Providing context for Smart Energy Cities

Baseline Analysis Method Manual

Baseline Analysis reports

Authors

*Joshua (G) Bird – Arup*

Paula Kirk – Arup

Contributors

Stef le Fevre, Bob Mantel, Amsterdam

06/09/2013

Introduction

This report summarises the work undertaken and methodology for producing the **City Baseline Analysis** as part of the EU-FP7 TRANSFORM project. Appended are the resulting **City Baseline Reports.**

The first deliverable from TRANSFORM is an outline of each city utilizing existing data; this is the City Baseline Analysis. As specified in the Transform proposal, the objective of the analysis is to produce a clear outline of each of the participating cities in the Transform project. This outline should draw on existing materials to describe the city in terms of climate, energy assets, ambitions, and targets. The outline should also include information on energy production, energy flows and energy efficiency, where possible.
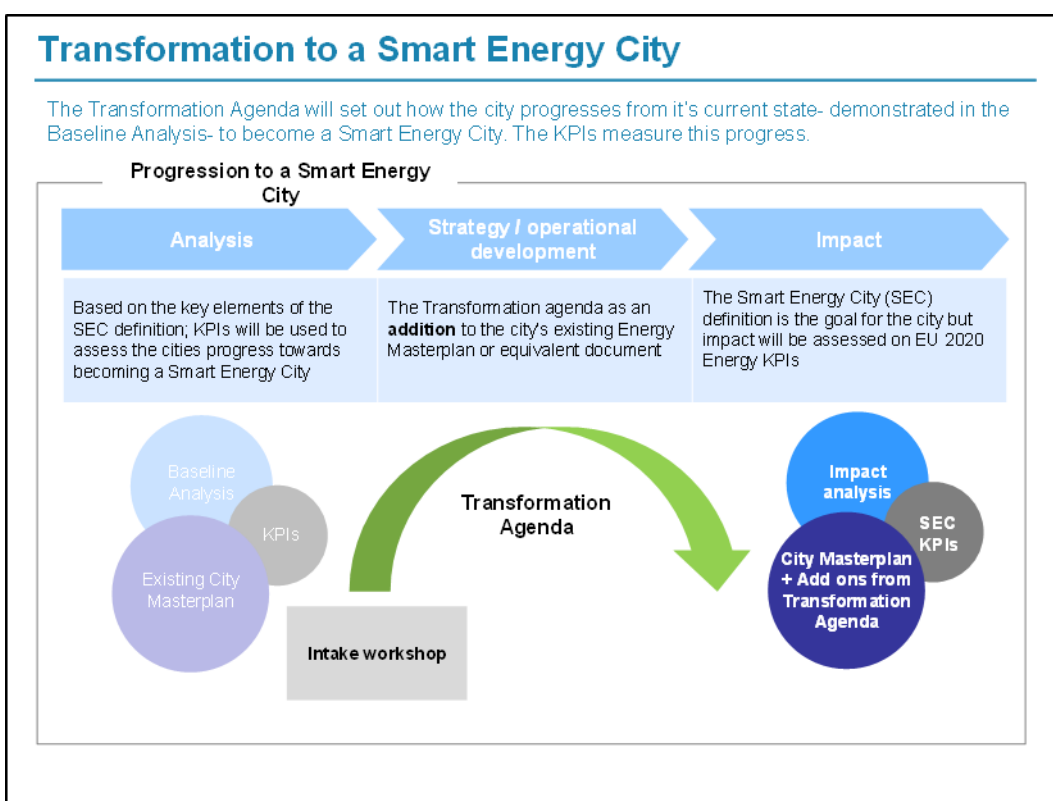
Figure 1. Illustration of the Transform progress including the positioning of the City Baseline Analysis

The role of the City Baseline Analysis is to hold up a mirror to each of the participating cities and to illustrate their current status across a range of sectors. The City Baseline Analysis should provide a snapshot in time of each city; this is a reference point, from which the Transformation Agenda will define the process to become A Smart Energy City.

The Smart Energy City Definition including the key elements and Key Performance Indicators (KPIs) have also been developed as part of work package 1 will provide a set parameters or metrics against which a city can monitor their progress (see fig. 1). The results of this work can be found in the following reports:

1.   Definition of a Smart Energy City;

2.   Becoming a Smart Energy City, state of the art of 6 TRANSFORM cities;

The findings of the baseline analysis are displayed in a series of six short reports; one per city. These are the City Baseline reports; the starting place from which the cities will begin their transition to Smart Energy Cities.

As well as providing a point of reference, each city will be able to use their City Baseline Analysis report in their intake workshop. The analysis will help them to decide the areas they would like to focus their efforts.

Roles and workflow

The Baseline analysis was carried out by WP1 overseen by the City of Copenhagen as WP1 leader.

Arup lead on the creation of the questionnaires, collection of data and development of the baseline reports.

1	2	3	4	5	6	7	8
Arup produced questionnaire	Questionnaire reviewed by WP1	Questionnaire issued to cities	Responses received from cities	Draft reports produced	Gap analysis	Updates received from cities	Reports Revised & issued

Figure 2. 'Creating the baseline analysis'- workflow

1) 2) The process began with Arup producing a draft questionnaire to be issued to the cities, for more information on the baseline questionnaire see section 1.3. This draft was reviewed by the other active parties in WP1: Accenture, DTU and the City of Copenhagen.

3) A blank questionnaire was then issued to each of the cities.

4) 5) Once the data was received from the cities, the most suitable data was then used to draft Baseline Reports. Where appropriate, the data was also supplemented with additional research. Hamburg and Amsterdam have produced an invaluable 'Status-quo report' detailing the characteristics and ambitions of Hamburg and Amsterdam. It has been suggested that all 6 cities

6) A gap-analysis was then carried out, and the draft reports were returned to each city with suggestion of how to improve their data.

7)8) The cities then provided updates to their data, and the baseline reports were revised and issued.

The Baseline questionnaire- data collection

Each city was issued with a blank copy of the questionnaire to populate. This self-assessment asked a series of questions about each city's current state.

Questions (or 'hard KPIs') were asked regarding the cities status across six sectors: Energy, Waste, Water, Transport, Buildings and ICT. The questions were divided thematically into these six sectors so that the questionnaire could be easily divided up amongst the departments within the city authority. Aligning the structure of the questionnaire as closely as possible with organisational structure of the cities allowed cities to respond more efficiently.

Questions were selected on the following basis:

- To provide a broad coverage across the cities sectors;
- Answers could be easily provided by the cities using existing data with minimal calculation or analysis; and
- In line with previous work carried out by Arup and Accenture on Smart Cities.

The questionnaire also contained a 'powers' assessment tool; this is used to establish a city authority's level of influence in each sector. For each of the six sections, the city was asked to report their level of influence over the visions, budgets and policies.

Building the reports- The analysis

The reports produced are a series of 2-page dashboards. Maximising the use of graphics, the reports provide a 10 minute overview of the quantitative data available on the city.

The 'powers table' issued in the baseline questionnaire was used to produce a graphic illustrating the city's control/influence over each sector. For each sector (i.e. water, waste, energy), and under each area of influence (i.e. set vision, budgetary control, etc.) cities were asked to nominate their level of power (i.e. Sets vision, no influence, etc. The diagram illustrates in relative terms, where the city has power, and at what stage in the process they can assert this power.
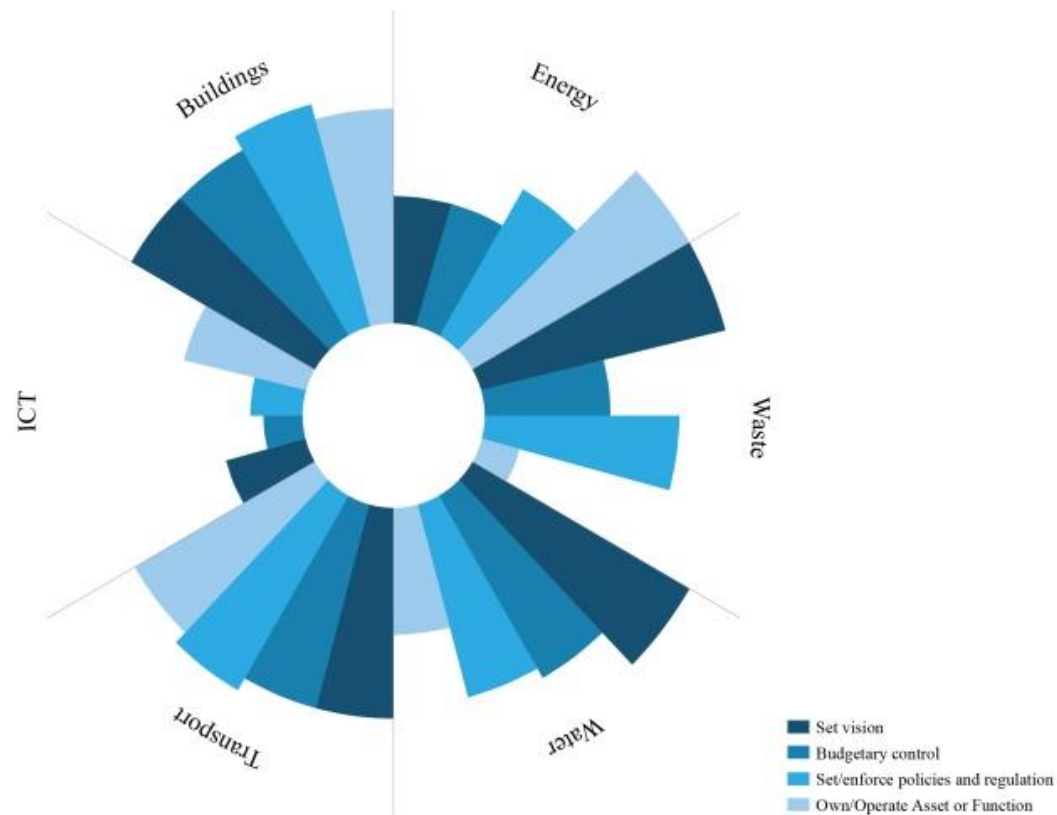

Figure 3. Diagram illustrating city influence over different sectors

Reflection- Improvements to the process

In terms of improvements to the process of producing the City Baseline Analysis, below are some points observed by WP1 and fed back from the cities.

