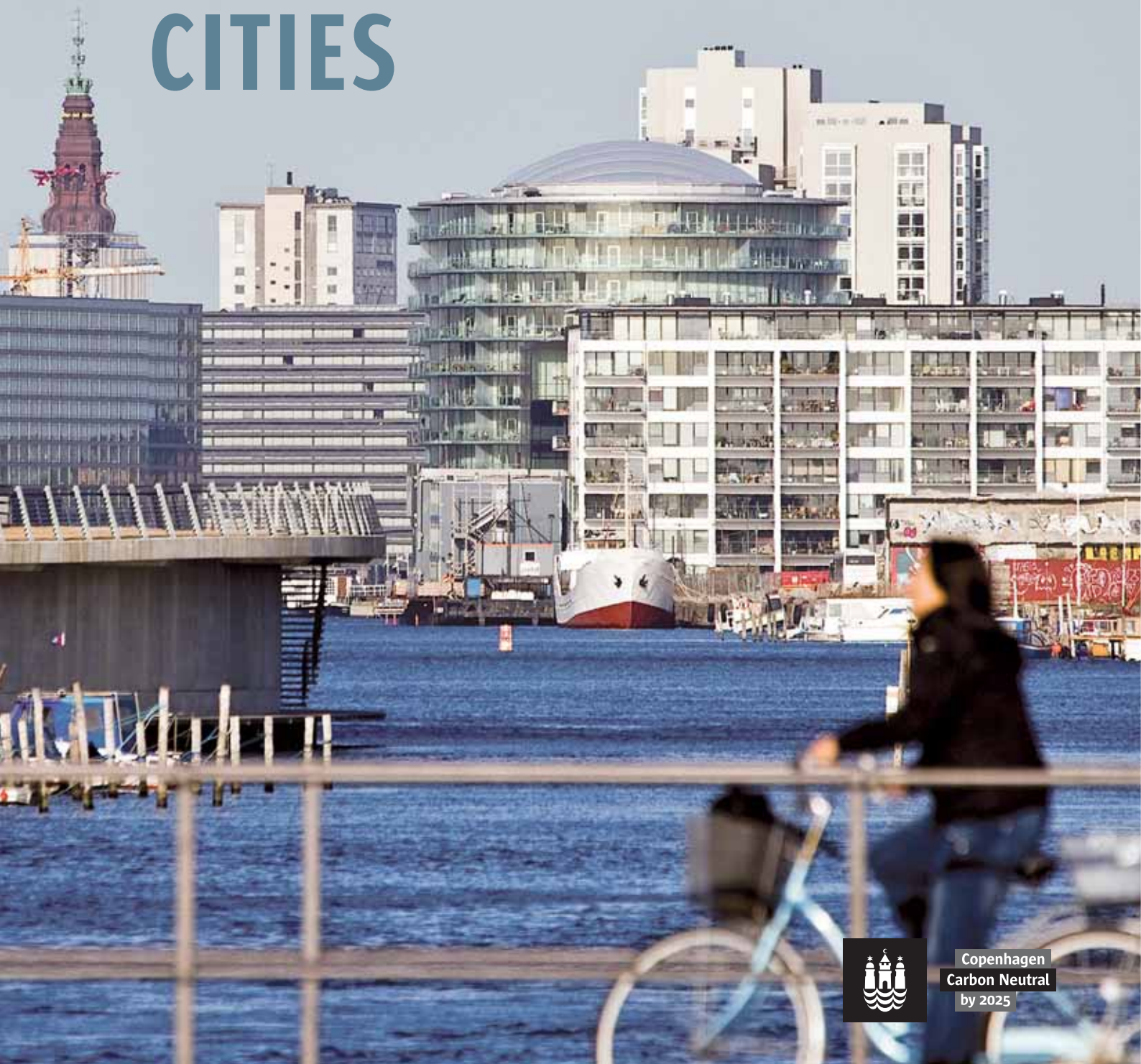


COPENHAGEN SOLUTIONS FOR SUSTAINABLE CITIES



Copenhagen
Carbon Neutral
by 2025



From runned down harbour to attractive urban area / Credit: Kontraframe

COPENHAGEN: SOLUTIONS FOR SUSTAINABLE CITIES

02/03

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This catalogue details 12 sustainable city solutions from Copenhagen. In developing these solutions we were inspired by other cities around the world. We hope that the lessons we learnt will, in return, be of inspiration to you and your city.



Lord Mayor Frank Jensen and Mayor of the Technical and Environmental Administration Morten Kabell / Credit: Jasper Carlberg/Ursula Bach

« MAYORS' **INTRODUCTION** »

04/05

A SUSTAINABLE WORLD STARTS WITH SUSTAINABLE CITIES. IN COPENHAGEN, WE KEEP THIS IN MIND AS WE STRIVE TO COMBINE SUSTAINABLE SOLUTIONS WITH FOCUS ON GROWTH AND QUALITY OF LIFE TO MAKE COPENHAGEN AN EVEN MORE LIVEABLE CITY.

More than half of the world's population lives in cities, and Copenhagen is growing, just like cities all over the world, also facing challenges such as carbon emissions, traffic congestion and waste accumulation.

In Copenhagen, we have addressed our challenges with both adaptation and mitigation initiatives, in recognition of the added benefits such as less air pollution, better health and optimised recycling on the way to our vision: A zero waste city.

Reducing carbon emissions is just a small part of being a sustainable city. It is also about growing our economy and, ultimately, improving the quality of life for our residents.

A sustainable city is also a liveable city where people can live and breathe, work and recreate. Green mobility with our combination of the best cycling conditions in the world and efficient and integrated public transportation make way for green growth and quality of life.

Investing in sustainability also has financial benefits. Cleaning the water in our harbour improved the marine environment, and it also benefited business, tourism and real estate prices. An integrated public transportation system fuelled with alternative environmentally friendly fuels, not only reduces traffic congestion, it also saves us billions of euros and keeps the city efficient and competitive.

This publication profiles some of our best sustainable solutions. In the spirit of sharing, Copenhagen reaches out to cities worldwide with our solutions, but we are also on the lookout for new ideas to improve Copenhagen and hope to be inspired by the lessons learnt by others.

If you are interested in learning more about Copenhagen and our sustainable solutions, please do not hesitate to contact us.



FRANK JENSEN
Lord Mayor of
Copenhagen



MORTEN KABELL
Mayor of the Technical and
Environmental Administration



THE FAST WAY FORWARD

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CYCLING: THE FAST WAY FORWARD

CYCLING HAS ALWAYS BEEN A DANISH TRADITION, BUT COPENHAGEN HAS GONE ONE STEP FURTHER AND MADE CYCLING INTEGRAL TO URBAN PLANNING AND DESIGN. THE MAJORITY OF COPENHAGENERS CHOOSE LOW-EXPENSE, BUT QUICK AND CONVENIENT CYCLING AS THEIR PREFERRED WAY OF GETTING AROUND. IN FACT, WE HAVE A TARGET TO INCREASE THE NUMBER OF COPENHAGENERS AND COMMUTERS CYCLING TO WORK AND EDUCATION FROM 35% IN 2011 TO 50% BY 2015.

In Copenhagen, urban planners have embraced the widespread bicycle culture with ambitious solutions that accommodate the city's many cyclists. This has inspired urban planners all over the world to 'Copenhagenise' their cities, making them more bicycle-friendly.

Besides providing a more livable city, reduced carbon emissions and air pollution in the city, the shift from cars to bicycles also saves time and money. Looking at the total cost of air pollution, accidents, traffic congestion, noise and wear and tear on infrastructure when travelling by bicycle and car, society actually benefits by € 0.16 for every extra kilometre travelled by bicycle instead of by car.



230 million €

Health expenses saved by cycling per year.

0.16 €

Net social gain for every km travelled by bike instead of car.

0.77 €

Healthier citizens reduce health care costs at an estimated rate of € 0.77 per km cycled.

SOLUTION

– FASTER, SAFER, MORE CONVENIENT

- Cycling infrastructure is central to urban planning and design.
- Investments in dedicated, uninterrupted cycle lanes.
- Easy transfer to public transport services.
- Focus on safety and sense of safety.

BENEFITS

- Reduced noise, air pollution and CO₂ emissions.
- Healthier citizens.
- Low-cost form of infrastructure.
- Short journey times and less congestion.
- Improved city life.

SOLUTION IN DETAIL

No missing links is a main factor in the strategy for making more Copenhageners jump on their bike whenever they are going to work or education. The goal is to create a network of bicycle lanes throughout Copenhagen. This will reduce traveling time and increase safety for their cyclists. Safety, convenience, comfort, timesaving and livability are the keywords in designing a city where cycling is the norm.

More and broader bicycle lanes, improved design of intersections and behavioral campaigns are the means of achieving a safer city for the cyclists. With those types of initiatives, Copenhagen wishes to achieve a rise in the proportion of inhabitants feeling safe while biking (from 67% in 2010 to 80% in 2015 and further to 90% in 2025).

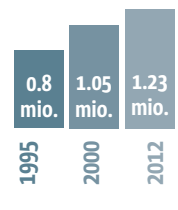
Heightened comfort and convenience is to be achieved through much the same means as increased safety, but also through better maintenance of bike lanes, snow clearance, and of course shorter travel time and easy transfer to train and metro.

The reduced travel time is to be made possible in a variety of ways including a better structured cycling network and 'green waves' for cyclists at traffic lights.

Furthermore, a new intelligent bike-sharing system will be implemented in fall 2013. The system makes for example train passengers able to book a bicycle at their arrival station and use the bicycle the remainder of the way to work or to any other destination in the city. The ambition of the bike-sharing system is to extend public transport and with the new bicycles make it possible for passengers to get from door to door instead of only being able to get from station to station.

88%

Number of people who cycle because it is the fastest or most convenient way to get around in the city.



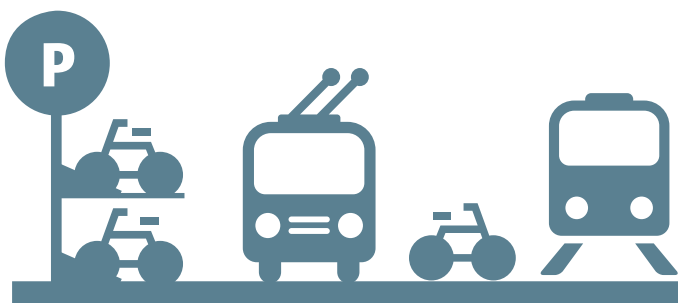
Distance in km travelled each workday in Copenhagen by bicycle.

DESIGNING A CITY FOR CYCLISTS

TIMESAVING

TRANSPORT NETWORK

Bicycles are integrated into the wider transport network. Passengers can easily transfer between cycling and public transport. Carriages on trains are upgraded to accommodate bicycles.



BICYCLE SUPER HIGHWAYS

A safer, faster, direct, continuous and comfortable way of commuting to work or education by bike.

SEPARATE LANES

Cycle lanes along roads include a curb to separate cyclists from cars and pedestrians, which maximises safety and sense of safety for cyclists.

CONVENIENT

NO MISSING-LINKS-STRATEGY

2 bicycle bridges have been constructed as part of the No Missing-Links-Strategy, which secures a city connected by bike routes that are made more direct to key destinations.



BICYCLE PARKING

Good parking facilities for bikes.

43 KM OF 'GREENWAYS'

In Copenhagen green cycle routes are made to provide routes away from main roads and through parks and recreational spaces.

CARGOBIKES

Design of different cargobikes gives families a great alternative to the car.

THE SUSTAINABLE BENEFITS



ECONOMIC

- Cycling provides a low-cost form of transport.
- Reduced journey times and traffic congestion increase economic productivity.
- Healthier citizens reduce health care costs at an estimated rate of € 0.77 per km cycled.



ENVIRONMENTAL

- Reduced noise.
- Reduced air pollution.
- Reduced CO₂ emissions.



SOCIAL

- 88% of cyclist do it because it is the fastest or most convenient way of getting to work.
- Creation of jobs.
- Improved city life.

