goal of responsible consumption and production (SDG 12), e.g. through efficient management of natural resources, safe disposal and treatment of toxic waste, which in itself often amounts to mitigation action.

The sustainable city as a multi-layer concept

Focussing on these interlinkages, the definition of ‘sustainable city’ in this paper will put an emphasis on the interdependency between urbanization and climate action. This means integrating the issues of mitigation and adaptation into policies and actions taken in cities, thereby acknowledging that climate protection must serve as an overarching principle that guides sustainable urban transformation. Sustainable urban policies are ultimately about improving living conditions to support human needs for opportunity, security, autonomy, wellbeing and health without undermining the natural systems on which human civilisation ultimately depends.²² Mitigating climate change and its effects on the urban environment itself is an inevitable premise of this outcome. For the purposes of this paper, a sustainable city is therefore a city that optimises living conditions and contributes to human wellbeing in a way that can be maintained, by implementing socially and economically responsible policies to reach a high level of environmental quality and to pursue the highest level of climate protection.²³

-
- 17 Kerstin Krellenberg et. al., Urban Sustainability Strategies Guided by the SDGs – A tale of four cities (2019), 1, available at <http://dx.doi.org/10.3390/su11041116> (last accessed 30/10/21).
 - 18 Prajal Pradhan et al, A systematic study of SDG interactions, Earth’s Future Vol. 5 (2017), 1173, available at: <https://doi.org/10.1002/2017EF000632> (last accessed 30/10/21).
 - 19 Robert Ndugwā „Tracking Progress Towards Inclusive, Safe, Resilient and Sustainable Cities and Human Settlements, available at: <http://uis.unesco.org/sites/default/files/documents/sdg11-synthesis-report-2018-en.pdf>, (last accessed, 30/10/21).
 - 20 Nadja Kabisch et al, Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers and opportunities for action, Ecology and Society 21, (2016), available at: <http://dx.doi.org/10.5751/ES-08373-210239>, last accessed (30/10/21).
 - 21 Robert Ndugwā „Tracking Progress Towards Inclusive, Safe, Resilient and Sustainable Cities and Human Settlements, 15, available at: <http://uis.unesco.org/sites/default/files/documents/sdg11-synthesis-report-2018-en.pdf>, (last accessed, 30/10/21).
 - 22 Melanie Crane et al., Transforming cities for sustainability: A health perspective, Environment International Vol. 147 (2021), 3, available at <https://doi.org/10.1016/j.envint.2020.106366> (last accessed 30/10/21).
 - 23 See for further discussion: R. Pace, Dr. Galina Churkina, Dr. Manuel Rivera, IASS Working Paper: How green is a green city?, available at: <http://doi.org/10.2312/iass.2016.035> (last accessed/30/10/21).

Policy approaches for the sustainable city

Cities must be built on the foundation of a set of sustainable urban systems. Myriad tools and sets of indicators exist to help cities assess their status and reach their goals on the road to greater sustainability. They vary in their fundamental purpose as well as in their scale, their measurement of sustainability and their associated indicators.²⁴ Finding the right one can pose a challenge, especially as every city exists in a different set of circumstances. A 'one-size-fits-all approach' is not feasible in this context. As a thorough analysis of the available indicators is not possible within the scope of this paper, we will categorise these more broadly in the context of sustainability through the lens of climate action. Fields of actions were therefore chosen along urban sectors that both have an immediate impact on climate and influence the living conditions of city dwellers, in line with the most urgent climate actions identified in the C40 initiative.²⁵ Sustainable urban systems must be developed in the areas of energy, buildings, transportation, waste and water management. On the following pages, we will first outline which challenges are specific to each area before identifying overarching trajectories which must be addressed through policies across the named sectors. We will then illustrate several good practice examples in various cities. Urban systems in need of transformation are predominately energy, buildings, transport, waste and water management.

Urban systems in need of transformation

When referring to the **energy** sector for this elaboration, this predominately means establishing a sustainable energy system. The energy system in general includes the provision of electricity, its grids, but also for example the delivery of natural gas by pipeline and truck delivery of petroleum to homes for their heating or to gas stations. A sustainable energy system therefore means, in particular, shifting away from emission intensive fossil fuels towards an energy system that runs on renewables. It can also entail access

to modern energy services as well as improvements in energy efficiency. In this respect, cities can pursue their sustainability by setting decarbonisation goals, aggregating demand for renewables,²⁶ In **buildings heating and cooling amount to 35–60 %** of the total energy demand and produce nearly 40% of the emissions on average.²⁷ Therefore, reducing energy use in new and existing buildings is one of the main challenges of urban sustainability. Retrofitting buildings can address energy efficiency and adaption simultaneously, e.g. by integrating greenery into the building. It is crucial not to focus solely on the operational impact of buildings to the environment. Materials used in construction have a major environmental impact during their production phase. A full consideration of the concept of a sustainable building sector therefore ideally entails its entire lifecycle, including material extraction, manufacturing, transport to site and on-site construction as well as disposal and recycling²⁸. According to the IPCC, transport accounted for 23% of the energy related GHG emissions globally. Within that, urban transportation made up the biggest part²⁹.

Urban transportation also contributes a significant amount to urban air pollution. Congestion due to extensive car use can even have strong negative impacts on the economy by lowering productivity due to long commutes. Moving towards a more sustainable urban transport system can inter alia entail the implementation of a public transport system, measures to lower car dependency as well as the use and promotion of green transport possibilities and renewable energies for transportation or local freight transport.³⁰

Methane released from **waste** disposal, particularly methane released from organic waste in landfills, is responsible for approximately 5% of the global GHG emissions.³¹ Negative impacts occur with waste incineration if the energy is not recovered. In addition to emissions from disposal, there are also CO₂ emissions embedded within consumer goods and materials that end up as waste. Furthermore, solid waste can occupy large amounts of urban space and open storage can carry health risks for city inhabitants. Sustainable urban waste management can include the reducing of waste

24 EC, Science for Environment Policy, In-Depth-Report: indicators for sustainable cities (2018), 8 available at: https://ec.europa.eu/environment/integration/research/newsalert/pdf/indicators_for_sustainable_cities_IR12_en.pdf, (last accessed 30/10/21).

25 C 40 cities, Focussed acceleration (2017), available at: https://www.c40knowledgehub.org/s/article/Focused-Acceleration-A-strategic-approach-to-climate-action-in-cities-to-2030?language=en_US (last accessed 30/10/21).

