Rotterdam Smart City and Quality of Life

Useful examples for your own city in water, energy, densification, greening and using city data

Nico Tillie @nicotillie72
Landscape Architecture, Delft University of Technology, World Council on City Data and advisor City of Rotterdam
# Rotterdam

<table>
<thead>
<tr>
<th>City</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>320 km²</td>
</tr>
<tr>
<td>Inhabitants</td>
<td>618,000</td>
</tr>
<tr>
<td>Nationalities</td>
<td>175</td>
</tr>
<tr>
<td>Municipal Budget</td>
<td>4.2 billion Euro’s</td>
</tr>
<tr>
<td>Sewer system</td>
<td>3000 km</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Port</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>105 km² (50 km² commercial sites)</td>
</tr>
<tr>
<td>Length of port area</td>
<td>40 km.</td>
</tr>
<tr>
<td>Direct employment</td>
<td>over 70,000 jobs</td>
</tr>
<tr>
<td>Goods throughput</td>
<td>over 400 million tonnes of goods per annum</td>
</tr>
<tr>
<td>Shipping</td>
<td>33,000 sea-going+110,000 inland vessels / yr</td>
</tr>
</tbody>
</table>
Part 1. Water
Innovative solutions start with understanding the system

History and water

Dikebuilding 1100 ad
Flood hills 100 ad - 1100 ad
Rotterdam dam, port and watercity
Topo map: above (brown) and below (blue) sea level
Water in Rotterdam

- Precipitation
- Groundwater
- River discharge
- Rising sea level
Challenges related to climate change and more

- Flooding
- Water quality
- Excessive rain fall
- Levee subsidence (drought)
- Inundated cellars
- Heat waves

Other challenges: Urbanization and Landuse, Air quality, Salination, Public health, Biodiversity, Recreation etc
Sea and safety

Dunes (natural and artificially induced)
Dikes
Technical solutions i.e. Storm surge barriers
Rivers and safety

Former innersea, now freshwater reserve

Upstream water retention and freshwater reserves and one of Europe’s biggest wetland nature reserves
What about precipitation and water in the city

1. Water: Precipitation, storage capacity per district

Quality of life data per district

The data and mapping made us combine water solutions and social, economic, spatial issues
Singelplan as an example?

What is the 21st century version of the Singelplan Rose from 1850’s?
From stand alone solutions to overall strategy (2005)

Water solutions good housing + public space + water transport
This lead to Rotterdam climate change adaptation strategy (RAS)

1. Robust system now: maintain en strenghten
2. Adaptation: make use of the public space
3. Cooperation and joining up
4. Added value for environment, society, economy and ecology
Combining technical and green approach, small and large scale

- Robust and resilient
- Protection and moving in tune
- Delta works, small scale projects
- Technology and nature

- Sewerage + watersquare
- Dikes + adaptive building en design
- Storm surge barriers + ‘Remove tile, plant greening’
- Pumping + green banks design with nature
Implementation and innovations

Waterliving Urban Agriculture and good housing + canals for transport

watersquares

green/water roofs sponge buildings
Community involvement: green roofs program
Roof Scan for green roofs or pv potential

http://www.rotterdamclimateinitiative.nl/nl/energieatlas/energieatlas-rotterdam
Water squares, topography decides what solution goes where
Watersquare finished in nov 2012
Watersquare finished in nov 2012
Watersquare finished in nov 2012
Water Square now

Daily Use

Veelvuldig gebruik bassin #2 voor samenkomst van mensen

Grote bassin ingericht op actief gebruik door verschillende groepen
...temporarily storm water storage
Urban Floodplain
Water storage Kleinplein
Water storage Kruisplein
MuseumPark Underground Parking + waterstorage for sewage overflow 10,000 m³ = 2.6 million gallon
Protection and moving in: A dike, with shops below and a roof garden to link the waterfront very active neighborhood involvement
Scale up towards a climate adaptive delta city with measures for different parts of the city

- Which measures where?
- Which stakeholders?
- What extra values do these measures create?
- Who profits from this?