SAFE

SAFER INTERSECTIONS

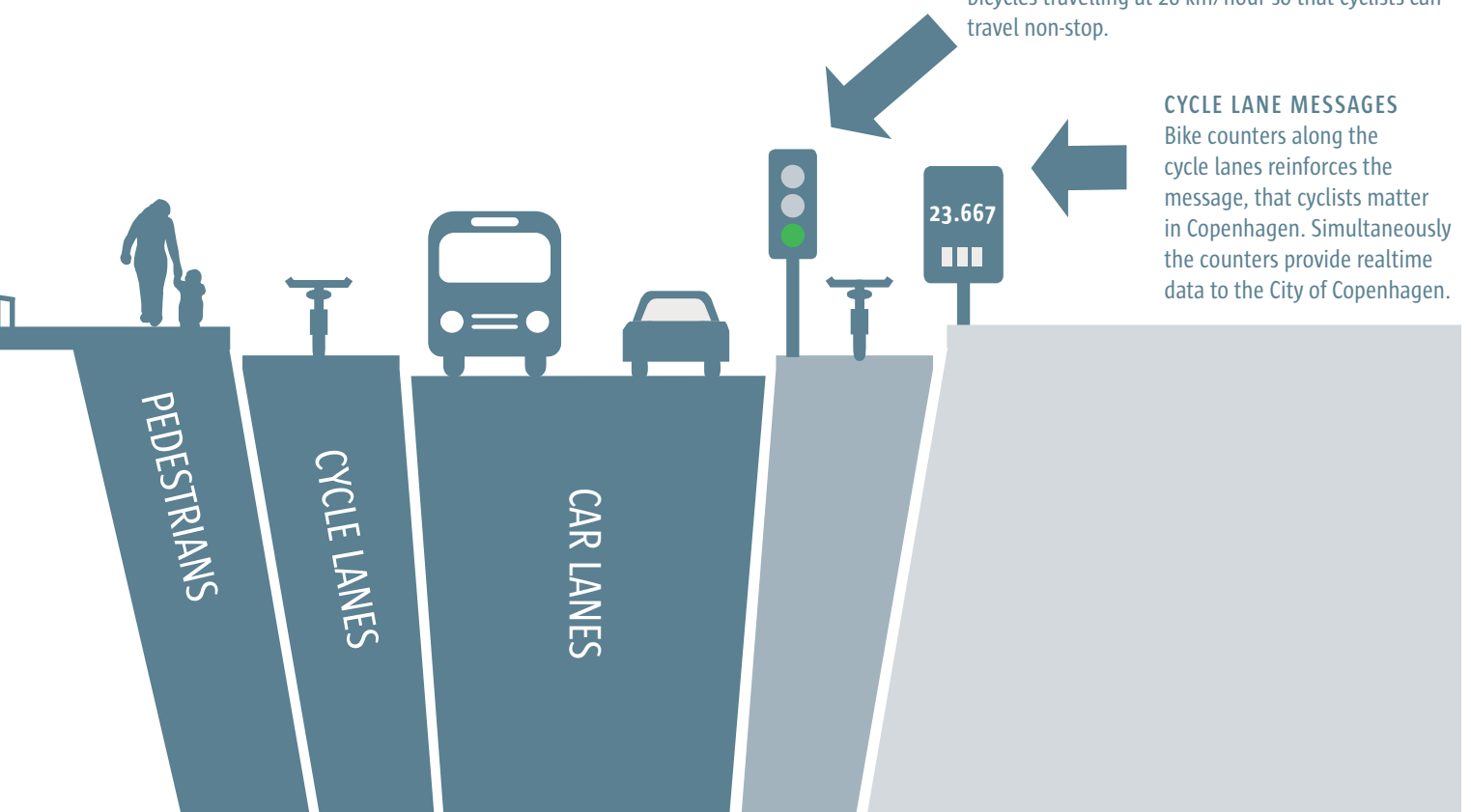
The design of intersections is improved to ensure safety for cyclists.

'GREEN WAVES'

'Green waves' along some of the primary routes prioritise bicycles by adapting the green light to bicycles travelling at 20 km/hour so that cyclists can travel non-stop.

CYCLE LANE MESSAGES

Bike counters along the cycle lanes reinforces the message, that cyclists matter in Copenhagen. Simultaneously the counters provide realtime data to the City of Copenhagen.



INTEGRATE THE TRANSPORT IN YOUR CITY

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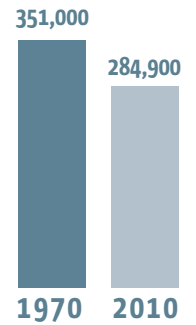
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GIVING INTEGRATED PUBLIC TRANSPORT THE GREEN LIGHT

LIKE MANY OTHER CITIES, ECONOMIC GROWTH IN COPENHAGEN HAS BROUGHT WITH IT INCREASED TRAFFIC CONGESTION. HOWEVER, BY INVESTING IN AN EFFICIENT, RELIABLE AND HIGHLY INTEGRATED PUBLIC TRANSPORT NETWORK, IT HAS BEEN POSSIBLE TO DELIVER SOME OF THE HIGHEST LEVELS OF MOBILITY IN THE WORLD. ALONGSIDE TRAFFIC, CONGESTION AND POLLUTION HAVE BEEN REDUCED TO LEVELS THAT ARE EXTREMELY LOW BY THE STANDARDS OF MAJOR INTERNATIONAL CITIES.



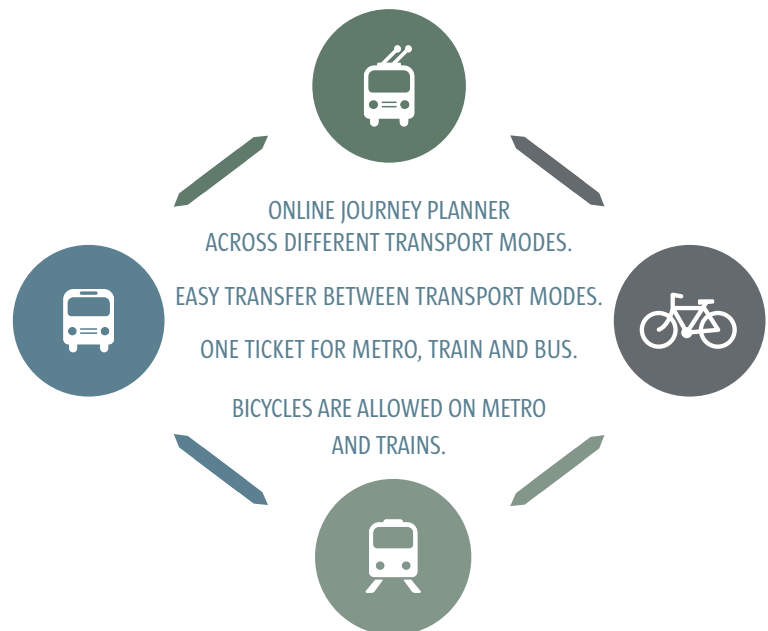
Number of car trips in central Copenhagen.

The CO₂ emissions from road transport rose along with the increased traffic to more than 500,000 tonnes in 2005.

Attempts to convince people to use public transport were hindered by: a massive improvement in travel time for car traffic due to investments in road infrastructure, unreliable and inconvenient public transport due to lack of investments in infrastructure and lack of integration between transport systems and operators. Without concerted action, Copenhagen could have faced the traffic congestion and pollution problems that have blighted many other cities.

The solution was investment in an integrated transport system between bus, train and metro.

INTEGRATED TRANSPORT SYSTEM



SOLUTION

– INTEGRATED TRANSPORT SOLUTION

- Developing physical and online integration between bus, train and the metro services to enable passengers to move seamlessly between different modes.
- Integrating bicycles in the public transport system.

BENEFITS

- A fall in private car usage reducing CO₂ emissions.
- Improved quality of life from convenient public transport.
- Reduced congestion saves time and money.

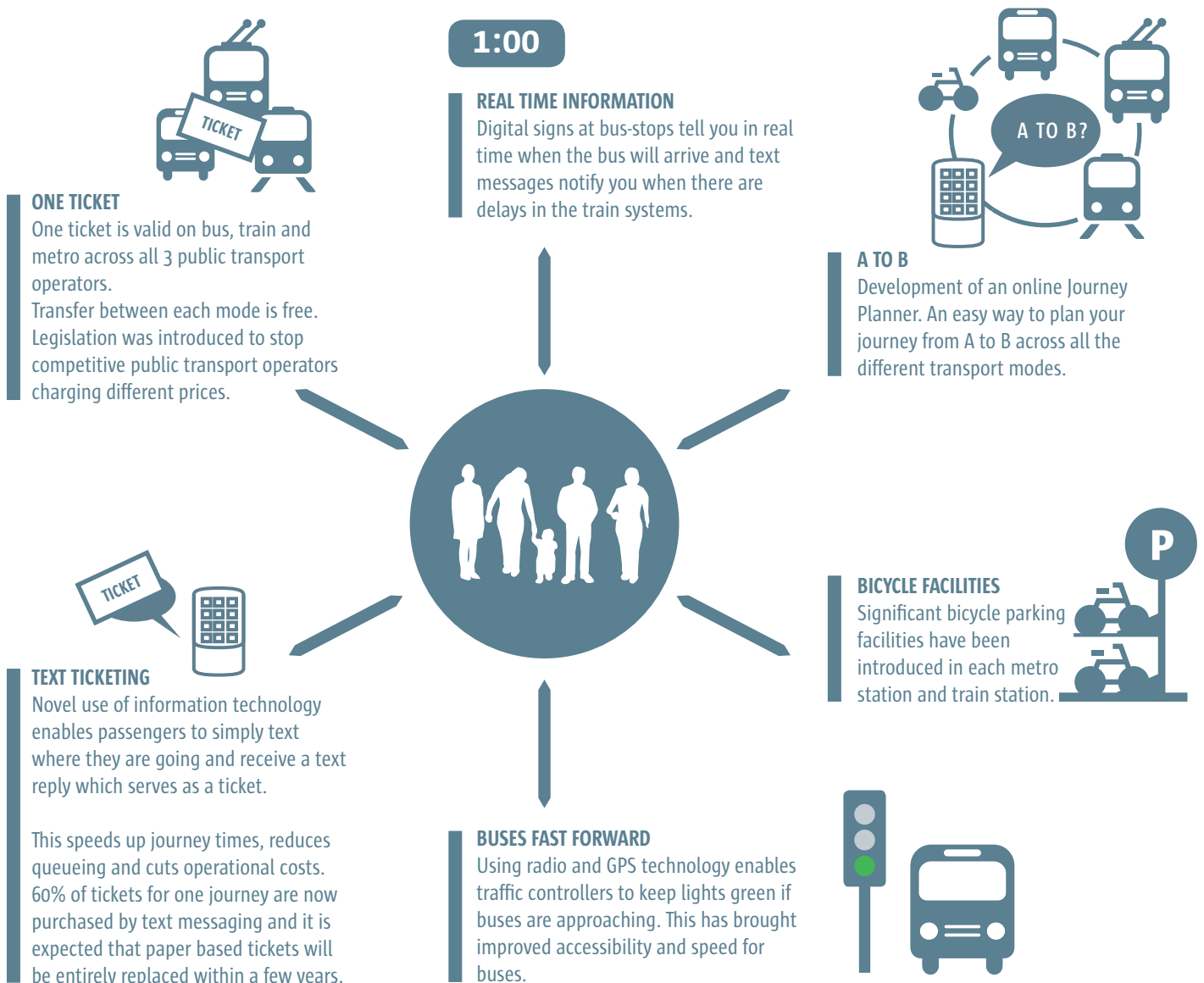
SOLUTION IN DETAIL

Green transport optimises urban space and moves a larger number of people in a more effective way. In the same amount of space and time, 1 person can be transported in a car, 6 persons can be transported by bicycle and 4.5 persons by bus. In the Capital Region

190,000 hours are lost per day due to traffic congestion, a number that would be considerably higher without the integrated transport solution.

Building a convenient and time-saving transport system makes it possible for passengers to move seamlessly between cycle, bus, train and metro services.

A CONVENIENT AND TIME-SAVING TRANSPORT SYSTEM



THE SUSTAINABLE BENEFITS



ECONOMIC

- Reduced traffic congestion and fast and reliable journey times for both passengers and freight make Copenhagen a good place to work and do business.
- A reduction in congestion and lost hours. The hours lost due to traffic congestion currently constitute € 0,76 billion per year for the Capital Region.



ENVIRONMENTAL

- Improved integration of the transport system has resulted in an increase in trips made by public transport and a fall in private car usage.



SOCIAL

- Faster, safer, healthier and less stressful journeys.
- People use public transport and cycling because it is the fastest, cheapest and most convenient way to travel.
- A reputation for Copenhagen as one of the most livable cities in the world.

GREEN TRANSPORT OPTIMISES URBAN SPACE AND MOVES A LARGER NUMBER OF PEOPLE IN A MORE EFFECTIVE WAY.



The relationship between number of people moved from A to B by different modes of transport in the same amount of space and time.

TURNING THE TIDE IN YOUR HARBOUR

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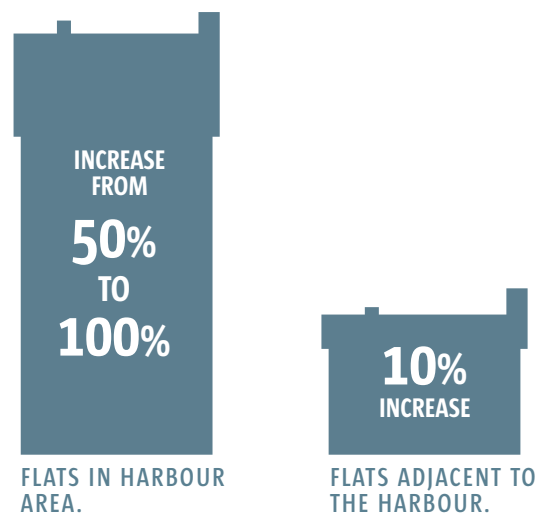


THE HARBOUR TURNS BLUE

THE IDEA OF SWIMMING IN COPENHAGEN'S HARBOUR WOULD HAVE BEEN OUT OF THE QUESTION FIFTEEN YEARS AGO. CLOSE TO 100 OVERFLOW CHANNELS FED WASTEWATER INTO THE HARBOUR MAKING THE WATER HEAVILY POLLUTED.

