



Green and Thriving Neighbourhoods

A pathway to net zero, featuring the '15-minute city'



Foreword

Shared responsibility

The majority of GHG emissions come from cities and their built environment. As urban populations increase, we know that compact and connected communities are the best way to preserve global resources and fragile biodiversity. Therefore, we must harness a model for low-carbon urban development that is human-scale, thriving and inclusive for our future; a model that promotes sustainable and equitable neighbourhoods that citizens and their leaders can strive for and then replicate it widely.

As mayors, we have the global responsibility to accelerate climate action, and we have the responsibility to do it in a way that creates change for the citizens and by the citizens, with them as part of the decision-making process.



Horacio Rodríguez Larreta

Mayor of Buenos Aires and Vice-Chair of C40 Cities

Accelerating towards net zero

The neighbourhood scale in a city offers some unique opportunities to accelerate towards net zero. When designing a new neighbourhood or beginning a major district-scale regeneration project, cities can set a clear vision and step up ambition on climate objectives. Taking advantage of the balance between scale and agility, neighbourhood projects can pioneer new policy, trial innovative partnership arrangements, consider creative ways to increase citizen participation and test new technologies or products that can support the overarching vision.

Developing neighbourhood demonstrators that set a positive vision of cities' low carbon future, can be a strong catalyst for change.



Anna König Jerlmyr

Mayor of Stockholm and Vice-Chair of C40 Cities

Putting people first

There is an appetite for more liveable, people-oriented cities that has been reinforced by the Covid-19 crisis, driving a surge of interest in the '15-minute city'.

A green and thriving neighbourhood should enable residents of all ages, backgrounds and abilities to meet their daily needs close to home. It should support the local economy and green jobs, provide opportunities to walk, cycle and take public transport, offer better waste management solutions and cleaner energy systems and incorporate green infrastructure - all of which contribute to accelerating climate action, while benefiting other critical urban agendas, such as promoting equity, prosperity, resilience and quality of life.



Anne Hidalgo

Mayor of Paris and former chair of C40 Cities

Introduction

Green and thriving neighbourhoods are an effective response to the urgent problem of climate change.

The need to act now

The 2020s will be a make-or-break decade for our environment. We need to halve global greenhouse gas (GHG) emissions by 2030 to avoid catastrophic climate change.

Cities have a pivotal role in helping the world meet this goal. Currently, 55% of the world's population lives in cities, rising to 68% by 2050. Opportunities arising from growth and regeneration, along with their devolved powers, their ability to attract investment and talent and foster innovation mean that cities are well placed to show leadership across a range of critical issues.

C40 Cities is a network of 100 mayors from the world's leading cities, working to deliver the urgent action needed right now to confront the climate crisis and create a future where everyone, everywhere can thrive.

C40 Cities represent more than a quarter of the global economy and 800 million people, with more than half our member cities based in the Global South. It is a platform supporting mayors in taking the urgent action required to avert a climate crisis. As part of C40 Cities' conditions of membership, all member cities have a science-based analysis of where and how emissions need to be cut in line with their fair share of halving global emissions by 2030 and a robust plan to achieve it. Through advocacy, policy-making, investment, capacity building and partnerships, these cities are driving climate action across key sectors where emissions must be reduced fast. Leadership and collaboration are essential to effect the kinds of changes needed to achieve this ambition.

Over the past ten years Arup has partnered with C40 Cities carrying out vital research to help cities measure, manage, and plan climate action, empowering their leaders to drive the climate agenda forward.

Together, C40 Cities and Arup believe 'Green and Thriving Neighbourhoods' provide a new focus to respond to the urgency of the global climate agenda. Neighbourhoods provide an ideal scale and context for equitable and sustainable recovery and an opportunity to develop replicable, net zero approaches that can be deployed city-wide and beyond.

This Guidebook provides cities, as well as national governments, private sector developers, residents and communities, with the framework and approaches to develop ambitious net zero and people-centred neighbourhoods that showcase today the future we want to see.



Mark Watts
Executive Director, C40 Cities



Alan Belfield
Chairman, Arup

Introduction

A new focus

Over the past decade, city governments, private sector developers and urban designers have increasingly worked towards low-carbon and sustainable neighbourhoods. Now is the time to accelerate action and increase our ambition.

Green and thriving neighbourhoods provide a new focus to respond to the urgency of the global climate agenda. These are neighbourhoods that reflect the priorities of a 'Green and Just Recovery' and the 'Global Green New Deal', while also contributing directly towards the UN Sustainable Development Goals on climate action (SDG 13) and sustainable cities and communities (SDG 11).

Green and thriving neighbourhoods reflect a holistic, integrated approach that maximises the synergies between different aspects of neighbourhood planning, design and operation. The result will be a robust and transparent net zero outcome, realised for the long-term in a resilient, people-centred neighbourhood, built around '15-minute city' principles.

About this guidebook

This guidebook addresses the transition to net zero in new and existing neighbourhoods, applying people-centred thinking to deliver this in all types of neighbourhood.

The guidebook summarises the opportunities at the neighbourhood scale, then sets out the two pillars at the centre of a green and thriving neighbourhood. Ten approaches respond to the two pillars, each with an explanation of the key concepts and accompanied by example actions and case studies from global cities.

The guidebook concludes with a pathway for implementation that complements existing strategic planning and development programmes. The pathway section includes a clear approach to calculating emissions, monitoring progress and demonstrating net zero outcomes.

The primary audience for this guidebook is city and sub-city local government authorities. In practice, a green and thriving neighbourhood requires the support, buy-in and contribution of a wider group of stakeholders. These include private sector developer organisations, national government bodies, residents and communities, and local businesses. The guidebook is also relevant to these important stakeholders.

More broadly, this guidebook will also be informative for net zero masterplanning in smaller settlements, where local authorities and private landowners are seeking to align decision-making with a net zero future. While some approaches in the guidebook work best at scale, the underlying principles can still be applied.

Navigating through the guidebook

In the guidebook, underlined text is a clickable link. Click on these to quickly navigate through.

Neighbourhood Opportunity

A neighbourhood is an area within a city. In different geographies neighbourhoods may be referred to as districts, precincts or communities, and although neighbourhoods will vary in size, there will typically be a mix of residential, commercial and retail buildings, green and public spaces and supporting infrastructure.

A neighbourhood is both a place and its people. As a place, the neighbourhood includes the infrastructure and buildings, the public and green spaces. The people include residents, workers and visitors of all ages, genders, races and abilities, and with different needs.

A neighbourhood will often have a unique identity that enables it to be recognised not only geographically but also through its people, character, and brand.

This identity, along with the scale of the neighbourhood, means that decisions made within its boundary can directly raise ambition and change behaviours. This is why neighbourhoods provide a great opportunity to deliver net zero outcomes and create resilient, people-centred places.

Scale

Neighbourhoods are big enough to provide economies and efficiencies of scale and provide additional opportunities from integration, compared with a single system- or sector-based approach. They are of a scale where quality of place and quality of life are tangible and can be measured. Yet neighbourhoods are also small enough to set a clear ambition within a defined boundary. This enables the mobilisation of a small and committed group of stakeholders who can respond quickly to opportunity and change.

Innovation

Neighbourhoods provide an opportunity to experiment with innovative or novel city policies, design approaches or partnership arrangements before these are scaled up. This means that outcomes, challenges and opportunities are visible in a shorter period of time, and at a lower cost than a city-wide initiative.

Governance

The physical boundary of a neighbourhood enables the creation of more manageable governance structures and monitoring and evaluation programmes to test emerging approaches for net zero development that ensure they are effective and scalable. Since net zero outcomes are likely to relate closely to

city-wide or even national policies, programmes and funding, the neighbourhood governance structure can act as a link between local ambition and higher-level government.

Financing and Funding

New initiatives at the neighbourhood level can typically be initiated with a lower level of investment compared with city-wide programmes. This provides an opportunity to design and deliver 'proof of concept' projects, which can attract further funding. The proximity to businesses and residents may also attract local or grassroots funding from organisations who may feel they can 'see' who and what their investment will benefit.

Communities and Collaboration

Implementing net zero solutions at the neighbourhood scale provides many opportunities for community participation to identify and strengthen the needs of the local residents and to the transition to behaviour change. A neighbourhood project also provides an opportunity to involve and up-skill a wide range of people (e.g. urban planners, developers, construction workforce, community groups). This exposes them to a range of emerging practices and helps them to recognise their capabilities and identify opportunities to contribute.



Two Pillars

A green and thriving neighbourhood will be planned, designed and operated to minimise emissions throughout the development lifecycle. It will achieve this in ways that meet the needs of residents, workers and visitors and provide a high-quality and resilient environment that enables the community to thrive.

This means that a green and thriving neighbourhood is defined by two key pillars, addressing both the emissions imperative and promoting quality of life at the neighbourhood scale. These pillars are inextricably linked and must be approached in an integrated way to create a green and thriving neighbourhood.

By addressing both pillars, a green and thriving neighbourhood will become a highly desirable place to be, for residents, workers and visitors, supported by a green business ecosystem. It will demonstrate meaningful emissions reduction in practice and stand out as a front-runner for other neighbourhoods to follow.



A pathway to net zero, featuring the '15-minute city'

Two Pillars

Pillar 1

Green: net zero emissions

A green and thriving neighbourhood will aim to minimise emissions throughout the project lifecycle and achieve net zero by counteracting any residual emissions in a robust and transparent way.

There are different frameworks for categorising emissions. For neighbourhood-scale projects, it is most straightforward to consider these three categories: operational, embodied and consumption-based emissions.

Neighbourhoods should aim to achieve net zero operational and embodied emissions, while taking ambitious action on consumption-based emissions.

Achieving net zero emissions will take time. The neighbourhood should adopt near-term targets, driving rapid emissions reduction now, aligned with the leading global commitments on emissions reduction.

