Urban Pathways

# Factsheet

## Low Carbon Neighborhood

Wuppertal Institut

UN HABITAT FOR A BETTER URBAN FUTURE

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Authors/Contributors:
Steven März (Wuppertal Institute)

Editor: Shritu Shrestha (Wuppertal Institute)
Eva Amon (Wuppertal Institute)

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The graphic design was prepared by
Barbara Lah (UEMI)

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Urban Pathways Secretariat

team@urban-pathways.org

Oliver Lah
Coordinator
+49 (0)30 2887458-16
oliver.lah@urban-pathways.org

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Author
Editor

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# Urban Pathways

***The Urban Pathways project helps to deliver on the*** Paris Agreement and the NDCs in the context of the New Urban Agenda and the Sustainable Development Goals. It has established a facility in close cooperation with other organisations and networks active in this area to support national and local governments to develop action plans and concrete implementation measures to boost low-carbon urban development. This builds on UN-Habitat's role as "a focal point on sustainable urbanisation and human settlements including in the implementation and follow-up and review of the New Urban Agenda". The project develops national action plans and local implementation concepts in key emerging economies with a high mitigation potential. The local implementation concepts are being developed into bankable projects, focusing on the access to urban basic services to create a direct link between climate change mitigation and sustainable development goals.

# Project concept

***The project follows a structured approach to boost*** Low Carbon Plans for urban mobility, energy and waste management services that deliver on the Paris Agreement and the New Urban Agenda. The project works on concrete steps towards a maximum impact with regards to the contribution of urban basic services (mobility, energy and waste management) in cities to global climate change mitigation efforts and sustainable and inclusive urban development. This project makes an active contribution to achieve global climate change targets to a 1.5°C stabilisation pathway by unlocking the global emission reduction potential of urban energy, transport and resource sectors. The project will contribute to a direct emission reduction in the pilot and outreach countries, which will trigger a longer term emission reduction with the aim to replicate this regionally and globally to make a substantial contribution to the overall emission reduction potential.

# Project aims

***This project implements integrated urban services*** solutions as proposed in the New Urban Agenda providing access to jobs and public services in urban areas, contributing to equality and social coherence and deliver on the Paris Agreement and the Sustainable Development Goals. This is the first dedicated implementation action oriented project, led by UN-Habitat to deliver on inclusive, low-carbon urban services. Securing sustainability and multiplier effect, the project aims to leverage domestic and international funding for the implementation projects that will follow from this initiative.

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## In brief

To tackle the pressing issue of climate change, cities and neighbourhoods must be transformed into low-carbon and sustainable places. There are few examples all over the world, which has incorporated low-carbon and sustainable planning and design measures in the city. Masdar City or Dongtan, China are examples of newly planned cities and neighbourhoods with such measures. There are also examples of existing low-carbon or eco- neighbourhoods in Sweden (Bo01 and Agustenberg in Malmö and Hammarby Sjöstad in Stockholm), Finland (Viiki in Helsinki), Germany (Vauban and Rieselfeld in Freiburg, Kronsberg in Hannover), Denmark (Vesterbro in Copenhagen), the Netherlands (Leidsche Rijn in Utrecht) and Great Britain (BedZED in Beddington). The neighbourhood scale level offers an integrated perspective on energy efficiency, renewable energies and mobility, e.g. to enhance sector coupling, it offers additional technological options (e.g. local heating, CHP) compared to solutions for single buildings and it has the potential to address real-world problems on the ground and thus creates local acceptance. In addition to reducing GHG emissions, low carbon neighbourhoods provide various co-benefits. They contribute to improving the local quality of life, are more resilient to the consequences of climate change and can support the local economy. It should therefore be in the interest of local authorities all over the world to transform their neighbourhoods to meet future needs.

## Measures

Below are some of the measures that a city can incorporate to develop low carbon neighbourhood:

**Urban Planning and vision**

In recent decades cities and neighbourhoods are widespread and infrastructures developments are primarily built for the use of cars, yet other urban development models are increasingly emerging. Today, cities and neighbourhoods should be compact and offer different uses in close proximity to each other (mixed land use). Ideal neighbourhoods include functions like employment, education, recreation, retail opportunities and regional transport connections within comfortable walking or cycling distances. There is strong evidence that densely populated neighbourhoods facilitate walking and cycling and make public transport more economic viable. In case of building construction, single-family detached houses normally have a higher energy demand per living space than multi-family houses with respect to operational and construction costs. According to Dutch data, houses

require 40% more energy calculated over the estimated lifetime of 68 years compared to apartments (Alfredsson, 2002). Moreover new buildings cause a lot of energy for construction. Improving public spaces also enhances the quality of life within the neighbourhood. Yet, compact and mixed-use cities can also have a negative impact on air quality and heat island effects as well, if fresh air corridors, green areas and water areas are not considered properly in urban planning.