We addressed the problem by investing in the complete modernisation of the sewage system. The water quality improved, and the City of Copenhagen was able to open the public harbour baths. Today the harbour is one of the trendiest spots in the city. In the summer and spring, the area is bustling with BBQ parties, couples strolling along the pier and students, families and businessmen having a swim in the heart of the Danish capital.

EFFECT ON REAL ESTATE PRICES



Effect on real estate prices in transforming harbour areas from industry to residential.

SOLUTION – A BLUE TRANSFORMATION

The harbour was transformed into a blue public space by:

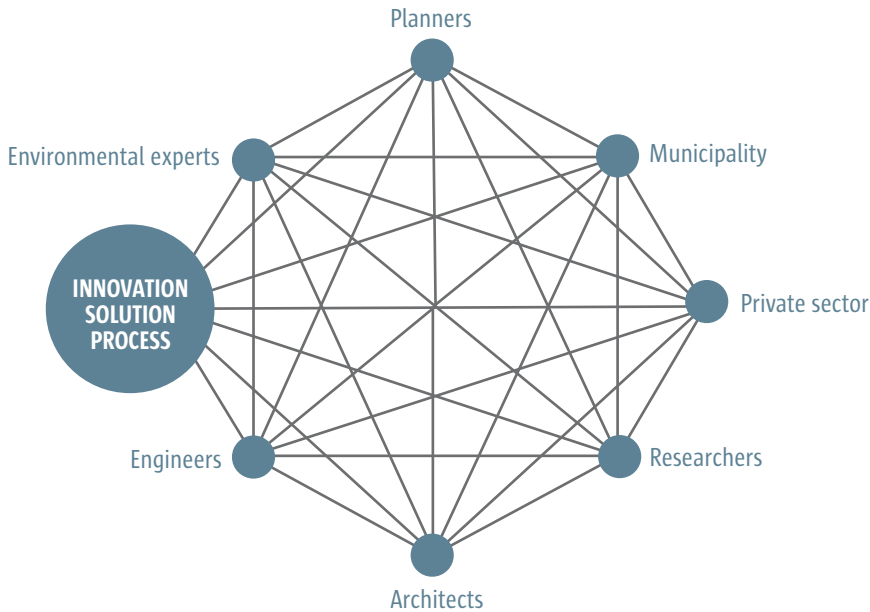
- Modernising the sewage system.
- Adopting a cleaning programme.
- Diverting local rainwater.
- Commissioning a strong urban design to create a recreational space.

BENEFITS

- Increased value of real estate.
- Increased quality of life and tourism.
- Revitalisation of local business life.
- Improved water quality in the harbour.

SOLUTION IN DETAIL

INTEGRATION OF URBAN DESIGN AND WASTEWATER MANAGEMENT



Collaboration between partners, including researchers, academics, architects, planners, engineers, municipal and private sector organisations led to the innovative solution of a harbour bath.

A COMBINATION OF INNOVATIVE SOLUTIONS CREATED A CLEAN HARBOUR



Mechanical, biological and chemical wastewater treatment

Wastewater treatment removes nutrients, salts and minimises discharge of heavy metals.

RESERVOIRS



Combined sewer reservoirs

Reservoirs with connecting conduits store wastewater until there is capacity in the sewage system.

RAINWATER



STORMWATER



Decoupling of rainwater

To ensure future function of the sewage system, decoupling of rainwater is a necessity. The utility provider operates a reimbursement scheme, in which a landowner connected to the sewage system is reimbursed a connection fee if the rainwater is decoupled and discharged locally.

THE SUSTAINABLE BENEFITS



ECONOMIC

- The revitalisation of the harbour areas has led to business and market regeneration.
- Local increase in property prices.
- Improved potential for investment: there are now plans for much improved local transport to the harbour baths.
- Job creation.
- Increased livability means that more families stay in the city contributing to a positive economic growth.



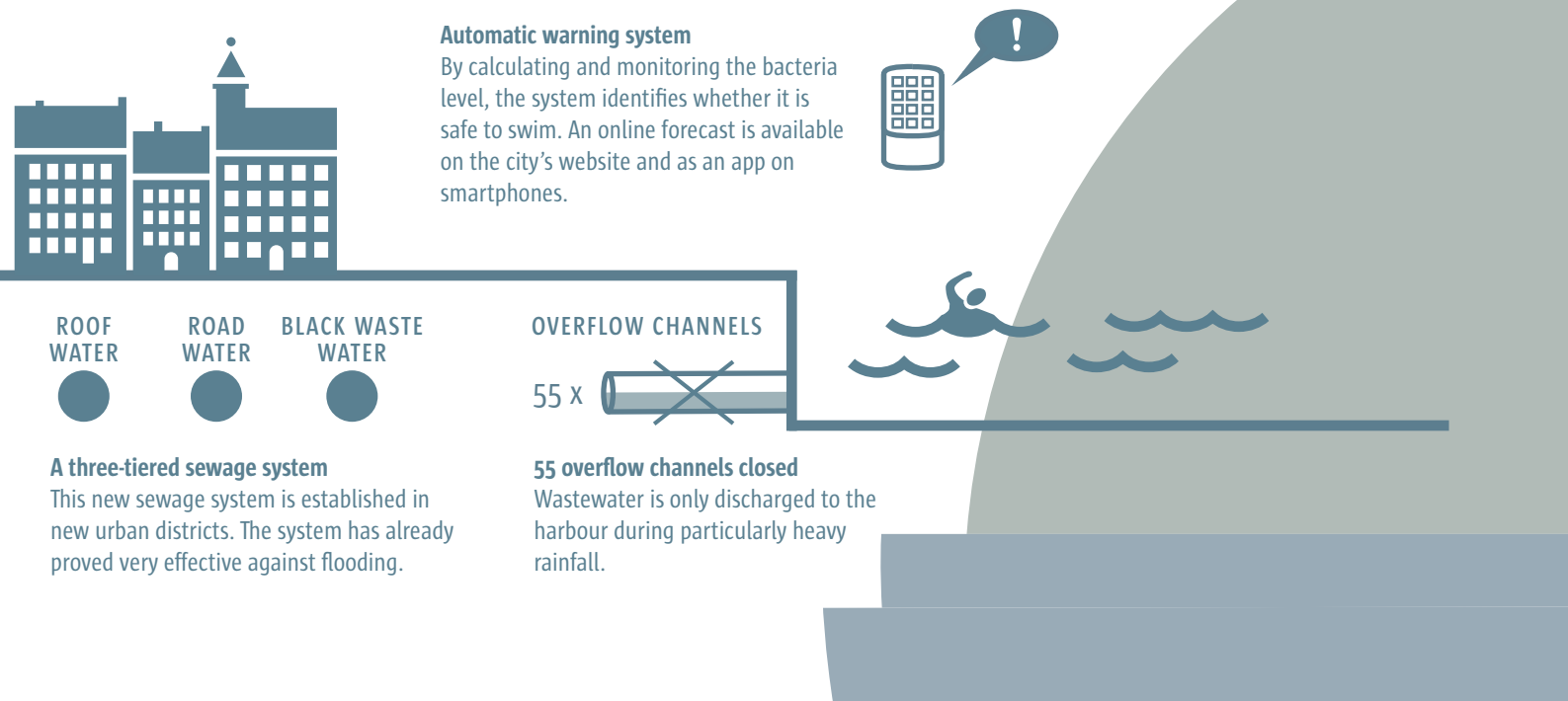
ENVIRONMENTAL

- Reduced risk of urban flooding polluting the harbour.
- More and diverse flora and fauna are returning to the area.
- Residents used to drive 10 km to a beach, now they can walk or cycle to the harbour baths.



SOCIAL

- Residents and others can swim, sail and fish in the harbour waters at the heart of their city.
- Almost every resident now lives less than 10 minutes by foot to a green or blue recreational space or park.
- The harbour baths has given residents a sense of pride, loyalty and ownership in the local area.



MAKE YOUR WATER DRINKABLE

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MEETING THE RISING DEMAND FOR WATER

COPENHAGEN IS ONE OF THE FEW CAPITALS IN WHICH YOU CAN DRINK HIGH QUALITY WATER DIRECTLY FROM THE TAP. AS COPENHAGEN IS GROWING, THE CITY FACES THE VERY REAL RISK OF DEMAND FOR WATER EXCEEDING GROUNDWATER SUPPLY.

The main challenge is to maintain a drinking water supply based on groundwater. Due to lack of water sources within Copenhagen and local contamination of water sources immediately around the city, water has to be conducted in pipes over long distances. By adopting

innovative technologies and policies, it has been possible to protect groundwater resources, limit the losses in the drinking water supply system and reduce drinking water consumption.



13%

Target reduction of water used per day, per Copenhagen citizen.



100 litres

90 litres

2017 2025

A planned reduction in each Copenhagen citizen's consumption from 100 litres per day to 90 litres per day in 2025.

SOLUTION – INNOVATIVE TECHNOLOGIES AND POLICIES

- Management of water resources by the use of new technologies to monitor and prevent leaks.
- Water purification and groundwater modelling and protection.
- Behaviour changes measured by water meters and pricing mechanisms to reduce wasteful consumption.
- Engineering solutions to reduce overall water demand to manageable levels.

BENEFITS

- Citizens can drink water of high quality directly from the tap.
- A reduction in water consumption of 26%.
- Water losses reduced to 7%.

SOLUTION IN DETAIL

A combination of the 3 elements: management of water resources, groundwater protection and behaviour change, makes it possible to maintain high drinking water quality in the future based on ground water supply.

Water cooperation

Copenhagen cooperates closely with the nearby municipalities and water supply companies. As a result, over-consumption and waste of the water resources can be limited. Water samples are analysed every day, and the results are shared within the water cooperation.

BETTER MANAGEMENT OF WATER RESOURCES

MANAGEMENT OF WATER

SIMPLE WATER CLEANING

A 'simple cleaning' of groundwater is undertaken involving oxygenation and filtration through natural filters such as sand.

MANAGEMENT OF WATER RESOURCES

Detailed mapping of sediments below the city, construction of models of a hydrological cycle around the city, and a detailed groundwater model and 3D mapping down to depths of 300 m.

SMART SYSTEM MANAGEMENT

A new SMART system management allows better regulation of water pressure.

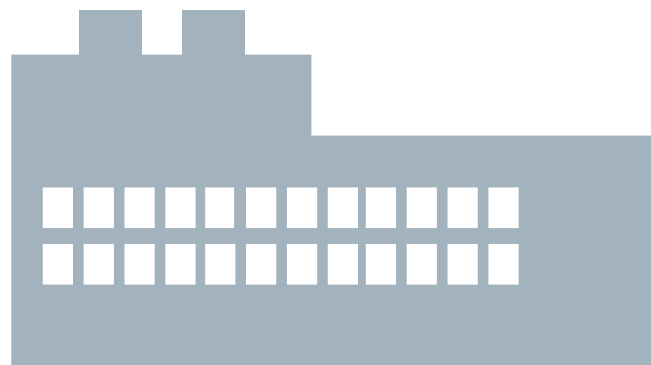
MINIMISATION OF WATER LOSS

Leak detection technology and regulation of water pressure decreases the water losses in pipelines in Copenhagen to nearly 8%. In some cities the figure is 40 – 50%.

GROUND WATER PROTECTION

REMEDIATION FACILITIES

In areas with polluted and pesticide contaminated groundwater the polluted water is pumped out and cleaned before it infiltrates and damages the large primary ground water resource.



GROUND WATER
RESERVOIR

THE SUSTAINABLE BENEFITS



ECONOMIC

Reduced long term costs through:

- Lower energy use.
- Less frequent need to fully replace existing pipe network.
- Better monitoring and repair.
- Local businesses achieve reduced production costs through greater water efficiency.



ENVIRONMENTAL

- Energy consumption from water services reduced.
- Energy intensive solutions like desalination avoided.
- No chemical treatment of drinking water.
- Low demand for bottled water.



SOCIAL

- The cooperation between municipalities and supply companies encourages mutual interest in groundwater protection.

BEHAVIOUR CHANGE

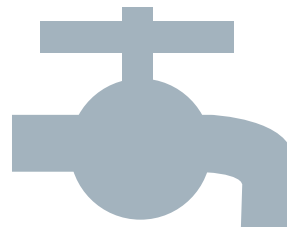
CLEAN TAP WATER

INSTALLATION OF INDIVIDUAL WATER METERS

Previously, residents in buildings paid a fixed share of the collective water bill for the entire building. With the individual water meters the consumption fell remarkably by an average of 26%.