- Compact city
- Neighborhoods
- Suburbs
- Areas in urban floodplain
- Ports
- Waterfronts
Scaling up: ZOHO, our first climate proof city district!

WORKSHOP
Climate Resilient
Zomerhofkwartier

E: presentatie groepswerk
F: discussie plenair
G: De top 3 kansen concretiseren en evalueren
Programmatic Approach on District Level

Building a green framework and programmatic clusters for and with the neighbourhood
Why not have this approach for Energy?
Energy costs rental homes the Netherlands

i. Straathof senternovem, 2008
Energy costs home owners

<table>
<thead>
<tr>
<th>Year</th>
<th>Energy</th>
<th>Mortgage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>17%</td>
<td>83%</td>
</tr>
<tr>
<td>2004</td>
<td>23%</td>
<td>77%</td>
</tr>
<tr>
<td>2006</td>
<td>27%</td>
<td>73%</td>
</tr>
<tr>
<td>2008</td>
<td>34%</td>
<td>66%</td>
</tr>
</tbody>
</table>

i. Straathof senternovem, 2008

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High energy use, low income, energy too expensive

Possible solutions: smart meters, insulation, own production, lower rent, green loans

CO2 reduction and renewable energy supply

From list of solutions to a spatial inclusive strategy for Energy transition and improving Quality of life

<table>
<thead>
<tr>
<th>Residential &amp; services</th>
<th>Transport</th>
<th>Behaviour</th>
<th>Innovation</th>
<th>Industry &amp; food</th>
</tr>
</thead>
<tbody>
<tr>
<td>• deals with corporations</td>
<td>• public transport, cycling</td>
<td>• All public vehicles co2 free</td>
<td>• innovationfund</td>
<td>• Carbon captivity storage</td>
</tr>
<tr>
<td>• Public lighting</td>
<td>• Renewable energy</td>
<td>• All public buildings co2 free</td>
<td>• Knowledge cluster of new techniques</td>
<td>• Deals with companies to filter</td>
</tr>
<tr>
<td>• Compulsory use of district heating</td>
<td>• Parkingfees</td>
<td>• Campagne</td>
<td>• Research connections with universities to implement</td>
<td>• Biofuel</td>
</tr>
<tr>
<td>• Fiscal incentives</td>
<td>• vehicles and ships</td>
<td>• Incentives</td>
<td>• CO2 to greenhouses</td>
<td>• Quai electricity</td>
</tr>
<tr>
<td>• Local laws</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

... to a vision ...from there, a tailormade plan for our specific situations, neighborhoods!

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Challenge still about how to scale up

to low carbon neighborhoods, districts, cities and regions
Solar Decathlon 2014: Scaling up in number: decarbon existing housing stock: 1.5 million in NL alone much more all over Europe
Relevant theme: energetic refurbishment

Facts...

* Our job is to take our homes to a sustainable future...

* We will retrofit on different scales
  - Urban scale
  - Individual homes
  - Building parts

* We will develop a set of tools to retrofit

* We will develop a platform for tools

* We are 1 of 20 competing teams across the globe

* Our house will be seen by 300,000 visitors
Prêt-à-Loger

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What it looks like
2 x gold, 2 x silver, overall 3rd at 3 of 1000 points from no. 1

Andy van den Dobbelsteen and his Pret A loger team from TU Delft

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Scaling up in Approach: energy as a 'layer' in urban planning!
From ‘Trias energetica’ to new stepped strategy

Prof. Andy Van den Dobbelsteen TU Delft
1. reduction of demand

Energy and CO2 per typology

Quick wins old buildings

Reduction potentials
Types of result – savings potential maps are easier to read than 10 excell sheets
2. Exchange waste flows
District heating networks

