

PRIMER

SUSTAINABLE SOCIETY

SEVEN BUILDING BLOCKS FOR RESILIENT CITIES

The Primer format presents short, thought leadership articles that share key learning points on planning, designing and building for sustainable societies.

Ramboll is a leading engineering, design and consultancy company founded in Denmark in 1945. The company employs 13,000 globally and has especially strong representation in the Nordics, UK, North America, Continental Europe, Middle East and Asia-Pacific.

With more than 300 offices in 35 countries, Ramboll combines local experience with a global knowledge base, constantly striving to achieve inspiring and exacting solutions that make a genuine difference to our clients, the end-users, and society at large. Ramboll works across the markets: Buildings, Transport, Planning & Urban Design, Water, Environment & Health, Energy, Oil & Gas and Management Consulting. www.ramboll.com

TABLE OF CONTENT

Preface **5**

How to pay for an unknown future **6**

How public decision making can make cities liveable **9**

Creating cost-effective and low carbon cities **13**

How to adapt buildings to the climate reality **16**

How public involvement can improve climate solutions **20**

Cloudbursts and flooding - a catastrophe or an opportunity? **25**

Making the dream real: Climate friendly urban mobility **29**

PREFACE

At Ramboll, we believe that knowledge connects people across professional and national boundaries. Through our partnerships with clients across the world, we have identified a number of insights, best practices and processes that we believe can strengthen cities.

In this collection of articles - in our new format, Primers - we have synthesised key learnings that have been central in adding value to urban planning processes and city solutions. The purpose is to equip our urban stakeholders around the world with a set of tools that allow for informed decisions when it comes to ensuring resilient cities.

In each Primer, we have identified a key area that can be a defining factor when cities are working to become more resilient. These building blocks include management, public sector engagement, energy, buildings, civil society engagement, water and infrastructure.

01 HOW TO PAY FOR AN UNKNOWN FUTURE

HOW IT IS DONE

Adapting to climate change is a financial burden which cities must bear. This means that they need to identify financing options, often requiring a new mindset and knowledge:

- Analyse potential risks and map the costs of not acting on these risks - from damage to infrastructure and property loss, social inequality, environmental degradation, insecurity and even lives lost.
- Encourage interdisciplinary, multi-stakeholder representation to maximise investments.
- Identify all stakeholders, and estimate each stakeholder's costs, benefits and return on investment (ROIs) to create leverage, buy-in and co-ownership.

Looking for the power to finance

Cities are the nexus of human life, welfare and economic growth. In other words, cities represent the backbone of society. But the backbone risks breaking as extreme flooding, heat waves and storms threaten billions of lives, natural capital and physical infrastructure.

Most cities are ready to act on climate change, and there are solutions available that can build resilience. However, a lack of legislative power and authority to mobilise finances within a national framework can be counterproductive.

We know that climate change affects and will continue to affect city budgets in decades to come. The uncertainty lies in the exact impact of climate changes. When looking 50-100 years ahead, forecasts become less clear, and it is important to approach the topic in a stringent and transparent manner. Otherwise the process will be lost in arguments over who has the best climate model.

Knowing the cost of doing nothing

Mapping the costs of action and inaction and gaining an understanding of the full consequences in a financial perspective is beneficial because: 1. An analysis is instrumental in achieving overview and scope, and 2. An analysis will pinpoint areas that can be used as business cases and for demonstration purposes.

The cost of doing nothing is not only measured in material damages, but also in lost investments, loss of working hours, insecurity, and in the worst instance - lives. Increased ecological degradation causes irreversible damage to the natural ecosystem with derived impacts on biodiversity, tourism, local industries and food supply, and a financial cost should be put on this as well.

Decision makers should apply a holistic approach to analyse economic, social and environmental consequences for all stakeholders involved. Making investments for climate adaptation and mitigation do not always require a unique business case. It is key to:

- Understand the wider socioeconomic potential of urban planning and design projects.
- Identify winners and losers and their expected ROIs to form a common language.
- Bring different professions and competences such as public utilities and private companies together in co-creation.

Guiding elements in attracting climate investments

Finding financing requires a different approach and bold moves to form new partnerships, e.g. in Public-Private Partnerships, via city networks, large infrastructure and/or public funds and more classical financial instruments, such as green bonds.

To attract investments in climate policy, the focus must be directed towards solutions that enhance overall liveability and strategy of the city. These are solutions with multi-purposes, where infrastructure does not lie dormant when not in use for its intended climate purpose. These are solutions that lift a neighbourhood in need of an upgrade, or help connect city areas where sustainable mobility is limited, and areas where parks and recreational spots are scarce.

Understanding what adds value to your city, your neighbourhood, and your stakeholders can guide climate investments to ensure that they support long-term, sustainable urban development.

Reaping the benefits of action

The payoff from knowing the costs of inaction is knowing the benefits of action. Climate adaptation and mitigation solutions must take into account worst case scenarios. However, the optimal climate solutions also have a purpose and function in a best-case reality – so that they are not only used for resilience purposes.

Therefore, solutions should be created as interdisciplinary and integrated projects designed in order to help enhance the overall liveability, attractiveness and competitiveness of a city – with resilience as a key component in each of these success factors. Such projects will contribute to growth and development to an extent that exceeds otherwise inevitable investments in maintenance and repair. If a city is worth living in and visiting, people will stay longer and spend more money.

Building a more resilient city will bring added benefits, including:

- Better, healthier and more democratic transportation systems
- Energy security and flexibility
- Access to better, smarter technology
- Business opportunities and green growth
- Social coherence and cultural stimulation

By grasping the full cost-benefit picture, cities first and foremost gain security – a risk-free environment that puts the price on an unknown future. Decision makers gain a more structured focus on the development of the city. Infrastructure investments must be incorporated from a multi-purpose point of view.

THE IDEA BROUGHT TO LIFE

Copenhagen Cloudburst Plan

Within one year, the city of Copenhagen got hit by three devastating cloudbursts in 2010-11, the most destructive one costing the city more than \$1.18 billion. An economic analysis indicated that the cost of inaction would triple in a century. To protect the city against future damage, Copenhagen has developed an ambitious cloudburst master plan that intends to improve the liveability of the city by using water on the surface as a resource in the city space.

The benefits include increased recreational value from the upgrading of parks and meeting places, improved microclimate, and important synergies with infrastructural transport planning.

Jeddah Masterplan

Rapid population growth since the 1970s has resulted in water scarcity and severe pollution issues in modern Arab cities. An environmental degradation study shows that Jeddah will lose 2-4% of its GDP, equaling 1-2 billion Euros annually, if nothing is done.

To tackle this issue and improve public life, Jeddah has developed a master plan, involving a Ramboll team of 40 specialists within e.g. environment, urban water and socioeconomics to conduct in-depth baseline studies and cost-benefit analyses that provide information on corrective actions in terms of prevention and mitigation of adverse impacts. The master plan will serve as a decision makers' manual and will pave the way for Jeddah to become a model for environmental and social improvement for the entire Kingdom of Saudi Arabia.