26 Stephen Cohen, *The Sustainable City*, Columbia University Press (2018), 17.

27 C 40 cities, Focussed acceleration (2017),6, available at:https://www.c40knowledgehub.org/s/article/Focused-Acceleration-A-strategic-approach-to-climate-action-in-cities-to-2030?language=en_US (last accessed 30/10/21).

28 Martin Röck et al., Embodied GHG emissions of buildings- The hidden challenge for effective climate change mitigation, *Applied Energy*, Vol.258 (2020), available at: <https://doi.org/10.1016/j.apenergy.2019.114107> (last accessed 31/10/21).

29 [1] IPCC Report 2014, Transport, p. 603, available at: https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter8.pdf (last accessed 30/10/21).

30 C 40 Cities, *Deadline 2020*, 55, available at https://c40-production-images.s3.amazonaws.com/researches/images/59_C40_Deadline_2020_Report.original.pdf?1480609788 (last accessed 30/10/21).

31 World Bank (2018), *Overview: What a Waste 2.0: A global snapshot of Solid Waste Management to 2050* (2018),ix, available at <https://openknowledge.worldbank.org/bitstream/handle/10986/30317/211329ov.pdf?sequence=11&isAllowed=y> (last accessed 31/10/21).

generation, minimising non-recyclable materials and single-use items in the waste stream, promoting reuse, increasing recycling, and enhancing the recovery and treatment of waste.³² Reliable access to clean and affordable water in an urban environment often comes with environmental externalities such as GHG emissions. Lifecycle analyses of cities in different regions of the world estimate that extraction, distribution, and treatment of urban water creates between 0.5 and 2.5 kg of equivalent lifecycle CO₂ emissions per m³ of freshwater delivered to end-use.³³ The management of water resources strongly relates also to climate change adaptation, due to water-related disasters and the fact that sustainable water management remains crucial for urban climate resilience.³⁴

Cross-cutting trajectories

How to best implement actions within these urban systems depends on the specific circumstances of the city. However, it is possible to identify overarching trajectories which are decisive for actions across sectors and across regions globally. These cross-cutting aspects include the promotion of cooperation and participation of different stakeholders of urban development, creating frameworks for and implementing comprehensive urban planning as well as successfully financing transformative action in an urban context.

Urban planning

In this discussion, urban planning is understood as a decision-making process aimed at realising set goals towards greater urban sustainability through the development of spatial visions, strategies and plans.³⁵ In this respect, planning can specify abstract targets for concrete measures and therefore promote the predictability of adaptation to those actions in various fields. That said, urban planning influences land use patterns, urban form and urban spa-

tial design, biodiversity and nature, transport investments as well as the connection to heating and cooling infrastructure within the city's boundaries. These actions have a strong long-term impact on the effectiveness of climate and sustainability efforts in transport, energy, buildings, and waste.³⁶ Additionally, urban planning can address the improvement of the microclimate, which can then directly reduce its need for energy consumption within the urban environment: large parks or natural sites can cool down local environments and thus reduce the need for cooling indoor spaces within the area, while at the same time leveraging co-benefits such as health and well-being for its inhabitants. The planning of sustainable land use, including nature-based solutions, therefore serves both mitigation and adaptation as well as the overall wellbeing of city dwellers.³⁷

Policy tools that are widely used and that promote the implementation of comprehensive urban planning include regulatory policy instruments, such as national or regional planning law or regulations, environmental regulation or building regulation. Economic instruments can be used to incentivise or disincentivise behaviour or certain developments in an urban planning context. These instruments typically include pricing such as taxes or fees as well as state subsidies. Another set of policies that is a prerequisite for efficient urban planning addresses research and monitoring. The commissioning of research projects can be part of it as well as monitoring systems for green infrastructure, implemented through manual or automated systems which collect data on activities or products.

Finance

The lack of finance and access to finance marks a major obstacle preventing cities, particularly but not exclusively in developing countries, from realising their ambitions towards a sustainable transformation. A gap of 1.8–2.4 trillion USD per year in finan-

32 Stephen Cohen, *The Sustainable City* (2018), 24.

33 Simon Parkinson, *Guiding Urban Water Management towards 1.5 °C*, npj CleanWater, but its provision in cities generates environmental externalities including greenhouse gas (GHG), available at <https://doi.org/10.1038/s41545-021-00126-1> (last accessed 31/10/21).

34 Gül Özerol, *Urban Water Management and Climate Change Adaptation: A self-assessment study by seven midsize cities in the North Sea Region*, *Sustainable Cities and Societies* (2020), 1 <https://doi.org/10.1016/j.scs.2020.102066>, (last accessed 31/10/21).

35 WHO, *Integrating health in urban and territorial planning – Sourcebook, VII*, (2018), Available at: <https://apps.who.int/iris/rest/bitstreams/1274206/retrieve> (last accessed on 27/10/2021).

36 C 40 Cities, *Deadline 2020*, 54, available at https://c40-production-images.s3.amazonaws.com/researches/images/59_C40_Deadline_2020_Report.original.pdf?1480609788 (last accessed 30/10/21).

37 Eeva-Sofia Säynäjoki et.al, *GHG Emissions Reduction through Urban Planners' Improved Control over Earthworks*, *Sustainability* (2018) 2, available at: <https://doi.org/10.3390/su10082859> (last accessed 31/10/21).to reach climate change mitigation targets, a more immediate reduction in GHG emissions is also needed as well as a reduction in GHG emissions in other fields. This article evaluates the important role of earthworks in the prompt and substantial reduction required for GHG emissions. The research includes a single case study and three focus group interviews. The results of the case study reveal the magnitude of possible emission reductions through urban planners' control over earthworks, whereas the findings of the focus groups shed light on the relevance of the findings beyond the single case. Three urban planning solutions were implemented in the case area to reduce GHG emissions from earth construction, resulting in the saving of 2360 tonnes of CO₂ emissions. Notable savings were also achieved in other emission categories. Such a successful management of rock and soil material flows requires a strong vision from the urban planner, cooperation among many different actors, and smart decisions in multiple planning phases. Furthermore, numerical data is needed to confirm the environmental benefits if the coordination of earthworks is to be widely included in regional climate change mitigation strategies.“,“container-title”:“Sustainability“,“DOI”:“10.3390/su10082859“,“ISSN”:“2071-1050“,“issue”:“8“,“journalAbbreviation”:“Sustainability“,“language”:“en“,“page”:“2859“,“source”:“DOI.org (Crossref

cing for low-emissions and climate-friendly infrastructure has been identified, most of which is needed in urban areas.³⁸ There are several long established, tried-and-tested financing methods for national and local governments to fund necessary measures for a sustainable transformation, such as public infrastructure. These include taxes or central government transfers. Yet, in light of the multiple challenges that cities face – such as international migration, urban sprawl, and climate change – there is a growing gap between available and needed financial support. Bridging this gap calls for structural measures and the strengthening of partnerships and dialogues. In addition to well-known strategies, innovative finance instruments can offer possibilities for closing this financial gap.