The neighbourhood should adopt near-term targets, driving rapid emissions reduction now.



Operational emissions

These are emissions that occur continually throughout the lifetime of the neighbourhood. They are measured on an annual basis and include emissions due to energy used in buildings, public spaces and transportation, or emissions arising from processing waste.

Annual operational emissions should be calculated using the Global Protocol for Community-Scale GHG Emissions (GPC) standard using the BASIC reporting level to capture Scope 1 and 2 emissions from stationary energy and transportation, as well as Scope 1 and 3 emissions from waste. The standardised GPC methods can be used to fill data gaps where necessary.

Operational emissions target

All new buildings in the neighbourhood should have net zero operational emissions.

The neighbourhood should define a strategy to ensure that all existing buildings achieve net zero operational emissions. An ambitious target would be to complete this renovation within the period of neighbourhood re-development. The latest this can be completed is 2050, in line with the World Green Building Council commitment.



Embodied emissions

These are emissions from the materials and construction processes of buildings and infrastructure, including new construction, retrofits and redevelopment. All embodied emissions should be assessed, including those due to material extraction, manufacturing, assembly, maintenance, repairs, replacements, deconstruction, demolition and any associated transport, waste and end of life impacts.

Embodied emissions only occur at specific points through the development cycle. Historic embodied emissions in existing buildings and infrastructure do not need to be included in the assessment, although any future embodied emissions should be captured.

Embodied emissions target

The neighbourhood should establish a process for requiring lifecycle emissions assessments from all construction.

It is recommended that neighbourhoods set a minimum reduction target for embodied emissions against a 'Business-as-usual' approach for a comparable neighbourhood in the city. An ambitious target would be at least a 50% reduction over the 'Business-as-usual' approach.



Consumption-based emissions

All goods and services have an emissions impact and as the people in a neighbourhood buy food or clothes, travel on holiday or invest in new technology, they are increasing their emissions impact. Since this considers a far broader set of emissions sources, consumption-based emissions assessments inevitably involve more complex data and more detailed calculations.

Given this, a green and thriving neighbourhood emissions assessment does not need a complete consumption-based emissions inventory, rather the neighbourhood should focus on delivering tangible and ambitious actions to reduce consumption-based emissions.

Consumption-based emissions target

Due to the wide range of consumption-based emissions and the difficulty in calculating them accurately, it is recommended that neighbourhoods focus on a small number of ambitious actions that have a measurable impact on consumption-based emissions through shifting lifestyles and behaviour. Examples include, locally grown food, transport or logistics hubs and 'sharing economy' initiatives.

Two Pillars

Pillar 2

Thriving: resilient, people-centred places

A green and thriving neighbourhood meets the needs of its people and strengthens quality of life. Its people, businesses and systems can survive, adapt and prosper no matter the shocks, stresses or climate related impacts they experience. All residents can access goods, services, education and employment in a fair and inclusive way; while the urban realm provides a vibrant, safe and friendly environment for all. The neighbourhood is distinctly 'human-scale', encouraging healthy lifestyles and providing seamless connectivity to the city and beyond.

The 15-Minute City

Many of the approaches proposed to achieve Pillar 2 are common to the "15-minute city" model, an increasingly valuable urban planning paradigm, especially since the COVID-19 pandemic re-emphasized the importance of the hyper-local environment to support quality of life.

Adopting a 15-minute city strategy means striving for an urban model that allows everyone, in every neighbourhood, to meet most of their everyday needs within a short walk or bike ride of their home. It creates a 'human-scale' city composed of vibrant, people-friendly, 'complete' neighbourhoods, connected by quality public transport and cycling infrastructure for the longer trips that residents want or need to make. It means decentralising city life and services and injecting more life into local areas across the city.

The concept of the 15-minute city is in sharp contrast to urban-planning paradigms that have dominated the past century, which have seen residential areas separated from businesses, retail, industry and entertainment.

This intuitive, adaptable and popular vision of urban living already takes many names and shapes around the world. Leading examples include Paris' 15-Minute City, Barcelona's Superblock, Portland's Complete Neighbourhoods, Melbourne's 20 Minute Neighbourhoods, Buenos Aires' Human-scale City as well as Bogotá's Barrios Vitales.

This guidebook intends to capture the key concepts rather than rely on one particular model or proponent.



Ten Approaches

Green and thriving neighbourhoods require a model for low carbon urbanization that is socially beneficial and widely supported, which can be rapidly endorsed and replicated. Achieving this will require comprehensive and integrated action to reduce emissions (Pillar 1) and create a place that recognizably meets the needs of people and strengthens quality of life (Pillar 2). This section outlines ten approaches that respond to these two pillars.

Navigating through this section

The ten approaches draw on global best-practice and case studies from cities across the C40 network. They are presented in this section on interactive pages.

- Each approach has a **summary**.
- The approach is explained in more detail through the key concepts, illustrated with example actions and supported by case studies from global cities.
- Use the **sub-menu** to navigate to the content;

[Overview](#) [Key concepts](#) [Potential actions](#) [Case studies 1](#)

Click the links below to navigate to each approach

Ten Approaches

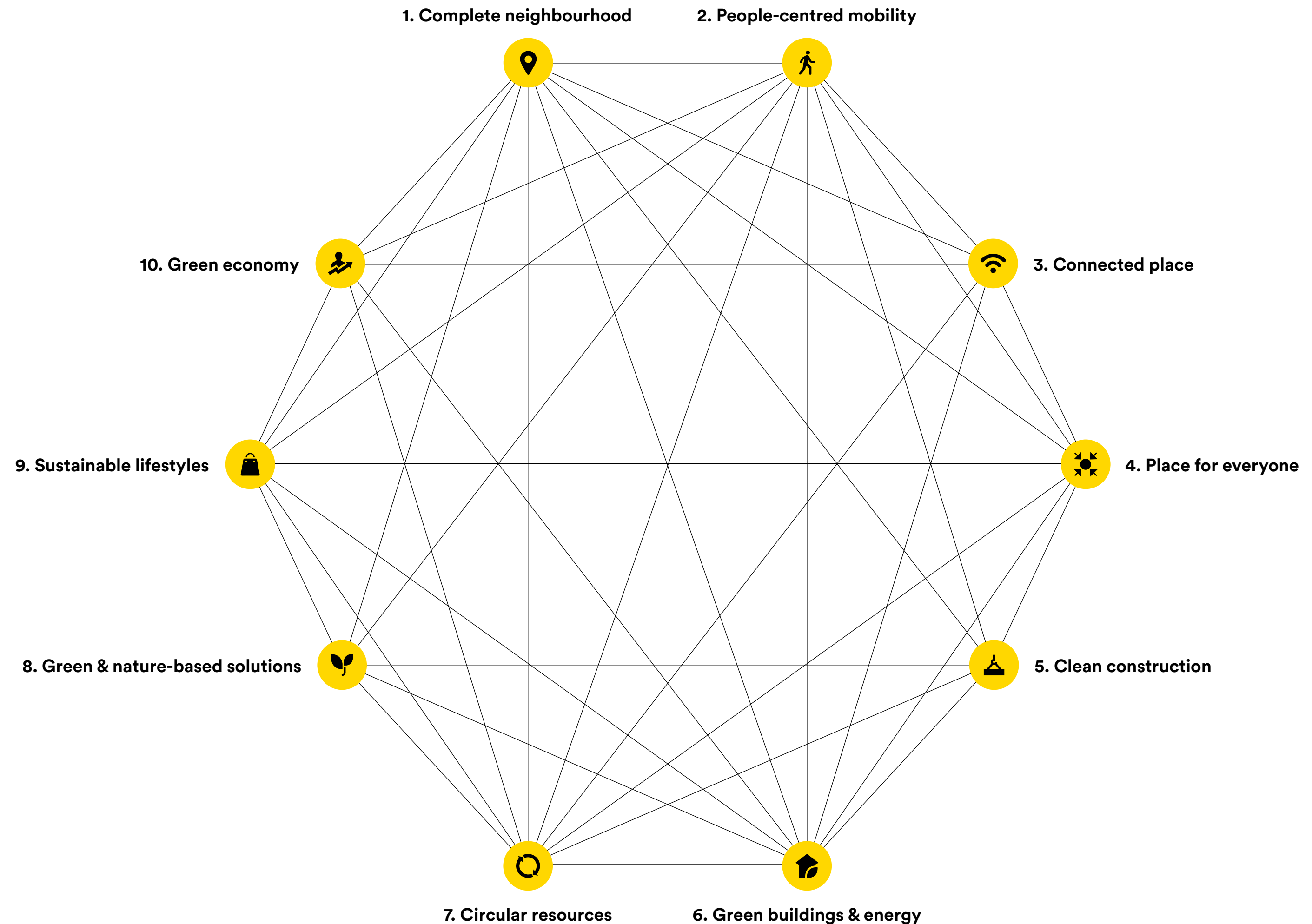
The ten approaches inter-relate and should not be treated independently.

Extending ambition through one approach will create opportunities in other areas too. Considering the ten approaches together will also help to ensure that they are delivered in ways that 'do no significant harm', and that one environmental objective is not achieved at the expense of another.

The ten approaches will be most impactful if they are adopted early in the development cycle. Many of the highest impact opportunities require deliberate decision-making from the project outset. These ten approaches will be helpful in informing the neighbourhood vision and objectives, identifying key stakeholders and setting the development brief. Nonetheless, where decisions have already been made, the ten approaches provide a framework for reviewing the direction of development and helping clients and stakeholders achieve a green and thriving neighbourhood.

Whilst important to seize opportunities to act early, it will also be necessary to track the ten design approaches throughout the development cycle. It is not sufficient to simply 'design in' best practice; thought must be given to the implementation, including construction and on-going maintenance. The end-user should be a particular focus, whether that is a resident, worker, or visitor.

The ten approaches will be most impactful if they are adopted early in the development cycle.