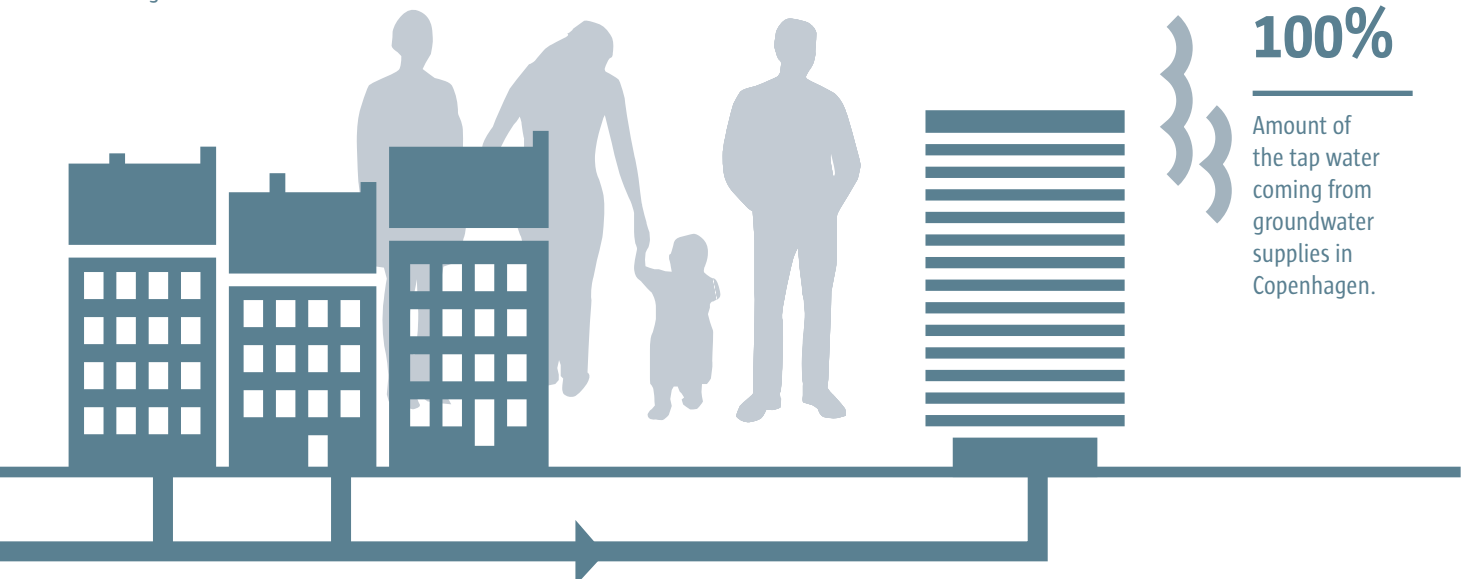
FINANCIAL INCENTIVES

Consumer charges of € 5 per cubic metre of water, hereof € 0.16 per cubic metre towards groundwater mapping and groundwater protection.



100%

Amount of the tap water coming from groundwater supplies in Copenhagen.



THE RIGHT CLIMATE FOR WIND

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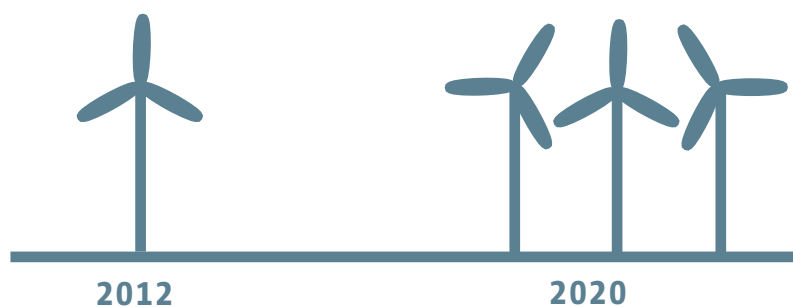
THE FORCE OF PUBLIC SUPPORT FOR WIND POWER

22% OF DENMARK'S TOTAL ELECTRICITY CONSUMPTION IS PRODUCED BY WIND TURBINES, THE HIGHEST RATE IN THE WORLD. IN COPENHAGEN A RENEWABLE ENERGY INFRASTRUCTURE HAS BEEN INTRODUCED THROUGH A UNIQUE PARTNERSHIP BASED ON LOCAL OWNERSHIP.

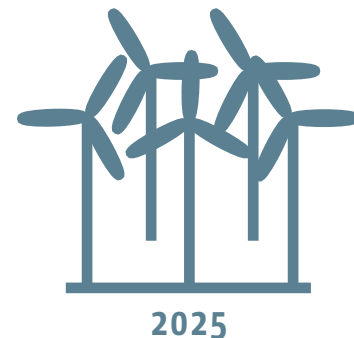
Like every city, Copenhagen faces challenges to wind power: limited space to implement wind energy on a large scale within an urban environment, wind turbines are expensive to build, and there is public resistance to the

perceived visual and noise impact of wind turbines in the landscape. The solution was to encourage public support for windpower by creating community-owned facilities and using local skills.

DENMARK



COPENHAGEN



ELECTRICITY PRODUCTION FROM WIND POWER

SOLUTION – LOCAL OWNERSHIP

- High-class technology.
- Community ownership.
- Overcome the 'not in my backyard' attitude.

BENEFITS

- Significant contribution to achieving carbon-reduction goals.
- Creation of new jobs.
- Boost to the Green Economy.

SOLUTION IN DETAIL

HIGH-CLASS TECHNOLOGY

At the first wind farm at Middelgrunden in Copenhagen Harbour specially designed foundations were developed to cope with the ice during severe winters. Accommodation of factors such as tidal movements, wave loading, ice loads, fatigue and the aggressive marine environment on submarine cables were incorporated.

Lessons learnt from the successful wind farm have been used to inform subsequent schemes, highlighting how replicable the model is.

A key issue was improving the ability of the power grid to accept and balance increased levels of intermittent energy from wind turbines.

COMMUNITY OWNERSHIP

The first wind farm at Middelgrunden created a Wind Turbine Cooperative that owned 10 out of the 20 wind turbines. The shares were sold to 8,650 members of the

local community. Each share represents production of 1000 kWh/year and was sold for € 570.

Based on the Copenhagen Climate Plan, the city-owned utility company plans to build more than 100 new wind turbines by 2025. Cooperatives will be able to invest in the turbines both in and outside Copenhagen.

OVERCOME THE 'NOT IN MY BACKYARD' ATTITUDE

A Public Awareness Campaign offered demonstration tours of wind turbines to help convince locals that there would be no noise impact from the project. A recent survey among the citizens of Copenhagen indicates widespread popular support for wind turbines in the city.

THE SUSTAINABLE BENEFITS



ECONOMIC

- The profit the City of Copenhagen made from the sale of its first successful wind farm has been recycled back into other city projects.
- Green Economy – through creating strong local demand, the Danish wind turbine industry has grown into a multibillion euro industry with over 350 companies producing turbine towers, blades, generators, gear boxes and control systems.
- Wind turbines have low running costs following initial investment.



ENVIRONMENTAL

- Significant contribution to achieving carbon reduction goals.
- Energy production at Middelgrunden wind farm is estimated at 89 million kWh of electricity per annum.
- Middelgrunden wind farm annually eliminates:
 - 232 tonnes of sulphur dioxide emissions
 - 208 tonnes of nitrogen oxide emissions
 - 68,000 tonnes of carbon dioxide emissions and 4,400 tonnes of dust and clinker.



SOCIAL

- Community commitment to the achievement of climate change objectives.
- Creation of new jobs.



RECYCLING WASTE IN YOUR CITY

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Copenhagensers for waste sorting | Waste sorting must be a natural part of everyday life for everybody / Credit: Ursula Bach

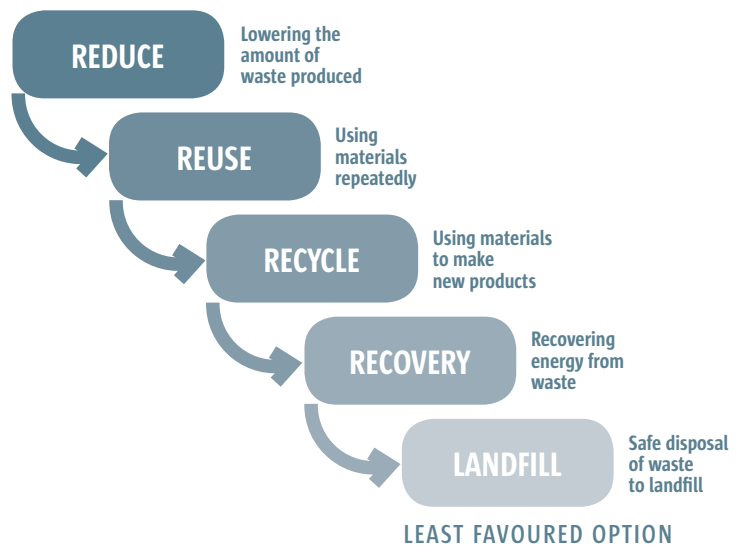
A CITY WITHOUT WASTE BUT FULL OF RESOURCES

ONE OF THE GREATEST CHALLENGES OF THE FUTURE WILL BE TO ACHIEVE A BETTER UTILISATION OF RESOURCES. WE NEED TO MAKE MORE WITH LESS. IN THE CITY OF COPENHAGEN, WE SEE THIS CHALLENGE AS AN OPPORTUNITY: WE WILL TURN COPENHAGEN INTO A RESOURCE-EFFICIENT METROPOLIS IN WHICH WE NO LONGER SEE WASTE AS A PROBLEM, BUT AS A RESOURCE NOT YET FULLY EXPLOITED.

Waste incineration has been essential in making the Copenhagen waste management system one of the best in the world. Incineration will continue to be an important part of an efficient waste management system and of our energy supply, but we only wish to incinerate materials when there is no better option for resource utilisation. This will not only be an environmental benefit, but also an economic benefit for the city, our citizens, businesses, and society as a whole. The benefit comes from the fact that due to the future scarcity of resources, raw material prices will increase – both when it comes to virgin and recycled materials.

New paths will appear for the waste management system of the future – or rather the resource management system. This will not happen overnight, but we are taking the first step with the Resource and Waste Management Plan 2018.

MOST FAVOURED OPTION



WASTE HIERARCHY

The waste hierarchy guides the efforts described in the Resource and Waste Management Plan 2018. The purpose is to lift waste management in Copenhagen as high up the hierarchy as possible.

SOLUTION

– TREATING WASTE AS A RESOURCE

- Generate less waste
- Increase direct reuse
- Recycle more
- Incinerate less

BENEFITS

- Saving of scarce resources
- Create closed-loop of recyclable materials
- Recyclable materials are traded at market conditions
- Global environmental benefits
- A sustainable city
- A city with no waste

SOLUTION IN DETAIL

COPENHAGEN HAS A PLAN

The vision and overall objectives reflected in the Resource and Waste Management Plan are ambitious and call for focused, persistent, and long-term efforts.

The efforts of the city for a more resource efficient waste management system fall under four topics each with a specific target and a number of areas of effort and concrete initiatives. Each topic furthermore contains a

flagship project. This is a special focused area of effort that is characterised, among others, by setting the agenda and having a significant environmental effect.

We will utilise waste better so that as many resources as possible are recycled and as little as possible is incinerated.



Reduction of incinerated waste in 2018.

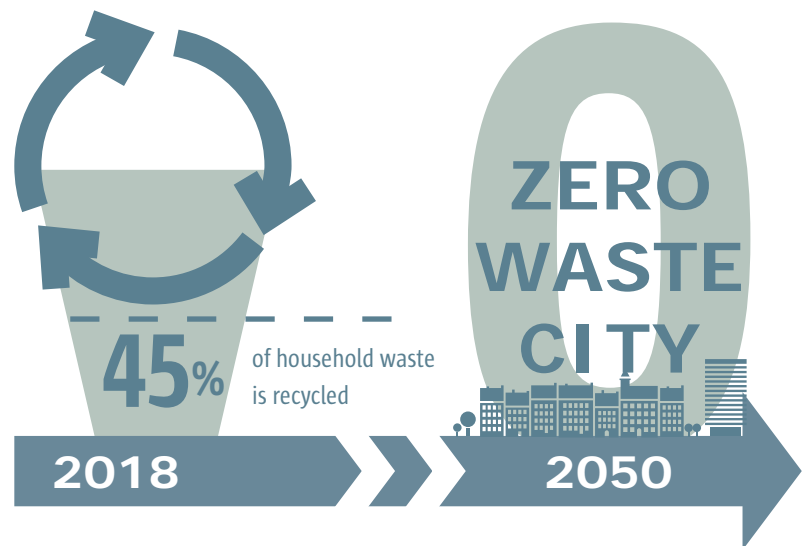
90,000



45,000



Amount of waste away from incineration into recycling and reuse.



THE SUSTAINABLE BENEFITS



ECONOMIC

- Increased economic productivity without damaging the environment
- New green treatment solutions provide growth
- Establishment of an economically and environmentally sustainable market
- Due to the future scarcity of resources, raw material prices will increase – both when it comes to virgin and recycled materials
- Improved corporate reporting and green credentials for business.



ENVIRONMENTAL

- Reduced pressures on finite resources, such as virgin aggregates
- Reduced greenhouse gas emissions from incineration
- Reduced energy consumption from the manufacturing process
- Reduced greenhouse gas emissions and pollution from mining of virgin resources
- Establishment of closed loop of resources.



SOCIAL

- Empowering and involving citizens in change
- Prevention of the harmful emission of pollutants to people and water as well
- Community building
- Increased environmental awareness
- Nudging as a means to change behavior
- Waste sorting as a social norm.