- Potential from industries 2000 MW = 1.000.000 households
- 120 MW planned for 55.000 households
- In dense cities 66% reduction in CO2 (same as passive house)
The New Stepped Strategy

...and upscales

00 standard building

01 reduce consumption
   - passive, smart and bioclimatic design

02 reuse waste energy streams
   - waste heat, waste water, waste material
   - in closed or connected cycles
Exchange of Energy waste flows in REAP

1 m² of super market can heat 7 m² of appartment
1 m² of green house can heat 4 m² of appartment and produce food!!
URBAN METABOLISM

sustainable development of Rotterdam
3. Renewable Production: Energy potential maps

By: A. Van den Dobbelsteen

Energy Atlas Rotterdam online
Amsterdam Energy Atlas also available.

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Basic information

Future

3000 dwellings:

Elektricity: 10,5 GWh\textsubscript{e}
Heating: 26,5 GWh\textsubscript{th (aeq)}

From: Prof. Andy van den Dobbelsteen, Delft University of Technology

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Energy potentials

Per house 40 m² pv or solar collectors

DGC: PV on roofs: 12 GWhₑ
DGC: SC on roofs: 35 GWhₜʰ

10,5 GWhₑ
26,5 GWhₜʰ
6750 GWhₚᵣ
12 GWhₑ

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Energy potentials

Electricity from wind 100 m (8 m/s)

10.5 GWh\textsubscript{e}
26.5 GWh\textsubscript{th}
6750 GWh\textsubscript{pr}
12 GWh\textsubscript{e}
35 GWh\textsubscript{th}
large turbines: 0.23 GWh\textsubscript{e}/ha
DGC: 0-160 GWh\textsubscript{e}

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Energy potentials

Electricity from wind at 30 m (5 m/s)

10,5 GWh<sub>e</sub>  
26,5 GWh<sub>th</sub>  
6750 GWh<sub>pr</sub>  
12 GWh<sub>e</sub>  
35 GWh<sub>th</sub>  
0 - 160 GWh<sub>e</sub>  

Wind at 30m:

Per Turby: 5 MWh<sub>e</sub>  
(DGC: 56 GWh<sub>e</sub>)

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Energy potentials

Energy from waste

- 10.5 GWh\textsubscript{e}
- 26.5 GWh\textsubscript{th}
- 6750 GWh\textsubscript{pr}
- 12 GWh\textsubscript{e}
- 35 GWh\textsubscript{th}
- 0 - 160 GWh\textsubscript{e}
- 5 MWh\textsubscript{e}/turby

Per household: 0.57 ton → 326 kWh\textsubscript{e} + 59 kWh\textsubscript{th}

DGC: 1.2 GWh\textsuperscript{(e+th)}

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Energy potentials

waste heat

- 10,5 GWh\(_e\)
- 26,5 GWh\(_\text{th}\)
- 6750 GWh\(_\text{pr}\)
- 12 GWh\(_e\)
- 35 GWh\(_\text{th}\)
- 0 - 160 GWh\(_e\)
- 5 MWh\(_e\)/turby
- 1,2 GWh\(_{e+\text{th}}\)

Cardboard factories: 2 x 125 GWh\(_\text{th}\)

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Energy potentials

biomass

10,5 GWh\textsubscript{e}
26,5 GWh\textsubscript{th}

6750 GWh\textsubscript{pr}

12 GWh\textsubscript{e}
35 GWh\textsubscript{th}

0 - 160 GWh\textsubscript{e}

5 MWh\textsubscript{e}/turby

1,2 GWh\textsubscript{(e+th)}

2 x 125 GWh\textsubscript{th}

biogas

Chicken farms:
129,000 m\textsuperscript{3} (Ae)
1.1 GWh\textsubscript{Ae}

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Energy potentials

Biomass

- Biomassa-incineration:
  - from maintenance of parks: 4.7 MWh$_{pr}$/ha
  - and gardens: 18.9 MWh$_{pr}$/ha
  \[ \Rightarrow DGC: 2.4 \text{ GWh}_p \]