Improving the efficiency of data collection

- Better definition of responsible parties within the cities;

- Greater use of local partners in data collection; and

- Greater customisation to the questionnaire to individual city requirements.


Functionality and additional value of the baseline analysis process

- Cities gained an insight into their data availability;

- Level of detail in the questionnaire allowed cities to realise what they do and do not know;

- Cooperation between stakeholders was strengthened through the data collection process; and

- Data collection and questionnaire formed an important intervention to start TA process;

Baseline Analysis reports
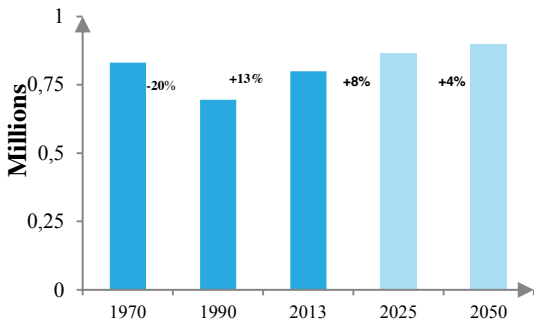
Amsterdam, Netherlands

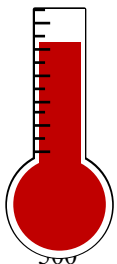TRANSFORM CITY 2013
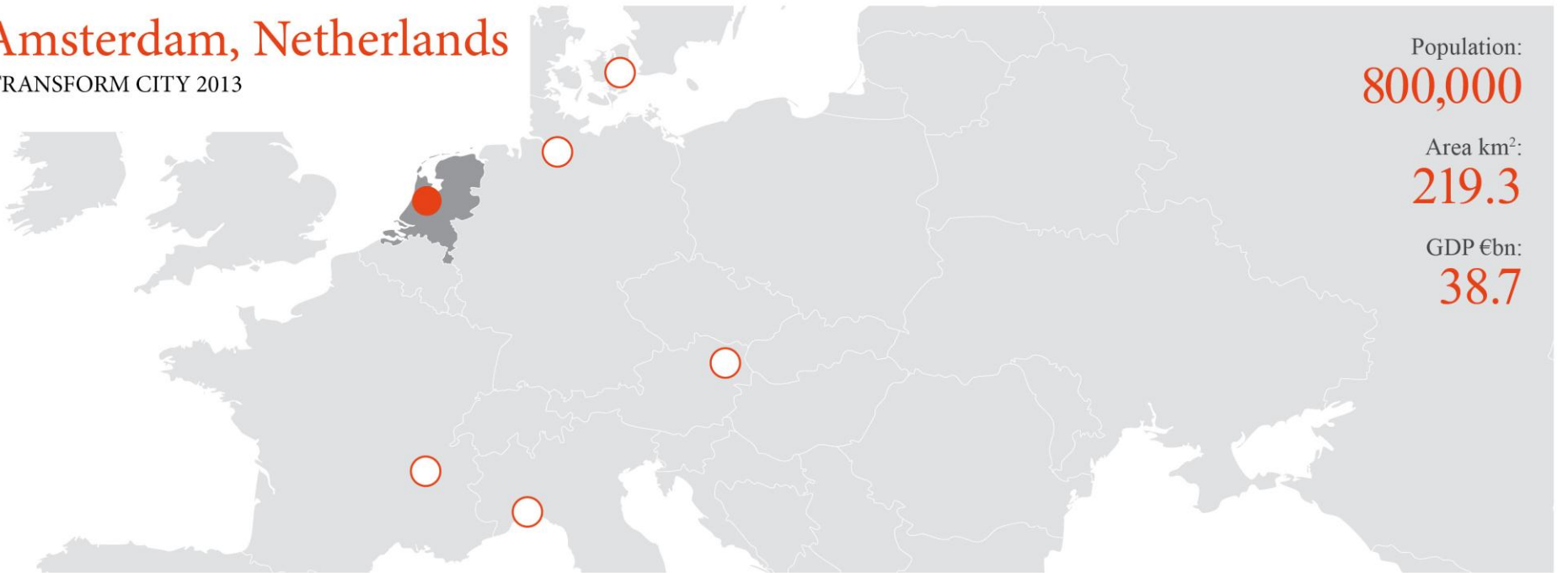
Population:
800,000

Area km²:
219.3

GDP €bn:
38.7

KEY FACTS

Population 800,000

Millions
- 1970
- 1990: -20%
- 2013: +13%
- 2025: +8%
- 2050: +4%

Temperature range

Max 35 °C

Min -24 °C

2139 heating degree days per year

Climate

776 mm average rainfall per year

9.7 °C average temperature

Economy

€ 38 billion GDP

- Business services: 15%
- Finance & insurance: 11%
- Health: 9%
- Light & Heavy Industry: 7%
- Public Sector: 6%
- Creative industries: 5%
- Education: 5%
- Tourism: 4%
- Agriculture: 2%

City land use

- Residential 31%
- Green areas 38%
- Transport infrastructure and logistics 11%
- Public services 2%
- Private business 18%

ENERGY

Grid mix
608 gCO₂ / kWhₑ

- Natural gas 28%
- Oil 12%
- Coal 17%
- Nuclear 4%
- Biomass 5%
- Wind 4%
- Energy from Waste 30%

Electricity demand
- Residential 748 GWh
- Non-residential 4032 GWh

Average fuel prices (€ / kWh)

No more than the price of natural gas

- Natural Gas
- Heat from district heating
- Electricity
- Biomass pellets

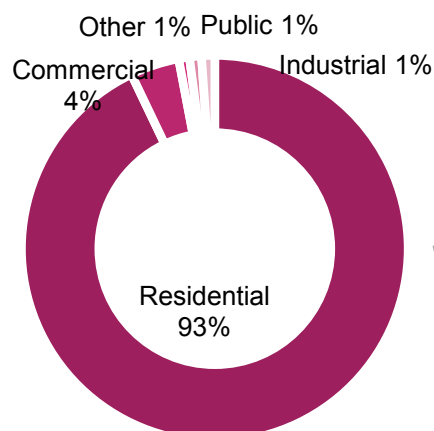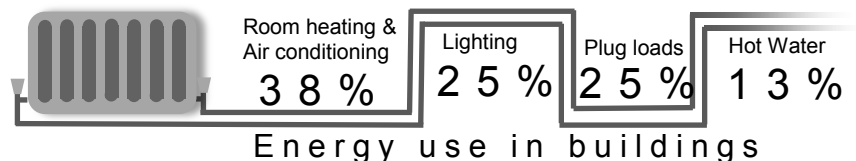■ Small consumers ■ Large consumers

BUILDINGS

From 2015 all new construction in the city must be **climate-neutral**. This means that the building-related energy consumption will be reduced as far as possible by means of insulation (while retaining proper ventilation) and the remaining energy demand will be met from sustainable sources.
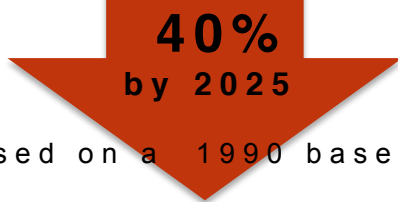
- Residential 93%
- Commercial 4%
- Other 1%
- Public 1%
- Industrial 1%

Room heating & Air conditioning **38%** | Lighting **25%** | Plug loads **25%** | Hot Water **13%**

Energy use in buildings

TRANSFORM TRANSFORMATION AGENDA FOR LOW CARBON CITIES

Total city-wide emissions

5,094,000

metric tonnes of CO₂ equivalent (CO₂e) per year
2011

The "Amsterdam Definitely Sustainable 2011 – 2014" programme focuses on 4 pillars:

- **Climate and energy**
- **Mobility and air quality**
- **Sustainable innovative economy**
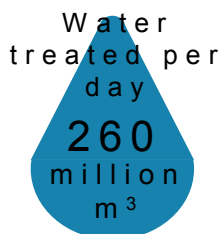- **Materials and consumers**

GHG REDUCTION TARGET
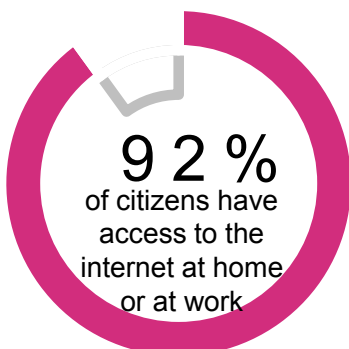
Amsterdam aims to reduce overall GHG emissions by