**6 BILLION
- THE NUMBER OF
PEOPLE LIVING IN
CITIES IN 2050**

02 HOW PUBLIC DECISION MAKING CAN MAKE CITIES LIVEABLE

HOW IT IS DONE

It is a rather simple task to build energy-efficient buildings or transport facilities. The challenging part is to create solutions that contribute to building resilience, while also enhancing quality of life in a city. Consider these steps:

- Identify and understand needs and wishes for society development at all relevant stakeholder levels.
- Work from a common vision and set up goals. All strategic decisions should support and enhance this vision, guiding the city towards its liveability goals.
- Use necessary investments to enhance urban equality and security, both in terms of socioeconomic development and climate change risks.
- Prioritise efforts within as many of the five driving forces for liveable city development as possible: social coherence, economic growth, environmental sustainability, good governance and urban planning.

The challenge of getting to know your stakeholders

More often than not, public authorities do not know the needs and wishes for development at different stakeholder levels, and organisational structures might not support a holistic approach where multiple purposes are included into climate initiatives. For instance, silo mentality can become a heavy barrier for progress, and Key Performance Indicators often do not allow or motivate overlapping activities and co-creation.

Another challenge is urban inequality. Urban areas with run-down buildings, high crime rates and poor or socially vulnerable people may be more at risk and less resilient to the impact of climate change, but might not have the financial clout to act. In other words, the people paying for investments are not always those who enjoy the benefits. This can reinforce the lack of incentives for funding and collaboration and widen the inequality gap.

Climate vision starts with liveability

Climate change decisions tend to focus on emissions reductions. To support liveability goals, public decision making should be focused on turning the city into an even better place to live. Liveable city development must be defined as the primary objective, while cutting carbon emissions and building resilience remain prerequisites for this.

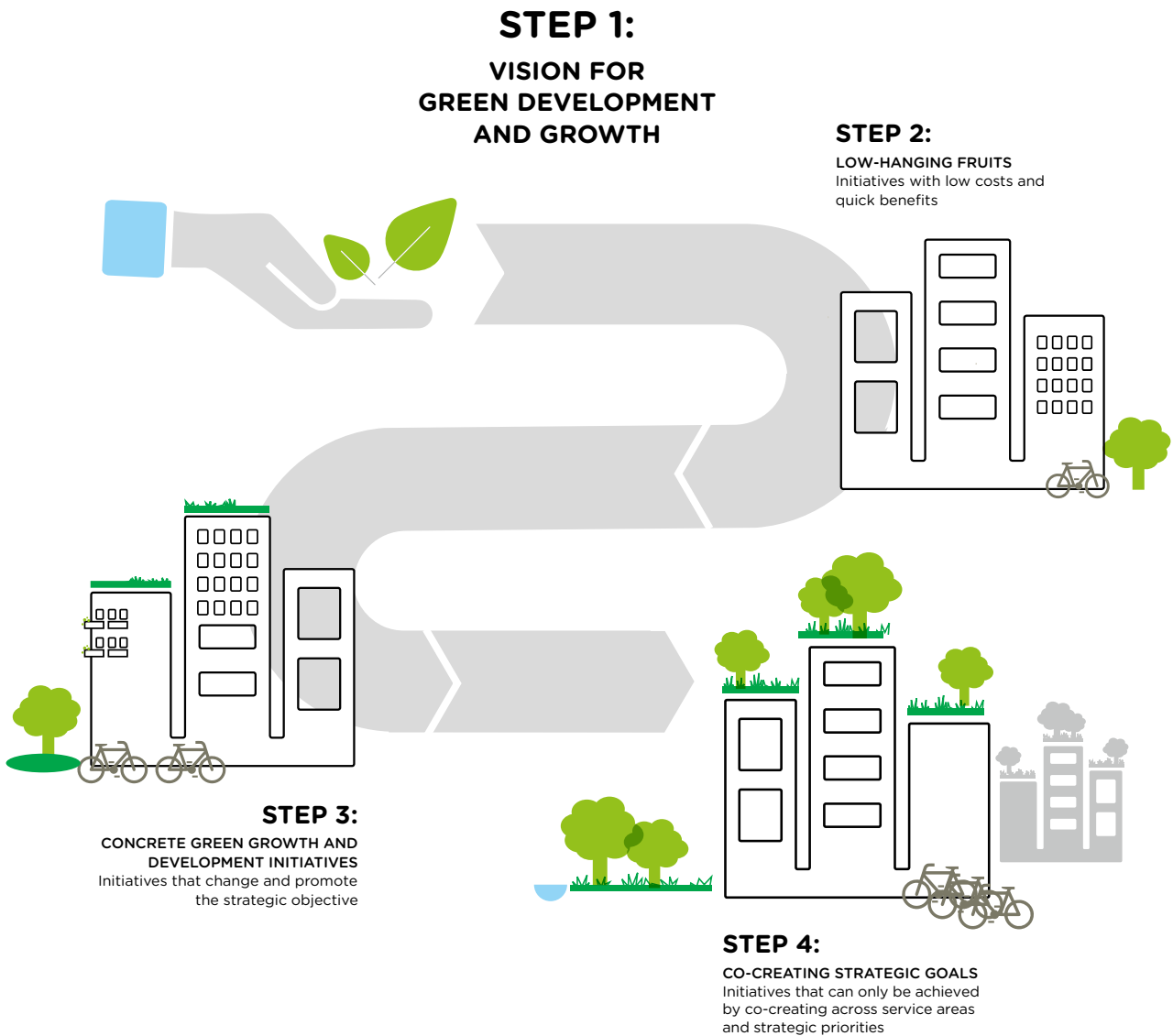
The city administration must understand local needs and wishes for sustainable development and growth by engaging in stakeholder dialogues with businesses, civil society engagement groups, and knowledge, social and cultural institutions. This development analysis will allow the municipality to define a city strategy with a common vision.

Co-creation is key

Decision makers must involve their own organisation and facilitate horizontal and vertical dialogue throughout the city administration internally to utilise existing relations and expertise. The environmental, social and economic motivation must be defined and aligned between stakeholders to reach the necessary level of commitment. In other words, co-creation is key.

The liveability goal is the guiding star of all related initiatives. Making strategic decisions that support the common vision requires stakeholder insights, e.g. via benefit realisation mapping, but also an ability to scale projects. Not every climate project in a city will serve all purposes. Many of the lower hanging fruits to reduce emissions will be less-integrated projects, which are easier, downscaled and cheaper to implement.

CO-CREATION OF A VISION FOR GREEN DEVELOPMENT AND GROWTH



Co-creating a vision with the inclusion of public stakeholders strengthens all steps in a phased process, and ensures increased social, economic and environmental strength.

As maturity grows and basic infrastructure, such as sustainable transport and energy solutions, are in place, development initiatives can become more integrated, advanced and multidisciplinary by working across service lines and strategic priorities.