A pathway to net zero, featuring the '15-minute city'

Ten Approaches



1. Complete neighbourhood

A green and thriving neighbourhood will prioritise local life, providing a compact neighbourhood where people can access everyday needs within a short walk or bike ride from their home. This includes safe and equitable access to fresh groceries, healthcare, jobs or workspace and other key services. It relies on mixed-use planning from the neighbourhood scale right down to individual buildings and spaces; every area of the neighbourhood will support multiple purposes. Streets will be energised by permanent and temporary initiatives, including active ground floor frontages and meanwhile uses, helping to drive local economic growth and create a comfortable, dynamic and safe urban environment.



A pathway to net zero, featuring the '15-minute city'

Ten Approaches



1. Complete neighbourhood

Click the links below to navigate to further content.

Ten Approaches



2. People-centred streets and mobility

Walking, cycling or other non-motorised modes will be the default choice for people to move around in a green and thriving neighbourhood. Active transport will be encouraged through the provision of well-designed spaces and supporting infrastructure and services. For example, street space can be reclaimed from private vehicles to allow the widening of footways, creation of segregated cycle lanes, and the greening of streetscapes to create a more pleasant place to be. Bike parking, repair services, pedestrianised zones and pedestrian/cyclist-friendly wayfinding will be central to the street scene. The use of private fossil fuel vehicles will be discouraged, as zero emissions public transit and vehicle sharing schemes are prioritised.



A pathway to net zero, featuring the '15-minute city'

Ten Approaches



2. People-centred streets and mobility

Click the links below to navigate to further content.

Ten Approaches



3. Connected place

While a green and thriving neighbourhood should focus on building a viable local lifestyle, it is also critical to ensure strong physical and digital connectivity with other parts of the city and beyond. High-quality digital infrastructure and well-integrated public transport networks are essential to improving social and economic links across the city and to enable more flexible working practices. Together, these approaches will both avoid unnecessary travel and ensure that mass transit is the go-to mode for longer journeys, helping to reduce transport emissions. Digital solutions will also be important to improve the efficiency of infrastructure and services across all sectors.



A pathway to net zero, featuring the '15-minute city'

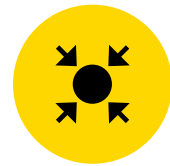
Ten Approaches



3. Connected place

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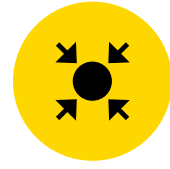
Ten Approaches



4. A place for everyone

Climate change is intrinsically unfair – the world’s wealthiest 10% produce half of all emissions, while the impacts often affect poorer communities more severely. A green and thriving neighbourhood should not only address the causes and impacts of climate change, but also improve living standards, create better job opportunities, and enhance public and environmental health for all. Equity, accessibility and inclusivity will be central goals. The neighbourhood should include varied and affordable homes and amenities that cater for a wide range of needs and incomes. The plan should promote healthy living, a sense of community, and connectedness through spaces dedicated to collective use, such as communal gardens and shared spaces. Active engagement with local stakeholders will be essential to harness local knowledge and support behavioural change, while a strong process for monitoring and evaluating the impacts of design choices will be important to ensure equitable distribution of benefits.

Ten Approaches

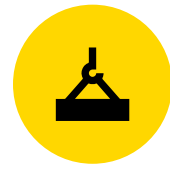


4. A place for everyone

Click the links below to navigate to further content.



Ten Approaches



5. Clean construction

All construction, both new assets and retrofits, will add embodied emissions to the neighbourhood emissions profile. To minimise this impact, it is important to make the most of the existing assets by optimizing, reusing and repurposing existing buildings and infrastructure or underutilised space. Where construction is required, it should be planned, designed and built for the long-term, ensuring the neighbourhood is resilient to future changes. Materials should be carefully selected and used efficiently to reduce embodied emissions, with decisions driven by lifecycle emissions data. Finally, construction processes should be rationalised and decarbonised, contributing to lower environmental impacts and generating multiple benefits.



A pathway to net zero, featuring the '15-minute city'

Ten Approaches



5. Clean construction

Click the links below to
navigate to further content.

Ten Approaches



6. Green buildings and energy

Buildings are one of the largest energy consumers in urban neighbourhoods. A green and thriving neighbourhood will need to minimise building emissions by adopting passive design principles, investing in high-efficiency neighbourhood-wide energy infrastructure and decarbonising energy supply.



A pathway to net zero, featuring the '15-minute city'

Ten Approaches



6. Green buildings and energy

Click the links below to navigate to further content.

Ten Approaches



7. Circular resources

It is vital to understand resources as limited and valuable. During the operation phase, a green and thriving neighbourhood should minimise resource use and waste generation. This applies to solid materials, as well as water and energy, aiming to minimise emissions associated with extraction, processing, transmission, distribution and use of all resources. Going further, a neighbourhood scale approach provides an opportunity to instil circular economy principles to conserve and manage resources, and to create a long-term value chain for materials. The neighbourhood scale offers opportunities for community reuse and recycling programmes, and for partnerships between businesses and communities to reuse materials, waste and by-products.



A pathway to net zero, featuring the '15-minute city'

Ten Approaches



7. Circular resources

Click the links below to
navigate to further content.

Ten Approaches



8. Green and nature-based solutions

Green and blue spaces are critical features of a net zero, resilient and thriving urban neighbourhood. Urban green spaces are proven to improve physical and mental health and wellbeing, inspire social interaction and improve footfall for local businesses, support biodiversity, and provide ecosystem services such as stormwater attenuation, localised cooling, carbon sequestration and improved air quality. Green and thriving neighbourhoods will provide high-quality open green spaces, while also adopting a 'green throughout' strategy in streets and public realm, and on walls and roofs of buildings. A wide range of green assets will be included, such as parks, tree planting, green roofs and walls, roof gardens, community gardens, allotments or urban farms. Green assets are not short-term interventions, but should be valued and continuously monitored, maintained and improved.



A pathway to net zero, featuring the '15-minute city'

Ten Approaches



8. Green and nature-based solutions

Click the links below to navigate to further content.

Ten Approaches



9. Sustainable lifestyles

Green and thriving neighbourhoods should make sustainable lifestyles attractive, affordable and easy to achieve. All goods and services procured in the neighbourhood have an emissions footprint, but the way streets are designed, the facilities that are provided, and the way land is allocated can encourage residents, workers and visitors to make lower impact choices. The neighbourhood should equip and empower individuals, promoting a service-based and sharing economy, and supporting long-term behaviour change through effective and sustained awareness-raising, education and skills campaigns, and appropriate financial and policy incentives.



A pathway to net zero, featuring the '15-minute city'

Ten Approaches



9. Sustainable lifestyles

Click the links below to
navigate to further content.



Ten Approaches



10. Green economy

The neighbourhood should create and support green jobs and contribute to long-term prosperity, within the bounds of ecosystem resilience and resource efficiency. It should sensitively connect with local communities and the local economic context, and meaningfully support a just transition. This can be achieved by using the development process to incubate new skills and green jobs, providing spaces and infrastructure to attract and support sustainable businesses, and promoting training and upskilling opportunities, especially for young people, older workers and under-represented groups.



A pathway to net zero, featuring the '15-minute city'

Ten Approaches



10. Green economy

Click the links below to navigate to further content.

Pathway

Successfully developing a green and thriving neighbourhood requires a strategic and holistic approach. Investing in standalone technical solutions will not be enough. Addressing the emissions imperative and promoting quality of life will be most effective and achievable if the city and relevant local government agencies have established an enabling environment. This means, for example, referencing the neighbourhood in relevant land use strategies and development policies, establishing programmes of capacity building, and directing funding as needed.

Investing in standalone technical solutions will not be enough.

This section outlines a strategic development pathway that integrates net zero considerations into five core stages:

1. Prepare the project

Make a commitment to invest in a site, identify the key stakeholders who will lead the vision and be accountable for success and establish partnering arrangements.

2. Establish a baseline

Develop an understanding of the broader context of the site, such as the surrounding environment, land use and open space, transport and utilities connections, and social and economic conditions. Use this to identify the key issues which need to be resolved and the various elements that could act as catalysts of change. Calculate an initial emissions baseline and determine the main quality of life indicators.

3. Set the vision

Establish a clear vision, objectives and targets for the neighbourhood. These set a framework to guide the development cycle from concept and design development through to implementation, construction and operation. Use the vision to build consensus among stakeholders and to establish a framework for measuring success.

4. Determine actions

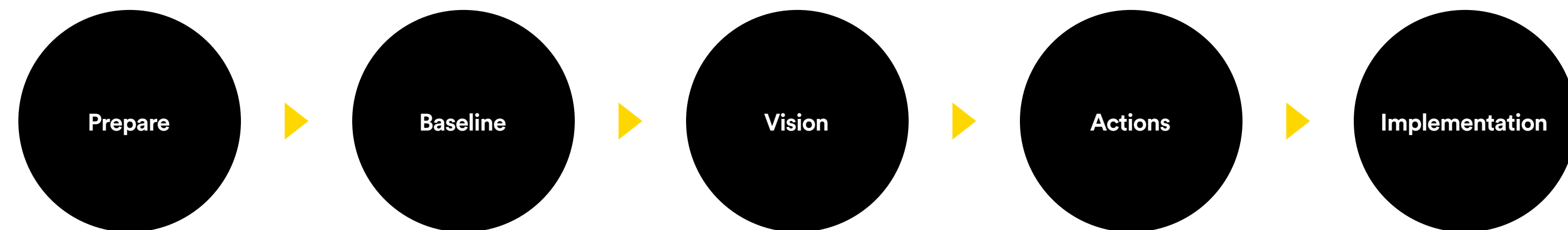
Achieve the vision, objectives and targets by establishing key actions, responsibilities and accountabilities for planning, design, development and operation of the neighbourhood. Prioritise the 'Ten Approaches' and incorporate into the action plan.