TOPICS	MEASURES	FLAGSHIPS	TARGETS 2018
LESS WASTE	<ul style="list-style-type: none"> • More reuse. • Less food waste. • Resource-aware procurement. 	<ul style="list-style-type: none"> • Sydhavn Recycling Centre. • The city will establish a centre for innovation, knowledge, and green growth in the resource and waste field. 	<ul style="list-style-type: none"> • The City of Copenhagen has reduced the waste generation with 6,000 tonnes through more direct reuse, less waste, and by supporting the development of cleaner products through partnerships.
BETTER WASTE SORTING	<ul style="list-style-type: none"> • Better waste sorting options in blocks of residential flats. • More options for sorting in single-family homes. • Integration of innovative waste solutions in the urban space. • More sorting by the business community. • Cleaner construction and demolition waste. 	<ul style="list-style-type: none"> • Copenhageners for waste sorting. • Waste sorting must be a natural part of everyday life for everybody. 	<ul style="list-style-type: none"> • All citizens in the City of Copenhagen must have access to source sorting of the most typical types of waste near their homes, and all municipal institutions will be sorting their waste.
MORE EFFICIENT AND ENVIRONMENTALLY FRIENDLY WASTE COLLECTION	<ul style="list-style-type: none"> • Noise-free and zero carbon waste collection. • Waste collection to improve recycling. 	<ul style="list-style-type: none"> • Biowaste and heavy transport fuelled with biogas • The city will utilise resources contained in biowaste better and ensure that nutrients remain in circulation. 	<ul style="list-style-type: none"> • 25,000 tonnes of biowaste is separated for anaerobic digestion. • At least 60% of the collection vehicles of the City of Copenhagen will be fuelled with alternative fuels.
BETTER WASTE TREATMENT AND RECYCLING	<ul style="list-style-type: none"> • New waste treatment centre in Amager. • More control of WEEE. • More waste outlets and development of new treatment options. 	<ul style="list-style-type: none"> • Recycling and prevention of plastics. • The city wants to divert plastic waste away from incineration to separate collection and reprocessing into a quality allowing for the manufacture of new plastics. This benefits environment and climate alike. 	<ul style="list-style-type: none"> • A high-tech waste treatment centre and a sorting plant that can post-separate recyclable materials to ensure higher quality and recycling has been established.

SWITCH ON DISTRICT HEATING

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KEEPING THE CITY WARM EFFICIENTLY

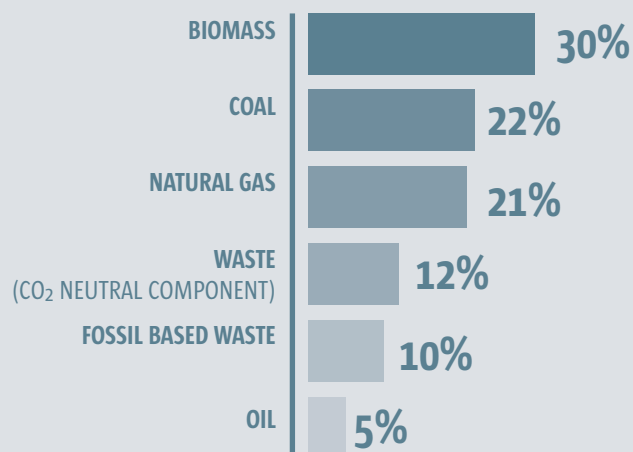
DISTRICT HEATING IS ONE OF THE MOST CARBON EFFICIENT AND FLEXIBLE WAYS TO PRODUCE AND SUPPLY ENERGY LOCALLY, CUTTING OUT MUCH OF THE WASTE ASSOCIATED WITH CENTRALISED POWER GENERATION. BY INTEGRATING RENEWABLE ENERGY SUCH AS BIOMASS, SURPLUS WIND ENERGY, GEOTHERMAL ENERGY AND BIOMASS TO REPLACE FOSSIL FUELS IN THE SYSTEM, FURTHER REDUCTIONS OF EMISSIONS HAVE BEEN ACHIEVED.

98%

98% of heating provided in Copenhagen comes from the district heating grid.

The district heating system was first established in the mid 1920s and was more intensively developed in the 1970s as a way to protect citizens and the economy from the dramatic rise in fossil fuel prices. This was a time when the city faced overdependency on increasingly scarce and expensive fossil fuels, air quality concerns caused by coal and oil burning within a city environment, and low efficiency in energy distribution in the existing district heating network. The solution was to reduce reliance on fossil fuels by maximising energy generated from waste, biomass and other fuel sources.

COMPOSITION OF THE DIFFERENT TYPES OF FUEL SOURCES USED FOR DISTRICT HEATING SYSTEM.



SOLUTION

– DECARBONISING THE DISTRICT HEATING

- Technologies such as Combined Heat and Power (CHP) to capture and re-use heat energy that is otherwise lost in the electricity generation process.
- The district heating network distributes heat energy efficiently around the city. The integration of renewable fuels such as biomass further reduces the carbon intensity of the network.

BENEFITS

- Creation of new jobs.
- Reduced CO₂ emissions.
- District heating costs around 45% less than oil by individual oil boiler.
- The most cost-effective way to heat buildings, taking into account environmental costs.
- Almost no negative impact on air quality.

SOLUTION IN DETAIL

Development of a district heating system that uses heat generated from waste-to-energy plants; along with CHP technology, initially fuelled by coal, natural gas and oil.

STEP BY STEP EXPANSION OF THE NETWORK

District heating does not necessarily require an overhaul of existing energy systems. It can be implemented over a suitable period of time. A steam network was originally established to supply hospitals and industry, and once a steam pipe was established, offices, daycare centres and private homes nearby were also connected.

This network is now replaced by water-based district heating which is more energy efficient and can be stored in thermal storages.

Regional co-operation in Greater Copenhagen:

The entire integrated district heating system spanning more than 20 municipalities in the region is developed and operated through regional co-operation and partnerships.

DECARBONISING THE HEATING SYSTEM

Strategy

The short-term goal of the city is to convert all remaining coal-fired CHP to biomass.

As a long-term strategy the City of Copenhagen is now using geothermal energy in the district heating network.

Renewable energy supply

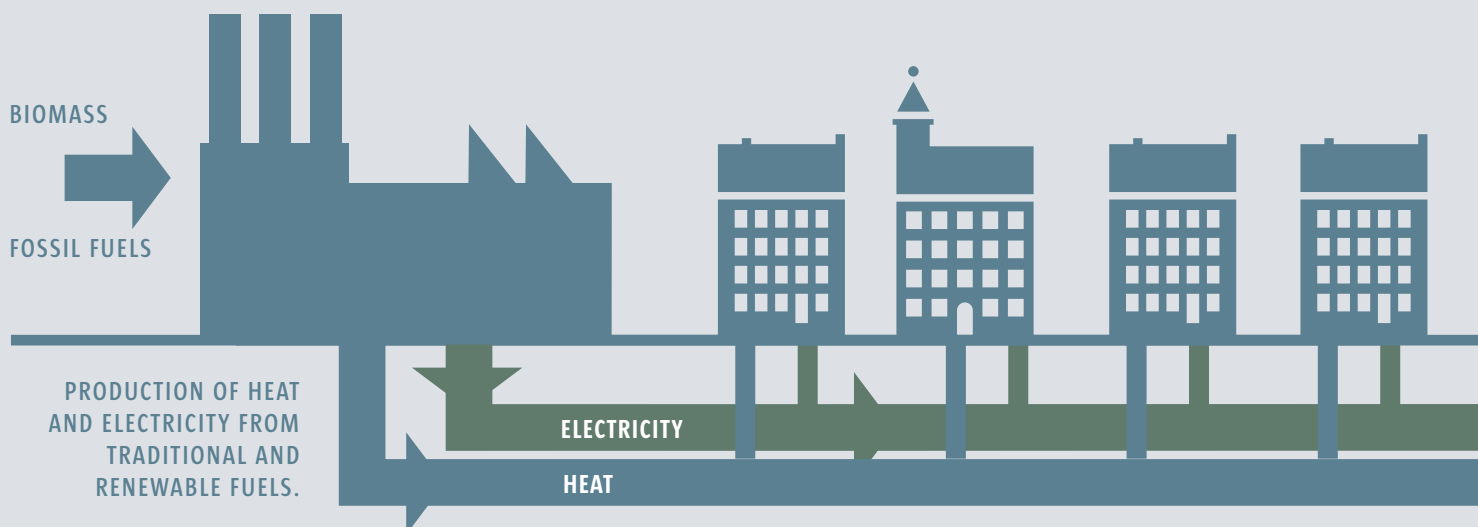
The use of CHP units allows highly efficient use of the energy in the fuels (up to 94%), and results in lower carbon dioxide emissions.

Biogas is being made an operational part of the town gas grid by extracting gas from sludge produced in wastewater treatment processes.

Biomass is planned to replace coal and provide 100% renewable energy from the CHP plant-one plant has already been converted to 100% biomass.

FUEL SOURCES FOR THE DISTRICT HEATING NETWORK

STEP-BY-STEP EXPANSION OF THE NETWORK. A DISTRICT APPROACH ALLOWS FOR FLEXIBLE, SCALED AND PHASED INTRODUCTION OF FUEL SOURCES AND TECHNOLOGIES.



THE SUSTAINABLE BENEFITS



ECONOMIC

- With high fuel efficiencies of up to 94% by simultaneously generating heat and power, the power plants need much less fuel per kWh generated. In comparison, conventional power plants have an efficiency of around 40%.
- For society in general, district heating is the most cost-effective heat supply taking into account environmental costs of CO₂ and other emissions.



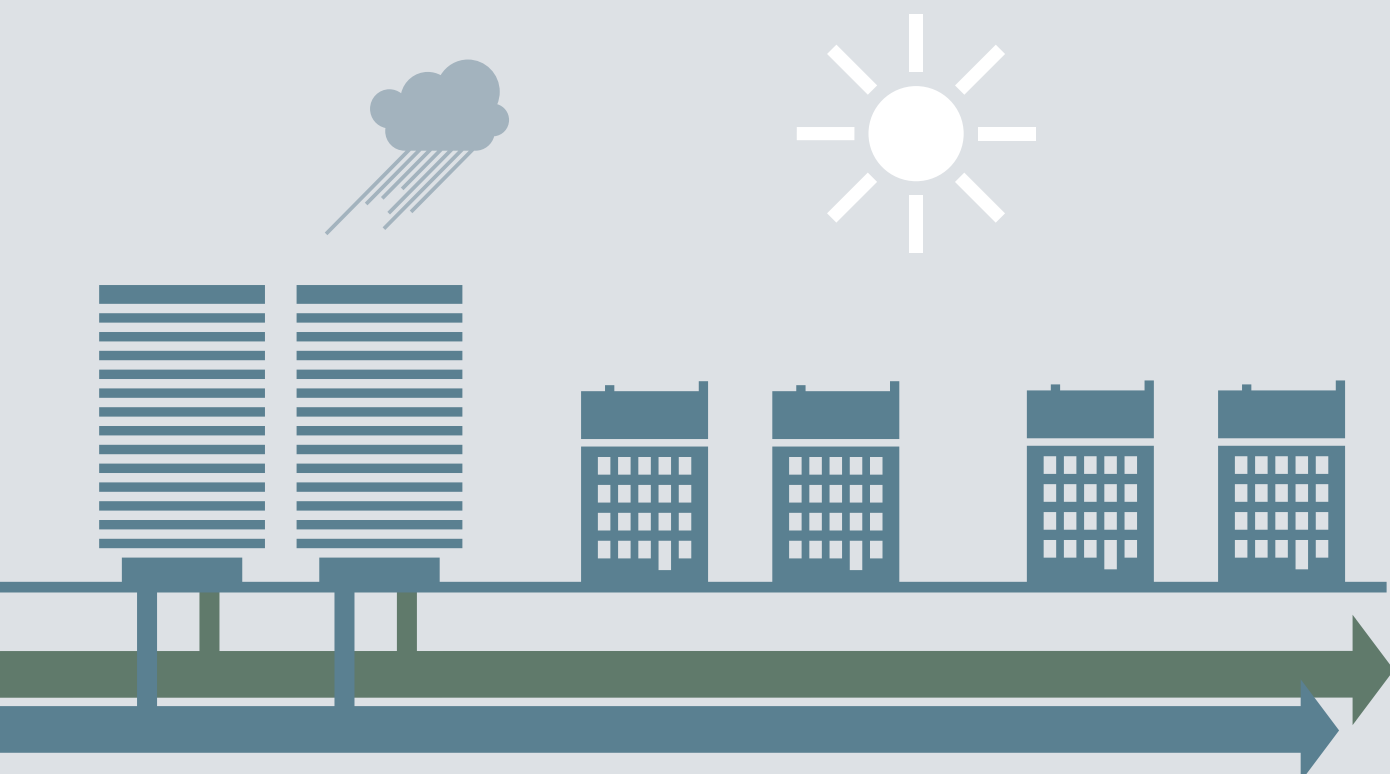
ENVIRONMENTAL

- The District Heating system achieves lower carbon dioxide emissions than the individual gas boilers (40% lower) and oil boilers (50% lower) it replaces.
- District heating can utilise and store the available heat from CHP plants and thereby reduce the primary energy consumption by 70% compared to individual boilers.
- Conversion to biomass-fuelled district heating is further decarbonising the energy supply.