- 5 MWh$_e$/turby
- 1,2 GWh$_{(e-th)}$
- 0 - 160 GWh$_e$
- 2 x 125 GWh$_{th}$
- 1,1 GWh$_{ae}$

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Energy potentials

biomass

- 10.5 GWh\textsubscript{e}
- 26.5 GWh\textsubscript{th}
- 6750 GWh\textsubscript{pr}
- 12 GWh\textsubscript{e}
- 35 GWh\textsubscript{th}
- 0 - 160 GWh\textsubscript{e}
- 5 MWh\textsubscript{e}/turby
- 1.2 GWh\textsubscript{(e-th)}
- 2 x 125 GWh\textsubscript{th}
- 1.1 GWh\textsubscript{Ae}
- 2.4 GWh\textsubscript{pr}

Biomassa-verbrandingsinstallatie:

Nature and woodland maintenance:

\[\rightarrow\text{DGC: 20 GWh}\textsubscript{pr}\]

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Energy potentials

Soil to 50 m. heat exchangers

- 10,5 GWh\textsubscript{e}
- 26,5 GWh\textsubscript{th}
- 6750 GWh\textsubscript{pr}
- 12 GWh\textsubscript{e}
- 35 GWh\textsubscript{th}
- 0 - 160 GWh\textsubscript{e}
- 5 MWh\textsubscript{e}/turby
- 1,2 GWh\textsubscript{(e-th)}
- 2 x 125 GWh\textsubscript{th}
- 1,1 GWh\textsubscript{Ae}
- 2,4 - 20 GWh\textsubscript{pr}