Cooperation and participation

The promotion of cooperation and participation calls for a comprehensive and integrated political and administrative management for the urban systems in need of reform. This involves partnerships (formal and informal) between governments at different levels.³⁹ Cities are in need of the possibility of system-oriented decision making. This means administrative structures need to be collaborative, engaging actors across levels and scales to plan and implement action rather than working through isolated sectoral structures. The formulation and implementation of policy does not only develop on the governmental level, but also through multi-level power and informal networks of actors inside and outside government. This includes, for example, actions for awareness-raising and participatory processes including citizens and the private sector. Integrative flexible city management is needed to efficiently implement policies and manage resources. Collaborative decision-making promotes the alignment of objectives with input from all actors involved in the city processes underpinning decision making.⁴⁰

38 UNFCCC, 2019 Forum of the standing committee on finance: Climate Finance and sustainable Cities (2019), 8 https://unfccc.int/sites/default/files/resource/SCF%20Forum%202019%20report_final.pdf (last accessed on 27/10/2021).

39 UN Habitat, WHO, Integrating health in urban and territorial planning: A Sourcebook, VII, <https://apps.who.int/iris/rest/bitstreams/1274206/retrieve> (last accessed on 27/10/2021).

40 Melanie Crane et al., Transforming cities for sustainability: A health perspective, *Environment International* Vol. 147 (2021), 7, available at <https://doi.org/10.1016/j.envint.2020.106366> (last accessed 30/10/21).

Good-practice examples

The building of a sustainable city does not have to start from scratch. There are various policy instruments towards the development of a sustainable city that have already been successfully implemented in different cities and that can serve as good-practice examples. A thorough analysis of these mechanisms is not possible within the scope of this paper. Still, five examples from the identified urban systems in need of transformation can illustrate how the three trajectories of better frameworks for integrated urban planning, the promotion of financial solutions, and enhanced coordination between different participants and stakeholders can be addressed and help foster sustainable urban development.

Energy: Adelaide

Adelaide has a population of approximately 1.37 million inhabitants. It is the largest city and capital of South Australia and the fifth-most populous city in Australia. The population density amounts to approximately 422/km². Mediterranean climate prevails in Adelaide, with hot and dry summers, cool winters with moderate rainfall.⁴¹ It is a windy city with approximately 2,774 annual hours of sun.

What has been done?

The program 'Adelaide solar city' ran from 2007 to 2013. It was part of the Australian government's 94 million USD 'Solar Cities' programme designed to trial new sustainable energy models. Adelaide was primarily chosen due to the high proportion of sunny days, peaky demand profile and relatively high electricity costs. The programme was designed to implement a range of elements, such as a market trial of commercial and residential solar photovoltaic systems, cost reflective pricing, smart meter technology, energy efficiency products, low-income energy assistance programmes, and community engagement initiatives. The funding contributed to the programme by the Australian government and an initially established consortium consisting of private and public actors amounted to 65 million USD.⁴² In addition, in 2019, the City of Adelaide installed its own on-site solar panels on buildings such as the town hall, an aquatic centre, parking spaces and bus stations.

Furthermore, the City of Adelaide cooperated with the private entity Flow Power to meet its electricity needs from a mix of wind and solar power through a renewable energy contract (since July 2020), utilising renewable electricity for all of its operations, which include community buildings, electric vehicle chargers, barbecues in the Park Lands, water pumps, street lighting and traffic lights. The electricity is delivered by Clements Gap wind farm, which accounts for 75% of the City of Adelaide's renewable energy, and the Streaky Bay and Coonalpyn Solar Farms, which were installed in June 2021 and together account for 25% of renewable energy.⁴³

How was it successful?

As laid out above, Adelaide used comprehensive financing programmes as well as cooperation between public and private entities and citizens. Their measures have produced considerable success:

As a result of its cooperation with Flow Power, Adelaide became the first council in South Australia to use 100% renewable energy. Some of the key benefits to the community resulting from the Adelaide Solar City programme include the recruitment of about 3,500 participants for product trials and around 500 residents attending energy education sessions. In addition, a total of 836 kW of solar PV system generation was installed with an estimated energy generation of 1,247,000 kWh, which saved around 1,072 tonnes of CO₂ equivalent per annum. A total of 21,600 tons per year of greenhouse gas emissions has been saved from being released into the atmosphere. Over the life of the program, an estimated 68,600 tonnes of greenhouse gas emissions have been avoided through the distribution of energy efficiency packs and the adoption of GreenPower-accredited products alone. The Business Energy Efficiency Program has provided participants with an estimated savings of 961,000 USD in financial benefits and a greenhouse gas emission offset of 5,980 tonnes per annum.⁴⁴ The named systems installed in 2019 brought the City's solar power to over 1.1 MW, accounting for approximately 12% of the electricity used by all council buildings combined. The project is saving Council around 300,000 USD on electricity bills and avoiding around 760 tonnes of CO₂ each year.⁴⁵

41 Wikipedia, Adelaide, available at <https://en.wikipedia.org/wiki/Adelaide#Climate> (last accessed 31/10/21).

42 Dario De Bortoli et al., Adelaide solar city: solar program (2013), 1- 50, available at: https://www.researchgate.net/publication/324279174_ADELAIDE_SOLAR_CITY_SOLAR_PROGRAM

43 City of Adelaide, Renewable Energy Contract (2021), <https://www.cityofadelaide.com.au/about-adelaide/our-sustainable-city/renewable-electricity/>, (last accessed 31/10/21).

44 Adelaide Solar City Final Report (2013) <https://de.scribd.com/document/494112034/Adelaide-Solar-City-Final-Report> (last accessed 31/10/21).

45 City of Adelaide, Renewable Energy Contract (2021), <https://www.cityofadelaide.com.au/about-adelaide/our-sustainable-city/renewable-electricity/>, (last accessed 31/10/21).