SOCIAL

- Jobs were created in developing the grid infrastructure required for the district heating system.
- Municipal and consumer ownership of the district heating grid infrastructure and the Danish Heat Supply Act ensure that all economic benefits of district heating are returned to the consumers.
- Joining the district heating system and sharing the fixed infrastructure costs reduces the heat price to the benefit of all consumers.





KEEP YOUR CITY COOL

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KEEPING COOL UNDER CO₂ PRESSURE

THE INCREASED DEMAND FOR AIR CONDITIONING AND COOLING HAS LED TO HIGHER ELECTRICITY CONSUMPTION IN MANY CITIES. IN OUR EFFORT TO PROVIDE LOW CARBON COOLING, WE HAVE BUILT THE FIRST TWO DISTRICT COOLING NETWORKS. THEY ARE BASED ON FREE COOLING FROM SEAWATER ABSTRACTION, ALONG WITH RUNNING SURPLUS HEAT FROM THE DISTRICT HEATING NETWORK THROUGH ABSORPTION COOLING AND TRADITIONAL COMPRESSION CHILLERS. THE PROJECT IS EXPECTED TO SAVE 30,000 TONNES OF CARBON DIOXIDE PER YEAR.

Peak summer temperatures in Copenhagen can reach 35°C and are expected to rise by 2 – 3% by 2050 – with average daily temperatures also rising. Consequently, the demand for traditional air conditioning is increasing. Dependency on electricity-based cooling appliances can create unsustainable electricity demand and overreliance on fossil

fuels. Traditional air conditioning systems are expensive, noisy and take up a lot of space. Additionally there is currently excess heat within the district heating system during summer months when demand is low. The solution was to develop a 'District Cooling' system to complement the highly successful District Heating system.



District cooling does not influence the architectural impression of the city.

SOLUTION

– DISTRICT COOLING NETWORK

- District Cooling is the centralised production and distribution of chilled water – partly cooled with cold seawater. It is distributed via underground insulated pipelines to commercial and industrial buildings to cool the indoor air.

BENEFITS

- Reduced CO₂ emission.
- Urban heat island effect is reduced.
- Zero noise, unlike conventional cooling methods.
- Reduced expenditure on energy imports.

SOLUTION IN DETAIL

District Cooling is the centralised production and distribution of chilled water, partly cooled with cold seawater. It is distributed via underground insulated pipelines to commercial and industrial buildings to cool the indoor air. The plant is designed around three different methods of cooling making it very flexible and highly energy-efficient, depending on the temperature of the seawater.

UTILISE EXISTING RESOURCES

Seawater from Copenhagen Harbour is one resource during periods when the seawater is sufficiently cold. Surplus heat from the district heating network during periods of low heat demand is another resource.

CREATION OF MULTIPLE CONNECTIONS TO A NETWORK

District Cooling works on the same principles as district heating. Chilled water is produced centrally and carried to the end users through a system of pipes. Network can be built adjoining district heating pipework, or can be laid where no existing network is in place.

INTEGRATION OF DIFFERENT PRINCIPLES OF COOLING

Free cooling

Seawater temperature is below 5.5°C and cooling demand low (less than 2400 kW). All cooling demands are covered by free cooling heat exchangers.

Combined operation

Seawater temperature is between 5.5°C and 11.5°C. Heat exchangers are used for pre-cooling of the water, before it is fully cooled by chillers to the desired temperature.

Chiller cooling

Seawater temperature is above 11.5°C. The seawater is too warm to be used for free cooling so absorption and compression chillers provide all cooling. Free cooling heat exchanges are bypassed completely.

70%

Up to 70% reduction of CO₂ emissions when using district cooling compared to traditional cooling methods.

80%

Up to 80% reduction of electricity consumption when using district cooling compared to traditional cooling.

THE SUSTAINABLE BENEFITS



ECONOMIC

- Reduction in expenditure on energy imports.
- Cooling contracts with different organisations and institutions can be replicated, allowing easy transferability.
- Frees up commercial, retail and parking spaces as conventional cooling systems and fan coils on roofs are replaced by underground infrastructure.



ENVIRONMENTAL

- Carbon dioxide reduction of 70%, compared to traditional cooling. The annual sulphur dioxide and nitrogen oxide savings are 62% and 69% respectively.
- Potential to negate or, at least reduce, the urban heat island effect.
- Demand for electricity is reduced because electrically operated chillers are replaced by free cooling and heat-operated chillers via district cooling.
- Excessive heat, noise and chemicals from compressor chillers are avoided in individual buildings.

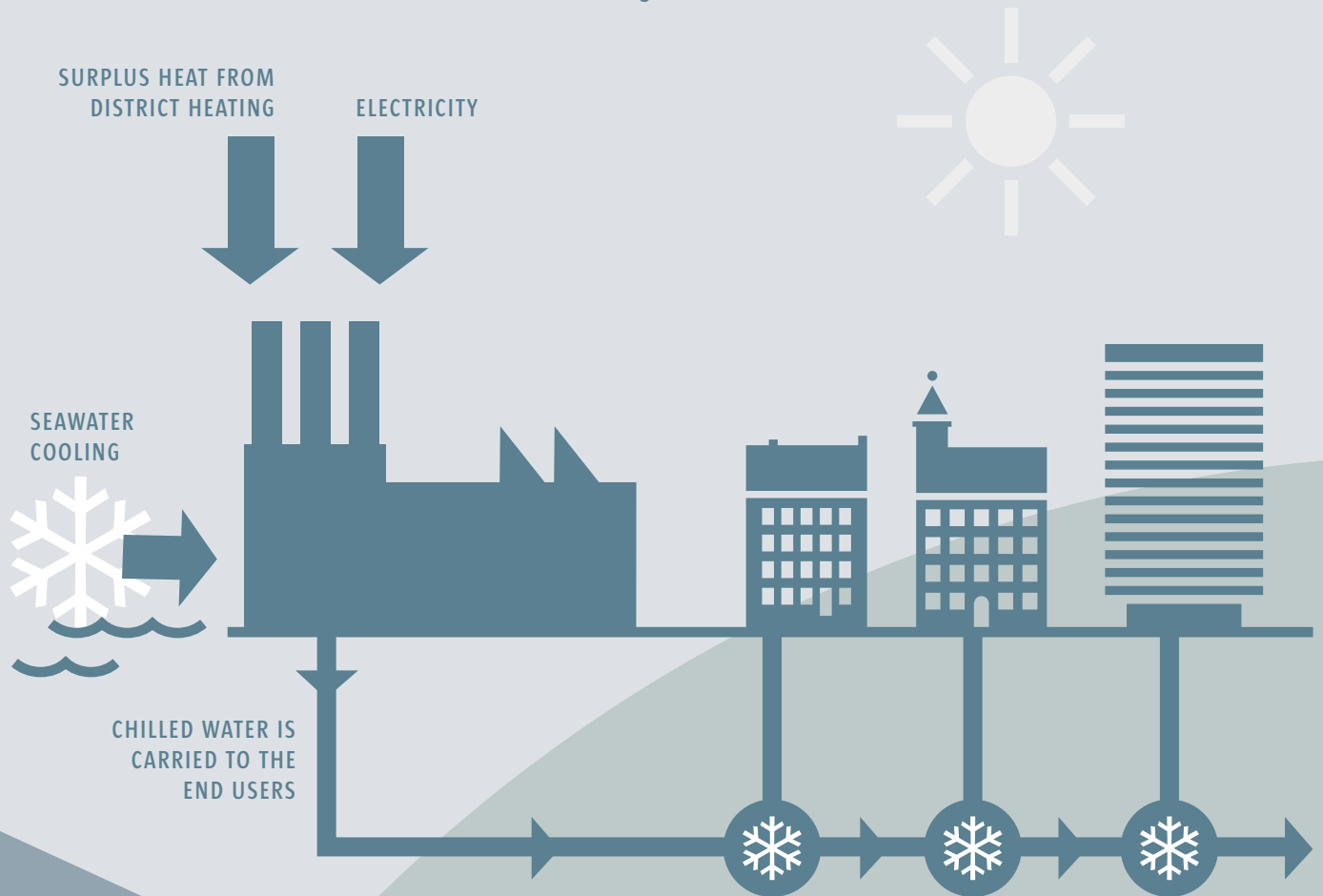


SOCIAL

- Zero noise to the customer, as opposed to conventional cooling methods.
- Removes many of the health risks associated with cooling towers, e.g. legionnaire's disease.
- Increased energy security from a centralised supply with improved resilience built in.
- Rooftop terraces instead of traditional cooling systems.
- Does not damage the architectural impression of a beautiful city.

DISTRICT COOLING

BUILDING A NEW COOLING STATION WITH A CAPACITY OF 15MW.



BUILD AND RETROFIT THE SUSTAINABLE WAY

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CREATING BUILDINGS FOR LIFE

BEING CONSCIOUS ABOUT ENERGY CONSUMPTION WHEN WE BUILD AND RENOVATE IS A GOOD INVESTMENT – FOR OUR WELL-BEING, FOR THE CLIMATE AND FOR THE ECONOMY. NO LESS IMPORTANT THAN THE ENERGY SAVED IS THE IMPROVED QUALITY OF LIFE THAT RESULTS FROM SUSTAINABLE BUILDINGS.

Collaboration between knowledge institutions, architects, engineers and private and public partners has led to creative solutions. Solutions that improve the quality of life for the people who live and work in the buildings as well as the overall impression of the city with innovative renovation projects and new world class architecture.

The technical solutions for sustainable buildings and retrofitting are available and well proven. There are huge savings to be made from energy optimisation in buildings, recovering the investments relatively quickly.



40% of Denmark's CO₂ emissions come from buildings.

SOLUTION

– SUSTAINABLE LIFE CYCLE

- Integrated design process from the very beginning of the project.
- Efficient use of energy, water and other resources.
- Reduce waste, pollution and environmental degradation.
- Creating an indoor climate of high quality to protect occupant health and improve employee productivity.
- New thinking on the economic feasibility of buildings.
- Focus on life cycle costs and material costs.

BENEFITS

- Reduced CO₂ emission and energy consumption in both refurbished buildings and new sustainable buildings.
- Urban areas become more attractive and the value of real estate increases.
- Improved health and quality of life; the ability to learn and the level of concentration and well-being are directly related to the quality of the indoor climate.
- Economic benefits from energy optimisation.
- Reduced risk and vulnerability to future increases in energy and water costs.
- Reduced life cycle costs.

SOLUTION IN DETAIL

Energy efficiency over the entire life cycle of a building is the single most important goal of both new sustainable architecture and retrofitting of old buildings. Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment.

NEW SUSTAINABLE BUILDINGS

Sustainable buildings are environmentally responsible and resource-efficient throughout the building's life-cycle: from siting to design, construction, operation and maintenance. This requires close cooperation between the design team, the architects, the engineers, the users, the authorities, and the client at all project stages. The Green Building practice expands and complements the classical building design concerns of economy, durability, architecture and comfort.

MAKING OLD BUILDINGS SUSTAINABLE

Retrofitting is the modernisation of old buildings with the aim of increasing energy-efficiency with respect for the aesthetics of the old buildings. Retrofitting has a significant and measurable impact on energy consumption and the indoor climate in buildings. In Copenhagen, retrofitting alone is expected to account for a decrease of 10% in electricity and 20% in heat consumption when comparing 2025 with 2010.

CERTIFICATION

DGNB Denmark is a Danish certification scheme within sustainability. A sustainable certification scheme provides the necessary framework and criteria for the planning, design, construction and property industries. By working with DGNB we want to improve quality and support the ambition that new buildings should be as sustainable as possible.

THE SUSTAINABLE BENEFITS



ECONOMIC

- Investments in energy savings have relatively short pay back periods.
- Retrofitting old buildings makes areas more attractive and increases the value of real estate.
- Investments in retrofitting have a positive affect on the economy of the city.
- The construction sector has experienced a much-welcomed boost in demand for their services.
- Public investments in buildings draw even greater private investment in a ratio 5:1.



ENVIRONMENTAL

- Reduced CO₂ emission and energy consumption in both refurbished buildings and new sustainable buildings.
- Living and working in sustainable buildings inspires children and adults to take climate-friendly initiatives themselves.
- The resources used have a reduced environmental impact.