**Renewable energy**

Renewable energies such as wind power, photovoltaic, biomass, hydropower, geothermal energy etc. can make an important contribution to the decarbonisation of the local energy system (CSE, 2018). Photovoltaic can be installed both on building roof-tops and façades as well as on existing vacant areas. Smaller wind turbines can be installed on roofs. Biowaste, local green waste etc. can be used by CHP (combined heat and power) plants. Many cities also have district heating, so that electricity and heat can be generated locally and regeneratively in an efficient way via CHP generation. The city of Copenhagen, for instance, has one of the world´s largest district heating system supplying 98% of all household in the city. The city aims to become carbon neutral by 2025 mainly due to a shift from coal to biomass in their CHP plants, the installation of new wind turbines and the use of geothermal energy.

**Energy efficiency**

The building sector contributes substantially to final energy consumption and CO2 emissions, globally, nationally and locally at the neighbourhood level. Globally, buildings account for 40% of final energy consumption and a third of total GHG emissions. Depending on the region of the world, energy consumption differs considerably. While in cold and temperate climates heat is primarily needed, in warm climates the demand for air conditioning and cooling increases. According to estimates of the IEA, global greenhouse gas emissions from the building sector could be reduced by around one third by 2050 through energy efficiency. In the lighting sector, LED and OLED technologies can save up to 80 per cent electricity compared to conventional light bulbs. Due to insulated facades, roofs and basement ceilings and triple glazing, passive houses consume only 10% of the average consumption of a German residential building.

In the building sector, however, it is not only a question of increasing energy efficiency, but also of the living space used and the associated energy consumption. The IEA estimates that global living space will almost double by 2050. Sufficiency strategies can therefore be an effective means of reducing living space growth and thus energy consumption. The neighbourhood perspective offers a number of advantages, e.g. upgrading public playing fields serving also as meeting places can reduce needs for individual living space.

**Sustainable transport**

Traffic performance can only be partially influenced by neighbourhood development since only a fraction of it takes place in the neighbourhoods themselves. However, strategies exist to reduce traffic locally. A good public transport connection of the neighbourhood therefore reduces individual traffic for instance. Public transport (trams, buses, metro, light rail transit systems, bus rapid transit) should enable feeder system at the station for the first and last mile connectivity such as shared bicycle facilities. Mobility hubs facilitate the modal shift and it should provide attractive tariffs (e.g. integrated ticketing, price structure). The City of Vienna, for example, offers a public transport ticket for 1€ per day. The city of Tallinn, Estonia even introduced a free public transport system for all residents. The Kölner Verkehrs-Betriebe (KVB), a public transport provider in the city of Cologne, Germany, has integrated transport system of public transport and bike sharing system to foster eco-mobility.

Mixed land-use, a planning approach which blends residential, commercial, cultural, institutional, or entertainment uses into one space, helps to ensure that shopping and local recreation activities takes place in a neighbourhood and encourage the use of non-motorised transportations instead of cars. Car-sharing services can reduce owning private cars and significantly reduces the number of parking spaces. Especially in cities with mixed land-use, smaller distances can often be covered on foot or by bike or e-bike to travel a bit longer range. The expansion of the bicycle infrastructure (e.g. protected bike lanes, bike highways, safe parking facilities, bike-sharing system) is therefore an important element that promote bicycle usage. The city of Copenhagen, for example, doubled its bicycle traffic since 1990 and is one of the most bicycle friendly cities in the world[1]. Shared space street design is another opportunity to foster sustainable modes of transport.

1 http://nws.eurocities.eu/MediaShell/media/CREATETechnicalMeeting.pdf

**Green infrastructure and public space**
High quality public spaces are a vital component of a low-carbon neighbourhood. It provides opportunities for people to interact, as well as opportunities for commerce and events. Streets make up to 80% of accessible public space, but are normally designed just for cars, not for people. People are more likely to interact on streets when traffic flows are low: evidence indicates that residents on quieter streets enjoy more friendships and connections with their neighbours. Green infrastructure is another important element of high quality public spaces and includes: parks, woodland, waterways and recognised nature reserves, as well as assets such as hedgerows, trees, canals or back gardens. Moreover, it includes different forms of urban agriculture (CSE, 2018).

There is strong and growing evidence that green spaces represent a key element of individuals' physical and mental health. Researchers from Exeter University, using data from 5,000 households over 17 years, found that people reported lower levels of mental distress and higher degrees of life satisfaction when they were living in greener areas (CSE, 2018).

# Results

The redevelopment or new construction of low carbon neighbourhoods offers various co-benefits for municipalities and residents. They also help tackling global challenges, such as climate change and boost green economy.

