Copenhagen Smart City
The challenge

- More Copenhageners
- Less carbon emissions

**Graph:**
- Carbon emissions (in 1,000 tonnes)
- Population size (exact numbers)

Time period: 1992 to 2025
The Copenhagen Story

Global view

Quality of life
- Safe
- Diverse
- Leisure
- Convenience

Growth
- Knowledge
- Innovation
- Employment
- Investments

Sustainability
- Carbon neutral
- Clean air & water

User involvement
Making the Smart City

• The smart city has sustainability, growth and quality of life as a solid foundation

• The smart city requires innovative partnerships and technological development

• The smart city uses the data generated within the city for creating intelligent, resource optimized and energy efficient solutions for the users of the city

• The smart city has innovative solutions spanning all city services and involves the city, citizens, users, businesses and knowledge institutions as active participants in creating new and smart city solutions

• The smart city is a test facility for testing new technology

• The smart city attracts businesses and a highly skilled workforce
Vision and goals

**COPENHAGEN VISION**

COPENHAGEN HAS THE WORLD´S BEST URBAN ENVIRONMENT AND A UNIQUE URBAN LIFE.

- **World’s Best City for Cyclists**
- **Carbon Neutral Capital**
- **Green and Blue Capital**
- **Clean and Healthy City**
World’s best city for cyclists

WORLD’S BEST CITY FOR CYCLISTS

Albertslundruten = 17,5 km.

C99

RODOVRE

KRH

ALBERTSLUND

GLOSTRUP

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.

500 m.
WORLD’S BEST CITY FOR CYCLISTS

- At least 50% of people will go to their work place or educational institution in Copenhagen by bike.
- The number of seriously injured cyclists in Copenhagen to be halved compared to today.
- At least 80% of cyclists in Copenhagen to feel safe and secure in traffic.
- A reduction of Copenhagen’s CO2 emissions of at least 20% compared to today.
Carbon neutral capital
CARBON NEUTRAL CAPITAL

- A REDUCTION OF COPENHAGEN’S CO₂ EMISSIONS OF AT LEAST 20 % COMPARED TO TODAY.
- COPENHAGEN CARBON NEUTRAL BY 2025
A green and blue city
A GREEN AND BLUE CITY

• 90% OF COPENHAGENERS SHOULD BE ABLE TO WALK TO A PARK, A BEACH, A NATURAL AREA OR SEA SWIMMING POOL IN LESS THAN 15 MINUTES.

• COPENHAGENERS WILL BE VISITING THE CITY’S PARKS, NATURAL AREAS, SEA SWIMMING POOLS AND BEACHES TWICE AS OFTEN AS TODAY.
A clean and healthy city
A CLEAN AND HEALTHY CITY

- Copenhageners should be able to sleep peacefully, free from noise from street traffic. All schools and institutions should be subject to only low traffic noise levels.
- The air should be so clean that Copenhageners’ health will not be damaged.
- There should be at least 20% organic food in the city’s food consumption.
- The city to lead the way with at least 90% organic food in its institutions.
- Copenhagen should be Europe’s cleanest capital and one of the cleanest capitals in the world. Rubbish should be cleared from public streets within eight hours.
Smart Projects

Work with targeted **use of data** in solving problems

Work with **new technology** or known technology in new ways

Work with **efficient** use of the Municipality’s or city’s **resources**

Work with new ways of involving **citizens** or **businesses**
New Smart City Initiatives

- Co-operation across seven administrations
- Project coordination board
- One strategy for Smart City
- Focus on lighthouse projects
  - Open city data platform
  - Copenhagen map
  - Big data platform with partners
  - Copenhagen Solution Lab
  - Mobility projects and ITS
  - Digital infrastructure
  - (and many more...)
Open city data platform
How It Is Today

Data

Services

Needs
The Future

Open Data

Services

Needs

Innovation

Growth

Entrepreneurship

Citizen Involvement

Relevant solutions
Open Data in Copenhagen

**IMPROVE OWN DECISION MAKING**
Enable holistic overview, better planning, improved transparency and build enterprise-wide architecture and processes for doing so

**CREATE A DATA MARKETPLACE**
Promote innovation, creativity, inclusion and solve challenges through public/private cooperation

**IMPROVE PUBLIC-PRIVATE PARTNERSHIPS**
Coordinated urban development and infrastructure improvement, optimized resource usage etc.