40%
by 2025

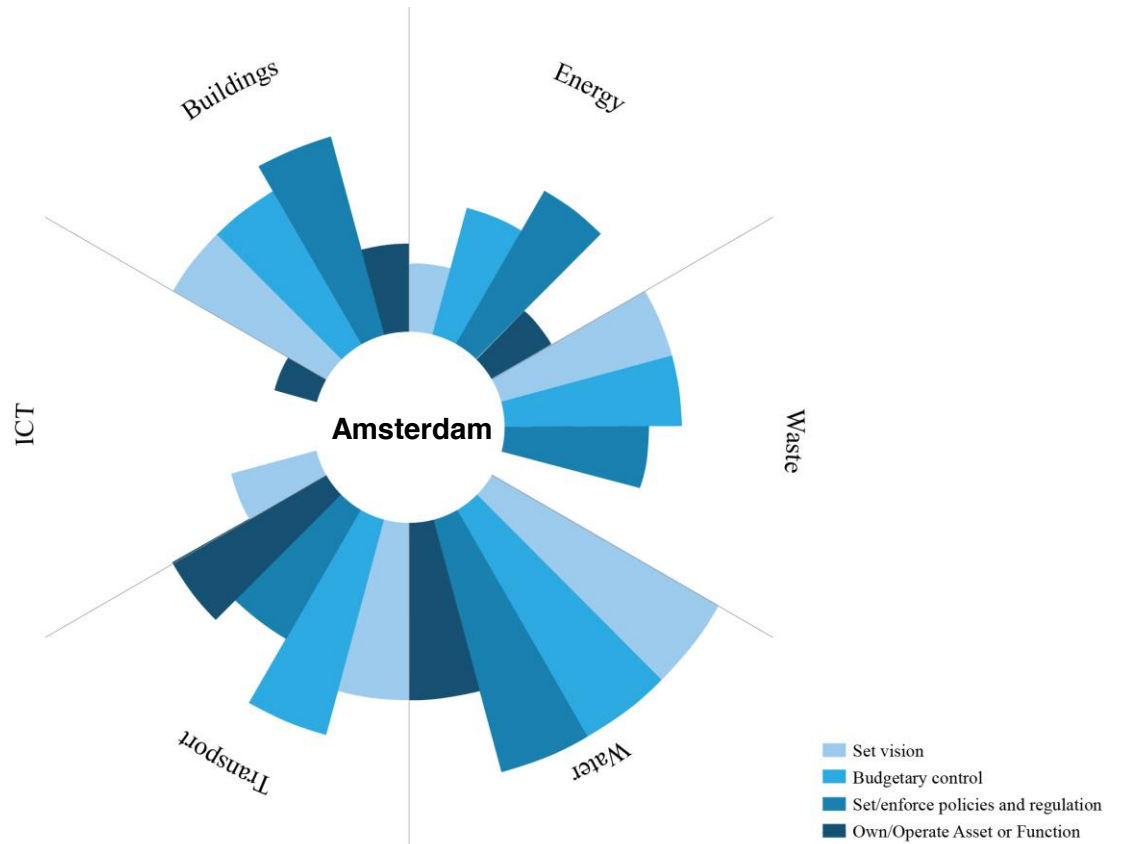(based on a 1990 baseline)

WATER

100%
Surface Water

| Residential; 55% | Industrial; 40% | Agiculture; 5% |

Water treated per day
260 million m³

ICT

92%
of citizens have access to the internet at home or at work

250,000
Registered wireless hotspot users

POWERS

- Set vision
- Budgetary control
- Set/enforce policies and regulation
- Own/Operate Asset or Function

(Radial chart axes: Buildings, Energy, Waste, Water, Transport, ICT — labeled "Amsterdam" at center)

WASTE

Make-up of Waste
- Organics 40%
- Paper and cardboard 25%
- Plastics 13%
- Glass 10%
- Textiles 7%
- Metals 3%
- Wood 2%

1.15 kg of waste generated per person per day

zero waste to landfill

Management of Waste
- Recycled 18%
- Waste to energy 82%
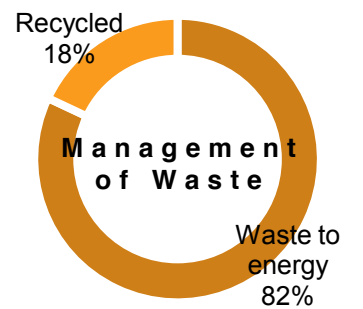
TRANSPORT

400km
of cycle lanes

67%
are segregated

Intermodal ticketing system
80% of citizens are members

350
On street electric vehicle charging points

Modal Split
- Cycling 31%
- Other 3%
- Private motorized transport 23%
- Rail / Metro / Tram 12%
- Buses 3%
- Walking 28%

TRANSFORM TRANSFORMATION AGENDA FOR LOW CARBON CITIES
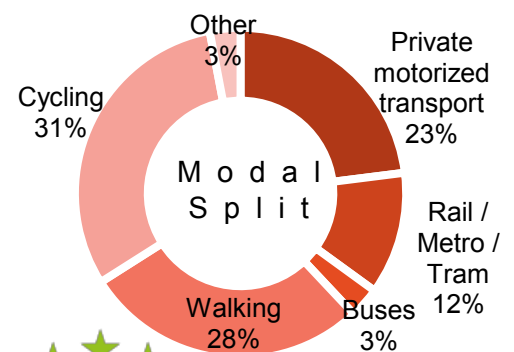
Copenhagen, Denmark
TRANSFORM CITY 2013

Population: **549,050**

Area km²: **74.4**

GDP €bn: **31.8**

KEY FACTS

Population 550,000
15% increase 1990 – 2013

Millions

1970	1990	2013	2025
-33%	+15%	+18%	

Temperature range

Max 36.2ºC *1974*

Min -31.2 ºC *1982*
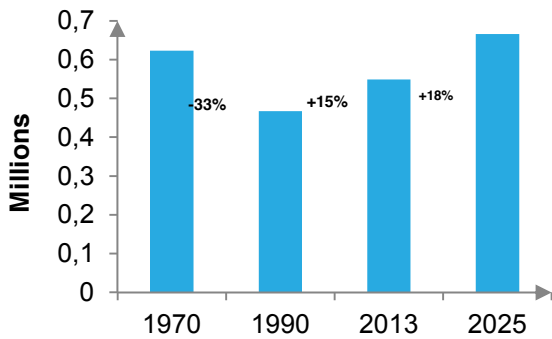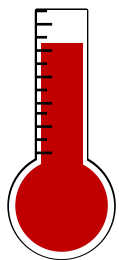
Climate
712 mm average rainfall per year

11 ºC average temperature

City budget
€ 12,000 per capita

Economy
€ 35 billion GDP

€ 63,000 GDP per capita

Business service	22,0%
Public Sector	17,1%
Finance & insurance	12,7%
Transport	9,4%
Property	7,0%
Trade	6,4%
Education	5,7%
Creative industries	4,5%
Industry	3,9%
Health	3,6%
Other servcies	3,1%
Culture and leisure	2,3%
Tourism	1,8%
Agriculture	0,01%

City land use

Area 74.4 km²

- Transport infrastructure and logistics 23%
- Residential 28%
- Private business 12%
- Public services 8%
- Green areas 29%

ENERGY

Grid Mix
426 gCO₂e/kWh 2011

- Oil, 1%
- Coal, 35%
- Natural gas, 16%
- Nuclear, 3%
- Energy from Waste, 4%
- Biomass, 9%
- Wind, 33%

Electricity generated from renewable sources **within the city**

- **Other** 133 GWh/yr 19%
- **Biomass** 484 GWh/yr 68%
- **Wind** 96 GWh/yr 13%
- **Solar** 0.1 GWh/yr 0.01%
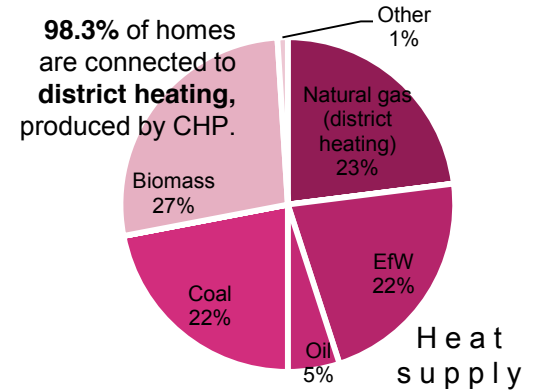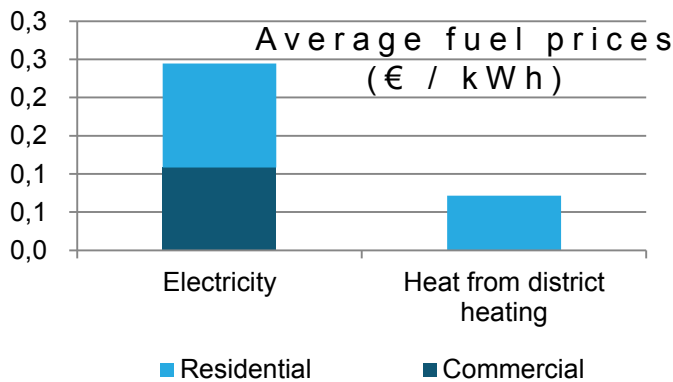
Primary energy consumption of Copenhagen **6,878** GWh / yr

Including 2,463 GWh of electricity per year

Average fuel prices (€ / kWh)

	Electricity	Heat from district heating
Residential		
Commercial		

98.3% of homes are connected to **district heating,** produced by CHP.