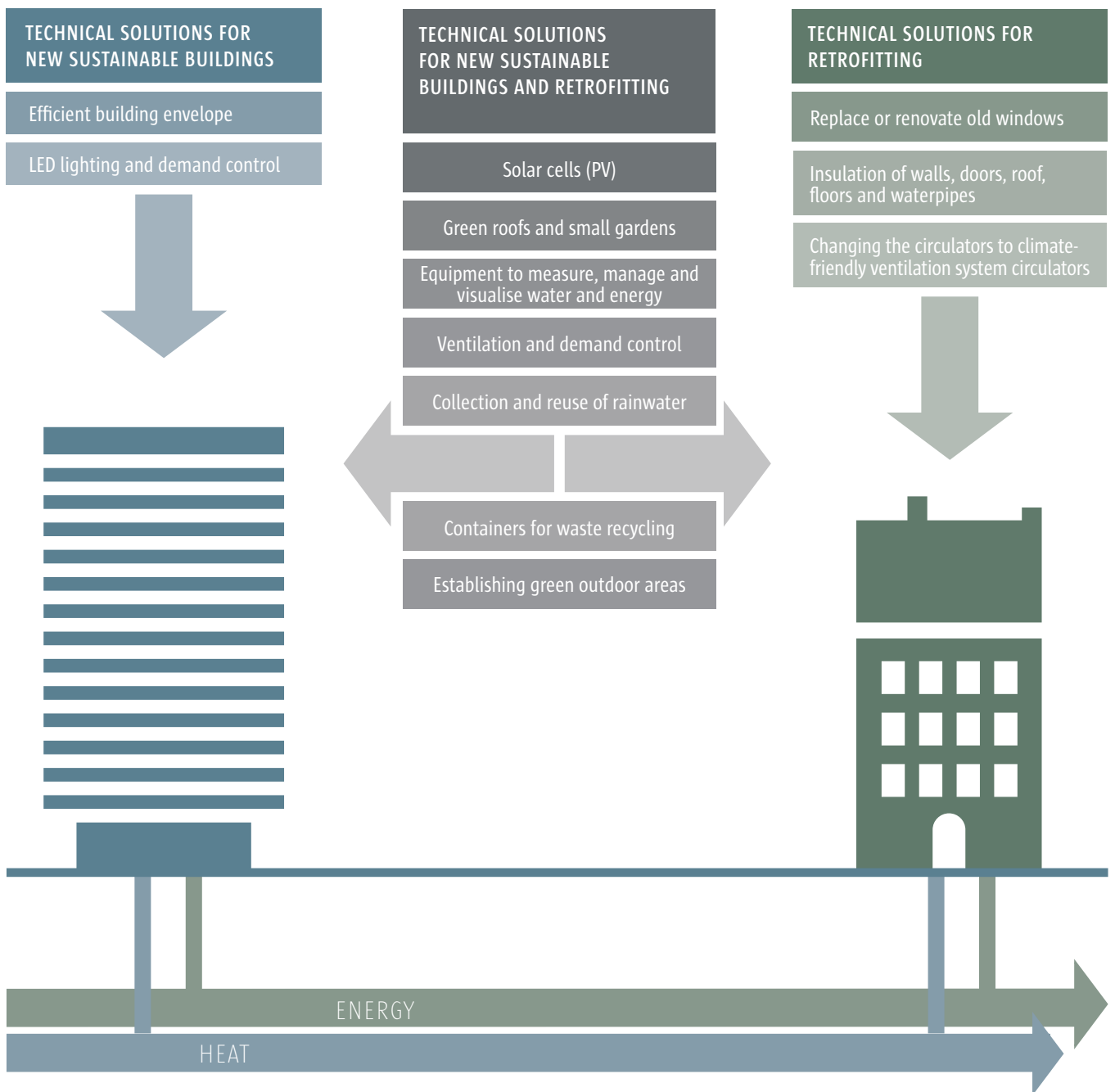


SOCIAL

- The existing buildings, which are part of the city history, are preserved.
- Refurbishment improves the quality of life and encourages families to stay in the city.
- Improved indoor climate in buildings has a positive impact on human health.
- Future-proof buildings.

COPENHAGEN BUILDS AND RETROFITS THE SUSTAINABLE WAY

THE TECHNICAL SOLUTIONS ARE USED IN BOTH NEW SUSTAINABLE BUILDINGS AND RETROFITTING.



GET THE SUSTAINABLE PLANNING TOOLS

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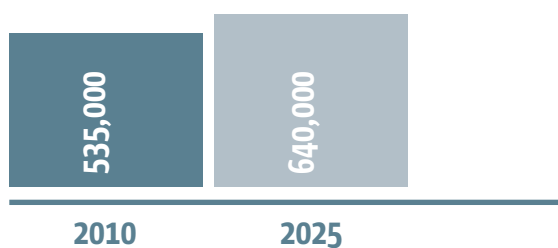
Copenhagens have large amounts of green space within a short walk or cycle ride, and good access to public transport / Credit: Kontraframe

URBAN PLANNING: ECONOMIC AND SOCIAL BENEFITS

COPENHAGEN IS WELL KNOWN FOR ITS GREEN ASPIRATIONS AND BIKES. WHAT IS NOT AS WELL KNOWN ABOUT THE GREEN CITY ARE THE SOCIAL AND ECONOMIC BENEFITS OF THE CITY'S APPROACH TO URBAN PLANNING.

How does a city improve quality of life, expand, and at the same time reduce car usage and CO₂ emissions? Intelligent urban planning is part of the answer. Through strategic urban planning and a history of environmental ambition, Copenhagen has created swarms of cyclists, large recreational areas, pedestrian streets, clean water in the harbour and world-class integrated public transport.

POPULATION GROWTH OF COPENHAGEN



SOLUTION – STRATEGIC URBAN PLANNING

- Municipal action plans and planning legislation for focused urban development.
- Partnerships and stakeholder commitment for innovative and sustainable solutions.
- Strategic site preparation to finance development.

BENEFITS

- Increase in land values.
- A green and blue city improves the quality of life for the citizens.
- Reduced CO₂ emissions.

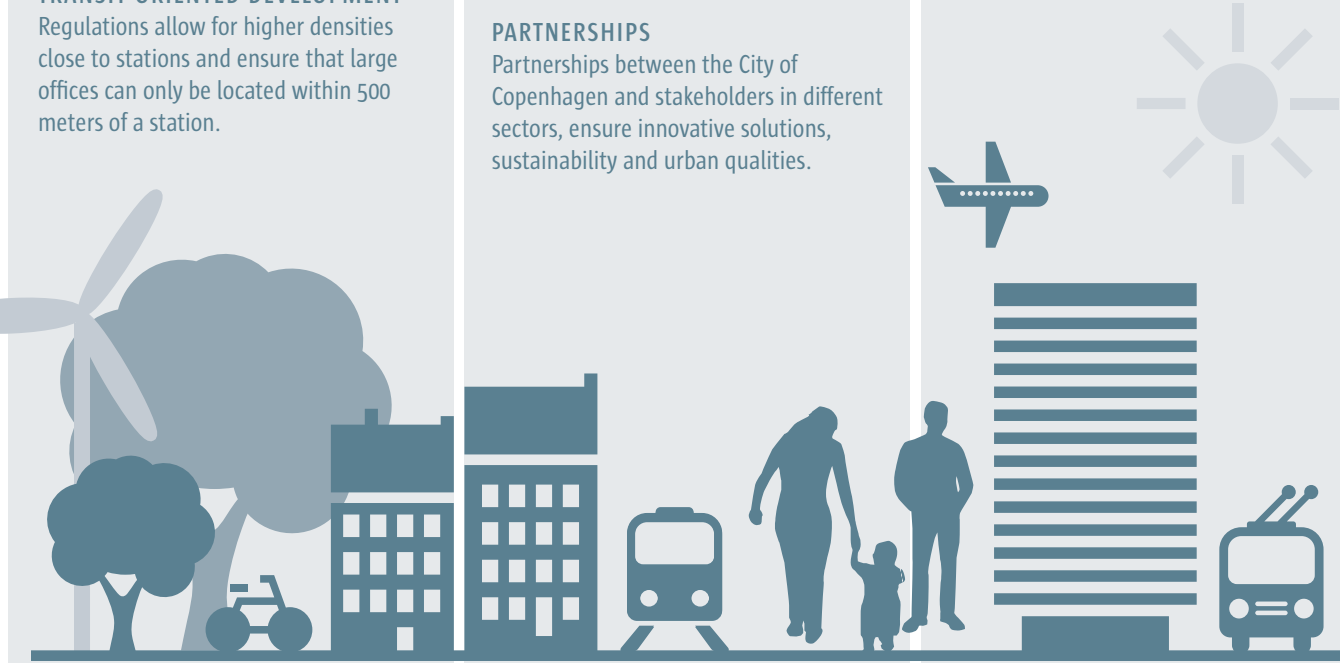
SOLUTION IN DETAIL

Planning tools, stakeholder commitment and collaboration between different sectors – that is our approach to sustainable urban solutions and how we meet the needs

of our city regarding social, environmental and economic challenges. The approach is useful for the development of new areas as well as for existing neighbourhoods.

STRATEGIC URBAN PLANNING

PLANNING TOOLS	FINANCING URBAN DEVELOPMENT	DIALOGUE
<p>FINGERPLAN The growth of Copenhagen has been set along five designated 'fingers' following train and major road routes, with open space between.</p> <p>TRANSIT ORIENTED DEVELOPMENT Regulations allow for higher densities close to stations and ensure that large offices can only be located within 500 meters of a station.</p> <p>CITY PLANNING City planning ensures sustainable development such as optimal facilities for bicycles, green areas and connection of the city to the water environment.</p>	<p>STRATEGIC SITE PREPARATION Investment in attractive urban qualities, as infrastructure and blue and green spots increase the land value. This is a way to finance urban development in a sustainable way.</p> <p>PARTNERSHIPS Partnerships between the City of Copenhagen and stakeholders in different sectors, ensure innovative solutions, sustainability and urban qualities.</p>	<p>CITIZENS' DIALOGUE Dialogue with citizens and qualitative analysis of their needs is important to get the strategy right and ensure a high quality of life and user friendly solutions.</p>



CASE

ØRESTAD: PLANNING SUSTAINABLE DEVELOPMENT

44/45

Planning economic growth

The development of a new master-planned city area called Ørestad was decided upon in the early 1990s. Politicians realised that Copenhagen lacked the dynamic attraction to be the driving force for Denmark and to be able to compete with other metropolitan cities in Europe. The masterplan had two main goals: getting companies to set up in the city instead of on the outskirts of Copenhagen — or abroad — and encouraging young families to stay in Copenhagen rather than buying a home in the distant suburbs.

Financing: Strategic Site Preparation

Financing the development of the new neighbourhood was made possible by strategic site preparation. “Ørestadsselskabet”, a development company, invested in attractive landscape qualities such as lakes and canals as well as pocket parks and the preservation of a large area of meadowland nearby. The construction of the Metro was part of the investment and has made Ørestad easy to reach by public transport. The first phases of the new Copenhagen Metro were financed by selling sites in Ørestad and taking out-loans.

Planning an attractive city area

Ørestad is constructed around natural surroundings and water, only 10 minutes from the city centre. The neighbourhood consists of a great mix of cultural and educational institutions, office blocks and dense pockets of housing. The masterplan secures high-quality architecture, public transport close to major destinations, and focus on sustainability.

Several buildings in Ørestad reflect the cream of contemporary architectural standards of form and function. Many buildings have received awards, and some of them may already now be considered modern classics. Interesting examples of modern architecture in Ørestad are: the IT University, the Bikuben Hall of Residence, DR Concert hall, Ramboll Head Office, VM Bjerget, Bella Sky Hotel and 8TALLET.

THE SUSTAINABLE BENEFITS



ECONOMIC

- The increase in land values generated by the construction of new high-class transport systems, landscaping and land-use regulations, is capitalised in the joint area development company.
- Urban areas of high quality increase the attractiveness of Copenhagen for residents, businesses and tourists.
- Businesses are located in central parts of Copenhagen without congestion.



ENVIRONMENTAL

- Reduced CO₂ emissions through high-class public transport and optimum facilities for bicycles.
- Compact mixed use developments reduce land-use and the need for transport.
- Integrating new green landscapes in urban development creates a more livable city with cleaner air and areas for discharge of rainwater.



SOCIAL

- Vibrant urban areas not dominated by cars promote social interaction.
- Easy access to regional green areas by metro improves the quality of life.
- Local parks, and ‘pocketparks’, reduce distances to recreative areas and provide space for sports and social activities.
- Canals and clean water create quality and a new identity in the city.