In other words, strategists must apply a holistic approach from planning to construction, covering the whole line from vision to goal-oriented development initiatives and daily operation, procurement and performance tracking.

For most administrations, limited resources are the biggest stumbling block on the road to long-term, liveable answers to climate challenges. To ensure that the investment has maximum impact, cities should:

- Perform comprehensive cost-benefit analyses.
- Identify the most vulnerable areas calling for urgent action.
- Focus on lifting neighbourhoods while adapting to the changing conditions and stimulating green growth.
- The most sustainable and feasible investments enhance urban equality and security at the same time.
- Understand their stakeholders needs and wishes for development through active and early engagement.

Building a foundation for increased social, economic and environmental strength

If public decision makers manage to design and co-create urban planning solutions for multi-functionality, they will build the foundation for a resilient and liveable city with increased social coherence, economic growth and environmental sustainability.

If a holistic approach is adopted, the strategy can lead to smart city solutions that ensure energy stability, democratic and healthy transportation systems, connectivity and mobility. A socioeconomic focus can enhance social equality and make poor areas more resilient.

A strong business focus on small-, medium-sized, large and international corporations can result in green growth, job creation, emerging start-up communities, new competences, competitiveness and innovation.

Climate change is not just a threat. It presents an opportunity to co-create recreational urban environments that are prepared for a future with changing conditions.

THE IDEA BROUGHT TO LIFE

Transition to a green growth society, Denmark

Gate 21 is a green growth partnership between Danish municipalities, businesses and knowledge institutions, facilitating knowledge sharing and projects that support Denmark's green transition and growth.

As a part of this process, Gate 21 has worked with the Capital Region of Denmark, KTC – Association of Municipal Engineering and Ramboll to develop a decision maker's guide on how municipalities can formulate green transition and growth initiatives in their planning activities and municipal strategies. The guide contains suggestions and inspiration on how to realise visions, goals and strategies by involving the right stakeholders, and how to ensure solutions that consider the needs for climate adaptation projects and the long-term wishes for development and growth.

From concrete canal to recreational river, Singapore

By its island nature, Singapore is an exposed city and state with limited land to collect and store water. As a response to heavy tropical rainfalls, the country has turned many natural rivers into concrete canals. One of them used to run through one of the most popular public parks, Bishan – Ang Mo Kio Park. The drainage system has now been converted into a 3.2 km natural river. Rather than being separate components, the idea of water and its surrounding area is thought of as a whole, where recreation and community bonding occur amidst the water conveyance system. The highlight of this project is the revitalisation of the river.

The changing waterscape creates multiple land use in the park. When the water level in the river is low, users can get closer to water and enjoy recreational activities along the river banks. During heavy rain, the river doubles up as a conveyance channel, carrying the flow downstream.

**CITIES ACCOUNT
FOR 75% OF THE
GLOBAL ENERGY
CONSUMPTION**

03 CREATING COST-EFFECTIVE AND LOW CARBON CITIES

HOW IT IS DONE

With the push that comes from urbanisation, economic growth, growing industry needs and changing energy needs, local governments must plan the improvement of the energy and building infrastructure. Consider including these elements to ensure an effective energy system moving your city towards carbon neutrality:

- Work on an energy strategy that focuses on integrated solutions for urban design, energy, buildings and transport. This makes it possible to create highly efficient district energy grids that facilitate the production and distribution of thermal energy throughout a city in the most cost-effective and sustainable way.
- Capitalise on the large-scale advantages that are natural in a city. Through creating city-wide district energy grids, it is possible to provide cost-effective and sustainable energy solutions rather than working on individual buildings or building blocks.
- Work cost-effectively by transmitting electricity from e.g. wind farms or solar panel electricity (solar PV) farms at suitable locations connected to the electricity grid, far from cities rather than using local wind turbines or solar PV on rooftops.

The challenge of connecting energy plans and climate proofing

Introducing district energy grids requires a solid strategy and city planning. With the push that comes from urbanisation, economic growth, growing industry demands and changing energy demands, local governments must plan the improvement of the energy and building infrastructure. And whenever urban development projects are planned, the establishing of a basic network for district heating and/or cooling is needed. These networks should be prepared for future expansion so that they can be scaled to meet a variety of demands rather than being limited to the area that is being developed.

In order to connect energy plans and climate proofing it is necessary – but not necessarily simple – to map and address all major economic, social and environmental consequences that the energy solution will have for the citizens.

A clever way towards CO₂ neutrality

It is possible to achieve CO₂ neutrality in numerous ways. The trick is to do it in the smartest way possible, which in this context means with maximum cost effectiveness taking into account the cost of CO₂.

- Work on holistic solutions and focus on cost effectiveness for both the project owner and for the society at large.
- Insist on integrating the planning of power, district energy and buildings which together form the most cost-effective solutions.
- Think large scale. Plan for integration of fluctuating/low temperatures and renewable energy into the district energy system. This can include large and cost effective thermal storages, large heat pumps, and combined heat and power systems. As this system can store an additional amount of electricity when electricity prices are low and hereby avoid the use of electricity on days of high prices, the system called “the virtual electric battery” has the same impact on the power system as a battery, only it is cheaper.

To reap the benefits of building up a centralised, cost-effective and environmental district energy system, identify the solution that is most economical for the city as a whole. How much can we spend on bringing down carbon emissions? And how to achieve the best possible indoor climate, a healthy environment, comfort in buildings and economic growth at the lowest cost?

Bear in mind that district heating and/or cooling is typically the most feasible solution for densely built-up areas. Likewise, it is smarter to transmit electricity via the power grid from e.g. wind farms or solar PV at suitable locations rather than using wind turbines or solar panels on rooftops, which are likely to produce only one-third of the energy.

Maximise the impact of the silent, invisible backbone of the city

By establishing district energy grids for hot and cold water, cities get more value for money with a high security of supply, a high quality of energy and a low environmental impact at a low cost.

At the same time, it is a valuable advantage that the district energy and power grids are invisible. No cables are hanging above the citizens, no wind turbines are sending out noise, and no solar PV are disturbing the aesthetic feel and architectural design. Centralised district energy and power grids are the silent and hidden backbone of the city.

THE IDEA BROUGHT TO LIFE

Carlsberg Byen – a new city district in Copenhagen, Denmark

Carlsberg Byen has planned and established a sustainable energy infrastructure. The 30 hectare district includes heat demand of 600,000 m² floor area of which 50% also has a cooling demand. The district has chosen the energy solutions which are most cost-effective for Danish society as well as for the local community in Copenhagen, lowering energy costs for all.

Buildings will be connected to the city-wide district heating system, approved by the city council and Carlsberg Byen to be most cost-effective for society, the local community and the consumers.

Buildings with a cooling demand will be connected to a local district cooling facility with chilled water storage in the city district. Carlsberg Byen has estimated the total NPV benefit in 20 years for consumers in 20 years to be 100 mill. DKK compared to chillers established upon the individual buildings.

Roof-top installations for solar PV, chillers and other energy equipment, are avoided to give space to green roofs and architecture.