5. Plan for implementation

Agree financing, policies, partnerships and contracting arrangements that need to be established to deliver long-term successful outcomes.

Emissions assessment

This section concludes with further detail on how to undertake a robust emissions assessment. It is essential that this is undertaken carefully and then regularly updated, ensuring that a science-based net zero claim is transparently achieved.



Pathway

Prepare the project

The Prepare stage considers governance models, selects a site and drives participation and engagement through effective stakeholder dialogue.

Site selection

Delivering a green and thriving neighbourhood will be made more, or less, challenging depending on the neighbourhood location. For example, infill development or regeneration on brownfield land is far less carbon intensive than developing greenfield sites on the edge of the city, or even as a satellite town. Some locations will be better connected for transport and offer better opportunities for extending existing energy, water or sewage networks, or digital infrastructure. Selecting a neighbourhood site within a wider signalled or planned development zone should be considered. This can help enable access to finance, resources, skills and expertise that can accelerate the green and thriving neighbourhood project and provide an opportunity to integrate climate action into broader development programmes.

Where various sites are under consideration, it will be beneficial to undertake some of the 'Baseline' activities (see below) to help inform the decision-making process.

Stakeholder engagement

The development of a green and thriving neighbourhood requires multiple stakeholders to understand the value of climate action and collaborate around a shared vision. It is crucial to map out and plan how to engage and work with important stakeholders over the project lifecycle. It is important to have a clear engagement process in place at the outset, so that all stakeholders understand how they can contribute most effectively.

There are many techniques that can be utilised to identify and engage the appropriate stakeholders, and C40 Cities have developed engagement guidebooks as part of the Inclusive Climate Action programme.

The stakeholders are likely to fall into the following categories:

- **City/Local Authority:** Play a key role in leading, enabling or delivering a neighbourhood, covering land use policy and provision of infrastructure.
- **Private Developers:** Make decisions about the way land is developed.
- **Construction Companies:** Influence materials choices and construction methods.
- **Utility Providers:** Provide energy, water and waste and ITC services to the neighbourhood and wider area.
- **Local Businesses:** Play a critical role in reducing consumption emissions through the goods and services they provide, as well as the choices they make about their supply chain.
- **Community Groups & Residents:** Can be a positive voice for the green and thriving neighbourhood if properly engaged in the planning process.
- **NGOs/Development Agencies:** Can help with financial resource, capacity and knowledge.
- **National Government:** May own and operate, regulate or fund key infrastructure, assets and services that are critical for the neighbourhood.

Green and thriving neighbourhoods present a unique opportunity to shift the supply chain, encourage innovation and develop new low-carbon demand in the marketplace. Strong leadership is important to send clear signals that will drive this change, and this can be amplified through the convening power of the Mayor or city government.

Community stakeholders will benefit from early engagement, ensuring their voice is heard during the planning of the neighbourhood. This relationship will grow over time, as understanding and trust develops. Supportive community groups can enhance and take ownership of longer-term initiatives that support low-carbon lifestyles.

Governance model

The governance model for a green and thriving neighbourhood will be determined by factors such as city powers, land ownership and financing arrangements. A lead agency should be established with the power to set the net zero agenda. This may be an entity within city government, created independently with public or private-sector partners, or an entirely private-sector enterprise. In each case, senior leaders (including elected officials in some cases), who have the power and mandate to drive the development plan and integrate net zero ambitions, will be key to delivering a successful green and thriving neighbourhood.

The C40 Powering Climate Action report identifies different power profiles and the respective levers that cities can use. It highlights areas where partnerships will be required in the absence of power or influence. Early dialogue framed around "Powers to Act" may help in formulating an appropriate development governance structure.

Stockholm Royal Seaport

In Stockholm, the city owns the Royal Seaport land which enables it to implement stricter requirements than existing building codes and legislation. The City Development Administration established administration- and company-wide working groups to set sustainability targets for developers. These requirements are reflected in land allocation and included in development contracts. They are reviewed and audited at all phases of a project, from preliminary concepts all the way through to property management. Developers submit results to an online database which are reviewed by City of Stockholm experts, so that the working groups can continuously evaluate the progress.

This process led to 8% energy consumption reductions after two years of occupancy, during which the City worked with the developers to implement corrective measures.

Waterfront Toronto

Waterfront Toronto (WT) is an independent, arms-length corporation with a Board consisting of representation from all three levels of government: the City of Toronto, Province of Ontario, and Government of Canada, each committing \$900m to the revitalization effort. This structure streamlined funding and approvals, improved coordination and defined a consistent vision for revitalization.

An independent review found that WT had successfully created high-quality public spaces, new real estate, local labour market benefits and government revenue. This 2015 review also identified that in some cases, a lack of clarity in WT's mandate may have led to ambiguity in project roles and responsibilities. The review recommended establishing a Master Service Agreement that clearly defines interlocking roles and responsibilities, particularly when operation or maintenance falls to other City departments.

Pathway

Establish a baseline

The Baseline stage ensures the whole team has a consistent understanding of the factors that will impact the green and thriving neighbourhood and establishes the emissions profile.

Pillar 1 – Green: Net zero emissions

Calculate the neighbourhood emissions profile

An emissions profile must be developed for the neighbourhood, whether it is a new or an existing neighbourhood. The emissions profile should be predicted during the baseline stage using best-available site data and benchmarks.

A plan to regularly update the emissions profile should be agreed. As more data becomes available, the annual operational emissions calculation should adopt the GPC standard.

Using a live, easily monitored and collaborative data platform will help provide consistent reporting and insight to all stakeholders. This will require appropriate digital infrastructure, supported by clear governance and data-sharing protocols. A third-party verifier can provide assurance of the emissions analysis using recognised international standards. This will help provide transparency on progress and support net zero claims or publicity.

Determine the factors that impact neighbourhood-wide emissions

There is a range of factors that contribute to the emissions profile of the neighbourhood. Some of these include:

- **Land use:** Zoning, density, activity distribution and the types of shops and businesses located in the area.
- **Transport and street network:** Public and active transport infrastructure, space allocated to car parking, and last-mile infrastructure.
- **Buildings and built form:** Type and scale of buildings.
- **Open spaces and public realm:** Green infrastructure and carbon sequestration opportunities, such as tree coverage, healthy water and soils.
- **Utilities and materials:** Sources of energy (e.g. renewable energy) and energy efficiency, management of waste, local sourcing of materials (e.g. wood), conservation and recycling of water.
- **Regulatory:** Requirements and standards, plans and policy, at a local, metropolitan, state and national level.

Identify how each of these factors contribute to the neighbourhood emissions profile and begin to test how changes to these factors reduce emissions in the new or regenerated neighbourhood. This will help identify the largest emissions sources and the best opportunities for emissions reduction.

Pillar 2 – Thriving: Resilient people-centred communities

Review the social, economic and environmental drivers

Alongside the emissions baseline assessment, it is important to establish a baseline for the other social, economic and environmental drivers. This will provide a consistent basis against which to test the impact of different development decisions. This should be a broad assessment, including:

- Capacity studies to assess the existing provision of education, healthcare and housing services, in the neighbourhood and in neighbouring areas
- Needs assessment to identify the most important amenities and services
- Employment surveys to highlight local job opportunities
- Evaluations of existing green space and water bodies, current biodiversity levels and air quality
- Reviews of existing local, state, and national policies and commitments that will determine minimum provisions and standards in the new or regenerated neighbourhood.

Agree the baseline quality of life requirements

With a clear understanding of the existing provision and environmental quality, the lead agency should agree baseline quality of life indicators. This process should be informed by consultation with the most appropriate stakeholder groups, particularly community groups that represent future residents, workers or visitors. The quality of life indicators should be prioritised and short-listed; it will be more effective to focus on a smaller set of ambitious and impactful indicators, rather than trying to deliver lots to a lower standard. Neighbourhoods can improve transparency and comparability by selecting existing development planning indicators used elsewhere in the city or region.

Pathway

Set the vision

The Vision stage embeds green and thriving outcomes into the neighbourhood vision and objectives and establishes a framework to monitor progress towards this goal.

The vision and objectives should always be tailored to the local context and link to the findings from the baseline stage.

Embed green and thriving outcomes in the vision and objectives of the neighbourhood

The vision and objectives should articulate how the neighbourhood responds to the two pillars, addressing both the emissions imperative and the need to deliver a high quality of life, resilient to the impact of climate change. The vision and objectives should always be co-created with stakeholders, reflect the local context and link to the findings of the baseline stage.

It may be helpful to engage a wider audience in the process of setting the vision and objectives such as key stakeholders and community members. This will help to promote ownership and achieve buy in to the vision. This process may also support the integration of wider co-benefits into net zero objectives, demonstrating the value of achieving net zero for all stakeholders.

Other high-level strategies (such as landscape, energy, waste, etc.) and a spatial framework may be developed at this stage. The green and thriving outcomes and corresponding objectives should be clearly linked throughout.

Set a net zero target and a trajectory to reduce emissions

The neighbourhood will target net zero emissions in the near term, aligning with the following principles:

- At least as ambitious as any national net zero target
- Achieved more quickly than any city-wide target

This requires a trajectory to net zero from the start of the project through to the net zero target year and beyond. The trajectory will depend on several factors:

- The cost and technical feasibility of measures to reduce emissions
- The social and political feasibility of measures to reduce emissions
- The co-benefits of delivering these climate actions

The trajectories should be modelled using the baseline emissions profile.

Establish a monitoring framework to ensure outcomes are achieved

Net zero is not a final state but an annual status that needs to be continuously monitored. A monitoring framework should be adopted by the lead agency and disseminated to all stakeholders. The framework should monitor both emissions and quality of life.