Buildings: Washington, D.C.

Washington, D.C., has a population of approximately 699,000. The federal capital spreads across 68.34 sq mi (177.0 km²). The city's per-capita emissions reached 10.12 tonnes in 2019. Washington, D.C., is a federal district under the exclusive jurisdiction of the U.S. Congress and not an independent state or a part of a state.⁴⁶

What has been done?

The city of Washington developed a number of city-wide strategies to reach its goal of becoming climate neutral by 2050. In its ambitious Clean Energy DC Plan, the city pledged to reduce greenhouse gas emissions from all local sources by 50%. District buildings account for 74% of the city's carbon emissions, representing the largest overall source of GHG emissions.

Washington, D.C., has introduced a number of legislative acts tackling the energy consumption of the building sector. This includes the Green Building Act of 2006, which requires that all non-residential District public buildings meet the U.S. Green Building Council's LEED certification standards for environmental performance at the 'Silver' level or higher. District-owned or -financed residential projects 10,000 ft² (roughly 930 m²) or larger must meet or exceed the Green Communities certification standard. Since January 2012, all new private development projects that measure 50,000 ft² (4,645 m²) or larger are now required to meet LEED certification at the 'Certified' level or higher.⁴⁷ Starting with the Clean and Affordable Energy Act of 2008, large private and public buildings were required to annually track their energy and water efficiency and report the results for public disclosure. With the introduction of the Clean Energy Omnibus Amendment Act of 2018, the benchmarking requirements were expanded to cover smaller buildings, and data verification requirements were added. The law also introduced the building energy performance standard, which establishes a minimum energy performance for large commercial and multifamily buildings. Beginning in 2021, buildings performing below that threshold are required to improve their energy performance by 20% over a five-year compliance period.⁴⁸ Smaller buildings will also be required to meet the standard over time. The city has committed to allocate 45 million USD to the city's green bank by 2025, which blends public and private capital to finance the upfront costs of clean energy improvements.⁴⁹ Additionally, there is an annual fund of 3,000,000 USD for energy improvements in low-income housing.⁵⁰

How was it successful?

Washington, D.C., successfully used regulatory instruments in its urban strategy to work towards a more climate friendly building sector as well as the D.C. Greenbank as an innovative financial policy tool to enable funding: the policies mentioned above are correlated with a significant reduction in per-capita emissions in the commercial and institutional building sector between 2006 and 2019.⁵¹ It is also estimated that the introduction of the new standard requirements will lead to a 12% reduction in emissions in Washington, D.C., equal to one million tonnes of CO₂ equivalent per year. Improving the energy performance of buildings will likely also improve the indoor climate, thereby improving living conditions for its residents.⁵²

Transportation: Copenhagen

The city of Copenhagen has a population of approximately 800,000 people. The average GDP amounts to 60,000 USD. Copenhagen is in the oceanic climate, resulting in unstable conditions throughout the year. Annual GHG emissions per capita amount to 2.93 tonnes, with 0.86 from transport alone.

What has been done?

Copenhagen has implemented the 2025 climate plan as an overarching strategy, with the goal of becoming carbon neutral in 2025. This includes plans for the mobility and transport sector (encompassing road traffic, shipping and rail traffic) consisting of several actions. For this good-practice example, we take a closer look at the bicycle infrastructure implemented.

Since 2002, Copenhagen has implemented four agendas explicitly dealing with cycling infrastructure. Concrete Measures taken by the municipality include the expansion of cycling networks, the implementation of green bicycle routes, enhanced bicycle parking as well as the implementation of intelligent traffic control. A particularly ambitious project is the cycle superhighway, which aims at connecting different municipalities via special bicycle lanes. The city is generally taking a multimodal approach, meaning aiming for integration of bicycle and vehicular traffic. The latest mobility plan, however, aims also at prioritising a larger part of the existing road traffic for bike traffic. The municipality of Copenhagen has the authority for infrastructure planning. Notably, urban and transport planning are integrated in a coherent way under a single

46 Wikipedia, Washington, D.C., available at

47 Green Building Act of 2006, available at <https://doee.dc.gov/publication/green-building-act-2006> (last accessed 31/10/21)

48 Department of Energy& Environment, Building Performance Helpdesk: What is benchmarking? Available at <https://dc.beam-portal.org/helpdesk/kb/benchmarking/5/> (last accessed 31/10/21).

49 <https://doee.dc.gov/greenbank>

50 C 40, Cities 100, Report 2019, 73, available at <https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000Mfjq/jNN04dftc8c7DuStWPE2ouYg1EiOkDP9Fdjo5Pxnjm4> (available at 31/10/21).

51 Clean Energy DC, the district of Columbia and Energy Action Plan (2018), available at https://doee.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/Clean%20Energy%20DC%20-%20Full%20Report_0.pdf, (last accessed 31/10/21).

52 C 40, Cities 100, Report 2019, 74, available at <https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000Mfjq/jNN04dftc8c7DuStWPE2ouYg1EiOkDP9Fdjo5Pxnjm4> (available at 31/10/21).

technical and environmental administration in the city government. User groups and cyclist are consulted by the municipality on cycling conditions regularly and invited to send in suggestions for improving urban design. The city has been collecting data on statistics and biking conditions via biannual surveys since 1996.

How was it successful?

Copenhagen became a global role model for bicycle-oriented planning via comprehensive planning frameworks for its cycle infrastructure as laid out in the formulated strategies. It utilized its integrated governance as well as strong participatory processes to best implement its bicycle infrastructure. Copenhagen's strategies have led to 88% of all citizens cycling regularly, as it is the fastest or most convenient way of commuting, thereby leading to a reduction of noise, air pollution and CO₂ emission of 80,000 tonnes annually.⁵³ Additionally, the total superhighway network will lead to one million fewer car trips, which is projected to reduce annual CO₂ emissions by 1,500 tonnes.⁵⁴ The increase in cyclists and bike trips also leads to the promotion of health.

Waste: eThekweni (Durban)

eThekweni or Durban is the third most populous city in South Africa. Approximately 3,730,000 people live in the city. The city spreads across 16,000 km². The GDP amounts to 15,575 USD per capita. eThekweni has a humid subtropical climate with hot and arid summer and mild and dry winters.⁵⁵ In 2018, the total greenhouse emissions for the entire eThekweni Municipal Area was 28,804,454 tonnes of CO₂.⁵⁶

What has been done?