Heat supply
- Other 1%
- Natural gas (district heating) 23%
- Biomass 27%
- EfW 22%
- Coal 22%
- Oil 5%

WATER

Water use is reportedly falling - approaching

100l/capita/day

Combined

Rainwater and wastewater system

Most of the city has a joint system where stormwater and waste water is discharged for processing in central treatment plants. Separate sewer systems only exist in the part of the city which is close to the ports.

- Residential 66%
- Industrial 18%

100% Ground Water
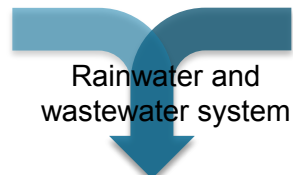
Water delivered per day

31.8 million m³

100% of all domestic users buildings are

TRΛNSFORM TRANSFORMATION AGENDA FOR LOW CARBON CITIES

Total city-wide emissions

2,124,312

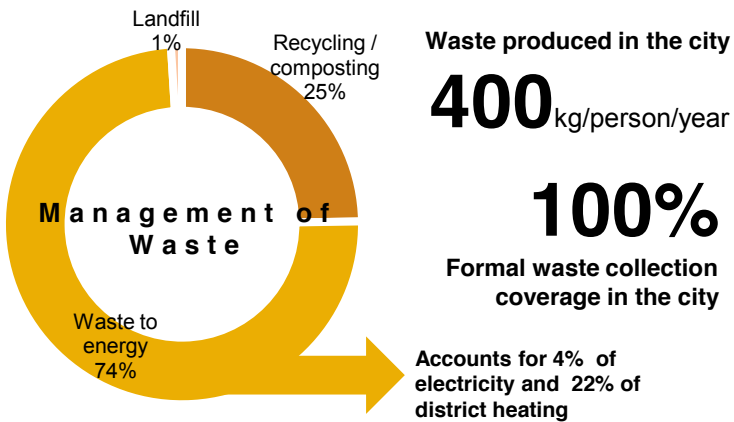metric tonnes of CO_2 equivalent (CO_2e) per year
2012

GHG REDUCTION TARGET

Copenhagen aims to reduce overall GHG emissions by **20% by 2015** (achieved in 2011)

100%

By 2025

(based on a 2005 baseline)

POWERS

Copenhagen

- Set vision
- Budgetary control
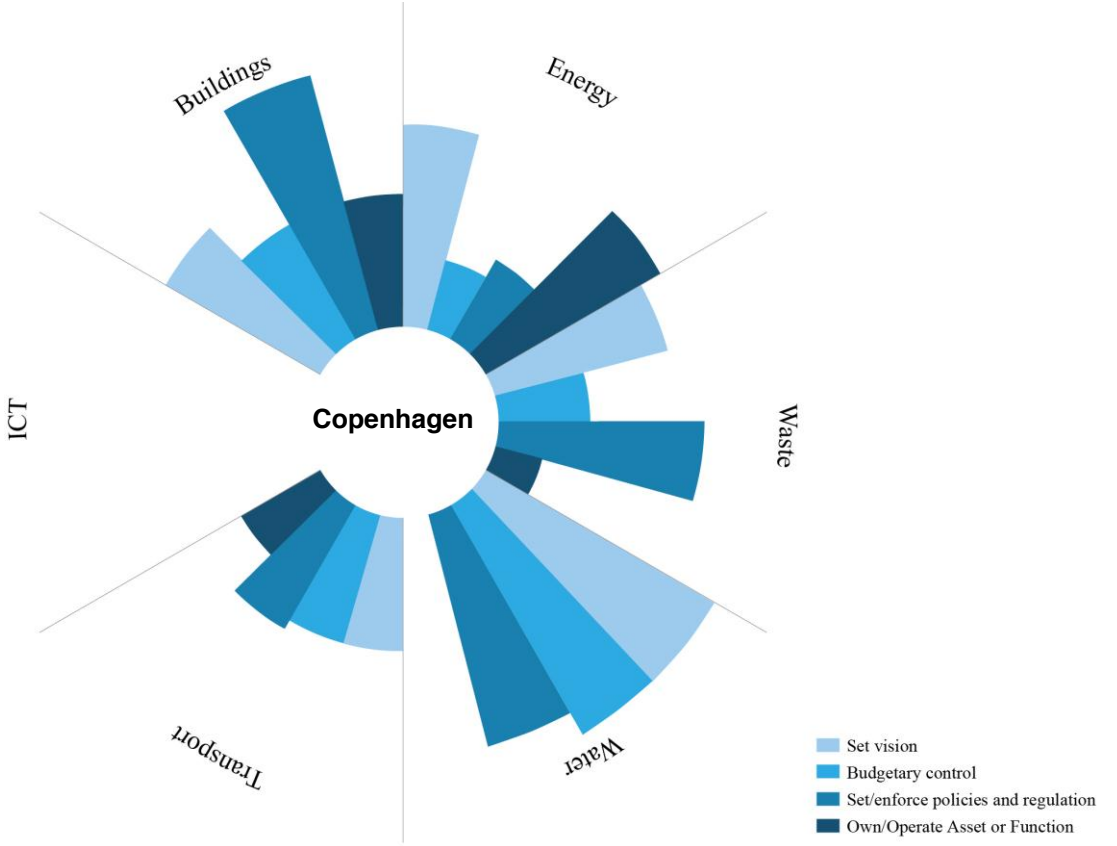- Set/enforce policies and regulation
- Own/Operate Asset or Function

WASTE

Better utilisation of waste is prioritised, so as many resources as possible are reused and less is incinerated.

Targets:
1. Reduce the amount of waste for incineration by 20%
2. Ensure 45% of household waste is reused by 2018

Management of Waste

- Landfill 1%
- Recycling / composting 25%
- Waste to energy 74%

Waste produced in the city

400 kg/person/year

100%

Formal waste collection coverage in the city

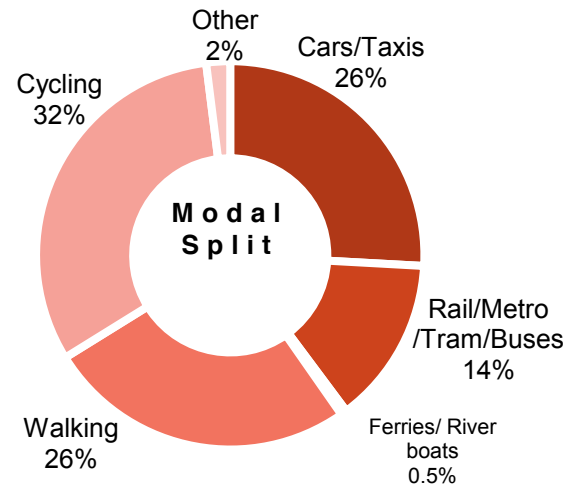**Accounts for 4% of electricity and 22% of district heating**

TRANSPORT

411km

of cycle lanes

94%

are segregated

High provision of facilities for cyclists has led to a large proportion of journeys being undertaken by bicycle. 32%

If the use of cars is necessary, the goal is that the large majority of them use electrical, hydrogen or are hybrids. Transport must contribute to making a greener, smarter and healthier city in 2025

129

On street electric vehicle charging points

Intermodal ticketing system

Modal Split

- Other 2%
- Cars/Taxis 26%
- Cycling 32%
- Rail/Metro /Tram/Buses 14%
- Ferries/ River boats 0.5%
- Walking 26%

Transport is a main part of the Climate Plan 2025. Copenhagen is focused on making cycling, walking or using public transport the most attractive means of transport for Copenhageners to get around the city.

ICT

Copenhagen's vision is that all Copenhageners have digital access to public services.

IT Strategy priorities divided into five categories:
Citizens, businesses and users   Municipality tasks   Employees   Managing IT development   Operation and development of the IT platform

The city has an Open Data strategy, where the city's data are available for citizens, business etc. to access and use
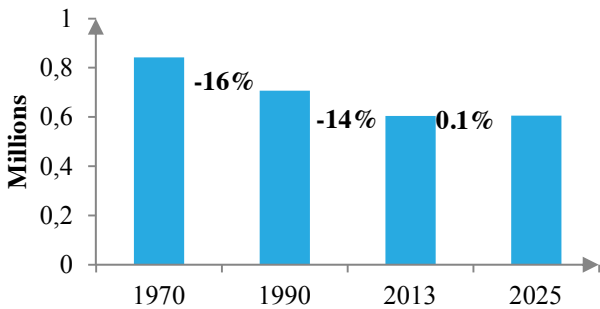
www.kk.dk

TRANSFORM **TRANSFORMATION AGENDA FOR LOW CARBON CITIES**

Genoa, Italy
TRANSFORM CITY 2013

Population:
604,848

Area km²:
243.6

KEY FACTS

Population 605,000
14% decrease 2002 – 2012

-16%	**-14%**	**0.1%**	
1970	1990	2013	2025

Millions (0 to 1 scale)