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Energy potentials

soil (50-500m): aquifers for heat cold storage

10.5 GWh\textsubscript{e}
26.5 GWh\textsubscript{th}

6750 GWh\textsubscript{pr}

12 GWh\textsubscript{e}
35 GWh\textsubscript{th}

0 - 160 GWh\textsubscript{e}

5 MWh\textsubscript{e}/turby

1.2 GWh\textsubscript{(e-th)}

2 x 125 GWh\textsubscript{th}

1.1 GWh\textsubscript{ae}

2.4 - 20 GWh\textsubscript{pr}

Very good
goood
Not good
Restricted areas
Energy potentials

Soil(3000m): geothermal

Temperature at 3000m: 105 °C
Energiepotenties

<table>
<thead>
<tr>
<th>Energiebron</th>
<th>DGC; 700ha</th>
<th>Toegepast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zon</td>
<td>9640 MWh/ha</td>
<td>PV, daken</td>
</tr>
<tr>
<td></td>
<td>6750 GWh</td>
<td>12 GWh</td>
</tr>
<tr>
<td>Wind, 100m</td>
<td>228 MWh/ha</td>
<td>Zonne-collectoren, daken</td>
</tr>
<tr>
<td></td>
<td>160 GWh</td>
<td>25 GWh</td>
</tr>
<tr>
<td>Wind, 30m</td>
<td>56 MWh/ha</td>
<td>Wind, grote turbines</td>
</tr>
<tr>
<td></td>
<td>5 MWh/turby</td>
<td>160 GWh</td>
</tr>
<tr>
<td>Afval, huishoudens</td>
<td>1,7 MWh(e+th)/ha</td>
<td>Wind, turby’s</td>
</tr>
<tr>
<td></td>
<td>1,2 GWh(e+th)</td>
<td>39 GWh</td>
</tr>
<tr>
<td>Restwarmte</td>
<td>Kappa</td>
<td>Afval, verbranding</td>
</tr>
<tr>
<td></td>
<td>2x 125 GWhth</td>
<td>1,2 GWh(e+th)</td>
</tr>
<tr>
<td>Biomassa</td>
<td>Natuuronderhoud</td>
<td>Restwarmte</td>
</tr>
<tr>
<td></td>
<td>4,7 MWh/ha</td>
<td>Kappa</td>
</tr>
<tr>
<td></td>
<td>Onderhoud DGC</td>
<td>250 GWhth</td>
</tr>
<tr>
<td></td>
<td>2,4 GWhpr</td>
<td>Biomassa</td>
</tr>
<tr>
<td></td>
<td>Eifarm</td>
<td>Onderhoud DGC</td>
</tr>
<tr>
<td></td>
<td>1,1 GWhpr</td>
<td>2,4 GWhpr</td>
</tr>
<tr>
<td></td>
<td>Onderhoud omgeving</td>
<td>Eifarm</td>
</tr>
<tr>
<td></td>
<td>20 GWhpr</td>
<td>1,1 GWhpr</td>
</tr>
<tr>
<td>Bodem tot -50m vertical WW</td>
<td>Bodemgeschiktheid WW</td>
<td></td>
</tr>
<tr>
<td>Aquifers w/k opslag</td>
<td>Aquifergeschiktheid</td>
<td></td>
</tr>
<tr>
<td>Geothermie, -3000m 105 °C</td>
<td>Geothermie</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zeer geschikt</td>
<td>Zeer geschikt</td>
</tr>
<tr>
<td></td>
<td>Geschikt</td>
<td>Niet geschikt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Onbekend</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Restrictiegebeiden</td>
</tr>
<tr>
<td></td>
<td>Zeer geschikt</td>
<td>Gasboorpoen</td>
</tr>
</tbody>
</table>

Energievraag 3000 hh: 10,6 GWh, 26,5 GWhth
Energy = Space, so we need to plan with it also spatially

<table>
<thead>
<tr>
<th>Power per unit land or water area</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>2 W/m²</td>
</tr>
<tr>
<td>Offshore wind</td>
<td>3 W/m²</td>
</tr>
<tr>
<td>Tidal pools</td>
<td>3 W/m²</td>
</tr>
<tr>
<td>Tidal stream</td>
<td>6 W/m²</td>
</tr>
<tr>
<td>Solar PV panels</td>
<td>5–20 W/m²</td>
</tr>
<tr>
<td>Plants</td>
<td>0.5 W/m²</td>
</tr>
<tr>
<td>Rain-water (highlands)</td>
<td>0.24 W/m²</td>
</tr>
<tr>
<td>Hydroelectric facility</td>
<td>11 W/m²</td>
</tr>
<tr>
<td>Geothermal</td>
<td>0.017 W/m²</td>
</tr>
<tr>
<td>Solar chimney</td>
<td>0.1 W/m²</td>
</tr>
<tr>
<td>Ocean thermal</td>
<td>5 W/m²</td>
</tr>
<tr>
<td>Concentrating solar power (desert)</td>
<td>15 W/m²</td>
</tr>
</tbody>
</table>

Table 4. Renewable facilities have to be country-sized because all renewables are so diffuse. This table lists the power per unit land-area or sea-area offered by a number of renewables.

Uit David Mackay, energy without hotair
The medium scenario was put on in a map

uit David Mackay, energy without hotair
4. Energy scenarios for existing Cities/

Different interests even within one group of stakeholders
And that while we have energy transitions as a task ahead of us.
Scenariotool GRIP

Total energy use

Heat source

Electricity

Total emissions *
Change in emissions

Changes in efficiency and use

* (elec. alleen lokaal verbuik, vandaar verschil)

Economy Consumption Supply Total Emissions

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Economy/demography consumption and supply see direct CO2 effects Low carbon !!