Establishing a district heating system in Greater Manchester, UK

In Greater Manchester, a metropolitan county in North West England, a district heating energy masterplan for ten local authorities of Greater Manchester has been initiated to facilitate the efficient, cost-effective development and delivery of heat networks to support carbon and energy policy commitments both locally and nationally.

Heat networks are key components in Greater Manchester's plans for low carbon growth, since they not only provide the opportunity to reduce CO₂ emissions from the city's existing activities, but will critically help ensure that they have the right infrastructure to enable future development to plug into low and zero carbon solutions.

**DISTRICT ENERGY
SYSTEMS CAN
RESULT IN
UP TO 50%
REDUCTION IN
PRIMARY ENERGY
CONSUMPTION
FOR CITIES**

04 HOW TO ADAPT BUILDINGS TO THE CLIMATE REALITY

HOW IT IS DONE

Buildings take up a lot of Earth's capacity to support human existence. Approximately 40% of our total energy consumption is related to buildings. However, the negative climate impact of buildings can be reduced while improving indoor climate, if these items are considered:

- Pass building legislation that focuses on sustainable parameters. These can be using healthy materials, reducing noise levels, making fresh air and natural light a priority in buildings.
- A building is an integrated part of a city. To reflect this, strive to include stakeholders from infrastructure, energy, health, environment and include their perspective and tie-in to design, construction and operation to dramatically minimise the environmental impact of buildings while improving the quality and healthiness of our indoor environment.
- Ensure that all aspects of sustainable construction are applied. The best way to do this is to set performance requirements through local building codes.
- Build synergies. It is rarely feasible to initiate energy efficiency measures on existing buildings purely to save money on energy because of economies-of-scale. But in combination with refurbishment needs for other reasons, the investment will be feasible.

Refurbishment improves energy efficiency

Buildings constitute the physical environment in which most of the world's population spend the majority of their time. We work, eat, learn, sleep and play in buildings. Buildings can provide a controlled environment in which we feel more comfortable and can get the services that we need such as heating, cooling, water, power, etc.

The challenge in the industrial world is that through the use of buildings, we consume approximately 40% of our total energy consumption throughout the building life cycle. We consume large amounts of high quality potable water and we cause a number of secondary effects such as reduced biodiversity, increased heat island effects and loss of prime farmland. Furthermore, buildings use a lot of natural resources and energy when being constructed, and they are the source of much waste material during demolition.

There are several ways of successfully adapting buildings to the reality of climate change. First of all, we can design buildings in a way that they consume less energy. This is true for new buildings but especially when it comes to refurbishment of older buildings where improved energy conservation is very feasible. In the last 40 years, a great deal of progress has been made to improve our understanding of how energy consumption can be reduced. This has resulted in modern buildings that only consume a fraction of energy compared to buildings constructed in the last century.

New elements include:

- Advanced design tools
- Improved construction techniques
- Better insulation materials
- Better air tightness
- Triple glazed windows
- Heat recovering ventilation systems
- LED lighting
- Energy efficient appliances and
- Heightened awareness of human behavioural patterns.

The added benefits of energy efficient buildings

Not only is it feasible to design energy efficient buildings to save energy, but the additional benefits of better thermal comfort would be a goal on its own. With energy efficient buildings we avoid cold draft and damp walls. At best, a building would be equipped with high temperature cooling and/or low temperature underfloor heating.

It is rarely feasible to initiate energy efficiency measures on existing buildings purely to save money on energy. Such measures should be taken in combination with refurbishment needs for other reasons.

Green roofs

Another feature of climate adaptive buildings is the option of green roofs. Green roofs help reduce urban heat island effects, which is the reason for increased temperatures in big cities. Large cities in temperate climates are experiencing 3-4 degree C higher temperatures than the surrounding landscape due to higher thermal masses from paved streets and building structures. Green roofs also absorb and retain rain water thus providing relief for the sewer system. Finally, green roofs lead to a greener city overall which has an empirically proven positive influence on the air quality and the improved quality of life of building inhabitants.

Always have lifespan and durability in mind

The use of materials in construction constitutes a major part of any building's environmental impact. To minimise the impact construction materials should be sourced locally when possible and materials should be chosen with lifespan and durability in mind. Whether a project involves building a brand-new facility or refurbishing an existing one, a key consideration is to determine how to use more recycled building materials to save resources.

Perform a life cycle analysis

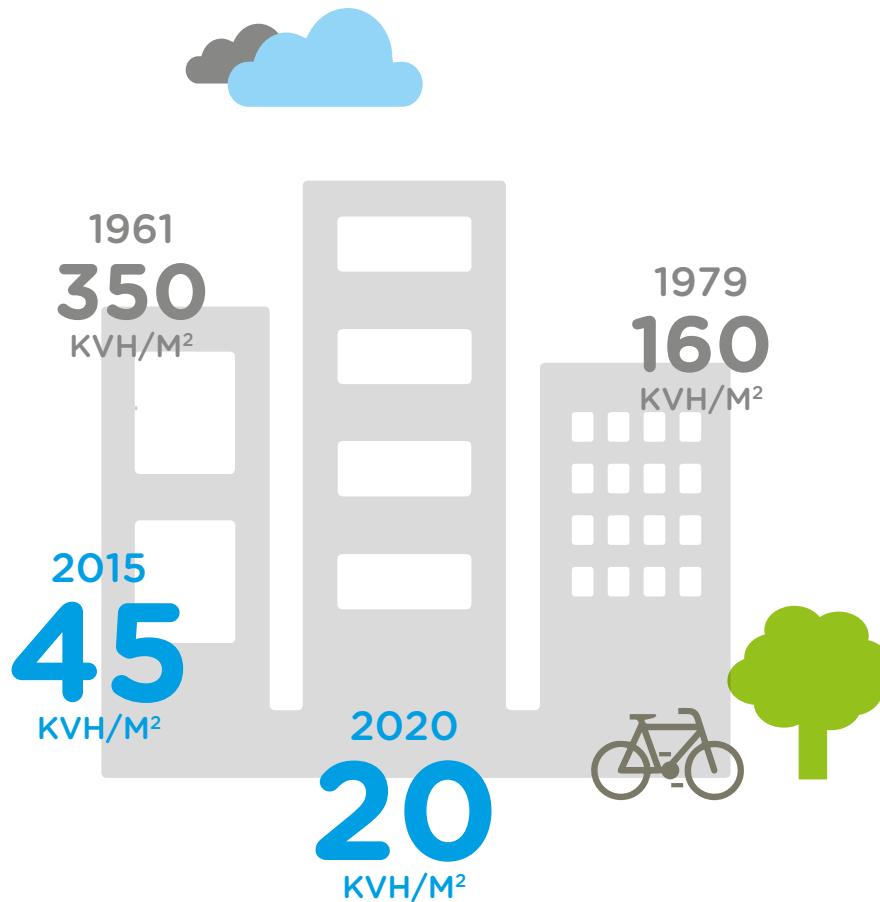
Performing a life cycle analysis of the building project and its functions is the best way to determine this. When doing so, it is possible to get a full picture of a building's performance. This includes taking into account what will happen when the building will be either refurbished or deconstructed. Recycling building materials requires that the various components can be easily disassembled. From a socioeconomic standpoint, recycling all materials can be a costly affair, especially in cases involving chemicals or other non-recyclable components like the PCB embedded in cement-based products. Analysing the lifetime expectancy of the specific project helps us choose the materials best-suited for each function.