Climate

14-20 ºC average temperature

1014 mm average rainfall per year
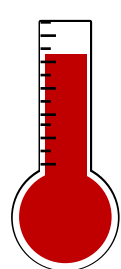
Frequent flooding events
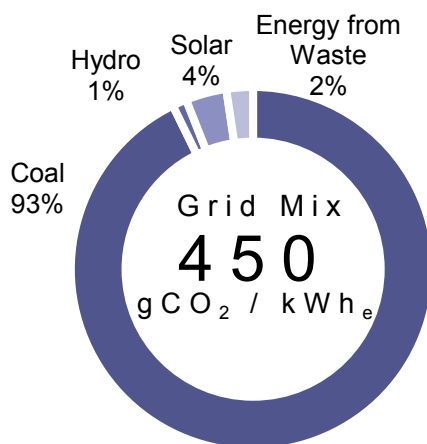Extreme floods experienced in **2010 & 2011**

Economy

Average disposable income of

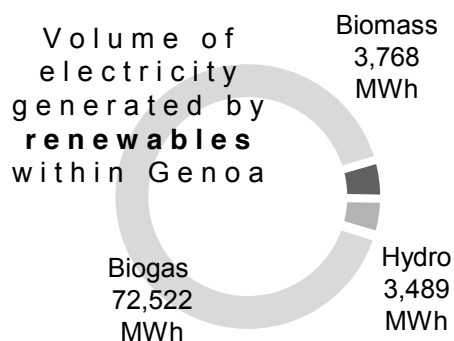**€17,045**
per capita
(2011)
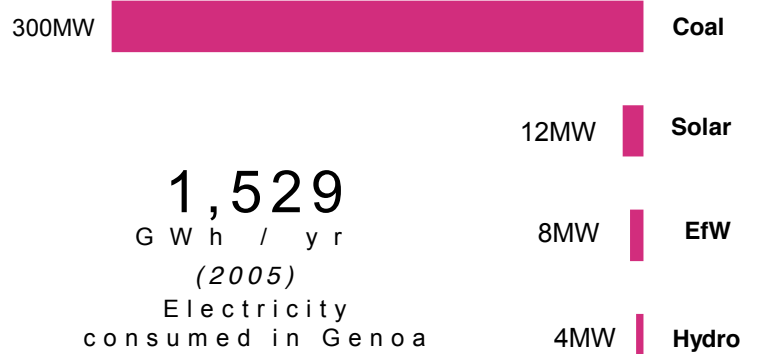
GDP per capita

€ 27,792
per capita
(2009)

ENERGY

Grid Mix
450 gCO₂ / kWhₑ

- Coal 93%
- Hydro 1%
- Solar 4%
- Energy from Waste 2%

8,077
GWh per year
Primary energy consumption
2005

Generation assets owned by Genoa

300MW	**Coal**
12MW	**Solar**
8MW	**EfW**
4MW	**Hydro**

1,529
GWh / yr
(2005)
Electricity consumed in Genoa

Volume of electricity generated by **renewables** within Genoa

- Biomass 3,768 MWh
- Hydro 3,489 MWh
- Biogas 72,522 MWh

- Public 7%
- Commercial 38%
- Residential 55%

- Liquid gas 1%
- Biomass 0.061%
- Solar thermal 0.002%
- Diesel 7%
- Natural gas (individual boilers) 65%
- Electrical heating 24%
- Fuel oil 3%
- **Heat supply**
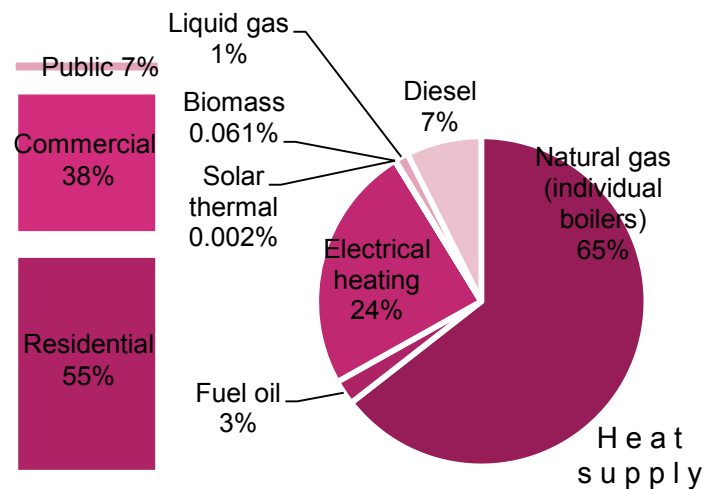
WATER

Combined Rainwater and wastewater system

23,000
tonnes of CO₂/year
Generated from supplying water

Residential, 62%	Commercial, 13%	Municipal, 7%	Industrial, 8%	Other, 9%

wastewater treated per day
0.17
million m³

Genoa's water supply by source
- Surface water 86%
- Ground water 14%
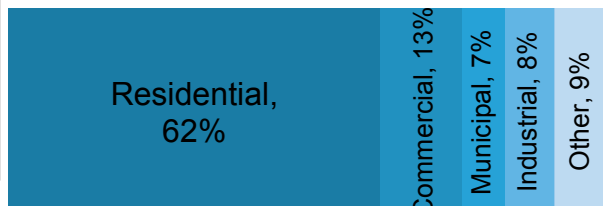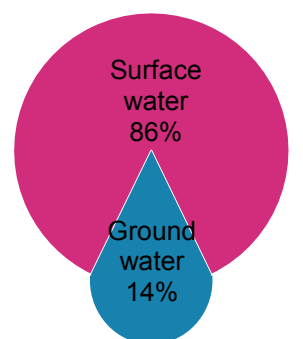
Total city-wide emissions

2,271,913

metric tonnes of CO₂ equivalent (CO₂e) per year

2005

GHG REDUCTION TARGET

Genoa aims to reduce overall GHG emissions by
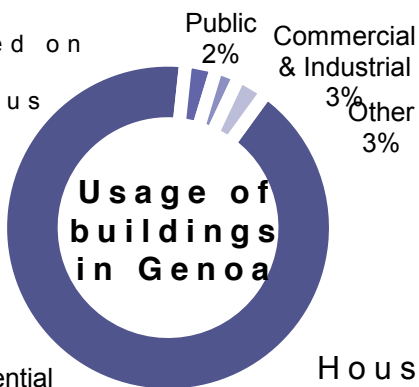
23.7%
by 2020

(based on a 2005 baseline)

ICT

www.comune.genova.it

92 **Wireless hotspots**

Ensuring participation & transparency

19,241 registered wireless hotspot users

BUILDINGS

Based on 2001 census data

Public 2%

Commercial & Industrial 3%
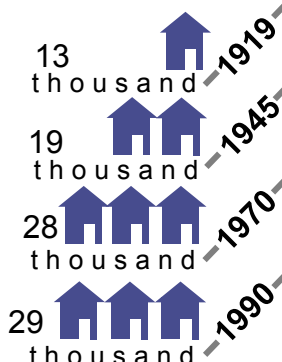
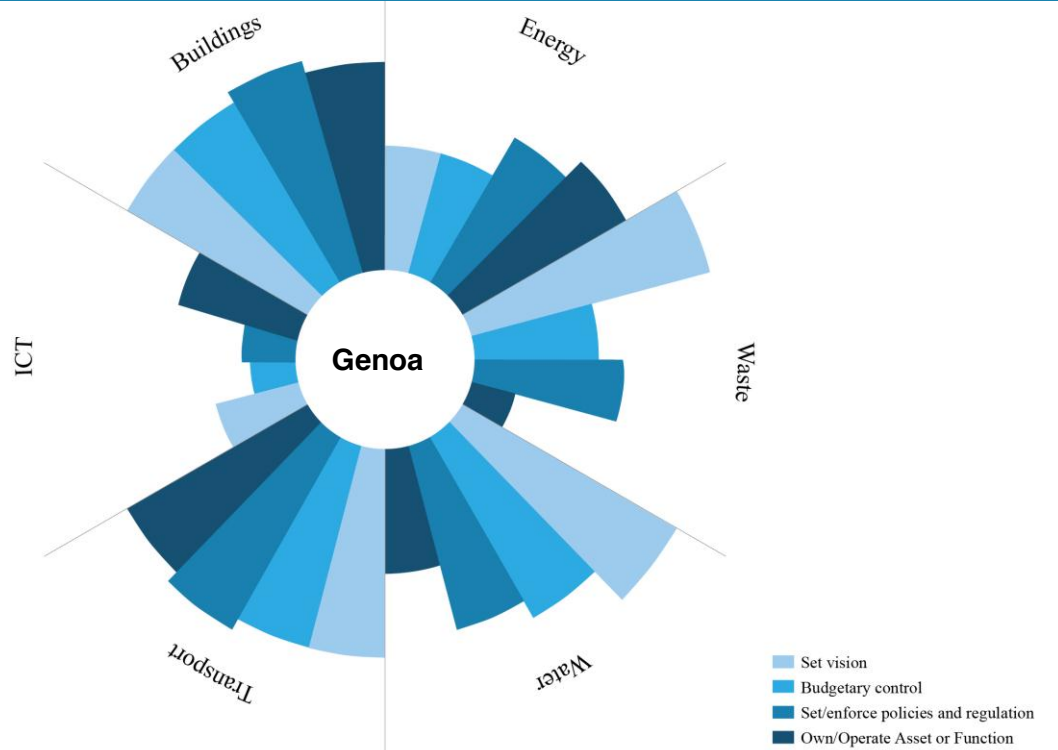Other 3%