**SUPPORT POLITICAL AND STRATEGIC INITIATIVES**
Support green growth, innovation, sustainability, job creation, ITS, Smart City, green urban planning etc.
FCK playing Real Madrid Tuesday 10. December 8 pm
data.kk.dk
Big data with partners
Founding Members Triple Helix

Private Companies and Organizations
- CBS Copenhagen Business School
- Aalborg University
- DTU
- Københavns Universitet
- Copenhagen Capacity
- Rambøll
- Bech-Bruun
- HOFOR
- DI
- Siemens
- IBM
- Copenhagen CleanTech Cluster

Research Institutions
- Copenhagen Business School
- Aalborg University
- DTU
- Københavns Universitet
- Copenhagen Capacity
- Rambøll
- Bech-Bruun
- HOFOR
- DI
- Siemens
- IBM
- Copenhagen CleanTech Cluster

Public Authorities
- Bygningsstyrelsen
- Region Sjælland
- Kalundborg Kommune
- Albertslund Kommune
Big Data Platform

Objectives:

• Construct a digital platform which centralizes data from a range of public and private sources
• Develop new business markets through the digital platform
• Planning/solutions
Mobility projects and ITS

ITS, traffic management and green mobility

- Real time data
- Optimising traffic signals
- Traffic control center
- ECO-driving
- Pilot projects
- Public privat innovation
- Traffic Management plan
Cooperative systems
– COMPASS 4D and ECO-driving

Communication between truck/bus and traffic controller
Intelligent bus priority
Pilot projects – bicycle ITS
Grøn bølge

Lige nu
18 km/t

Din fart
15 km/t
Intelligent lighting at intersections

EXTRA LIGHT WHEN BIKE IS COMING

BIKE LANE
CPH Solutions Lab
The vision for CSL

Copenhagen must offer a specific test environment for intelligent urban solutions where both large and small companies can demonstrate solutions and help to develop future green urban solutions in Copenhagen.

CSL must be a common meeting place for entrepreneurs, companies, knowledge institutions and citizens dealing with smart city and data-driven urban solutions.
Phase 1 project

- Inner City Zone for Urban Services based on workshop input from Municipality departments
- Known technologies, Waste management, Parking services, IoE & Wifi for tourism
- Copenhagen innovation focus
  - Water defenses
  - Traffic management
Water defences

Innovation focus

• Accurate Measurement & Situational Awareness
• Decision-making Platform
• Rapid response across city services
• In collaboration with HOFOR
Traffic management

Innovation focus

- New ways of generating data for optimizing of traffic lights
- Chip based cost effective bike theft prevention & tracking of municipality's material
- Research from Technical University of Denmark: Space, Compute, Transport
<table>
<thead>
<tr>
<th>Use Case</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 City WiFi</td>
<td>Build a city WiFi platform that can be used as a common infrastructure to support the City’s smart services. After supporting and securing the city’s smart solutions, additional capacity on the WiFi will be made available for limited public access for tourist services, healthcare &amp; municipal use.</td>
</tr>
<tr>
<td>2 Smart Parking</td>
<td>Smart parking solutions leverage sensors on parking spots, intelligent meters, and smartphone-based applications to enable drivers to quickly identify open parking spots, reducing congestion in key cities areas. Future advances on Smart Parking could include the ability to reserve a parking spot, as well as dynamic pricing of parking spots.</td>
</tr>
<tr>
<td>3 Traffic Optimization</td>
<td>Smart Traffic systems will leverage analytics available from the network (eg., routers, access points) as well as from other data sources to monitor real-time traffic conditions enabling real-time decisions re: city signage and signaling. Trend data will also be used to inform long-term urban planning.</td>
</tr>
<tr>
<td>4 Smart Water Defense</td>
<td>Greater Copenhagen will explore ways to leverage the Smart City infrastructure (hybrid IoT city architecture, WiFi platform, data analytics, distributed sensors) to augment and assist ongoing water defense efforts under the Cloud Burst program. For instance, sensors in pumping stations can provide real-time insight into capacity availability, signage throughout the city can alert citizens of closures and dangers when flooding is possible. Copenhagen can leverage analytics from sensors through its water system to identify opportunities to maximize rainfall capture while ensure all rainwater during extreme events is directed to sewage treatment facilities and/or the ocean.</td>
</tr>
<tr>
<td>5 Smart Waste</td>
<td>Sensors in garbage bins send alerts when full to enable trucks to optimize their routes and prevent trips for empty bins. Sensors could also provide information on level of fullness to enable usage-based pricing. Finally, sensors could provide alerts when in-appropriate or hazardous material is thrown away.</td>
</tr>
<tr>
<td>6 Establishment of Copenhagen Solutions Lab</td>
<td>Copenhagen Solutions Lab will lead the implementation of innovation and smart city development in close collaboration with knowledge institutions and companies as well as citizens.</td>
</tr>
</tbody>
</table>
Let's build the infrastructure for the future!