- Natural Gas
- Fossil Solid
- Petroleum
- Bio-fuel
- Hydrogen
- CHP - Heat/Cooling
- Renewables (Heat/Cooling)
- Other
- New Electricity
- External Heat

Grid Sourced Electricity: 41%
On-site renewable electricity production: 50%
CHP - Electricity: 9%

Electrical Consumption % Change:
-100 0 500

9% Electrical Efficiency
46% Non-electrical efficiency
40% Energy Intensity
-83% Emissions
Energie scenario tools is fed by 'all the previous' and discussion from SH

Figure metrex euco2 project
Having these results we can than use GIS for optimal locations where DH and all other solutions (might) go

- 240,000 dwellings in concession zones
- 50,000 connected
- 20,000 new buildings
- 85,000 existing rental (125,000 in these areas penetration of 80%)
- Total 155,000 dwellings in 2035 (=47%)
Part 3. Densification & Greening

see for pdf on internet at Rotterdam 'people make the innercity'

Densification plus Green = sustainable city ?
5000 trees, 80 ha of routes and green, 30,000 people?

- Walkability
- Childfriendly
- Energy advantages
- Cycling
- Public transport
- More program, economic input
- Lively streets
- Cleaner air and water
- Less heat island effect
People in the city had already started so we just mapped it
Klushuizen / DIY houses Rotterdam

DENSIFICATION STRATEGY 07
DO-IT-YOURSELF

De bestaande woonvoorraad niet vergeten vraagt om een verdichtingsstrategie die omgang weet te vinden met een bestand aan te kleine, bouwtechnisch matig en slecht geklasseerde woningen in vooral de neogotische- en eeuwse ring binnen de binnenstad. Hierbij gaat het niet om verdichting in vierkante meters maar het geschenk maken van bouwblokken voor meer inwoners. Waar de te kleine woningen op de huidige woonmarkt alleen aantrekkelijk zijn als studio’s en maisonnettes, kan juist het vrijgeven van samengestelde kavels als kluswoning ervoor zorgen dat grotere woningen voor gezinnen tot stand kunnen komen.

De bestaande stedelijke structuur in de oude stadsdelen wordt benut in economische en sociale zin, alsmede de bestaande groenstructuur en speelruimten. Woonconsument en coöperatie investeren samen in de verbouwkoesten. Uitermate geschikt voor jonge stellen en gezinnen die een wooncarrière willen maken in een bestaande woning. Tevens biedt de aanwezigheid van bestaande scholen en levensvorming van de binnenstad een aantrekkelijk woonmilieu.

IN PROGRESS

?SHALL WE ADD ALL HOUSING COOPERATIONS FROM 19TH CENTURY?

POTENTIAL MAP 2040 & infographics of +houses/district
But if you densify...
more green qualities needed 7 green strategies!!
Parking lot becomes green public space
Urban farming: what does the 'garden city' of the 21\textsuperscript{th} look like reusing phosphorus, producing biogas, social cohesion etc.
Childfriendly city 'woonerf revival ?' sidewalks go on for kids, special circulation for cars, public transport and bikes in all suburbs since 1980's
Green network with more walking and biking

- Biking high ways, 1,3 bikes per capita
- Rotterdam 70% of bike use in 10 years
- Central Station 5500 Bike parking spaces
public transport 300 m from every home...and use grass!
Integrated planning with green

...in neighborhoods for heat island, watergardens, wind, solar rights etc
Healthy Life expectancy increased with two years.

Quality of Life increases mainly by introducing a green/blue network and smart transport.

Assessment 30,000 inhabitants + 141 ha green

Question is how does Rotterdam compare to other cities?
Part 4. Using City data comparing cities & city rankings

- Many rankings, standardization needed
- Feedback on your score
- Standardized 3rd party verified data
- Indicator evolution
- Weighing black box
- Resilience, adaptation capacity
- Governance
- Use of local potentials (renewables)
- Indirect impacts of consumption elsewhere...so footprint
It is about improving. How do we perform, monitor, target actions and improve?

If you can’t measure it, you can’t manage it
NEED FOR STANDARDS, INDICATORS 'FRAMEWORK'!