The best way to ensure that all aspects of sustainable construction have been applied is to set performance requirements through local building codes. Such requirements would be along the lines of the existing voluntary certification schemes such as LEED, BREEAM or DGNB.

Reaping the benefits of building smarter

It is possible and feasible through better legislation, planning, design, construction and operation to dramatically minimise the environmental impact of buildings while at the same time improving the quality and healthiness of our indoor environment. For all stakeholders, such a development represents a learning curve that every local building sector has to go through. But the sooner this is started, the sooner it is possible to reap the benefits of building smarter.

THE HISTORIC DEVELOPMENT IN THE LEVELS OF ALLOWABLE ENERGY CONSUMPTION OF BUILDING



From 1961 until today, the levels have fallen from 350 KVH/m² to 45 KVH/m², and the global ambitions are to bring these to less than half of this within the next five years.

THE IDEA BROUGHT TO LIFE

Nordhavn

A good example of sustainable urban development is the Nordhavn project, located in Copenhagen. In collaboration with COBE architects and SLETH and Polyform, Ramboll experts have developed a concept that drastically rethinks how different ways of living can be combined with sustainable energy, environment, traffic and cityscape solutions.

At Nordhavn it will be easier to walk, cycle and use the metro than to use your car. And one very good answer to the energy and climate challenge is exactly this kind of approach, as one of the greatest advantages of a dense city is that the need for transportation gets smaller.

Tate Modern II

Tate Modern is located on the site of the UK's first oil-fired power station on the south bank of the River Thames in London. Tate Modern II, an extension, located on a site with a complex history of potentially-contaminative industrial activities, including asbestos, gas, engineering, chemical and printing works.

Our work as project environmental consultants has included the detailed assessment of soil gas regimes and groundwater regimes, a review of historical and existing data, ground investigations, chemical testing and monitoring.

A Conceptual Site Model has been developed, highlighting potential pollutant linkages. Following this, a strategy for management of these during demolition and construction phases was developed. Additional risk assessment for infiltration systems as well as input into BREEAM assessment work has also been completed.

60%
**- PROPORTION
OF URBAN AREAS
EXPECTED TO BE
DEVELOPED BY
2030 THAT HAVE
NOT YET BEEN
BUILT**

05 HOW PUBLIC INVOLVEMENT CAN IMPROVE CLIMATE SOLUTIONS

HOW IT IS DONE

When developing a city's climate adaptation plans, it is critical to involve and engage with all stakeholders. This, however, is not always done. If you make a decision before you engage, this can result in suboptimal solutions and lack of power to implement. To establish a process that allows for public involvement in a way that benefits and strengthens climate solutions, consider the following:

- Involve key stakeholders as early as possible and continuously, to ensure co-ownership and reduce negative impact from public resistance.
- Take an open, holistic and dialogue-based approach to make sure that no needs are ignored.
- Assess stakeholder's knowledge base, likeliness to act, bias, and favourite causes to ease prioritisation and resource management.
- Use socioeconomic impact assessment as an integrated part of political and administrative decision making to ensure long-term positive impact.
- Be agile and ready to act on public input to realise possibilities and maximise synergies.

The challenge of involvement

Planning and implementing climate solutions demand a certain level of prior understanding. Identifying the different interests at stake can seem like a mountain to climb, and it remains a central barrier for involvement of society stakeholders, whether it be the voices of the business community, knowledge institutions, social organisations or the actual citizens. Sometimes, not all relevant voices are heard before initiating a climate adaptation project. When this is the case, it is often a question of restricted resources and time – not lack of will or intent. Yet, the negative impacts of not engaging the most relevant society groups in the decision-making process are likely to exceed the initial investment in early involvement.

There are at least three society groups that can influence climate investments:

- It is crucial to examine the needs and wishes among business leaders. If not, you may miss the commercial concerns and lose out on investment, green growth potential and job creation.
- It is necessary to consult knowledge institutions and industry experts. If this step is omitted, you may lack the evidence-based insights needed to invest in a solution that actually works and stimulates long-term development of the city.
- Finally, involve the citizens. Skipping this step implies that you risk developing a technical solution that only contributes to create resilience, and does not support overall liveability goals that benefit the general public.

The lesson is that the point of departure cannot be defined solely by decision makers' own perspectives and perception of who is central to the project and who is not. Meanwhile, resource management is a key topic to address in stakeholder management and civil society involvement. Assessing what projects will lead to the greatest long-term positive impacts and how to prioritise them is a determining factor for the level of public involvement.

Mapping so that no one is left behind

The process of engaging stakeholders in climate initiatives can be divided into two phases: Identification and involvement. The benefit of incorporating these two phases in the decision-making process is that your city becomes more resilient and better equipped to tolerate climate change.

The two phases can be further detailed into the following compartments:

Identification

- Ensuring that no significant stakeholders are overlooked takes an open, holistic and dialogue-based approach to the initial identification and mapping of relevant stakeholders.
- When decision makers engage with people, they should anticipate perspectives, needs and wishes to arise – some can be foreseen while others will appear new and enlightening. This process demands openness, agility and a readiness to act accordingly until every possible angle of a project – including opportunities, risks and threats – has been covered and addressed.
- To be holistic entails that cities assess environmental as well as socioeconomic and political impacts at all relevant stakeholder levels.

Involvement

- When the influenced stakeholders are mapped and the project is well-defined, the specific involvement and engagement initiatives can be determined.
- Stakeholders must be involved as early as possible in a co-creative shaping of the project and design of the solution, both initially and continuously throughout the implementation steps to evaluate and refine the project as it proceeds.
- Some cities tend to make decisions first and engage afterwards, but in doing so you miss the opportunity to incorporate knowledge and context in the design of specific solutions.

Activating society in the decision-making process

If you engage your society early in the decision-making process, you will experience less resistance and higher buy-in. It will become a project that is co-created, rather than a project, which is forced upon them.

The earlier and the more targeted you engage stakeholders, the better the chance of positive feedback you will likely experience. In addition, the risk of negative impact will be reduced, because you enable early interventions before conflicts or misunderstandings manage to grow too large to handle. In other words, projects become easier to complete with a higher success rate.

By taking more factors and local actors into account, projects will become more integrated and tailored to combined public needs. This approach will create higher engagement and a sense of ownership that is integral for a successful project which moves beyond the technical solution and enhances the quality of public life.

Best practice examples have shown how citizen involvement can inspire user-driven, innovative solutions, because all levels of society contribute to define them. Ideas, opportunities and synergies rise to the surface, inputs that would not have materialised with a less involving approach.