Usage of buildings in Genoa

Residential 92%

Space conditioning makes up

96%

of building energy use

7,500 homes to be build in the next **10 years**

Housing stock built prior to

13 thousand — 1919
19 thousand — 1945
28 thousand — 1970
29 thousand — 1990

POWERS

Genoa

Buildings
Energy
Waste
Water
Transport
ICT

- Set vision
- Budgetary control
- Set/enforce policies and regulation
- Own/Operate Asset or Function

WASTE

1.45 kg waste generated per person per day

Fines (soil, dust etc) 1%
Other 8%
Organics 43%
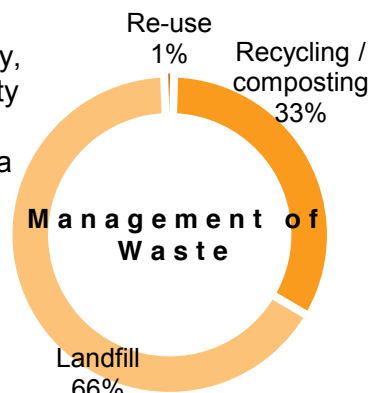Paper and cardboard 13%
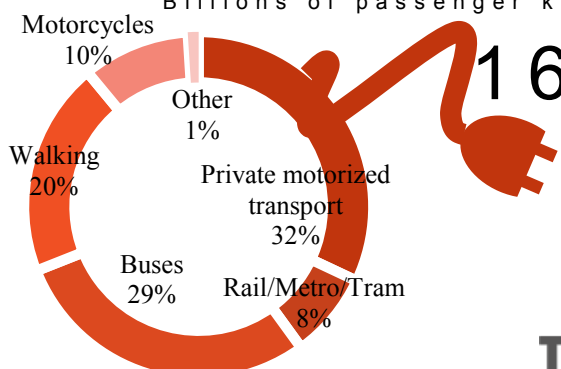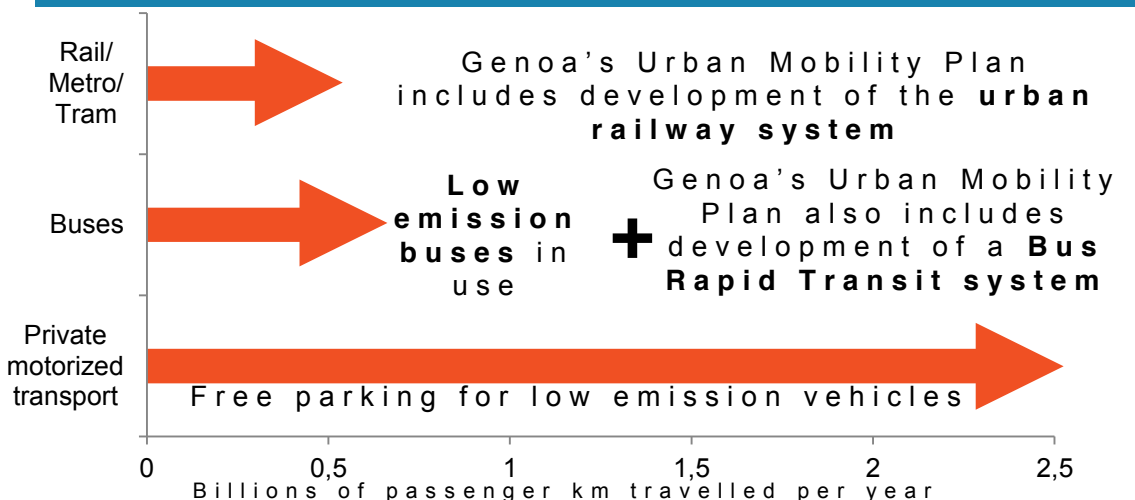Plastics 17%
Textiles 7%
Glass 5%
Wood 3%
Metals 3%
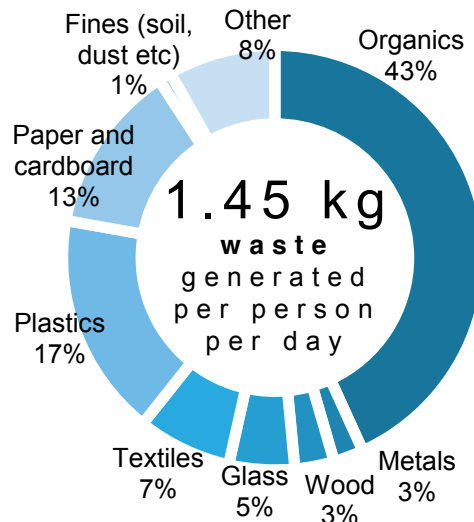
Amiu is a public company, owned by the municipality of Genoa who have recently commissioned a **new recycling plant.**

Genoa's citizens are offered **economic incentives** for using recycling sites of for composting at home.

Management of Waste

Re-use 1%
Recycling / composting 33%
Landfill 66%

TRANSPORT

Rail/Metro/Tram
Genoa's Urban Mobility Plan includes development of the **urban railway system**

Buses
Low emission buses in use **+** Genoa's Urban Mobility Plan also includes development of a **Bus Rapid Transit system**

Private motorized transport
Free parking for low emission vehicles

0   0,5   1   1,5   2   2,5
Billions of passenger km travelled per year

Motorcycles 10%
Other 1%
Walking 20%
Private motorized transport 32%
Buses 29%
Rail/Metro/Tram 8%

16 On street electric vehicle charging points

3.8 km of cycle lanes
37% are segregated

TRANSFORM TRANSFORMATION AGENDA FOR LOW CARBON CITIES

Hamburg, Germany
TRANSFORM CITY 2013
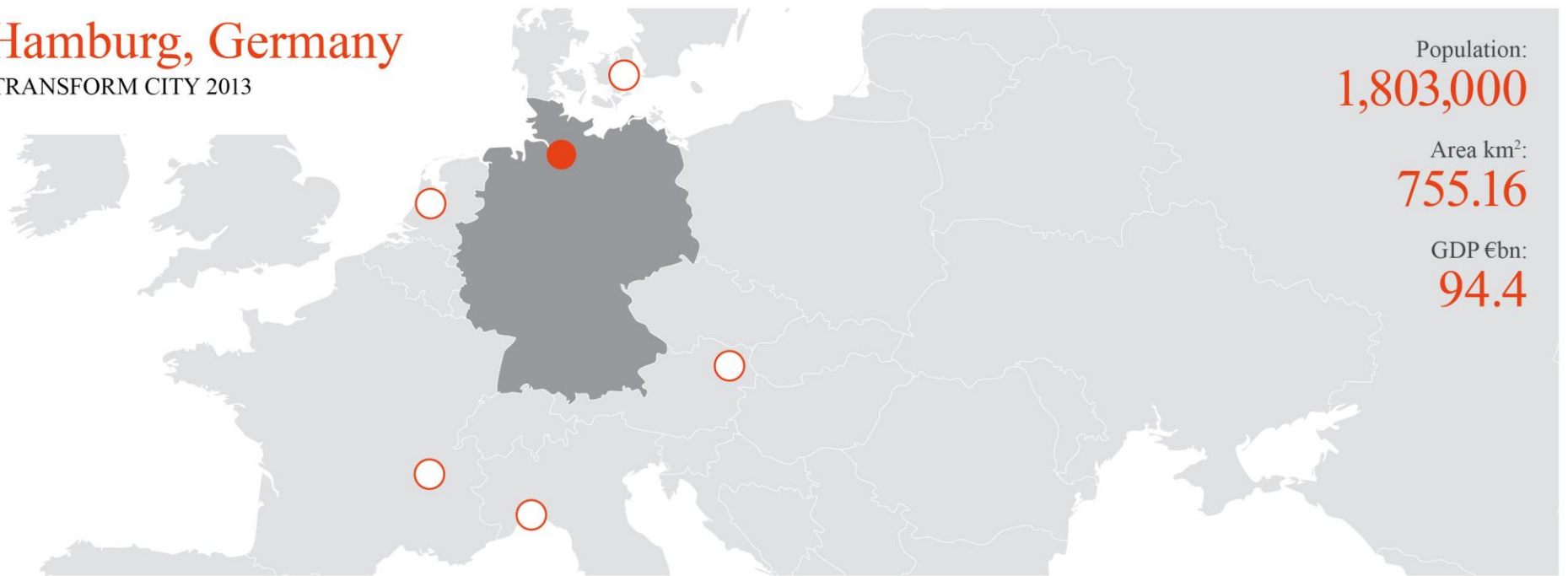
Population:
1,803,000

Area km²:
755.16

GDP €bn:
94.4

KEY FACTS

Population 1.8m

Millions

| 1970 | 1990 | 2013 | 2025 | 2050 |

-9% +8% +3% -5%
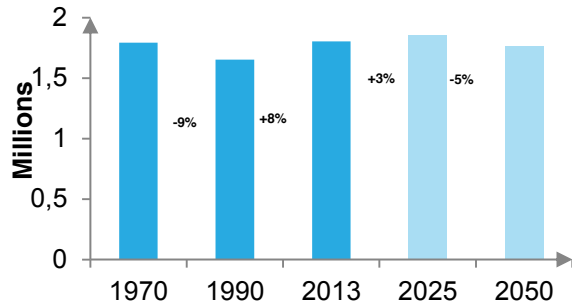
Temperature range
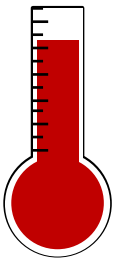
Max 37.7°C