SINCE 2008

MEMBERS - 255 CITIES ACROSS 82 COUNTRIES
studies

CITIES AND AGEING
ISO 37120

Sustainable development of communities
Indicators for city services and quality of life

Manage and make informed decisions through data analysis

Benchmark and target

Leverage Funding with senior levels of government

Plan and establish new frameworks for sustainable urban development

Evaluate the impact of infrastructure projects on the overall performance of a city
20 FOUNDATION CITIES, NOW 40 - 100 BY DUBAI SUMMIT

Cities By Phase

Legend
- Certified
- Nearing Certification
- Certification Pipeline

Updated March 17, 2016

@wccitydata
WCCD certification levels are based on the number of indicators reported by the city. The WCCD offers a wide range of certification levels.

<table>
<thead>
<tr>
<th>ASPIRATIONAL</th>
<th>BRONZE</th>
<th>SILVER</th>
<th>GOLD</th>
<th>PLATINUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-45 Core Indicators</td>
<td>46-59 Indicators (46 Core + 0-13 Supporting)</td>
<td>60-75 Indicators (46 Core + 14-29 Supporting)</td>
<td>76-90 Indicators (46 Core + 30-44 Supporting)</td>
<td>91-100 Indicators (46 Core + 45-54 Supporting)</td>
</tr>
</tbody>
</table>
## Welcoming Cities of All Sizes to Become ISO 37120 Certified

<table>
<thead>
<tr>
<th>Population Range</th>
<th>City Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 250,000</td>
<td>Small</td>
</tr>
<tr>
<td>250,000 – 500,000</td>
<td>Medium</td>
</tr>
<tr>
<td>500,000 – 750,000</td>
<td>Large</td>
</tr>
<tr>
<td>750,000 – 1,000,000</td>
<td>Extra Large</td>
</tr>
<tr>
<td>1,000,000 – 5,000,000</td>
<td>Very Large</td>
</tr>
<tr>
<td>5,000,000 – 10,000,000</td>
<td>Gigantic</td>
</tr>
<tr>
<td>10,000,000 +</td>
<td>Particularly Large</td>
</tr>
</tbody>
</table>

@wccitydata
OPEN DATA PLATFORM

THE FIRST ISO CERTIFIED CITY DATA
#dataforcities

WWW.DATAFORCITIES.ORG
TO ANSWER QUESTIONS LIKE …
HOW HEALTHY IS MY CITY?
High life expectancy
BARCELONA, SPAIN
83 years
HOW GREEN IS MY CITY?

High area of green space

HELSINKI, FINLAND

1,489

Hectares per 100,000
HOW DO PEOPLE MOVE AROUND MY CITY?

High kilometers of bike lanes

ROTTERDAM, NETHERLANDS

102 km per 100,000 population
HOW DO PEOPLE MOVE AROUND MY CITY?

High percentage of commuters using alternative transportation

LONDON, UNITED KINGDOM

74%
HOW CLEAN IS MY AIR?

Low PM2.5 concentration

MELBOURNE, AUSTRALIA

6.1 $\mu$g/m$^3$
EXPLORING THE WCCD OPEN DATA PORTAL: ANALYTICS AND GRAPHING
ISO 37120 - 100 INDICATORS ACROSS 17 THEMES

- Economy
- Education
- Energy
- Environment
- Finance
- Fire & Emergency Response
- Governance
- Health
- Recreation
- Safety
- Shelter
- Solid Waste
- Telecommunications
- Transportation
- Urban Planning
- Wastewater
- Water & Sanitation
ANALYTICS, EXPLORING RELATIONS WITH 100 DATA POINTS

- PM2.5 CONCENTRATION
- PM10 CONCENTRATION
- GHG EMISSIONS
- NO2 CONCENTRATION
- SO2 CONCENTRATION
- O3 CONCENTRATION
- NOISE POLLUTION
- CHANGE IN NATIVE SPECIES