The vision of a trade town
Establishment of channels and harbor areas

The vision of the industrial city
Establishment of train lines, roads, cycle paths

The vision of a digital future
Establishment of visionary digital infrastructure

Copenhagen anno 1790
Leading the national and international trade through traffic

Copenhagen anno 1930
Leading the industry through mobility labor, goods and services

Copenhagen in 2020
Leader in green growth through data and innovative technology solutions
Digital infrastructure
Copenhagen Connecting

CITY FLOW DATA
ASSET TRACKING
SENSOR PLATFORM
DATA CONNECTIONS

- Sensors monitor water, air, noise, weather, waste, and condition of sewer systems.
- Buildings' energy data are collected and usage is optimized in real time.
- Traffic is monitored and regulated in real time, reducing CO2 emissions.
- People movement patterns are known and used in city planning, security, and optimization of resources.
- Tourists are offered free Wi-Fi.
- Fleet management of citizens, municipality, and companies is monitored in real time.
- Free parking spaces are known in real time.
Core services enabled by Copenhagen City Grid

• **Big Data city flow**
  Data being collected from triangulated Wi-Fi devices creates knowledge about people movements, cars, bikes etc. throughout the city in real time and aggregated over time.

• **Asset tracking**
  Active and passive RFID tags enables tracking of equipments in the city using cost efficient compact wireless chip as an alternative to GPS

• **Sensor platform**
  Cheap, wireless, compact sensors creates data about the city condition in real time – driver for Internet Of Things.

• **Cost efficient data connections**
  Consolidation of data network infrastructure enables unified communication. Wifi covering the city can be offered to telecom industry to offload mobile networks
Big Data
City flow

- Optimization of the traffic flow, knowledge of traffic jams and automatic actions to remedy the situation
- Crowd control at public events
- Emergency Management: Ambulance on the way through town
- Delay in public transportation system alarms
- Dynamic pricing of parking tariffs based on local traffic situation or availability of free parking spaces in area
- Dynamic road pricing based on RFID tags which matches the actual use of roads
Asset tracking

- Theft protection, deterrent, real time alarms and rapid localization of stolen goods

- Low cost tracking of stolen bikes

- Active and passive RFID tags can be installed in all non-fixed assets - vehicles, containers, trucks, waste containers etc. Active RFID tags have battery lasting 5 years, readable from 100-150 meters

- Cheaper and more effective theft prevention of indoor assets

- Fleet management, cost efficient and easy to deploy large scale leads to productivity gains
Data offloading
Results from socioeconomic analysis

• Highlights:
  • 11-32% optimized car traffic flow
  • 2,4 million car hours saved
  • 30,7 million driven kilometers saved 1.7 million L fuel reduction
  • 5.5 million m3 water consumption reduction
  • 180,000 ton CO2 emission reduction
  • 50% reduction in bike thefts
  • An increase in tourism by 1%
  • Job creation €104 million
  • Vulnerable citizens - kids and people suffering from dementia €28 million
### Results from socioeconomic analysis