Min -29.1 °C

Climate

733 mm average rainfall per year

8.7 °C average temperature

City budget

€ 6,159 per capita

Economy

€ 94 billion GDP

€ 52,400 GDP per capita
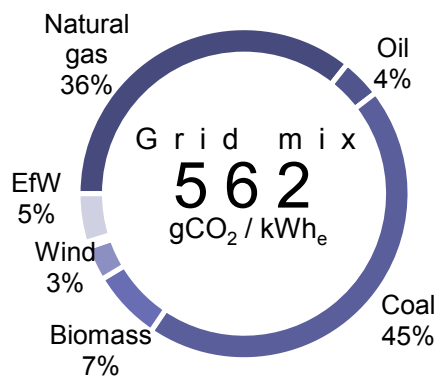
Business services	61.3%
Light Industry	12.8%
Finance & insurance	6.1%
Health	5.6%
Public Sector	4.7%
Education	3.1%
Heavy Industry	2.7%
Creative industries	2.1%
Tourism	1.7%
Agriculture	0.1%

City land use

Residential 39%

Private business 12%

Transport infrastructure and logistics 23%

Green areas, watercourses & lakes 26%

ENERGY

Grid mix
562 gCO₂ / kWhe

Natural gas 36%
Oil 4%
EfW 5%
Wind 3%
Biomass 7%
Coal 45%
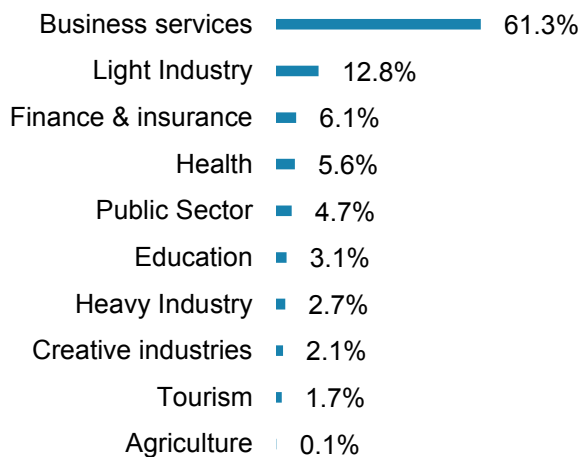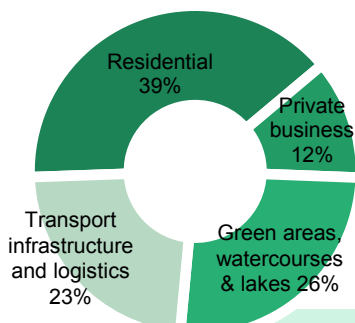
Hamburg has established a city-owned energy supplier- Hamburg Energie. This organisation, in cooperation with the city, tackles the challenges of furthering energy efficiency measures, low carbon heating, energy storage and virtual power plants.

The city authority currently owns just over 25% of the cities energy networks. In September 2013 a referendum will be held on the municipalisation of all Hamburg's of gas and power grids.

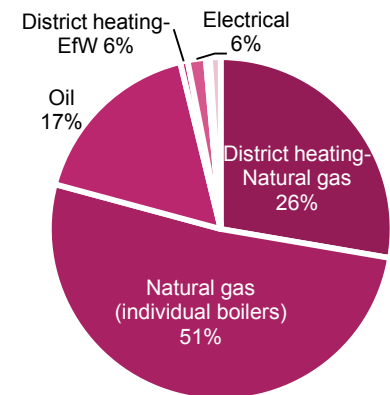Primary energy consumption of Hamburg

18,995

GWh / yr
(2011)

with

2.5%

of electricity generated from renewables

Hydro, 500 GWh
Solar, 12 GWh
Other, 86 GWh
Biomass, 164 GWh
Wind, 82 GWh
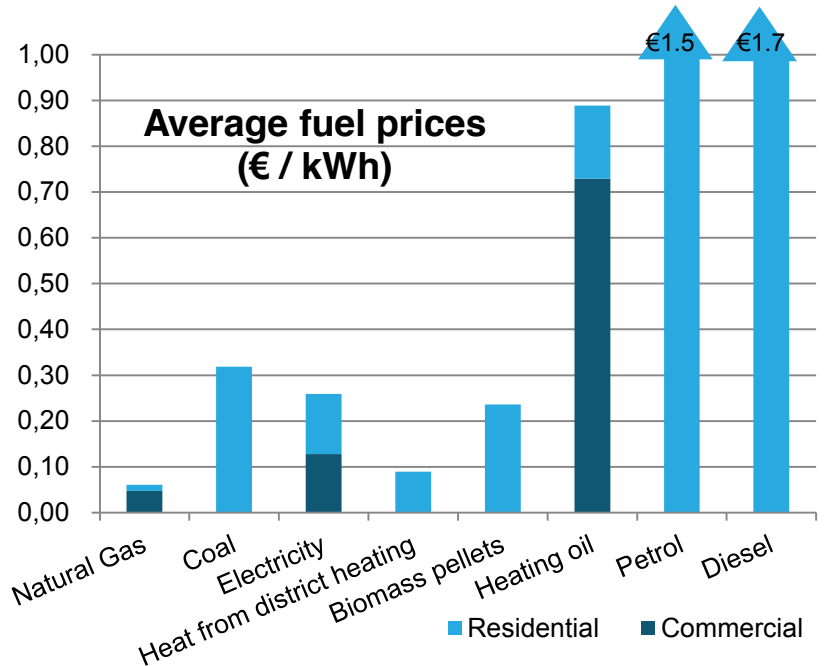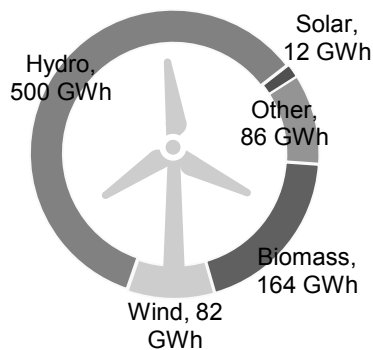
74 km²

of port spaces
Hamburg Port

- Generates €50,000 per capita
- 11,000 ships per year
- 1,800 employees
- 220 trains per day

Average fuel prices (€ / kWh)

€1.5   €1.7

| Natural Gas | Coal | Electricity | Heat from district heating | Biomass pellets | Heating oil | Petrol | Diesel |

■ Residential   ■ Commercial

Heat supply

District heating- EfW 6%
Electrical 6%
Oil 17%
District heating- Natural gas 26%
Natural gas (individual boilers) 51%

TRɅNSFORM **TRANSFORMATION AGENDA FOR LOW CARBON CITIES**

Total city-wide emissions

11,445,000

metric tonnes of CO₂ equivalent (CO₂e) per year *2009*

Breakdown of carbon emissions

- Public, 18.40%
- Residential, 13.70%
- Transport, 18%
- Commercial, 14,30%
- Industrial, 6.80%
- Electricity, 47%
- Commercial; 11,20%
- Heating, 34%
- Industrial, 17.40%
- Residential, 16.10%
- Public; 1,20%
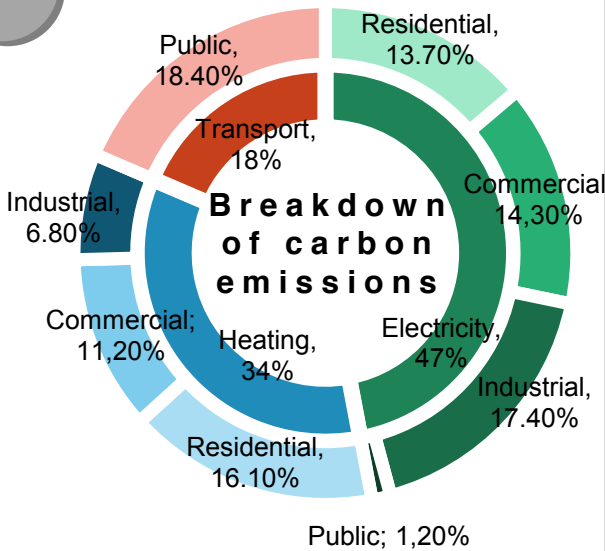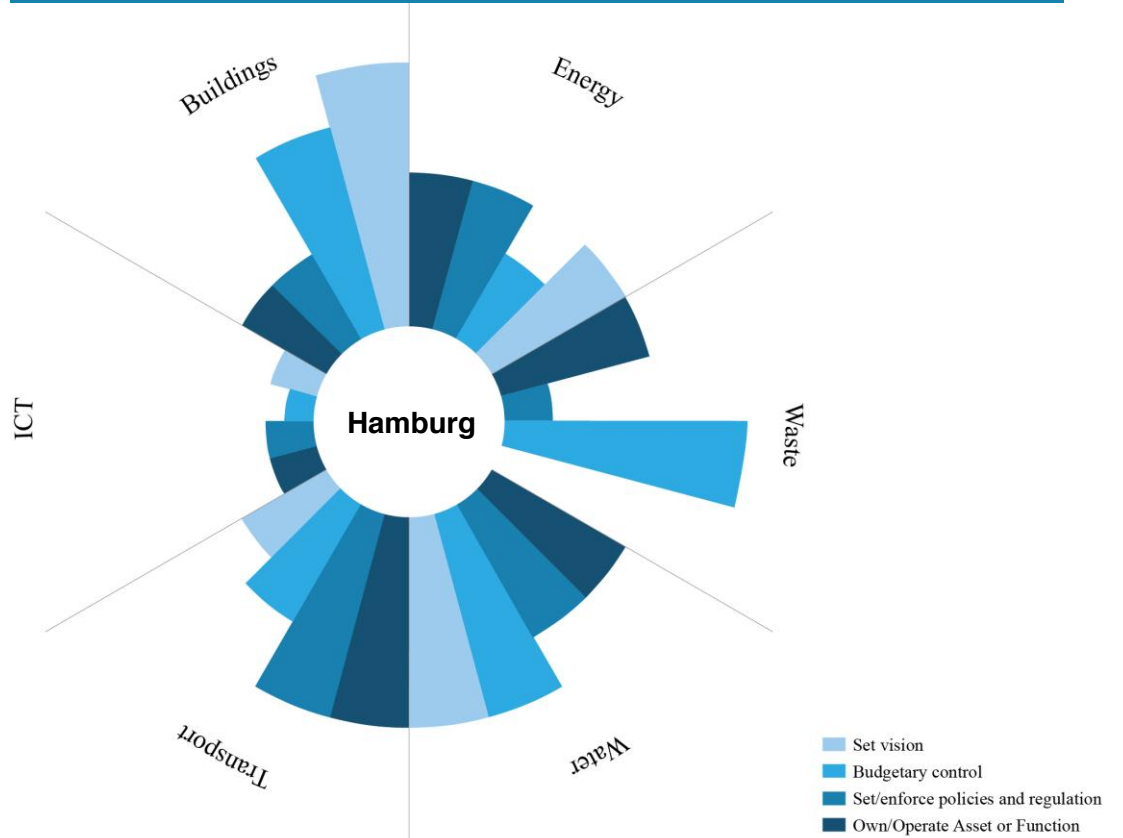
GHG REDUCTION TARGET