The eThekweni Landfill Gas to Electricity Project first started in 2004. It involves extracting methane from landfills in the eThekweni Municipality and using it to run generators which produce electricity for the local grid. The electricity produced is sold to the Municipalities Electricity Department and provides the municipality with approximately three megawatts of electricity.⁵⁷ The pro-

ject was financed by the World Bank and was the first of its kind to be registered in Africa under the Clean Development Mechanism. The Clean Development Mechanism (CDM) was introduced as a market mechanism through the Kyoto Protocol with the aim of directing private-sector engagement. The CDM allows developing countries to benefit from reducing GHG emissions through the generation of certified emissions reductions. As of April 2015, the project has issued 181,000 carbon credits.⁵⁸

How was it successful?

Made possible through the financing mechanisms of the Kyoto Protocol,⁵⁹ the eThekweni's landfills have avoided around 2.4 million metric tonnes of CO₂ equivalent emissions. In addition, the project has improved air quality in the area by reducing the amount landfill gas released into the atmosphere and by diminishing the negative effects of local coal transport and coal mining, such as dust and acid drainage, according to UNEP.⁶⁰

Water management: Wuhan

Wuhan can be categorised as a mega city with a population of 8.5 million and 11 million inhabitants living on the prefecture and sub-provincial level. The annual GDP per capita amounts to around 40,000 USD. It is considered the political economic, financial, commercial, cultural and educational centre of central China. The Yangtze and Han rivers traverse the urban area and divide Wuhan into three districts. Historically, Wuhan has suffered enormous risks of flooding.⁶¹

What has been done?

China's national government launched the 'sponge city programme' in 2013. The programme is a response to water management challenges aimed at increasing the resilience of urban areas to climate change. It encourages cities to adopt green and blue infrastructure that is based on natural areas and water elements rather than concrete or steel. The sponge city program sets ambitious targets: 80% of each pilot city's land is supposed to have been

53 Aber Elshater, Copenhagen, A Model for Regenerative Cities, available at: https://www.researchgate.net/publication/354074064_Copenhagen_A_Model_for_Regenerative_Cities (last accessed 31/10/21).

54 The city of Copenhagen, Copenhagen, City of Cyclists - The Bicycle Account 2018, S. 20, available at: <https://cyclingsolutions.info/wp-content/uploads/2020/12/CPH-Bicycle-Account-2018.pdf> (last accessed 1/11/2021).

55 Wikipedia, Durban, available at, <https://en.wikipedia.org/wiki/Durban> (last accessed 31/10/21).

56 Energy Office Durban, Final Summary Document: eThekweni Greenhouse Gas Emissions Inventory 2018, available at http://www.durban.gov.za/City_Services/energyoffice/Documents/eThekweni_GHG_Inventory_2018_SummaryReport.pdf (last accessed 31/10/21),

57 UN EP, Green warriors in Durban convert trash to treasure (2018), available at: <https://www.unep.org/news-and-stories/story/green-warriors-durban-convert-trash-treasure> (last accessed 31/10/21).

58 World Bank Group, South Africa: Durban Landfill Gas-to-Electricity Project: Prototype Carbon fund (2015), available at: <https://www.worldbank.org/content/dam/Worldbank/document/Climate/Climate-Finance-Projects-briefs/South-Africa-Durban-Landfill.pdf>, (last accessed 31/10/21).

59 It remains to be seen how methodologies, activities and credits issued under the CDM will fit into the regime of the envisioned market mechanisms under Art. 6 of the PA.

60 UN EP, Green warriors in Durban convert trash to treasure (2018), available at: <https://www.unep.org/news-and-stories/story/green-warriors-durban-convert-trash-treasure> (last accessed 31/10/21).

61 Wikipedia, Wuhan, available at: <https://en.wikipedia.org/wiki/Wuhan>, (last accessed 31/10/21).

constructed to sponge city standards by 2030. The primary goals are retaining 70–90% of average rainwater onsite by applying the green infrastructure concept and using low-impact measures, eliminating water logging and preventing urban flooding, improving urban water quality, mitigating impact on natural ecosystems and alleviating the urban heat island effect.⁶² China's national government has created the Sponge City Development Committee, a multi-stakeholder panel of experts who provide technical assistance to municipalities and track best practices.

The national implementation framework allows lower levels of governments to establish basic laws and regulations, relating to sponge city infrastructure such as outlining compulsory standards and targets.⁶³ Wuhan, as part of its efforts, planned 380 sponge projects, in total covering 38.5 km² in two demonstration districts. These projects include the construction of urban gardens, waterbodies in parks, roads and buildings, as well as the construction of two rainwater pumps and the repair of water channels. A citywide sponge city monitoring and evaluation platform was introduced. The Chinese government provides major financial support for the SCCP, assisted by a large amount of non-governmental investment through public-private partnership (PPP) projects.

How was it successful?

The governmental planning framework for the sponge city provided a comprehensive urban water management plan. It enables the city of Wuhan to establish regulations in order to implement the action laid out above and information-based action due to monitoring programs. It also established structures for coordination and cooperation with different stakeholders to support the municipalities.

The actions implemented resulted in heightened ability of flood control in 2020. The city showcased a much greater ability of flood control and water logging while facing one of the longest rainy seasons of the century.⁶⁴ There were also significant co-benefits connected with the implemented project, including improved local air quality, biodiversity and conservation benefits, and increased land value. The city's Yangtze River Beach Park demonstrates this: temperatures in the park can be three degrees cooler than in the city; the vegetation sequesters 724 tonnes of carbon annually; and the value of land in surrounding areas has more than doubled to CNY 10,218 (1,471 USD) per square meter.⁶⁵

62 General Office of the State Council (GOSC), 2015. Guideline to Promote Building Sponge Cities.

Available at: http://www.gov.cn/zhengce/content/2015-10/16/content_10228.htm (last accessed 31/10/21).

63 Lucy Oates et al., Building climate resilience and water security in cities: lessons from the sponge city of Wuhan, China, 4 available at: <https://urbantransitions.global/wp-content/uploads/2020/03/Building-climate-resilience-and-water-security-in-cities-lessons-from-the-Sponge-City-of-Wuhan-China-final.pdf> (last accessed: 31/10/21).