Effective monitoring will help identify actions which are or are not having the desired impact, or where significant barriers and constraints have occurred. Regular monitoring means these can be identified early, so that a new course of action can be planned, and resources can be managed to ensure the neighbourhood remains on track to achieve its net zero ambition.

Key performance indicators (KPIs) can be used to model the anticipated performance of the neighbourhood during planning and design. The same indicators may be measured during construction and operation to test whether the expected performance is being realised. KPIs can be grouped into 'Reporting' metrics that summarise the overall performance (e.g. emissions reduction) and 'Monitoring' metrics that help track broader progress.

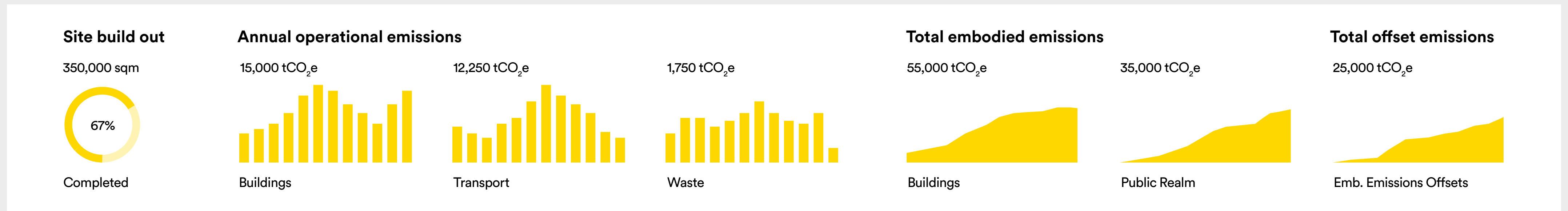
KPIs will draw on quantitative metrics, geodata and qualitative information about the neighbourhood sourced from residents and other stakeholders. Where relevant, KPIs should be disaggregated according to all relevant demographic and community groups to ensure that the benefits of the development are distributed equitably.

It is important to share the findings of your monitoring activities with the wider stakeholder network to maintain engagement and attract ongoing support and investment.

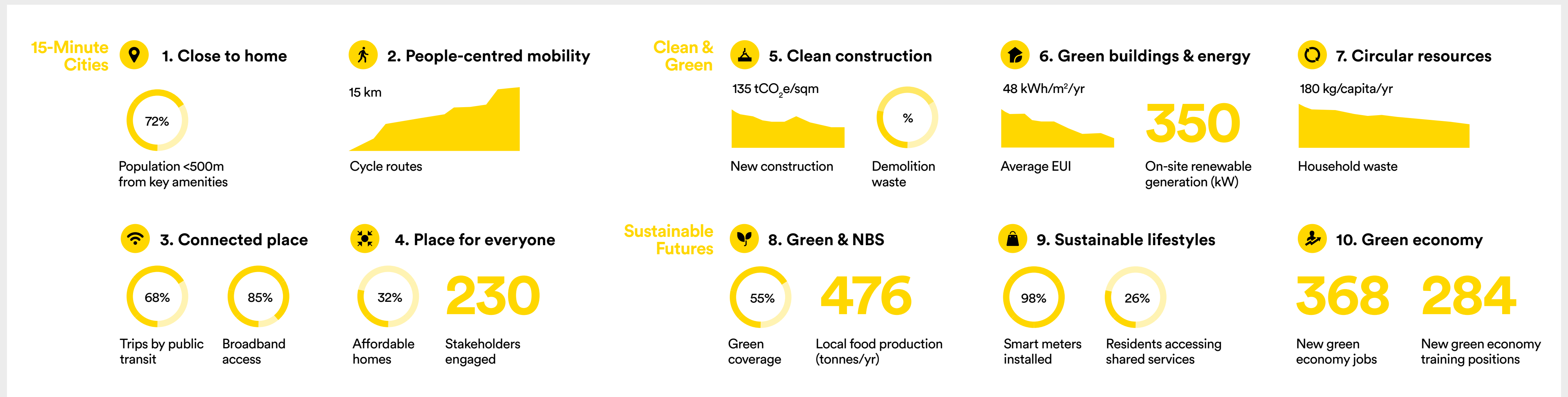
Pathway

This example dashboard shows a set of KPIs that reflect the two pillars and ten approaches in this guidebook

Reporting



Monitoring



Pathway

Determine actions

The Action stage defines clear design, technology or process interventions that will support a green and thriving neighbourhood.

Achieving quick wins will help build momentum, improving a neighbourhood's potential to attract further funding and investment.

Prioritise the 'Ten Approaches'

Take time to review the approaches and create a long list of example actions that align with the vision and objectives of the neighbourhood. Identify actions that reinforce and others that enable further opportunities. The long list provides a basis for a broad, coherent action plan.

It is important to balance quick wins with large-scale ambitious actions. Successfully delivering small-scale emissions reduction projects within a short timeframe will help demonstrate serious commitment to the net zero target. Achieving quick wins will help build momentum and the neighbourhood is likely to be better placed to attract funding and investment. These projects can be inexpensive and simple.

Integrate actions throughout the development

The lead agency (or partnership) should identify an effective method for cascading the net zero vision and objectives, as well as priority actions, to individual plots, projects or stakeholders. One approach is to produce a neighbourhood-wide net zero strategy document, applied and tailored through plot or project briefs. The brief should guide the development but allow enough flexibility for design teams to innovate. Targets should be identified as either mandatory or optional, and it should be clear how achieving these targets supports neighbourhood-wide objectives. Performance against the plot or project briefs should be regularly reported as part of the overarching programme management and control.

Test neighbourhood-wide innovation

A neighbourhood-scale development offers an opportunity to trial and test new and innovative approaches to emissions reductions. Establishing a neighbourhood-wide innovation framework will help identify the types of actions that can reduce operational, embodied and consumption-based emissions. This will require cross-sectoral collaboration and innovative approaches to engagement, particularly with supply chains and manufacturers.

Businesses, developers and community groups should be supported and funded to help develop new approaches. Activities that can support identification of new approaches include:

- Design competitions to put forward specific solutions to a neighbourhood-scale problem (e.g. C40 Cities 'Reinventing Cities')
- Directed research and development funding for businesses to explore new solutions in the context of the neighbourhood (e.g. comparing hydrogen against existing neighbourhood heating schemes)
- Work with research organisations and universities to create pilot scale trials of new technologies.

Innovating early will allow time to monitor performance, so that lessons learned can be embedded throughout the rest of the development cycle.

Pathway

Plan for implementation

The Plan stage will prepare the lead agency and neighbourhood stakeholders to deliver a successful green and thriving neighbourhood.

Agree a lifecycle perspective

Many green and thriving actions will save money over the longer term. It is important for all stakeholders to share a common understanding of how to value emissions reductions and financial costs over the development lifecycle. It will be necessary to incentivise and mandate lifecycle perspectives to avoid selecting solutions that minimise up-front costs at the expense of longer-term benefits. Addressing this effectively will impact procurement specifications, cost controls and stakeholder remuneration.

Share risk

Pursuing green and thriving outcomes requires innovative approaches and solutions. This comes with a certain level of risk. Sharing these risks (and benefits) between stakeholders can increase the feasibility and attractiveness of taking action. Forms of contracting should support a collaborative risk-sharing approach, rather than creating a combative environment that stifles innovation.

At the neighbourhood-scale, consider the benefit of public-private partnerships (PPPs) to combine the delivery efficiency of the private sector with the vision and local expertise of the city government. Research has shown that when local authorities collaborate, they are twice as likely to deliver effective climate action.

It might also be possible to consider public-public collaboration, whether with another public authority or with a community group. These approaches have been used effectively to create neighbourhood heating systems or community-owned renewable energy companies.

Procurement powers

Depending on the ownership and partnership arrangements, procurement requirements can provide an opportunity to embed green and thriving standards across the design, development, and operation of a neighbourhood, particularly on publicly funded projects. This can set a benchmark for the neighbourhood, incentivise contractors to increase their climate awareness and capabilities, and demonstrate the broader value of climate action.

The procurement strategy will ensure that green and thriving objectives are considered from the outset and favoured during tendering. This will help drive innovative responses and provide reassurance that the emissions imperative and thriving neighbourhood objectives will be achieved. Establishing a Code of Construction Practice will require minimum standards from all contractors and suppliers, and this can be used to monitor performance throughout the development cycle.

Identify funding and financing opportunities

Funding green and thriving actions will sometimes be challenging. Beginning with 'easy-wins' and 'low-cost interventions' can help build momentum in the near term, while waiting for larger investments.

Look for opportunities to leverage existing neighbourhood investments, such as planned transport or utilities upgrades. It may also be possible to target city-wide plans or strategies that make investment funds available (e.g. tree planting funds, LED lighting upgrades).

It is particularly important that early investment aligns with the long-term green and thriving outcomes. The first phases of development will embed habits and behaviours in residents and workers, so catalytic projects should set the tone of what will come.

Consider broader funding sources or arrangements such as green finance, grant funding, environmental upgrade agreements or tax benefits to close the finance gap. These funds could come from local or international sources. When accessing these funds, often evidence of the value of the investment on climate mitigation is needed. Quantifying the impact of actions, sharing case studies, embedding commitments into formal strategies or plans, and telling the story of small wins as you go can help to develop this evidence base.

Plan handovers early

Each plot or project will go through several important handovers during the development cycle, and the green and thriving vision needs to be carried through every stage. Eventually someone will occupy each building and manage each service. The end-user needs to be equipped with the correct tools and a thorough understanding of how to use the assets in the most efficient and effective manner. This is vital to close the 'performance gap' – the difference between what is designed and what is achieved in practice. Determine in advance what commissioning and handover information is required and ensure that this is provided through the monitoring framework. Digital information should be stored in a central repository, subject to clear governance and data-sharing protocols.