Civic involvement and ownership can improve multi-purpose climate solutions and make them long-term sustainable, because they do not only meet the demands of the policy makers but also the needs and wishes of people. If performed systematically and holistically, the investment in involvement is marginal compared to the potential value-creation and long-term socio-economic benefits.

THE IDEA BROUGHT TO LIFE

Gaining access to travel and traffic data in the EU

Multimodal travel and traffic data is the basis for creating journey planners that offer a choice between different modes of transport. Through a comprehensive social impact assessment, the EU Commission has gained an overview of possibilities and barriers for strengthening the availability of and accessibility to transport data in Europe. By consulting relevant stakeholders, the Commission has obtained new knowledge about the ways different policy options can affect key stakeholders and how negative impacts can be mitigated and positive impacts enlarged.

Ramboll conducted the study by examining the availability of, access to and interoperability of travel and traffic data on the European market and help identify the appropriate policy response. The assessment included desk research, case studies in eight different EU countries and interviews with stakeholders.

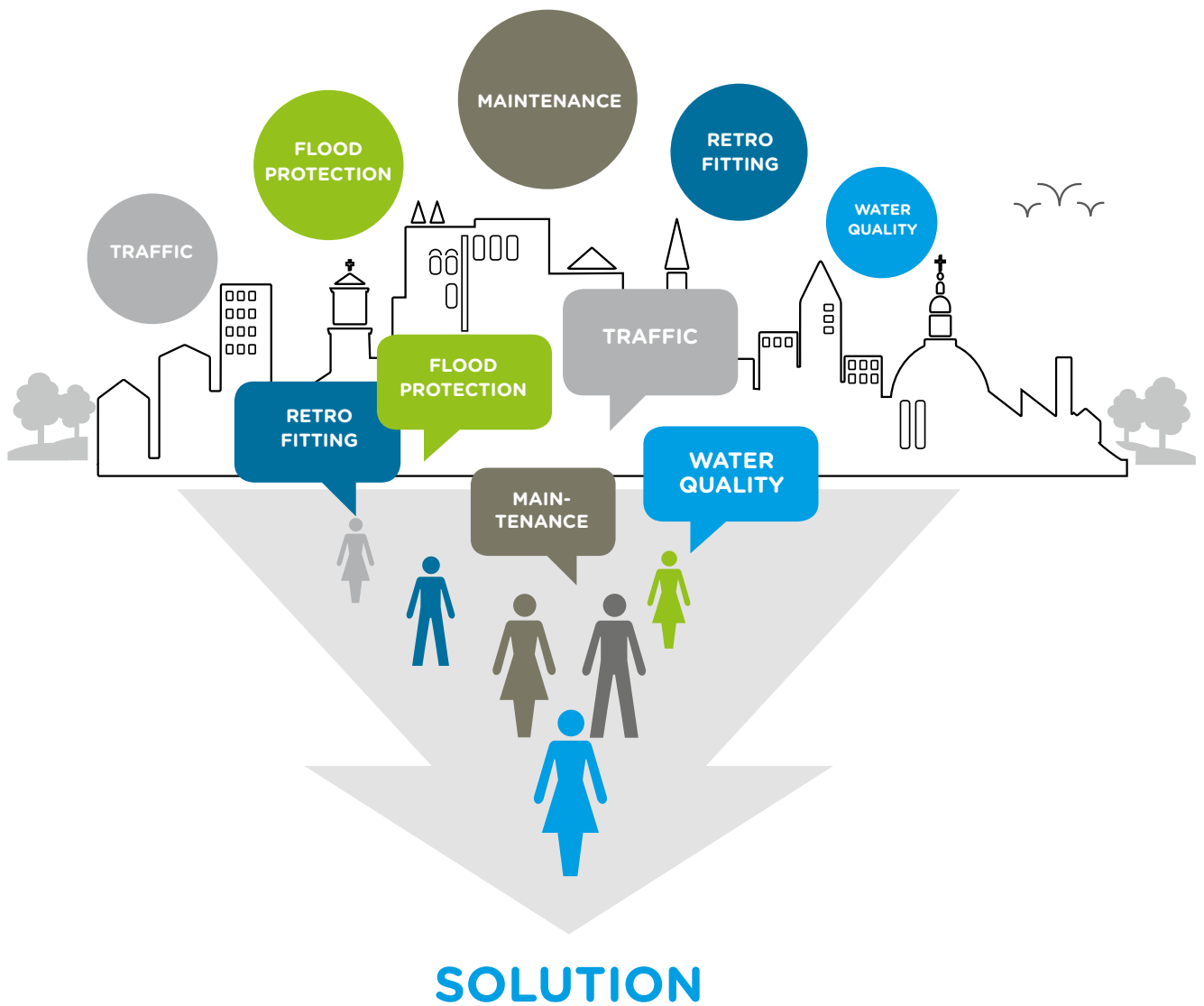
A new way to involve citizens in public decision-making, Germany

Setting the direction for an entire region is like flying a plane with hundreds of captains in the cockpit. That is, if you're ambitious enough to invite them in. The German State of Schleswig-Holstein finds itself in the middle of a complex development process where the level of citizen participation reaches new heights. And the forecast is that the approach will empower the regional strategy to become long-term sustainable.

While the approach may seem simple, the complexity of the project is huge. Like many European regions, Schleswig-Holstein deals with more than a few challenging changes: Demographic and climate changes, energy policies, debt-ceiling, increased individualisation and the demands of the knowledge society, just to name a few.

Co-development is at the core of the strategy. From the very beginning of the process, citizens and stakeholders have played a strong role. The idea has been to kick off the strategy building with very limited pre-defined input and content requirements from the government and leave it to citizens and relevant stakeholders to define topics from scratch. Usually, citizen participation begins at a later stage when key aspects of the decision process have already been defined. The risk is that citizens will only get the chance to comment on an existing draft with little chance of changing it. This represents a new way of involving the public in political decision-making.

THE MULTI-STAKEHOLDER URBAN PLANNING PROCESS



When planning a city's climate adaptation plans, it is critical to involve and engage with all stakeholders.

**\$1 TRILLION
- PROJECTED
ANNUAL COST
OF FLOODING IN
URBAN AREAS
GLOBALLY BY
2050**

06 CLOUDBURSTS AND FLOODING - A CATASTROPHE OR AN OPPORTUNITY?

HOW IT IS DONE

With the change in weather patterns caused by climate change, many cities experience heavy and unexpected rain storms, at times causing flooding. However, any city can benefit by considering the following tools in order to build resilience to the climate changes:

- Climate change adaptation should not only focus on minimising negative impacts. Turn it around to capitalise on possible opportunities such as converting rainwater into a valuable resource to benefit urban life.
- Create blue and green infrastructure where trees, plants and water are incorporated and integrated in the city planning. This can build resilience and innovative, aesthetically pleasing recreational areas that improve quality of life for the residents and increase the cities' global value.
- Plan and build for health, recreation and water management at the same time. This makes it possible to ensure that the handling of stormwater will be part of infrastructure and building projects as well as the overall city planning.