- LIFE EXPECTANCY
  - IN-PATIENT HOSPITAL BEDS
  - NUMBER OF PHYSICIANS
  - UNDER AGE 5 MORTALITY RATE
  - NUMBER OF NURSES/MIDWIVES
  - NUMBER OF MENTAL HEALTH PRACTITIONERS
  - SUICIDE RATE
LIFE EXPECTANCY

ANALYTICS, EXPLORING RELATIONS WITH 100 DATA POINTS

MEAN (24.6 μg/m³) vs. MEAN (76 years)

PM2.5 CONCENTRATION

LIFE EXPECTANCY

MEAN (24.6 μg/m³)

MEAN (76 years)
Local data in 'Smart City Planner'

For developers

Local Social Index
Local Health index
Local Safety index

For Politicians

Core is 3rd party verified data to compare to other cities / rest is local

For innovation

Hackaton with Open Data for CleanWeb in Rotterdam

For investors expats

For people neighborhoods

Leed USGBC

Breeam

Gemeente Rotterdam Stadsontwikkeling
Example Rotterdam: Smart City architecture and iso37120

Users:
- Business
- Citizens
- Knowledge institutes
- Government
- Visitors
- Objects

Applications:
- Mobility
- Sustainability
- Smart city planner
- Environment
- Citizens

Intelligence:
- sharing
- fusion
- export
- interpretation
- statistics

Data:
- Internal data
  - closed data
  - open data
- External data
  - Wearables
  - History
  - Demographic

Communication:
- wifi
- 3g/4g
- M2M (Lora, Sigtran)
- fixed
  - fiber
  - coax
  - copper
- IP core
- talk

Sensors:
- Sound
- Visual
- Movement
- Temperature
- Speed
- Senses

'Objects':
- Mobile
- Car
- Lamppost
- Bridge
- Building
- People

bron: Frank Vieveen Gemeente Rotterdam
Makes mapping easier. A map is easier to read than many excell sheets.
Themes and indicators (orange is threshold)

Helps with focusing, behind each indicator is a GIS map
For whole city and for all 90 neighborhood
Facilitate the transition, Use 'smart city planner'

PROJECT

Inhabitants, stakeholders

Government as a stakeholder

Smart City Planner & Profile

challenges opportunities Coalitions Goals

actions

Put open, objective data on the table
Example of red scores can be:

**Water problems, recreation shortage, poor public space**

Possible solution: RainGain monitor (smart) watergarden, water square (resilience!)

This leads back to the basic indicators in the standard 37120
WORKING WITH GLOBAL PARTNERS TO BUILD ANALYTICS AND TOOLS FOR EVIDENCE BASED DECISION MAKING
EXPANDING THE CITY NETWORK WITH GLOBAL PARTNERSHIPS

- Partnership with Executive Council of Dubai
- Regional Cities Meeting – Dec 2015
- Hosting the WCCD Global Cities Summit Dec 2016
- MOU signed with Smart Cities Joint Lab – MOHURD, China
- Shanghai, Beijing and smart cities pilot
- ISO 37120 being adopted by Standards Association of China
- WCCD Office in Beijing (MOHURD)
- Mission to India in December 2015
- Smart Cities Initiative in India

- Agreement with National Government of Mexico
- Pilot cities
WCCD and Dutch National Statistics Office as partners
CBS Urban Data Center (UDC) is a joint operation between CBS and cities.
Focused on the improvement of urban statistics by linking to CBS national data and at urban and neighborhood level as well as CBS expertise.
Urban advantage: public added value of data for their inhabitants, companies, and visitors.
Poverty monitor for Eindhoven
Job
Mobility and healthy innercity
ISO-certification for Eindhoven, many data provided by CBS
GLOBAL CITIES SUMMIT
DUBAI MARCH 2017
Thank you for your attention!

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