Establish whole life governance

The lead agency must plan early to ensure that green and thriving actions are continued as planned, especially if their responsibilities end at the completion of construction. A new organisation may be required to monitor emissions, manage and maintain assets and oversee end-of-life disassembly and deconstruction. This responsible organisation will need sufficient power and resources to undertake these roles. It will be important to ensure the community has an active voice in this to influence future decision-making.

In preparing for this, notice should be given to ownership of end-of-life assets. The circular principles adopted across a green and thriving neighbourhood imply that there will be residual value, in materials and in demountable components. This value should be captured and used for the long-term benefit of the neighbourhood and the community it serves.

Many green and thriving actions will save money over the longer term.

Pathway

Emissions assessment

It is vital that global emissions fall quickly and permanently. Neighbourhoods are complex systems and a green and thriving neighbourhood must be supported by a robust, evidence-based emissions assessment.

There are several important concepts behind a transparent, science-based net zero claim. These align to the different stages of the pathway and are explained here, followed by a worked example.

Prepare

Step 1: Boundary definition

The geographic boundary of the neighbourhood defines which emissions sources (and activities) should be included in the net zero emissions assessment. This is the natural delineation between the neighbourhood, the adjacent neighbourhoods and the city beyond.

It is important to understand the degree of influence (also known as 'operational control') that the lead agency holds over the various emissions sources within the geographic boundary. A lack of influence will affect the emissions reduction strategy but is not a basis for excluding emissions sources from the assessment.

Baseline

Step 2: Emissions Profile

During the 'Baseline' stage, the emissions profile should be predicted using best-available site data and benchmarks. As the development begins, more data will become available, providing the opportunity to improve the quality of the emissions profile.

Basic Approach

Use industry benchmarks for both construction and operational emissions, based on building type and materials. Consumption-based emissions are unlikely to be calculated or estimated.

Improved Approach

Model the emissions profile using estimated or occurring operational performance of the buildings and infrastructure based on agreed specifications. Embodied emissions will be calculated using secondary data sources and applying high quality emissions factors. Consumption based emissions will be estimated using average per capita emissions based on city-wide data.

Best Practice Approach

Produce a modelled profile supplemented with direct measurements and meter readings to create a more accurate emissions profile. Embodied emissions are re-calculated following completion using actual material quantities and environmental product declarations, which detail the product carbon footprints using primary data. Consumption-based emissions will be estimated using survey data for travel, food and retail consumption.

Vision

Step 3: Targeting Net Zero

There are two net zero phases during the development cycle:

Net Zero Enabled

This is the period between the date when the net zero target is set and an action plan is established, and the target date itself. During this phase, there is a clear direction of travel, but the emissions have not yet been balanced to zero. Each year, the emissions profile should be updated and revised. Significant deviations from the predicted profile will warrant a review of the action plan and offsetting strategy.

Net Zero Achieved

This is the period after the net emissions are reduced to zero. This continues to be monitored annually to ensure that net emissions remain below zero. Where there are new construction works, including replacement or deconstruction, the offset emissions may need to be increased.

The speed with which net zero is achieved depends on various factors, including how many existing assets are retained and the efficiency of new assets in-use. Neighbourhoods should work with stakeholders to agree the rate of decarbonisation.

Pathway

Actions

Step 4: Emissions Hierarchy

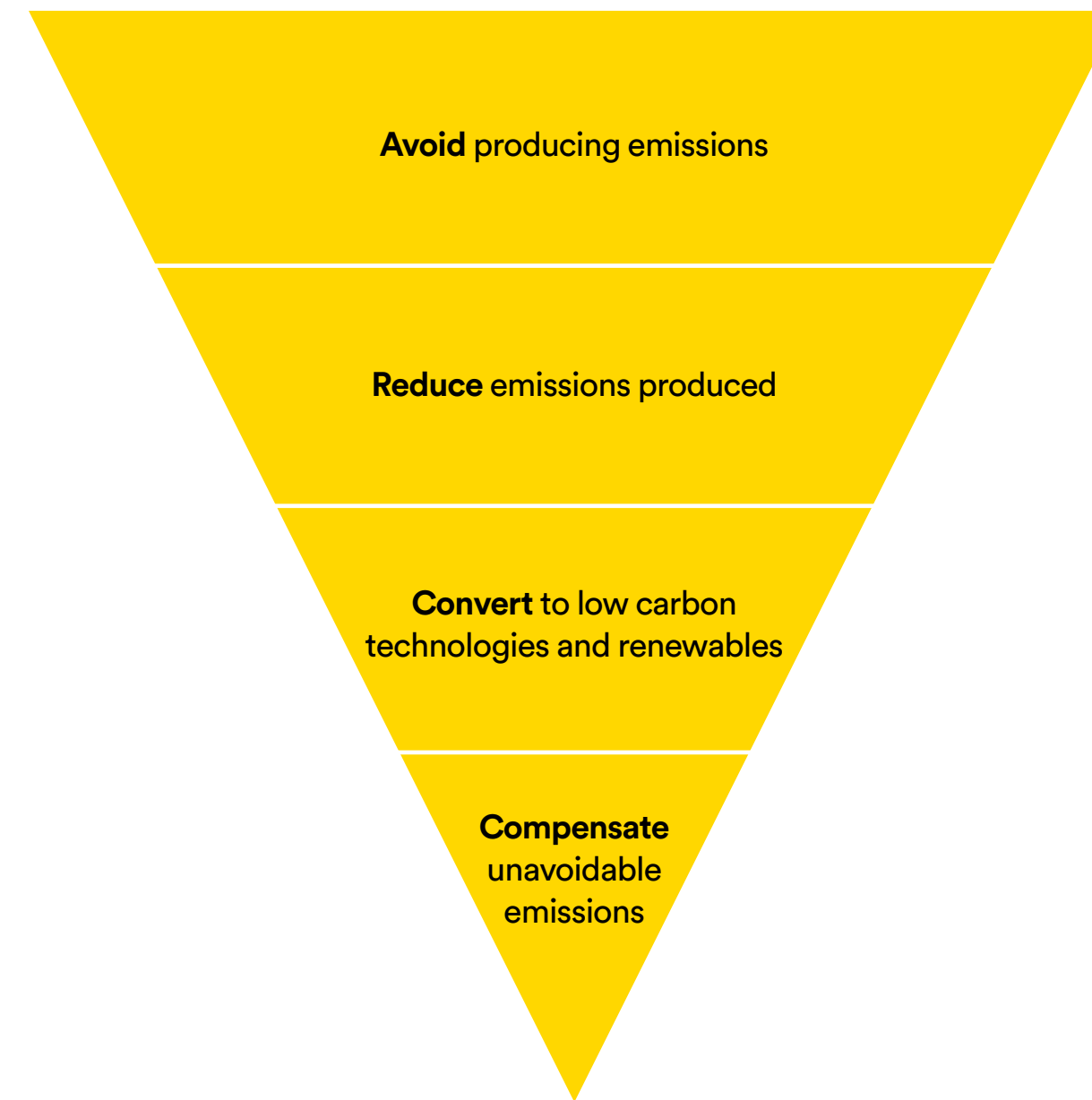
It is essential that neighbourhoods seek to minimise operational and construction emissions throughout the development cycle. The net zero emissions hierarchy should underpin all decision-making and should be applied to both operational and construction emissions.

Avoid: Preventing emissions occurring wherever possible. For instance, repurposing existing buildings will avoid the embodied emissions in new foundations and building superstructure.

Reduce: Adopt interventions that reduce emissions, compared with a standard or conventional approach. An example of this may be utilizing materials from decommissioned sites when undertaking new construction.

Convert: Enable and promote renewable energy and low carbon technologies. For instance, a neighbourhood may choose to convert existing buildings with gas-fired heating to low-carbon neighbourhood heating.

Compensate: Any residual emissions must be counteracted by robust, transparent offsetting.



Implementation

Step 5: Offsetting

The neighbourhood should establish a clear offsetting strategy to compensate any residual emissions. This should include a process that shows all reasonable emissions reduction actions have been undertaken, followed by a robust approach to offsetting. Since offsetting best-practice is rapidly evolving, the offsetting strategy should be regularly revised.

A green and thriving neighbourhood has a unique opportunity to extend the benefits of low-carbon infrastructure to the rest of the city. For this reason, the preferred approach to offsetting is 'avoided emissions', where a neighbourhood investment reduces emissions outside the neighbourhood boundary (e.g. low-carbon neighbourhood heating replaces gas-fired heating in neighbouring parts of the city). If this investment would not have otherwise been required, the emissions reduction may be counted towards the neighbourhood.

All remaining residual emissions should be compensated by 'high-quality offsets'. This means that the emissions associated and transferred from the offset activities are measurable, permanent, additional, verified and unique, while avoiding social and environmental harm. Emissions removals (i.e. sequestration) should be preferred, so should activities that store emissions for the long-term.

The neighbourhood should clearly disclose the quantity, type and cost of emissions offsetting on a regular basis.

Pathway

This example illustrates how to create an emissions profile using benchmark data

Emissions Source	Neighbourhood Strategy	Operational Emissions	Embodied Emissions
Retain existing commercial 500,000 sqm	Reduce measured energy use by 50% Retain sub-structure and super-structure	Electricity consumption 90 kWh/sqm/yr Multiply by electricity emissions factor	LCA calculation 175 kgCO _{2e} /sqm
New residential 100,000 sqm	Design to PassivHaus standard Reduce BAU embodied emissions by 50%	Benchmark EUI 55 kWh/sqm/yr Multiply by fuel emissions factor(s)	Benchmark 250 kgCO _{2e} /sqm
New retail 30,000 sqm	Design to high-efficiency standard Reduce BAU embodied emissions by 50%	Benchmark EUI 75 kWh/sqm/yr Multiply by fuel emissions factor(s)	Benchmark 375 kgCO _{2e} /sqm
New public realm 70,000 sqm	LED lighting Reuse aggregate on-site and switch materials	Benchmark EUI 5 kWh/sqm/yr Multiply by electricity emissions factor	Benchmark 115 kgCO _{2e} /sqm
New public realm 200,000 daily trips	Only-EV strategy	Scale city-wide transport model data	
Waste 10,000 tonnes / year	90% waste recycled, 0% waste to landfill	Average intensity 30 kgCO _{2e} /tonne	

Pathway

This example illustrates how to create an emissions profile using benchmark data

Create the emissions profile

Once the neighbourhood strategies have been defined and data has been collected, the emissions profile can be constructed. For each year over the development lifespan:

Embodied Emissions

Include embodied emissions from initial construction and predict significant maintenance or refurbishment activity and end-of-life emissions.