How can city water drive growth and resilience?

Rising sea levels, heavier and more unpredictable rain patterns and inland flooding are just some of the climate change related issues that will have an effect, and that are already now beginning to make a huge global impact on urban areas. Causing damage to infrastructure and buildings, prompting a reduction of property values, and even causing loss of human lives, the consequences and costs are severe for individuals, municipalities, regional and national governments.

Most cities are planning for climate change adaptation, but it can be difficult to choose the right approach that matches the cities' individual needs while at the same time creating more value for the city and its residents.

As facilitators of this process, cities need to establish a common ground and understanding between different parts of the governing bodies, i.e. municipalities, utility companies, and developers and ensure that the handling of climate change events such as heavy rainfall is part of all city and infrastructure planning.

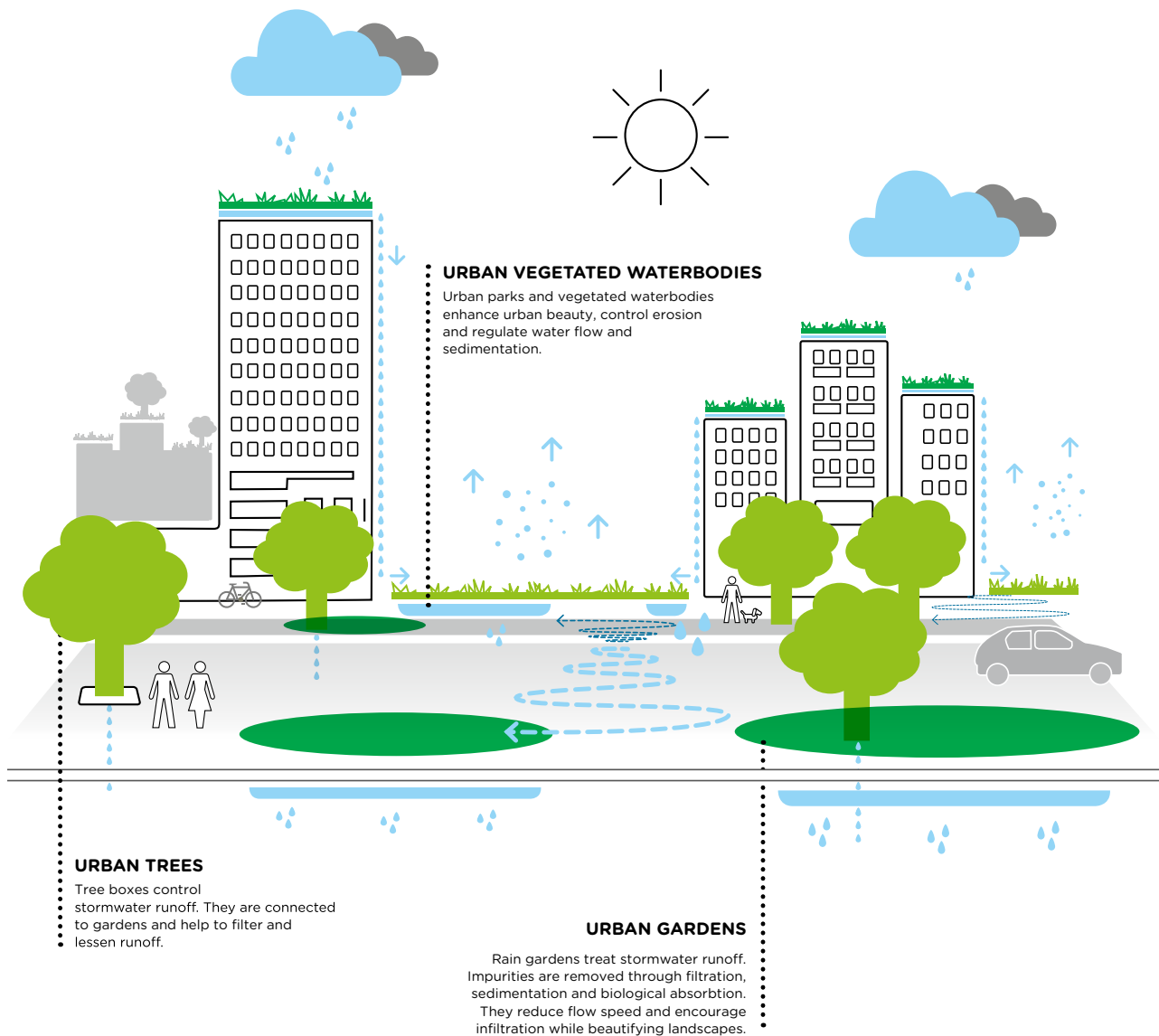
Blue and green infrastructure is the answer

Addressing urban climate challenges is possible if you apply the principle of building with nature -the blue green infrastructure approach. With this approach it is possible for cities to add an extra layer of water, trees and plants that branch out through the streets, between and on top of the city landscape. This adaptation method strengthens the ecosystem, enhances social cohesion, improves well-being and increases property prices.

Furthermore, it is necessary to consider the opportunity to use the rainwater for different purposes:

- Deploying it for livestock
- Irrigation
- Garden watering
- Indoor heating/cooling.

URBAN BLUE GREEN SOLUTIONS



Create blue and green infrastructure where trees, plants and water are incorporated and integrated in the city planning. This can build resilience and innovative, aesthetically pleasing recreational areas that improve quality of life for the residents and increase the cities' global value.

Each element in an adaptation strategy can offer great value to the city on top of building resilience. And through strategically planning and designing for the individual elements to have more than just one function, cities can obtain the highest possible value for money:

- By adding layers of water, trees and greenery, a city that is suffering from heat and/or lacks recreational options can create both resiliency and aesthetically pleasing recreational areas, e.g. by establishing a rainwater basin that is designed to create recreational value for residents and at the same time control storm water.
- Trees and greenery can provide shade and cool the air by evaporating water.
- A dike can prevent flooding but if designed smartly can also serve as a road, combining infrastructure solutions and adaptation.

A holistic approach to building resilience

Building with blue and green infrastructure brings about potential solutions that address and benefit a city's strategy towards stormwater management, climate change adaptation, less heat stress, more biodiversity, food production, better air quality, sustainable energy production, clean water and healthy soils. It is a holistic approach to building resilience that at the same time creates more liveable cities and gives residents the opportunity to be close to nature in a highly urban environment.

With thorough planning and collaboration between the governing bodies, the blue and green infrastructure approach has proven to be highly cost effective:

- Natural surface adaptation will most likely be less expensive than extending sewers.
- Lots of the elements provide double value and can alleviate congestion issues, increase property prices and provide more liveability.
- Planning ahead and creating blue and green infrastructure in areas where construction work is already being carried out saves money and reduces inconvenience for residents.