#### Table 1: CC’s samlede potentielle gevinster 2013 (mio. kr.)

<table>
<thead>
<tr>
<th>Analyseområde</th>
<th>Estimerede gevinster, MIO. DKK (2013 pr.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITS – Transport, parkering mv.</td>
<td>1.756</td>
</tr>
<tr>
<td>Miljømålinger, luft, støj</td>
<td>832</td>
</tr>
<tr>
<td>Vand</td>
<td>199</td>
</tr>
<tr>
<td>Affald</td>
<td>1</td>
</tr>
<tr>
<td>ICT og Smart Grids</td>
<td>382</td>
</tr>
<tr>
<td>Innovation og vækst</td>
<td>775</td>
</tr>
<tr>
<td>WiFi-opkobling til turister</td>
<td>31</td>
</tr>
<tr>
<td>Sikkerhed</td>
<td>80</td>
</tr>
<tr>
<td>Asset tracking</td>
<td>195</td>
</tr>
<tr>
<td>Sikring af udsatte borgere</td>
<td>128</td>
</tr>
<tr>
<td>Telesundhed</td>
<td>4</td>
</tr>
<tr>
<td><strong>Samlet</strong></td>
<td><strong>4.383</strong></td>
</tr>
</tbody>
</table>

Note: De samfundsøkonomiske gevinster vedrører både Københavns og Frederiksbergs Kommune.
1. Da dette er baseret på forregler af boligværdien i København og Frederiksberg Kommune kan denne gevinst kun realiseres én gang.
2. Endelige gevinster er ikke ophørt, oplysninger fra Københavns Politi udstår.

#### Tabel 39: Kommunale gevinster ved et MAN i Københavns Kommune (mio. kr. per år)

<table>
<thead>
<tr>
<th>København</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netværk, tele- og datakommunikation</td>
</tr>
<tr>
<td>95,4</td>
</tr>
</tbody>
</table>

Kilde: Københavns Kommune, Cisco, egne beregninger

#### Tabel 40: Samfundsekonomiske gevinster ved et MAN i Københavns Kommune (mio. kr. per år)

<table>
<thead>
<tr>
<th>København</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netværk, tele- og datakommunikation</td>
</tr>
<tr>
<td>19,1</td>
</tr>
</tbody>
</table>
Copenhagen Connecting supports the city's adopted strategies – examples

<table>
<thead>
<tr>
<th>Strategy Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>KBH 2025 Klimaplanen</td>
<td>Øget reduktion af CO₂-udledning eksempelvis gennem effektiv udnyttelse af 'Big Data' i trafiklysregulering, ruteoptimering af kommunens egen bilflåde, lavere søgetrafik efter ledige p-pladser og energioptimering af bygninger.</td>
</tr>
<tr>
<td>Skybrudsplan</td>
<td>Varsling af skybrud via opsamling af data, således at underjordiske overløbsdepoter bedre kan styres og skader forebygges.</td>
</tr>
<tr>
<td>Handlingsplan Grøn mobilitet</td>
<td>Intelligent trafikstyring hvor brug af 'Big Data' kan anvendes til bedre afvikling af trafiklysregulering i form af grønne bølger, eco-driving m.v.</td>
</tr>
<tr>
<td>Cykelstrategi 2011-2025</td>
<td>Billig chipteknologi minimerer cykeltysveri, forbedrer ruteplanlægning for cyklister og giver mulighed for bydækkende prioritering af cykeltrafik over biltrafik.</td>
</tr>
<tr>
<td>Parkerings-strategi</td>
<td>Søgetrafikken efter ledige p-pladser minimeres og muligheder skabes for optimering af kontrol.</td>
</tr>
<tr>
<td>Kommuneplanen</td>
<td>Ved at udnytte ‘Big Data’ om bevægelsesmønstre m.v. skabes der et bedre beslutningsgrundlag og dermed grønbund for byplanlægning, der understøtter byens behov.</td>
</tr>
<tr>
<td>IT-strategi 2010-14</td>
<td>Konsolidering af netværksinfrastruktur i KK, hurtigere og billigere dataforbindelser, samt IP-telefoni til kommunen.</td>
</tr>
<tr>
<td>Smart city, 7 dir beslutning 2012, Open data strategi</td>
<td>Udstilling af offentlige data, skabe en platform for vækst, inddragelse af borgere og virksomheder i udvikling af velfærds- og Cleantech-løsninger i stor skala.</td>
</tr>
</tbody>
</table>
Ruteplanlægning
Wifi til turister med en indgang til KBH
Realtdsdata fra sensorplatformen
The area – Skt. Torv to Nordhavn
Copenhagen Smart City