Operational Emissions

Include annual operational emissions from buildings and infrastructure, plus associated transport or waste emissions.

Negative Emissions

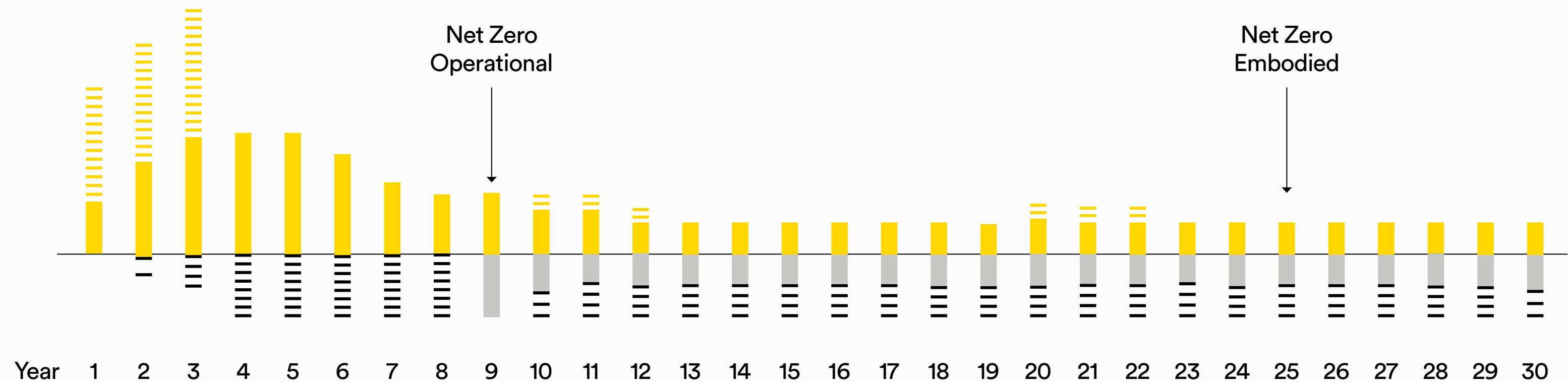
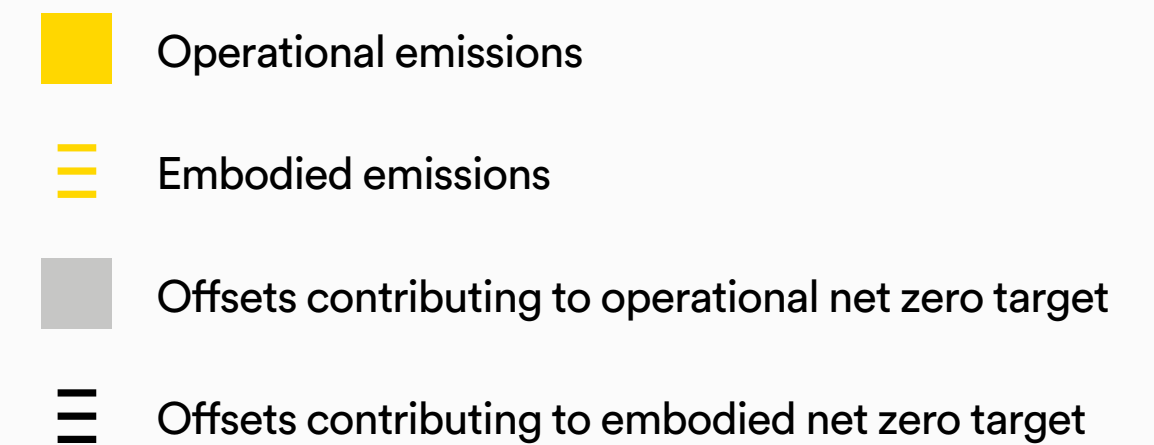
Subtract emissions compensated by high-quality offsetting (see Step 5 of the pathway for more information).

Agree net zero target dates

Net Zero Operational is achieved when the annual operational emissions are either reduced to zero or completely offset. This should be reassessed each year.

Net Zero Embodied is achieved when the total embodied emissions are completely offset. This is calculated over the lifecycle of the development.

It is essential that offsets are only counted towards either the operational or the embodied target to avoid double-counting.



Scaling Up

The development of a green and thriving neighbourhood should be celebrated and then learning should be captured so that future neighbourhoods can refine and improve the approach.

Sharing successes

Determining and promoting the success of the neighbourhood will be crucial for securing further support and funding. It is important to identify effective projects and interventions which have delivered significant emissions reductions, but more so the factors which enabled success. Examples of factors to consider, include:

- Governance model
- Stakeholder support (including political)
- Planning and design guidance
- Financial delivery
- Uptake rate and behaviour shift
- Collaboration

The outputs of the monitoring framework can help to identify and review these factors. It is not necessary to wait until the end of the development cycle to recognise, celebrate and showcase success. The earlier this begins, the greater the opportunity there is for other neighbourhoods to learn and adapt, and the more likely additional budget can be secured along with support from wider stakeholders.

Be open about challenges and lessons learned

When sharing successes, also recognise that other neighbourhoods will benefit from hearing about challenges and the lessons learned. Establish trusting relationships with other neighbourhoods and open forums for communicating the circumstances, reasons and contributing factors to each challenge. Then explain the actors, the incentives and the decisions behind each resolution.

Improve and replicate

After identifying successful components of the green and thriving neighbourhood, it is important to consider how applicable, relevant and effective the same approach could be in other areas of the city, or even nationally or globally in other cities.

Conduct a comparative analysis with other potential neighbourhood sites based on scale, geography, demographics and community behaviour, stakeholders, existing infrastructure, services and industries and city powers. For each of these conditions, consider how they may further support or inhibit the green and thriving approaches used in this neighbourhood. It is important to be particularly mindful of how different power structures or policy environments will affect how the green and thriving vision and objectives are achieved elsewhere.

Consider:

- Will the funding model and policy mechanisms used in the first neighbourhood apply to another situation?
- Does a change in scale offer opportunities through economies of scale, or reducing construction and operational cost?
- Are there new local fund-raising opportunities including setting local taxes or adjusting developer costs?
- Which leaders can transfer learning?
- Will the relationships already established carry over to a new neighbourhood opportunity?
- Can the business or the benefits case be made more clearly, perhaps using evidence from the first neighbourhood?
- Which barriers can be overcome this time?
- Have data points or costs been established that can be reused?
- Has the proof of concept, and ongoing dialogue with national government, opened up opportunities to further strengthen the national or local policy framework for green and thriving neighbourhoods?

Consider how applicable, relevant and effective the same approach could be in other areas of the city.

References

Precedents

Although the green and thriving neighbourhood concept brings a new focus to the importance of rapid, transparent emissions reductions coupled with holistic liveability, there are global examples of neighbourhoods that have already begun taking action towards minimizing emissions and delivering thriving neighbourhoods. This section includes summaries of some of these neighbourhoods.

Barrios Vitales, Bogota

Mayor Lopez announced a 15- and 30-minute city strategy in 30 vital neighbourhoods (Barrios Vitales) connected by 27 green corridors.

The vision is to improve the city's quality of life through its neighbourhoods and streets and to support more sustainable lifestyles. The city is piloting this approach now (Distrito 10) and planning for regulatory long-term change in the comprehensive plan (POT).

The wide range of actions include:

- Generating low-carbon mobility solutions including the development of green corridors that prioritise walking and cycling.
- Reclaiming public spaces from private vehicles to develop new uses for social and community building.
- Activating the ground floors and support local retailers to create pleasant streets and revitalise the economy.
- Developing community-building amenities, with public and/or shared social spaces, and well-designed streets that foster social interaction.
- Promoting flexible use of spaces and encouraging tactical urbanism and temporary uses, to help neighbourhoods evolve and thrive more quickly.
- Increasing green public spaces.

Bahnstadt, Heidelberg

Bahnstadt is a 100ha former brownfield site that it is now in its final phase of construction. It is Heidelberg's first neighbourhood and one of the largest Passivhaus neighbourhoods in the world. The development is a testing ground for the most ambitious initiatives of Heidelberg's '100% Climate Protection Masterplan', which aims to cut greenhouse gas (GHG) emissions by 95% by 2050. Once complete in 2022, the Bahnstadt neighbourhood will be home to around 6,500 people and be near zero carbon in operation. The homes built in the neighbourhood to date have annual CO₂ emissions for energy use of just 0.13 tonnes per inhabitant compared with the Heidelberg city average of 2.0 tonnes. In addition to having all buildings, both public and private, constructed according to Passivhaus standards, smart meters have been installed to monitor energy consumption and identify areas for potential savings, and the neighbourhood's energy demand is fully met by a wood-chip combined heat and power station, which is part of the local neighbourhood heating network. Bahnstadt has also been designed to minimise transport emissions. A tramline has been extended to include three stops in the area, while 3.5km of new cycle paths to date connect the neighbourhood with the city centre and other neighbourhoods. A network of charging stations for electric vehicles has been installed, including in public spaces and in private underground carparks. Lastly, to reduce the risk of flooding in spring and autumn, the neighbourhood has water-retention basins that allow rainwater to infiltrate into the ground rather than flood the sewer system. Bahnstadt's building-scale goal of 66% green roofing also helps to reduce flood risk, as well as to provide a habitat for wildlife.