**Address climate change**
LCNs will reduce the energy consumption through various energy efficiency measures and also provide an opportunity to use renewable energies for the remaining demand. They thus contribute to climate protection by reducing greenhouse gas emissions. Moreover, they also adapt to the consequences of climate change through planning measures. The greening and shading of areas is an example of the synergetic effect of both, climate protection and adaptation. By greening roof-tops, planting trees along streets, creating parks, etc., the heat island effect is reduced, which also decreases the cooling requirements and thus the electricity consumption of buildings. At the same time, plants are CO2 sinks and can buffer rainwater during heavy rainfall. Another example is the exposure and construction of new buildings. On the one hand, it can be used to generate the highest possible solar yields

for power or heat generation, but at the same time it can reduce the overheating of buildings (e.g. size and placement of windows).

**Improve health and quality of life**

LCN with reduced individual car use lowers air and noise pollution and thus contributes to improving health. The use of renewable energies can also reduce the particulate matter pollution caused by the combustion of biomass. Houses that are poorly heated and ventilated increase health risks for residents. Energy efficiency in the building sector thus contributes to health improvements. It also reduces the risk of energy poverty. In LCNs, the public space is redistributed. Parking lots in public spaces are substituted by new cycle paths and footpaths. Streets can be developed as shared space or completely car-free, so that the public space becomes a meeting place again and offers a high quality of life.

**Support local economy**

The redevelopment or new construction of low carbon neighbourhoods initially contributes to the local added value of the crafts and construction sectors. Decreasing energy costs due to energy efficiency also mean that household income is not spent to energy companies, but can be kept in the region and reinvested in the community and for local consumption of the households. In addition, local resilience to globally influenced energy price developments is increased. By upgrading the public space, new businesses and thus jobs can be created locally (e.g. gastronomy). These effects lead to an increase in municipal tax revenues.

**Empower local communities**

The integration of local people in the planning and design of low carbon neighbourhood helps to develop solutions that are supported by the community. Citizens do not only become recipients of planning, but actively participate in shaping it (citizen science). The participation of residents also enables the development of community-based projects (e.g. citizen energy cooperatives).

## Technical and financial considerations

Sustainable urban development models with energy efficiency technologies, renewable energies or a transport infrastructure that promotes environmentally friendly modes of transport can easily be taken into account when constructing new neighbourhoods. The transformation of existing neighbourhoods is much more complex. Existing energy and transport infrastructures can lead to path dependencies due to their high investment costs and lifetime. In a neighbourhood with district heating, the heat supply will be different in the future than in a neighbourhood without district heating. The economic operation of a district heating network can also conflict with the energetic renovation of buildings. Moreover, the built environment also sets limits for optimal transport planning. The examples show that low carbon neighbourhood development is usually a balancing act and a compromise. Planning is also made more difficult by the fact that infrastructures will exist for many decades, while neighbourhoods are subject to short-term social, economic and technological innovations and megatrends. How is the population size and structure developing in the neighbourhood? How does innovations such as autonomous driving affect residents' mobility patterns? What adjustments are necessary as a result of climate change? These are just a few of the questions that neighbourhood development must face in order to provide infrastructures that are needed and used in the long term and to avoid stranded investments.

**Inventories and potential analysis**
Municipalities need to develop tools to identify suitable areas for the installation of renewable energies or to inform property owners about the energy efficiency potential of their buildings on the basis of building typology. These tools are important to create transparency and to set investment incentives.

## Policy/legislation

**Neighbourhood development plan or strategy**
Neighbourhood development plans or strategies provide the framework or vision for the sustainable neighbourhood and thus provide the guard rails for concrete planning. They should be integrated into various other city-wide plans (e.g. traffic development plan, land use plan). Nowadays, in many cities conventional land use plans still exist, which rely on area development without mixed use and therefore create mono-functional neighbourhoods. Local governments may instead provide a framework that allows developers a side-by-side view of workplace and residential buildings as well as leisure facilities. Mixed-land use

would be stimulated by allowing a variety of building types within neighbourhoods. Row houses, building duplexes, and multi-family houses enhance the diversity and healthy appearance of neighbourhoods. This also includes strategic objectives for the development of green infrastructure and the designation of appropriate areas. The city of New York has set itself the target to ensure that all New Yorkers live within a 10-min walk of a park.

**Performance standards**

Cities should allocate land development according to contextual social and ecological needs and not only looking at financial benefits. For example, minimum energy performance standards above legal requirements can be demanded when selling land for new buildings. The allocation can also be linked to the underlying concept of use. The building of social housing, multi-generation houses or accessible housing should be given preference. Furthermore, performance standards should apply not only to new buildings, but also to existing buildings. US cities, such as San Francisco and Berkeley, California have local ordinances in place that require the installation of certain energy efficiency measures in existing homes before they can be sold (UNEP, 2009). The city of Boulder, Colorado allows the renting of apartments only if a certain minimum energetic standard is met.