64 Yunyue Peng, Kate Reilly (IUCN European Regional Office), Grow Green, Using Nature to Reshape Cities and Live with Water: An Overview of the Chinese Sponge City Programme and Its Implementation in Wuhan, 24, available at: <http://growgreenproject.eu/wp-content/uploads/2021/01/Sponge-City-Programme-in-Wuhan-China.pdf> (last accessed 31/10/21).

65 Lucy Oates et al., Building climate resilience and water security in cities: lessons from the sponge city of Wuhan, China, 13, available at: <https://urbantransitions.global/wp-content/uploads/2020/03/Building-climate-resilience-and-water-security-in-cities-lessons-from-the-Sponge-City-of-Wuhan-China-final.pdf> (last accessed: 31/10/21).

Sustainable City under the UNFCCC and the PA

Above, we developed a definition of sustainable cities and a definition of sustainability, using the SDGs as a strong indicator. The case studies showed different approaches taken by cities to tackle challenges on the way to sustainability. Sustainability, as described above, covers a variety of fields. As a holistic approach, sustainable cities not only represent an end in themselves, but also implicitly contain subitems like climate protection. It is against this background that the sustainable city is also a city contributing to climate protection. In fact, cities are a key component of global climate change mitigation at local and national levels. Remembering the impact cities currently have with regard to the global emission of GHG, it becomes obvious that cities are an important if not the biggest lever to shift to climate neutrality as part of sustainability.

Because global climate change can only be mitigated by measures that are implemented at a national level but coordinated at the international level, it is of interest how sustainable cities are addressed under the given instruments of international climate law. Before we dive into legal texts of international climate law it must be mentioned that this coordination can be done outside of binding international treaties. Indeed, cities do have, if any, only limited competence to take part in international treaties. Cities and other local authorities are non-party stakeholders to the UNFCCC and the PA. Thus, transnational rather than international coordination marks the first step for cities to act on sustainability and climate change in a global perspective. Consequently, cities and other local authorities did form different transnational cooperation aiming at achieving sustainability and climate neutrality.

Transnational coordination

So far, cities have already been recognised as being relevant actors in the context of the fight against climate change. Many initiatives at the international level have been launched, both with the support of the UN and in the sense of independent alliances of cities. The UN sustainable cities programme, for example promotes good environmental governance by offering a platform for best practices. With regards to SDG 11, independent cities and city alliance networks have started to integrate into the UN-associated Global

Covenant of Mayors for Climate & Energy defining self-committing goals. The carbonn® Cities Climate Registry (cCCR) initiative presents a unified process for subnational climate action reporting. But still, consistent and comparable data on cities' GHG emission reductions remain scarce (Mi et al. 2019)⁶⁶ and local climate protection action has so far been insufficiently integrated into international initiatives, both formally and institutionally (Fuhr et al. 2018).⁶⁷ As the financing of urban climate protection remains – as several studies indicate (Sharp et al 2011, Zahran et al., 2008, van der Heijden 2019)⁶⁸ – a crucial condition for urban climate activities, the City Climate Finance Leadership Alliance has already tried to address the question of how to stimulate investments in low-carbon and climate-resistant infrastructure in cities in low- and middle-income countries.

However, various studies (Sharp et al 2011, Zahran et al., 2008, van der Heijden 2019)⁶⁹ show that insufficient budgets also pose enormous challenges for cities in industrialized countries in terms of climate protection.

International coordination

Acknowledging the existing efforts of cities and local authorities to transnationally cooperate and coordinate sustainability and climate neutrality, it must be emphasised that these efforts fall behind the scope of the UNFCCC and PA. In particular, the strength of the PA can be attributed to the temperature limit legally binding almost every national state. In other words: there is no need for another international treaty on climate protection alongside to the PA. Opposite to this, the identified transnational coordination by cities is a collection of cooperation mechanism that by no means include every city.

Interestingly enough, cities, local authorities and their contribution to hold the PA temperature limit regularly has been highlighted. A lot has been said on the impact cities and their climate protection efforts have. In this sense sustainable cities are a means to contribute to the PA's purpose and the goal of the UNFCCC. However, little research has been done on the impact the UNFCCC and PA

66 Zhifu Mi et al.,:Cities...The Core of climate change mitigation, *Journal of Cleaner Production*, Vol. 207, 10 (2019), 582-589., available at: <https://doi.org/10.1016/j.jclepro.2018.10.034> (last accessed 31/10/21).

67 Harald Fuhr, Thomas Hickmann, Kristine Kern, *The Role of Cities in Multi-Level Climate Governance: Local Climate Policies and the 1.5 C Target*, *Current Opinion in Environmental Sustainability* (2018),1-6., available at: <http://dx.doi.org/10.1016/j.cosust.2017.10.006> (last accessed 31/10/21).

68 Elaine B. Sharp, Dorothy M. Daley, Michael S. Lynch, *Understanding Local Adoption and Implementation of Climate Change Mitigation Policy*, *Urban Affairs Review*, 433–457 (2011), available at <https://doi.org/10.1177%2F1078087410392348>

Sammy Zahran et al., *Vulnerability and Capacity: Explaining Local Commitment to Climate-Change Policy*. In: *Environment and Planning C: Government and Policy*, 544–62, available at: <https://doi.org/10.1068%2F2g>, Jeroen van der Heijden, *Studying Urban Climate Governance: Where to Begin, What to Look for, and How to Make a Meaningful Contribution to Scholarship and Practice*, *Earth System Governance*, 1-10 available at: <https://doi.org/10.1016/j.esg.2019.100005> (all articles last accessed 31/10/21).

69 Ibid.

have on sustainable cities. In order to achieve sustainability, cities demand international coordination as the existing transnational coordination shows. The transnational cooperation, first and foremost, has a gap-filling function. For there currently is no adequate coordination under international law that includes cities, they turn to transnational mechanisms.

However, the UNFCCC and the PA as the central international instruments on global climate change do not only depend on the contribution by sustainable cities, but they might also support cities on their way to sustainability. According to this, there might be an interdependency between cities and the UNFCCC and PA: sustainable cities are factual necessary to achieve the goals under the UNFCCC and PA, the UNFCCC and PA might enhance sustainability in cities. It is against this background that in the following we analyse the UNFCCC and PA regarding the enhancement of sustainable cities.