Elephant & Castle, London

Elephant Park is a major mixed-use regeneration project in the historical neighbourhood of Elephant & Castle situated in the Borough of Southwark in Central London. The redevelopment includes a major new public park, 3,000 new homes of which at least a quarter have to be available for affordable housing, substantial accessible public space and provision of private and communal residential amenity across the site. Strategies are being implemented to maximize carbon reductions whilst minimizing (wherever possible) any negative impacts. The best carbon outcomes are explored with a flexibility to accommodate changes in technology and fuel supply. Key initiatives include an on-site combined heat and power plants that will utilise a biomethane offset to deliver net zero carbon heat and hot water to Elephant Park and beyond, new energy efficient homes and offices including 15 townhouses that have achieved Passivhaus Standard, a wide range of green spaces and the planting of more than 1,200 trees in the streets surrounding the development. The development has also created hundreds of jobs and training opportunities for local people as part of its strategy to deliver benefits to the wider community.

References

L’Innesto, Milan

L’Innesto, the first Zero Carbon “Housing Sociale” project in Italy, aims to become the showcase of Milan’s new sustainability strategies. L’Innesto includes the development of an innovative 4th generation neighbourhood heating system, powered by renewable sources combined with an urban wastewater heat-recovery system. The design of Nearly Zero Energy Buildings is coupled with a pre-assembled construction technology and an optimal mix of bio-sourced materials. The aim is to reduce CO₂ emissions and waste, allowing the structure to be disassembled and 100% recycled. Soil excavation is also minimised and treated on site applying bio-remediation techniques to be re-used for landscaping. Vegetable gardens, a nursery garden, nature-based roofs, and edible landscapes create a food and agricultural hub.

A comprehensive sustainable mobility approach ensured citizens full accessibility. The project promotes active mobility, sharing systems and a drastic reduction in the use of private vehicles by discouraging resident car ownership. This will be reached by reducing the availability of resident parking areas and by offering alternative mobility options.

Beyond reaching zero carbon, L’Innesto encompasses a bold proposal for a private Milan Zero Carbon Fund aiming to implement citywide solutions to reduce GHG emissions and the establishment of a Circular Economy Neighbourhood. L’Innesto is also a Human Adaptive Zone, where innovative shared spaces help establish relationships among residents, engaging the entire neighbourhood in a 30-year commitment to integrated management.

Clichy-Batignolles, Paris

The Paris ‘Econighbourhood’ is a dense, inner-city urban renewal area due to be home to 7,500 residents and 12,000 jobs across 54 ha by 2022. The former railway yard is owned by a mix of private and government landholders. The Econighbourhood label is achieved through its commitment to triple-bottom line sustainability targets, covering environmental, social and economic sustainability. Environmental efficiency is maximized through precinct-wide infrastructure, including Paris’ first smart energy grid distributing a substantial amount of solar generated energy, and a neighbourhood heating system using geothermal energy. Beyond the environmental credentials, a commitment to generous provision of community infrastructure and open space, including 50 per cent affordable housing and a 10 hectare park at the heart of the site, makes the precinct highly inclusive in an increasingly expensive city. Other features of the project include water positive credentials, a pedestrian prioritised street network, mandated building energy performance standards and green infrastructure standards, and limits on car parking.

South Waterfront District, Portland

South Waterfront District started in early 2000 and will be completed in the coming years. The project transforms a former marine industrial site with significant brownfield conditions and lack of basic infrastructure into 2,500 new households in high-rise mixed-use towers, as well as the creation of 10,000 new jobs centred about the expansion of Oregon Health Science University into the district and new private sector jobs in the biotech industry. A focus on creating a sustainable, green, riverfront district, with a rich multi-modal transportation network was the primary vision for the district that will have a lower carbon footprint than other mixed-used districts in the City. The district achievements include:

- New buildings constructed to date have all received LEED Gold or Platinum certification.
- Restored greenway for riparian habitats and bike/pedestrian trail, by establishing a setback of 100-150 feet.
- Established a district-wide public/private stormwater management strategy.
- Incorporated green roofs on all development to address stormwater, heat island, and habitat issues.
- Established district-wide multi-modal transportation network with a focus on pedestrian, bicycle, bus, streetcar, light rail, and aerial tram connectivity.

Climate Positive District, Shougang

The Shougang Climate Positive Development Project is situated within the New Shougang Comprehensive High-end Industry Services Park that spans over 8.6 sq. km. The project itself has a planning area of approximately 40 ha at the heart of the wider regeneration of the Park, and will be home to 5,000 residents and 25,000 jobs.

The new district aims to act as a pilot for a new approach to low carbon, sustainable urban development within the city of Beijing. To achieve a climate positive impact, the carbon emissions within the boundary of the project have been minimised through significant savings in energy consumption and use of renewable and clean energy. The project will then off-set the remaining emissions to achieve a carbon neutral objective. The project adopts a series of on-site low carbon strategies for the design, construction and management of the district: building energy saving and Green Building certification; renewable energy usage; transit-oriented design and low carbon mobility; water resources management; domestic waste management to reduce need of landfill including waste separation and recovery; waste-to-energy as well as urban tree planting to enhance carbon sink capacity in green areas.

References

Stockholm Royal Seaport, Stockholm

Stockholm Royal Seaport is one of Europe's largest urban development projects. Former industrial areas are being transformed into an urban environment on land owned by the City of Stockholm. The land is managed by the City Development Administration which also manages the project in close co-operation with other City of Stockholm administrations and companies. The project is financed by land sales and leases.

In 2009, Stockholm City Council decided that the urban development project was to be a model in sustainable urban development. The vision and goals are set in the Sustainable Urban Development Programme. Five strategies form the basis of the project, which combines sustainability targets and principles of city planning, and include ecological, economic, and social aspects. Stockholm Royal Seaport will be a fossil-free district with low resource use and minimal environmental and climate impact. Infrastructure is being developed with the integration of energy, water supply, wastewater, and transport systems. It will be a diverse neighbourhood with a green inner-city character combining offices, retail, and residential energy efficient buildings. At the end of 2020, approximately 3,000 homes, one school, eight pre-schools as well as office and retail space have been built. By 2030, at least 12,000 new homes and 35,000 new workspaces will be created.

Barangaroo, Sydney

Barangaroo South extends Sydney's Central Business Neighbourhood to its western harbour, and is the city's largest urban regeneration project since the 2000 Olympics. Barangaroo has demonstrated world leadership in environmental sustainability from the beginning with ambitious targets including carbon neutral in operation, water positive capable, targeting the diversion of 80% of operational waste from landfill and contribute to community wellbeing.

In December 2019, Barangaroo South claimed the title of Australia's first carbon neutral precinct. Lendlease, in partnership with the NSW Government, received the certification awarded by the Commonwealth Government.

To achieve this ambition Barangaroo South developed a robust carbon neutral strategy aimed at maximizing energy efficiency on site, achieved in part through precinct infrastructure and highly efficient building design, maximizing on-site renewable energy generation and offsetting remaining carbon financed through a community carbon fund.

Shinagawa Development Project, Tokyo

The Japanese Railroad Company, JR East, are undertaking a major urban redevelopment in the Shinagawa-Takanawa area of Tokyo. The 13ha former railyards site is in a strategic location, with access to the major stations in Tokyo City and Haneda Airport. The first 4 blocks are under construction, including residences, offices, commercial facilities, and cultural facilities, and are due for completion in 2024, after which final 2 blocks will be completed post-2030.

The project has high sustainability aspirations and follows the emissions hierarchy. To deliver a low-carbon district, the buildings have reduced heat loads due to high-performance façades and highly insulated fabric. This is matched with a high-efficiency district energy system, using wastewater heat and previously unutilised energy (biogas from waste processing facilities).

Takanawa Gateway Station, which opened in 2020, is also equipped with technologies for environmental protection such as solar panels and small wind turbines.

In addition, as part of a strategy to achieve Climate Positive, the project also aims to reduce off-site emissions in neighbouring communities.

The project set an emissions reduction target from 96,700 to 53,600 tCO₂e p.a. in Phase 1 and from 134,400 to 73,800 tCO₂e p.a. in Phase 2.

Waterfront Toronto, Toronto

The new Waterfront Toronto district aims to develop low-carbon, livable and resilient waterfront neighbourhoods in Toronto, based on an ambitious Green Building Requirements. This includes:

- New buildings will be designed for zero-carbon operations, through passive design and clean electricity, certified either LEED Gold or Platinum.
- All new buildings will disclose their embodied carbon content using the Canada Green Building Council's lifecycle analysis process. They will be required to use more sustainable building materials, including 50% recycled metal in steel and rebar, low-carbon concrete (with 25% SCM), or timber products certified by the Forest Stewardship Council.
- The landscape around new buildings will feature green spaces with biodiverse plantings, native species and generous tree canopies, as well as rooftop garden plots for community urban agriculture.
- In addition to transit-oriented development, the precinct will provide infrastructure and services for electric vehicles and bicycles

Acknowledgements



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C40 is a network of the world's megacities committed to addressing climate change. C40 supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change. C40's mission is to halve the collective carbon emissions of our member cities within a decade, while improving resilience and equity and creating the conditions for everyone, everywhere to thrive.

Arup is the creative force at the heart of many of the world's most prominent projects in the built environment and across industry. Working in more than 140 countries, the firm's designers, engineers, architects, planners, consultants and technical specialists work with our clients on innovative projects of the highest quality and impact.

Arup has worked with C40 since 2009 to develop strategic analysis and research that is central to progressing our understanding of how cities contribute to climate change mitigation and adaptation. The partnership supports a strong analytical research agenda while helping city actors to identify opportunities, collaborate and develop deliverable solutions to accelerate and expand action on climate change.

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