THE IDEA BROUGHT TO LIFE

A blue and green garden city, Denmark

The town of Kokkedal has undertaken Denmark's largest climate adaptation plan to date, a project that safeguards against water damage and capitalises on stormwater by using it for aesthetic, social, and health-promoting purposes.

The dilapidated area of town is grappling with more than the severe consequences of heavy rains as the town is socially divided and has a reputation of suffering from juvenile crime. To address these issues, the town has made social cohesion and safety a crucial element of its climate adaptation plans, using water and greenery to establish outdoor areas that can bring people together and give the area a much-needed boost.

Crucial parts of the adaptation plan is the expansion of an existing stream, the restoration of the original water cycle, and the creation of a delta formation to make the water flow through the town. Together this forms a strong connection between the water, the parks, and the buildings as the water branches out and creates social and visual connections.

Building resilience in Asian cities

Inhabitants in coastal regions of Asia could face some of the worst effects of global warming. Hence, a new study funded by the Asian Development Bank has been launched to identify the most effective adaptation and funding options to create the strongest resilience possible in six Asian cities.

The goal is to invest efficiently in a comprehensive low carbon adaptation plan that focuses on people and health, thus reducing carbon emissions and increasing resilience.

Despite economic growth, much of Asia continues to grapple with an infrastructure deficit and is struggling to provide power, water, and transport systems to meet population needs. For this reason, the study prioritises solutions that include infrastructure and buildings needs as part of the overall adaptation process.

**1.4 BILLION
TONNES
- ANNUAL
REDUCTION
IN CARBON
EMISSIONS IF THE
WORLD'S LARGEST
CITIES HAD
MORE EFFICIENT
TRANSPORT
SYSTEMS**

07 MAKING THE DREAM REAL: CLIMATE FRIENDLY URBAN MOBILITY

HOW IT IS DONE

Transport infrastructure is an integrated part of designing cities to maximise resilience towards climate change. Consider these points in planning for urban mobility in your resilient city:

- Efficiency, sustainability, and liveability are heavily dependent on basic design principles. Cities should organise communities tightly around mixed-use centres of density to the extent that everyday activities within urban communities are mostly walkable or reachable by bicycle.
- Work towards providing a mix of modal choices at multiple price points, and prioritise the most community-friendly options (walking, bicycling) by implementing carefully managed pricing schemes.
- Combine transport planning skills with technology to make cities' transport systems even greener, safer and more efficient. Today's technology also supports green mobility. Intelligent transport systems (ITS) provide innovative services that give better information for travellers on the traffic conditions and different mobility options and improve traffic safety significantly.
- Ensure a continued and strong focus on the multidisciplinary approach to planning, with equal presence of both social and technical disciplines.

The city transport conundrum

Many cities are caught in a conundrum wherein development is leading to ever-increasing urban populations while transport infrastructure is quickly reaching or exceeding its design life and, at the same time, budgets are tighter than ever. To be successful, cities can shift policies to focus on liveability priorities that have been proven time and again to support strong economic development.

Urban mobility strategies - or lack thereof - are critically linked to environmental and economic sustainability in cities. Making the wrong choices in terms of urban transport infrastructure can lead to unnecessarily high capital expenditures as well as decade-long commitments to extremely costly maintenance programs. Moreover, poor transport strategies have unanticipated, indirect "knock-on" effects, such as increased obesity and physical isolation of communities from one another.

Minimising spatial distances

Cities should consider growth strategies that organise smaller communities within the greater urban area around mixed-use centres of density to the extent that everyday activities within each community (groceries, day care, school, pharmacy, shopping, workplaces, etc.) are mostly walkable or reachable by bicycle. This means that before transport infrastructure is even considered, land use and urban planning must define a progressive strategy that minimises spatial distances and travel times for the majority of residents' needs. When densities are optimised and land use mixes are prioritised in this way, public transport infrastructure becomes cost-effective, intuitive to implement, as well as more viable and attractive to residents for longer distance trips.

Cities should also aim to provide a mix of modal choices at multiple price points, prioritising the use of the most community-friendly options by implementing carefully managed pricing schemes. Far too often, legacy policies from the 20th century have led to hidden subsidies for the most inefficient urban transport infrastructure. Providing the flexibility of a balanced multi-modal transport system does not single out any particular mode as inappropriate; rather, it allows residents to choose the most convenient travel option that best suits each individual trip, while still encouraging the use of transport options that result in the highest overall benefit to sustainability and, critically, the lowest cost to taxpayers.

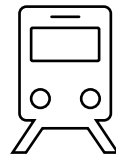
Empowering all citizens

Together with improved governance, digitalisation and new ITS solutions make mobility increasingly safer and more convenient for users of all transport modes. With today's technology we can inform travellers immediately when disturbances occur and offer new options for their trip. ITS together with mobility management schemes also create totally new transport modes – in Nordic cities, bike and car share schemes and Mobility as a Service (MAAS) concepts are now taking over traditional transport modes.

Cities can greatly improve liveability, reduce or eliminate the significant loss of time and money associated with delays caused by traffic congestion, whilst simultaneously saving money and resources on much lower cost urban transport infrastructure. Moreover, multi-modal transport systems overlaying densely organised cities more fairly empower all residents, resulting in more attractive conditions, stronger social cohesiveness, and increased economic competitiveness.

The five-minute city principle designed for sustainable mobility:

- Ensure that public transportation is provided
- Allow for direct and high-class bike routes
- Plan for indirect car routes
- Locate all services within five minutes of walking distance



THE IDEA BROUGHT TO LIFE

Thoughtful city development in Helsinki, Finland

In Jätkäsaari, a dense, mixed-use redevelopment of a former shipping harbour for 17,000 residents and 6,000 workplaces has been successfully integrated with nearby communities within Helsinki. Critical transport infrastructure included walking streets, excellent bicycle facilities connecting deep into the city centre, as well as direct connections to bus, tram, and metro systems.

Connected to this, the concept for the first Mobility as a Service (MAAS) operator in Finland has been developed. The aim of MAAS operators is to provide new and innovative possibilities to travel in greater Helsinki region. The users will pay a monthly fee to get an exclusive access to public transport, car sharing and taxi rides among other possibilities. The MAAS initiative aims to reduce the number of private cars in the Helsinki region.

Five-minute City, Copenhagen, Denmark

In Nordhavn, a holistic planning solution for 40,000 residents included the so-called “five-minute principle”, successfully integrating a prioritised walking and bicycling scheme with the new metro line extension to service the community. This is one example of how liveability can be used as a focal point in an urban plan that strives to “create the good life”.

Plussby 2050, Oslo, Norway

A large part of the inner city fringe in Oslo Norway, now a mix of warehousing, recycling industry and housing, is to be transformed into a dense, urban and progressive part of the city in the coming years.

PLUSSBY2050, the winning strategy, advocates for a strategic and comprehensive approach to secure continuity and interaction between different levels of infrastructure, absent in the existing urban fabric. The concept creates convergence and interconnections between different functions in various aspects of daily life.

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