Sustainable cities under the UNFCCC

The Framework Convention does not mention cities. Cities are non-party stakeholders that do not take part in the obligations and rights under the UNFCCC. However, cities and other local authorities can profit from the capacity building and financial mechanism under the UNFCCC. Education, training and public awareness shall be promoted by the parties also on a subregional and regional level, Art. 6 UNFCCC. The financial mechanism and thus the provision of financial resources and the transfer of technology has potential impact on cities. In fact, the Standing committee on Finance addressed climate finance and sustainable cities in the year 2019.⁷⁰ The final report highlighted barriers and offered possible solutions.⁷¹ In short, there is a lack of finance and access to finance. To match supply with and demand for climate finance there is a need for capacity building and institutionalisation of this capacities. Besides these rather soft linkages the UNFCCC does not offer further legal enhancement of sustainable cities.

Sustainable cities under the PA

When it comes to the role of the development of sustainable cities for the fulfilment of the PA, the PA does not offer any concrete modalities. Whilst cities' efforts are being welcomed (e.g. in par. 133 or 134 in the decision of the adoption of the PA) and local knowledge is being recognised (as in par. 135), no concrete outlook is being given. In a sense, this is logical, as nations are the stakeholders of the agreement,⁷² and the agreement therefore has no binding effects on subnational entities. But viewed from a multi-level-governance-perspective wanting to make the agreement work, this lacuna still needs to be addressed as cities' GHG emission re-

ductions will play a vital role for achieving the NDCs. Moreover, cities will directly be affected in terms of climate change adaptation failure. As already indicated in par. 136 (FCCC/CP/2015/10/Add.1), there is a special need for developing strategies on how to provide incentives for cities' GHG emission reductions also at the international level. Having in mind that the PA neither binds cities nor mentions them based on a textual analysis we will further investigate potential enhancement of sustainable cities under the PA. In doing so we will turn back to the above identified categories of measures taken by cities to achieve sustainability. In other words, neither the PA nor other international agreements on climate change may directly address cities nor sustainability, yet the international frame may set incentives for successful above-mentioned municipal mitigation strategies, which can be condensed to three governance instruments, that the international level should address. These are I) planning instruments, II) financing and III) participation. The following section examines how these instruments can be addressed under the PA.

Urban Planning: Enhancing sustainable cities in the NDC and NAP

Planning has been identified as the key component of measures cities take on their way to sustainability. It encompasses the adoption of climate protection targets as well as other (regulatory) planning instruments, i.e. with regard to infrastructure and buildings. In this sense planning does not only set benchmarks and standards but also may have direct or indirect influence on climate-relevant private behaviours. Having in mind the relation of cities to the PA as non-party stakeholders it must be said that the PA neither introduces obligation for planning instruments on a local nor on a national level. Indeed, it is upon the national states to adopt adequate measures aiming at the achievement of the binding temperature target under Art. 2.1 PA. Nonetheless the PA itself established a decisive planning instrument which might serve a starting point for the (formal) integration of a multi-level planning.

In accordance with Art. 4.2 PA parties, and thus national states, shall prepare, communicate and maintain successive nationally determined contributions (NDCs). According to FCCC/PA/CMA/2018/3/Add.1 – Appendix II NDCs should be estimated using IPCC guidelines in a consistent and transparent way. These IPCC guidelines also refer to measuring relevant data at the local level,⁷³ but methodologies are not imperative so far. NDCs furthermore can show a spatial focus on regional, subregional levels and cities in particular. A study provided by UN-Habitat for example shows that in 2017, at least 113 out of 164 NDCs showed urban content, indicating a significant effort to ensure sustainable urba-

70 UNFCCC Report of the Standing Committee on Finance addendum, 2019 Forum of the Standing Committee on Finance: "Climate finance and sustainable cities", FCCC/CP/2019/10/Add.1-FCCC/PA/CMA/2019/3/Add.1.

71 Ibid.

72 Prof. Claudio Franzius, *Das Paris-Abkommen zum Klimaschutz als Umweltvölkerrechtlicher Paradigmenwechsel* (2019), available at: https://www.unibremen.de/fileadmin/user_upload/fachbereiche/fb6/feu/FEU/Arbeitspapiere_FEU/FEU_AP3_Paris-Abkommen_als_Paradigmenwechsel.pdf (last accessed 31/10/21).

73 E.g. IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2 Approaches to Data Collection, (2006) available at https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_2_Ch2_DataCollection.pdf (last accessed 31/10/21).

onisation.⁷⁴ The NDCs and the national measures to achieve the objectives under the NDCs can be crucial for sustainable cities. However, the PA does not give any procedural obligation to include cities and other local authorities in the NDC. Whether cities and other local authorities, their interests and perspectives are fully represented under the NDC depends on the national states. The international community could therefore define in a more concrete way, how multi-level governance standards, starting even with suggestions on how to integrate local level regulatory measures stemming from building and town planning law could be set.

The analysis of the national adaptation plan (NAP) under Art. 7.11 PA does not offer any different findings. Even though the parties recognize the (also) local dimension of adaptation, there is no obligation to involve cities and other local authorities when establishing such a NAP under Art. 7 PA.

A mandatory or even voluntary integration of cities and other relevant local authorities, depending on their significant relevance with regard to their impact on climate change, could lead to (formal) integration of cities in the process of developing the NDCs and NAPs. It is not possible to set any obligation on which measures have to be taken on a national and local level under the PA. However, as the NDCs, and the temperature limit, are the benchmarks for the adoption of national measures, the integration of cities and other local authorities may on the one hand lead to better representation of hurdles and interests on a local level, on the other it might enhance the introduction of adequate instruments on a national level.

Finance: Enhancing sustainable cities through climate finance

Lack of and access to finance is essential to conduct climate protection and adequate measures on the way to sustainable cities. The PA does not mention any mechanism to directly financing cities or other local authorities. Besides, existing mechanisms are based on international climate finance, presumably excluding financial flows in one national state, and in particular focus on climate finance in the relation between developed and developing countries. This said, any adjustment of climate finance towards cities under the PA must be done very carefully.

Even though Art. 6 PA does not mention explicitly how cities could serve as substantial actors for combatting climate change, it offers several possibilities for the inclusion of cities and therefore for intensifying cities' commitments. The article offers first of all the possibility to more formally including already existing transnational city-led activities at the international level. Art. 6.1 PA for example recognises that some Parties choose to pursue voluntary cooperation in the implementation of their nationally determined

contributions to allow for higher ambition in their mitigation and adaptation actions and to promote sustainable development and environmental integrity. In future negotiations, cities could be identified as substantial drivers of this voluntary cooperation and cities' transnational efforts could be supported in a more formalised and more institutionalised way by establishing a special body interconnecting the UN secretariats and the secretariat established by the Global Covenant of Mayors for Climate & Energy. This could be helpful in order to formally integrate cities' independent initiatives to an even greater extent than has been possible so far (see also Art 16.1).