**Low-carbon infrastructures**

It is the task of cities to enable sustainable and low-carbon lifestyles, by providing the respective infrastructure. The construction of a bicycle-friendly infrastructure (cycle paths, fast cycle paths, parking facilities, etc.) will encourage more cyclists. Cities are often operators of public transport and can influence how attractive it is for residents. The design of parks is also in the hands of local authorities. Cities also often own public utilities and can thus influence the sources (renewables vs. fossil fuels) from which electricity is produced.

**Collaborative Governance, participation and demonstration**

It is essential to inform residents about planned projects via public meetings and the media (e.g. brochures, direct mail to individuals, newspaper etc.). However, it is even more important to involve residents in an open and transparent planning process. A collaborative governance allows to integrate local expertise and thus to create transparency and public legitimacy for tailored projects. The demonstration of good practice also helps to raise awareness for new

innovations. The empowerment and participation of locals may also include the support of citizen energy cooperatives.

**Financial incentives**
Cities can set financial incentives for energy efficiency or the expansion of renewable energies through support programmes. They can grant subsidies for energetic renovation measures. Cities can support the purchase of cargo bikes or the installation of photovoltaic or solar thermal systems.

## Institutions

The development of low carbon neighbourhood is a cross-sectional municipal task. The urban development department should take the lead. However, close coordination with other municipal offices (e.g. building, green spaces, transport, economic development department) is required. It is also important to address private sector players. Bike rental systems or car sharing are for instance often operated privately. The same can be true for public transport or taxi services. Also buildings are usually planned and built by private project developers and existing buildings rarely belong to the city itself, so that only indirect investments can be generated. Moreover, cities should be empowered by national governments to pursue ambitious urban planning beyond national targets. National funding programmes should also support local pilot projects. The exchange between cities, for example through city alliances and networks such as C40, is important.

## Transferability

The technological and planning options for the design of low carbon neighbourhoods are widely known. Success strongly depends on identifying the correct solutions appropriate for local conditions. Cities and neighbourhoods can be very different. A business model for a bike rental system that works in city A can fail in city B. It is also crucial to know which success factors have contributed to the success of previous business models, infrastructure projects or planning or social innovations. The networking of cities and neighbourhoods through city networks and peer learning are important elements to get benefit from the experience of others and to assess the transferability of projects.

# Case study: Bottrop, Germany (Innovation City)

**Context**

The city of Bottrop is located in the Ruhr area, an old industrial region in Germany. The region has long benefited from mining and the coal and steel industry. Since its decline in the 1960/70s, the city and the entire region have been struggling with the consequences of structural change. In 2010, a regional body consisting of public and private companies (InitiativkreisRuhr) launched the Innovation City Ruhr competition to stimulate innovation. The city of Bottrop was the winner of the competition. The city has set itself the goal of halving GHG emissions in a neighbourhood with 70,000 inhabitants by 2020.

**In action**

The low carbon transformation of the neighbourhood is based on a master plan that was developed from a bottom-up process in cooperation with academia, business, municipal and state administrations, civil society, and the general public. The plan contains over 350 individual measures. The latter address sectors such as housing, energy, mobility, infrastructure, and working environment. More than 200 projects have already been implemented or are in the process of being implemented (Schepelmann, 2018). In the building sector, the activities are primarily aimed at the topic of energy-efficient refurbishment. Through comprehensive on-site energy consulting, it has been possible to significantly increase the renovation rate. There are also three ambitious demonstration projects, which aim at transforming energy-consuming homes into energy-plus dwellings (which generate more energy than consume). The “CHP 100” project for instance creates 100 CHP plants in residential buildings; other projects include industrial waste to heat that is used to heat apartments. In the transport sector, city logistics measures optimise freight traffic flows. Hybrid and E-buses have been purchased and the street lighting was converted to LED. In addition, the existing green areas were upgraded and many roof areas were subsequently greened.

The financing of the process is managed in public–private partnership with the European Union (EU) structural funds, regional, municipal, and corporate investments, as well as research and technological development funds.

**Results**

The measures do not only contribute to climate protection. The project also generates local added value and municipal tax revenues. It also contributes to improving the quality of life and gives the neighbourhood

a new perspective for the future. Until 2015, the measures and projects had resulted in absolute terms in a reduction of CO2 emissions of about 100,000 tons, which is equivalent to a 38% reduction compared to 2010 emission levels. Between April 2014 and September 2015, 111 individuals had applied for a total financial support of €3.58 million for energy-related modernization activities. Together, all government and nongovernment stakeholders have invested €183 million in low-carbon transition. Until 2020, more than €290 million will be invested (Schepelmann, 2018).

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