GET YOUR CITY CARBON NEUTRAL

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COPENHAGEN – CARBON NEUTRAL BY 2025

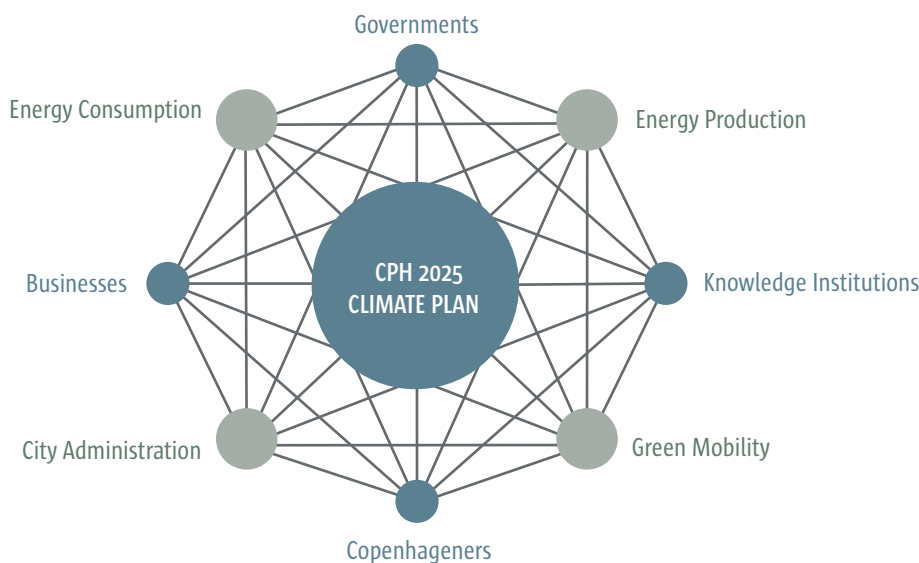
COPENHAGEN ASSUMES ITS SHARE OF THE RESPONSIBILITY FOR CLIMATE CHANGE WITH THE CPH 2025 CLIMATE PLAN. WE WANT TO SHOW THAT IT IS POSSIBLE TO COMBINE GROWTH, DEVELOPMENT AND INCREASED QUALITY OF LIFE WITH THE REDUCTION OF CO₂ EMISSIONS. IT IS ALL ABOUT FINDING SOLUTIONS THAT ARE SMARTER, GREENER, HEALTHIER AND MORE PROFITABLE. AND BY 2025 WE WILL BE ABLE TO CALL OURSELVES THE WORLD'S FIRST CARBON NEUTRAL CAPITAL.



CO₂ emissions were reduced by more than 20% from 2005 to 2011.

The CPH 2025 Climate Plan is a holistic plan as well as a collection of specific goals and initiatives within four areas – energy consumption, energy production, green mobility and the City Administration. Work in the four areas must be set in motion immediately for Copenhagen to become the world's first carbon neutral capital.

The CPH 2025 Climate Plan describes how our ambitions for carbon neutrality should be used as leverage for a better quality of life, innovation, job creation and investment, and how the goal of carbon neutrality can be achieved by 2025 through close cooperation between government businesses, knowledge institutions and Copenhageners.



Focus areas and stakeholders contributing to the CPH 2025 Climate Plan.

A SUSTAINABLE SOLUTION

With the Climate Plan, the Danish capital combines growth, development and a higher quality of life with a reduction in carbon emissions of around 1.2 million tonnes.

The plan creates environmental benefits such as clean air, less noise and better quality of life.

CLIMATE GOALS

Climate actions have been operating in Copenhagen since 2009 when the Copenhagen Climate Plan up to 2015 was adopted. The initiatives which have been launched since then have contributed to substantial CO₂ reductions. The goal of a 20% reduction by 2015 was already achieved by 2011 when CO₂ emissions were reduced by 21% compared to 2005. Today, Copenhagen emits 1.9 million tonnes of CO₂ annually. By 2025, this will have fallen to 1.2 million tonnes due solely to a number of planned initiatives, e.g. switching from coal to biomass in combined heat and power plants in the Capital Region together with changes in the existing legislation on energy and transport. In order to become carbon neutral by 2025, the city must use less energy than it does today and at the same time switch energy production to green sources.

GREEN LABORATORY

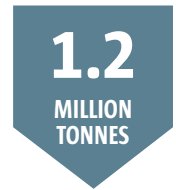
Copenhagen is ready to make the city available as a green laboratory and, with the CPH 2025 Climate Plan, is prepared to meet the climate challenge and take the steps towards a carbon neutral Copenhagen by 2025.

Our ambition is to make Copenhagen an international centre for cleantech companies. With a carbon neutral Copenhagen, Danish companies will have a unified platform to demonstrate green Danish technologies. This will not be the case just for embryonic projects and demonstration facilities on a smaller scale, but in a full-scale metropolis where technologies are in symbiosis with solutions, showing their strength both separately and together at the same time.

IMPROVED QUALITY OF LIFE

Copenhagen is now internationally recognised and designated as one of the world's best cities to live in, winning the prize of European Green Capital 2014.

Work done to become the world's first carbon neutral city is not only a gain for the climate and environment. The initiatives will have positive effects on Copenhageners' lives generally as well as on an everyday basis. The Climate Plan will create solutions that promote green growth and enhance the quality of life for the individual citizen without additional expense to those citizens.

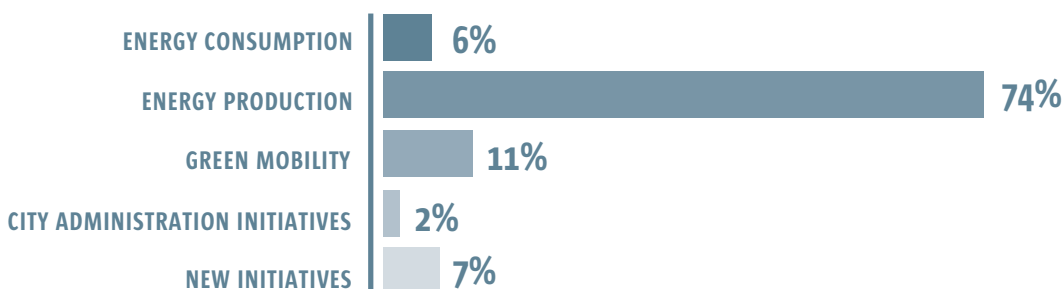


In 2025 the CO₂ emissions in Copenhagen will be 1.2 million tonnes. A reduction of 39% since 2012.



Copenhageners can look forward to saving an average € 537 on their electricity and heating bills each year when the Climate Plan has been implemented.

DISTRIBUTION OF CO₂ REDUCTION



Distribution of the CO₂ reduction in 2025 caused by the initiatives in the Climate Plan.

PRINCIPLES IN THE PREPARATION OF THE CPH 2025 CLIMATE PLAN TO KEEP COSTS DOWN:

- The transformation takes place gradually over a long time period.
- Sound financial initiatives are set in motion as soon as possible.
- The shift to green transport, which is relatively expensive, starts with development projects in most cases.
- As well as reducing carbon emissions, initiatives should also, if possible, create green growth and enhance the quality of life.

ADAPTING TO THE FUTURE CLIMATE

GLOBAL CLIMATE CHANGES WILL SET THEIR MARKS ON COPENHAGEN OVER THE NEXT 100 YEARS: DRY SUMMERS WITH INTENSIVE RAINFALL, WETTER WINTERS, HIGHER TEMPERATURES AND RISING WATER LEVELS. TO SAFEGUARD COPENHAGEN AND PREPARE THE CITY FOR THE CHANGING CLIMATE, THE CITY OF COPENHAGEN HAS PRODUCED A CLIMATE ADAPTATION PLAN. WITH LONG-TERM INVESTMENTS AND TIMELY PLANNING, WE WILL HAVE THE REQUIRED EDGE TO ENSURE THAT THE CITY IS PREPARED FOR VIOLENT RAINSTORMS AND HEAT WAVES.

Initially changes come gradually but will then happen faster and faster. The most dramatic changes will occur after 2050. In preparation for the future, we are collaborating across different sectors to develop smart solutions which do not only prepare the city for the climate changes, but also make the city a better place to live with its green islands and blue canals in the middle of the city.

THE BLUE AND GREEN AREAS IN THE CITY HAVE SEVERAL FUNCTIONS:

- Reduce stormwater flows by absorbing and detaining rainwater.
- Moderate and balance temperature changes.
- Reduce the city's energy consumption for cooling buildings by creation of shade and air circulation.
- Increase biodiversity.
- Reduce noise and pollution.
- Create possibilities of recreation.

FOUR ADAPTION INITIATIVES



Peak summer temperature in Copenhagen is expected to rise 2–3 degrees by 2050.



Precipitation will increase 30–40% by 2100.



Sea water levels around Copenhagen will rise approximately 1 metre within the next 100 years.



RAINWATER

Development of various methods of draining water from big storms, which will be applied throughout the city.

GREEN AREAS

Additional green areas, pocket parks, green roofs and green walls slow down rainfall runoff and reduce the risk of flooding.

AIR CONDITION UNITS

More buildings use alternatives to air conditioning units such as sunshades, improved ventilation and insulation.

SAFEGUARDING

Safeguarding against flooding and rising sea levels.

CONCEPT FOR SCREENING OF FLOOD RISK

It is not possible, neither technically nor financially, to secure Copenhagen completely against climate-related incidents. Nevertheless, an extended series of measures can be implemented which will either prevent the incident, reduce its extent or reduce the city's vulnerability to it.

The trick is to pick the right ones. That is why a unique concept for screening of flood risk has been developed.

A UNIQUE CONCEPT

The concept combines information on the topography, the sea level rise, the storm surge, the rainfall/runoff distribution and knowledge of the economic values of property etc. in the area. The idea uses flood risk defined as vulnerability (economic value) times the probability of flooding in a given area. The flood risk was first assessed by screening methods followed by prioritised detailed dynamic modelling of floods and economic consequences over the next 100 years.

FLOOD AND RISK MAPS

All information is gathered in a GIS in which the spatial extent and depth of the flooding can be viewed together with area maps showing economic values of properties, infrastructure etc. The flood risk maps will identify areas which are most important or most beneficial to protect, and these areas should be given highest priority for the most cost-efficient climate change adaptation. Climate adaptation measures are planned to be such as recreational areas, businesses, beaches, landscape and infrastructure.

CONTINGENCY PLANS

The flood and flood risk maps give a solid background for contingency plans and disaster risk management, and can be used during emergency actions to prioritise activities and forecast where flooding will occur if the event continues. A series of contingency plans and adaptation activities have been screened in this manner, and the most effective in economic terms have been identified.

PREPARE YOUR CITY FOR THE FUTURE

PLEASE CONTACT US FOR FURTHER INFORMATION

+45 3334 3871

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www.cphcleantech.com/cph-adaptation



COME AND SEE US

We hope you were as inspired by our sustainable solutions as we often are by other cities and their solutions.

The City of Copenhagen is pleased to inform and discuss our achievements on the strategic and political level.

Please contact The Finance Administration for further information:

www.kk.dk/sustainablecph

copenhagensolutions@okf.kk.dk

Tel: +45 3366 2800

For specific information on the concrete solutions, please contact Copenhagen Cleantech Cluster via the contact details you will find in each chapter.

PRESS CONTACTS

If you would like to report on Copenhagen's sustainable solutions, we will be happy to assist you with information, setting up interviews or providing photos.

Photo downloads are also available on www.kk.dk/english

Please contact us for further information.

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Copenhagen: Solutions For Sustainable Cities

January 2014

3rd edition

Prepared by: Ramboll and CITY OF COPENHAGEN







CLEAN

CLEAN is a green cluster organisation in Denmark with more than 170 members from the entire cleantech ecosystem, including companies, knowledge institutions and public authorities. We facilitate partnerships, drive projects, boost innovation and entrepreneurship, support internationalisation, host events, conduct analyses, support the establishment of world-class Danish test and demonstration facilities and much more to achieve our goal of generating green growth in Denmark.

From the outset, CLEAN has sought a strong international outreach. As the initiator of the International Cleantech Network (ICN), we work closely with like-minded clusters in Germany, Austria, Singapore, US, Italy, Norway, France, Spain, Canada, China and many other countries.

A ONE-STOP-SHOP FOR CLEANTECH IN DENMARK

CLEAN is the main entry point for concrete business opportunities in Danish cleantech. We can provide you with an overview of the Danish cleantech market, interesting projects and connections to key stakeholders.

For more information:

CLEAN

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INNOVATIVE SOLUTIONS TO COMPLEX SOCIETAL CHALLENGES

Cities across the world face major challenges related to rapid urbanisation and climate challenges. As a result, cities play a key role in the development of tomorrow's sustainable societies. However, many societal problems are simply too large and too complex to be solved by a single technology. Green innovative solutions require complex combinations of technologies and competences across industries.

Instead of seeking standard solutions, CLEAN engages in urban projects by bringing together companies, knowledge institutions and public authorities to provide problem-oriented solutions in specific demand. CLEAN facilitates partnerships between foreign local authorities and Danish cleantech players to develop customised, sustainable solutions.

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Denmark has decided to lead the transition to a green growth economy and will be independent of fossil fuels by 2050 as the first country in the world. As the official green brand for Denmark, State of Green gathers all leading players in the fields of energy, climate, water and environment and fosters relations with international stakeholders interested in learning from the Danish experience. State of Green is your gateway to learn more about the ambitious Danish plan and the innovative solutions which are essential to make it happen.

ABOUT STATE OF GREEN

State of Green is a public-private partnership founded by the Danish Government, the Confederation of Danish Industry, the Danish Energy Association, the Danish Agriculture & Food Council and the Danish Wind Industry Association. H.R.H. Crown Prince Frederik of Denmark is patron of State of Green.

EXPLORE SOLUTIONS AND CONNECT WITH DANISH EXPERTISE ONLINE

Stateofgreen.com is your online entry point for all relevant information on green solutions in Denmark and around the world. Here you can explore solutions, learn about products and connect with profiles (companies, organisations, research institutions, public sector etc.).

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Take advantage of the lessons learnt by leading Danish companies, municipalities and organisations on a customised State of Green Tour in Denmark. Serving businesses, politicians, civil servants and journalists, State of Green creates visiting programmes tailored to your needs.

For more information:
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Copenhagen
Carbon Neutral
by 2025

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