Being one of the central articles of the PA dealing with finance, future negotiations could also have the local perspective in mind when it comes to establishing emission trading systems aiming at strengthening cities fiscal capacities. In the past, the emissions trading system established under the Kyoto Protocol was designed to enable emissions trading between states. The three mechanisms (international emissions trading system, Joint Implementation and Clean Development Mechanism) were geared towards state action. So far, Art. 6.4 PA establishing a mechanism to contribute to the mitigation of greenhouse gas emissions and support sustainable development, has not taken into account the possible role of cities and other local actors (for example local companies) as active entities. However, as a study by the OECD⁷⁵ has shown, even in the past, cities have served as real-world laboratories often relying on the support of local private investors: there have been successful projects within the Joint Implementation as well as the Clean Development Mechanism that were led by cities as local entrepreneurs. Future negotiations should therefore incentivise and facilitate participation in the mitigation of greenhouse gas emissions by public and private entities authorised by a Party and offer a scheme which makes it possible for small entities to also financially benefit from the mechanism established under Art. 6.4 PA. Platforms for encouraging a mechanism-based cooperation between industrialized cities as well as developing cities and local private actors could be a first step towards 'localising' such mechanisms and offering a market-based incentive for intensified local sustainability. The ongoing negotiations on the design of such a mechanism as foreseen in Art. 6.4 PA should therefore take into account also a local perspective.

Art. 6.8 PA foresees integrated, holistic and balanced non-market approaches being available to Parties to assist in the implementation of their nationally determined contributions. Based on cities' commitment mentioned above, cities could serve as best practices examples for developing strategies for fulfilling locally determined contributions summing up to the fulfilment of the NDC. Taking into account the aforementioned interdependency between cities' commitments and the international treaties, the UNFCCC and PA

74 UN Habitat, Sustainable Urbanization in the PA Comparative review for urban content in the Nationally Determined Contributions (NDCs), (2016), available at: <https://unhabitat.org/sustainable-urbanization-in-the-paris-agreement> (last accessed 31/10/21).

75 Christa Clapp et al. (OECD Environment Directorate) Cities and Carbon Market Finance: Taking Stock of Cities' Experience with Clean Development Mechanism (CDM) and Joint Implementation (JI) Executive Summary (2010), available at: <https://www.oecd.org/env/cc/46501427.pdf> (last accessed 31/10/21).

might enhance sustainability in cities by offering a platform for gathering such best practices and outlining procedures on how to best integrate cities' efforts into a multi-level-governance system. This could also be seen as an important step towards more formally integrating cities' initiatives at the international stage.

Studying possibilities for strengthening cities' fiscal capacities, Art. 9 PA also could be considered as an important source. As Art. 9.8 PA points out, the Financial Mechanism of the Framework Convention serves as the financial mechanism of the PA. The climate finance (e.g. Green Climate Fund) under the PA is deeply focused on developed country parties assisting developing country parties, Art. 9.1 PA. Thus, climate finance does – at least not in its original meaning – intend the direct assistance of cities and local authorities, in particular of such authorities in developed countries. Nevertheless, using the international visibility of the UN secretariats, transnational bodies as well as the IPCC, these could work on alternative suggestions on how to encourage cooperation between more developed and developing cities, be it a taxonomy defining standards for sustainable investments, be it a catalogue on possible financial instruments that are applicable to developed as well as to developing cities. These financial instruments could be based on best practice experiences communicated by more developed as well as developing cities.

Cooperation and participation: Enhancing sustainable cities with informal and formal participation

Cooperation and participation, as shown above, not only are a necessary instrument in a democracy as such. With regard to sustainability and climate protection in particular contribution by non-party entities, public and private, is key. Neither sustainability nor climate neutrality can be achieved without an adjustment of current living conditions on all levels, including private behaviour. In accordance to this, participation does not only consist of the (formal) integration of non-party stakeholders like cities and other local, but public, authorities. Yet it also encompasses public and private education and awareness. Having said this, the PA in fact offers some starting points for this kind of cooperation and participation.

Under the PA capacity-building is explicitly (also) directed to local levels. However, capacity-building shall be country-driven, Art. 11.2 PA. Formally integrating transnationally identified successful local capacity-building strategies at the international level could therefore lead to accelerating cities initiatives. In accordance with Art. 16.4 PA the Conference of the Parties shall make the decisions necessary to promote the effective implementation of the agreement. This includes explicitly the establishment of such subsidiary bodies as deemed necessary for the implementation of the PA. Implementing a subsidiary body for local challenges could therefore play an important role for an improved coordination between the transnational and the international level.

Resume

Neither the UNFCCC nor the PA bind nor mention cities and other local authorities. Nonetheless the PA offers various opportunities to enhance sustainability in cities directly or indirectly. First and foremost, the NDCs as the key component to the PA are the major opportunity for cities and local authorities to contribute to the fulfilment of the PA.

Obviously the PA cannot make it mandatory to involve cities and local authorities in the NDCs. However, the Conference of the Parties may adopt procedural rules for the NDCs that put an emphasis on cities and that make it at least voluntary to include cities and other non-party stakeholders when establishing the NDCs. Doing so the PA might offer an incentive for national states to involve non-party stakeholders in the process. Interests and perspectives of cities thus might be better represented. Although it should be critically considered that cities have only a very limited subjectivity under international law and that there may be conflicts of interest between the state level and local actors, greater involvement of local action at the international level is an essential requirement

for the fulfilment of the PA. Regardless the role of cities and other local authorities as non-party stakeholders the Conference of the Parties may therefore deem it necessary to establish a subsidiary body for local challenges in implementing this agreement and for sustainable cities in particular. Cities' voluntary self-commitments should be integrated in the international combat against climate change in a more formal way and market-driven approaches as well as non-market-driven approaches under the PA should be designed having the local perspective in mind.

As the case studies presented in this article have shown, cities in both developed and less developed countries are working on strategies to combat climate change, as well as to adapt to climate change. While this article also has dealt with better financial mechanisms for developed cities, the notion of global justice still makes it necessary to mainly focus on less developed cities, as described in the PA. The flexibility to think locally even at the international level, could be a decisive prerequisite for the success of the PA.

IKEM