Hamburg aims to reduce overall GHG emissions by

40%
by 2020

(based on a 1990 baseline)

Per capita emissions have already been reduced by 15% compared to 1990.

WATER

The Hamburg Water Cycle is a water management project which will be implemented at two locations in Hamburg. It aims to separate grey water, black water and storm water for separate treatment; this will both increase drainage capacity and maximise the reclaiming of nutrients from black water.
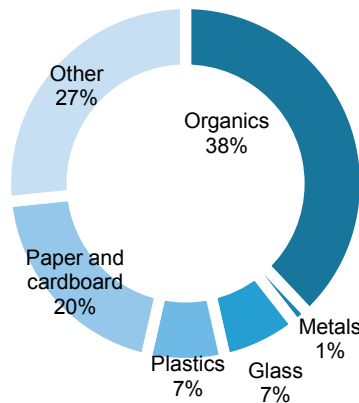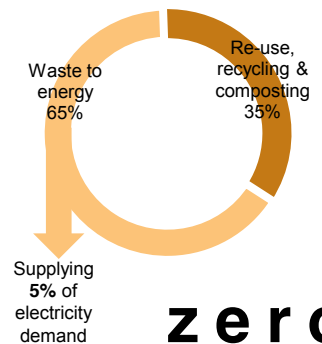
wastewater treated per day

0.54
million m³

- Residential, 73.20%
- Commercial, 20.00%
- Industrial, 2.80%
- Other, 1.50%
- Municipal, 2.50%

It is currently mandated that all buildings shall be on a metered water supply.

ICT

Accountability

Connectivity
Contact with the city authority
Follow Hamburg on **Twitter**
Live data
Open data
@hamburg_de

www.hamburg.de

POWERS

Hamburg

- Buildings
- Energy
- Waste
- Water
- Transport
- ICT

Legend:
- Set vision
- Budgetary control
- Set/enforce policies and regulation
- Own/Operate Asset or Function

WASTE

- Other 27%
- Organics 38%
- Paper and cardboard 20%
- Plastics 7%
- Glass 7%
- Metals 1%

Stadtreinigung Hamburg (SRH) is a Hamburg owned waste management company responsible for the management of residual waste, bulky waste, bio-waste, paper waste and organises the recycling, energy recovery and disposal of all waste streams
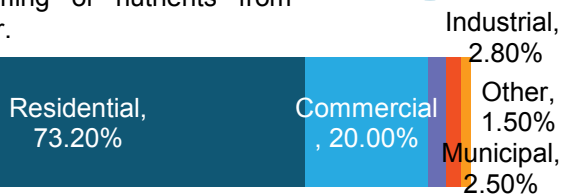
- Waste to energy 65%
- Re-use, recycling & composting 35%
- Supplying **5%** of electricity demand

zero
waste to landfill

TRANSPORT

100
On street electric vehicle charging points

1,700km
of cycle lanes

200km
are segregated

27.7 bn
passenger kms travelled by Rapid Transit Rail every year

Intermodal ticketing system

The city also has over 1,200 buses; 38 of which a low emission models..

Modal Split
- Other 2%
- Cycling 12%
- Private motorized transport 41%
- Walking 28%
- Public Transport 17%

TRⱯNSFORM **TRANSFORMATION AGENDA FOR LOW CARBON CITIES**

Lyon, France
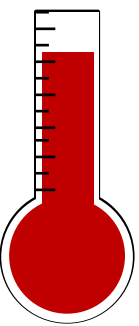## TRANSFORM CITY 2013

Population: **1,281,971**

Area km²: **527**

GDP €bn: **56.1**

KEY FACTS

Population 1.3m

Temperature range

Max 40.5°C

Min -24.6 °C

Climate

835 mm average rainfall per year

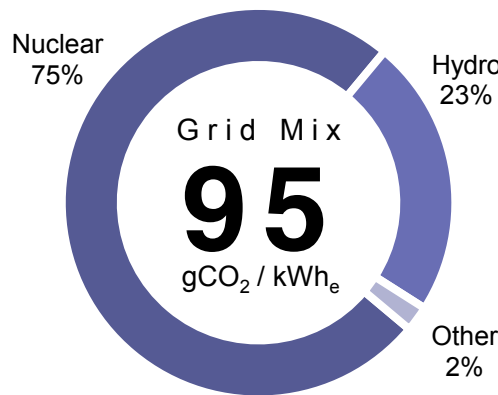11.39 °C average temperature

Economy

€ 56 billion GDP

€ 42,831 GDP per capita

€ 19,286 disposable income per capita

4 actions clearly identify in Lyon's Sustainable Energy Action Plan (2011):

1. To develop biomass heating district,
2. Support to organize wood market at regional level
3. To drive the territory and the private and public entities in the development of renewable energy
4. To ease implementation of smart grids for private companies

Lyon has created a specific administrative entity to define the energy strategy and put in place an operational action plan.

ENERGY

Grid Mix
95 gCO$_2$ / kWh$_e$

- Nuclear 75%
- Hydro 23%
- Other 2%

Electricity generated by renewables in Lyon (per annum)

- Other 6%
- Biomass 12%
- Hydro 82%

Primary energy consumption of Lyon
40,000 GWh / yr *(2006)*

175,000 Number of residences installed with smarter energy meters since 2011

Heat supply

- District heating Gas 46%
- Electrical heating 27%
- Oil 14%
- EfW 9%
- Other 4%

Average fuel prices (€ / kWh)

Price

€1.6   €1.4

- Commercial
- Residential

Natural gas | Propane | Oil | Coal | Electricity | District heating | Biomass pellets | Heating oil | Petrol | Diesel

---

TRANSFORM TRANSFORMATION AGENDA FOR LOW CARBON CITIES
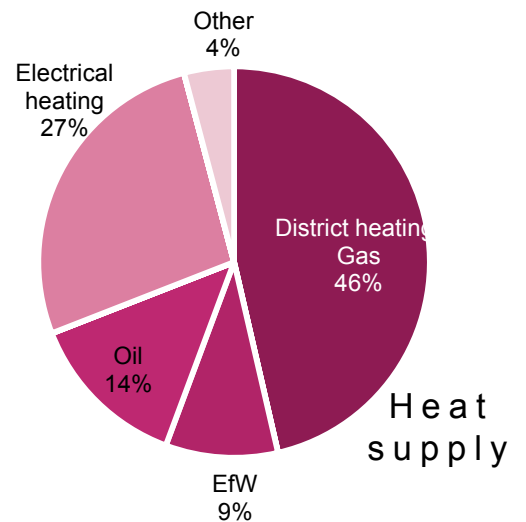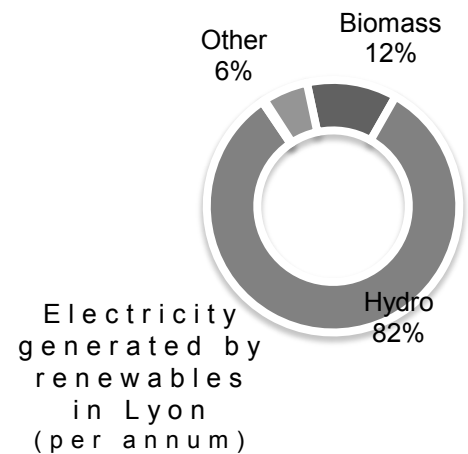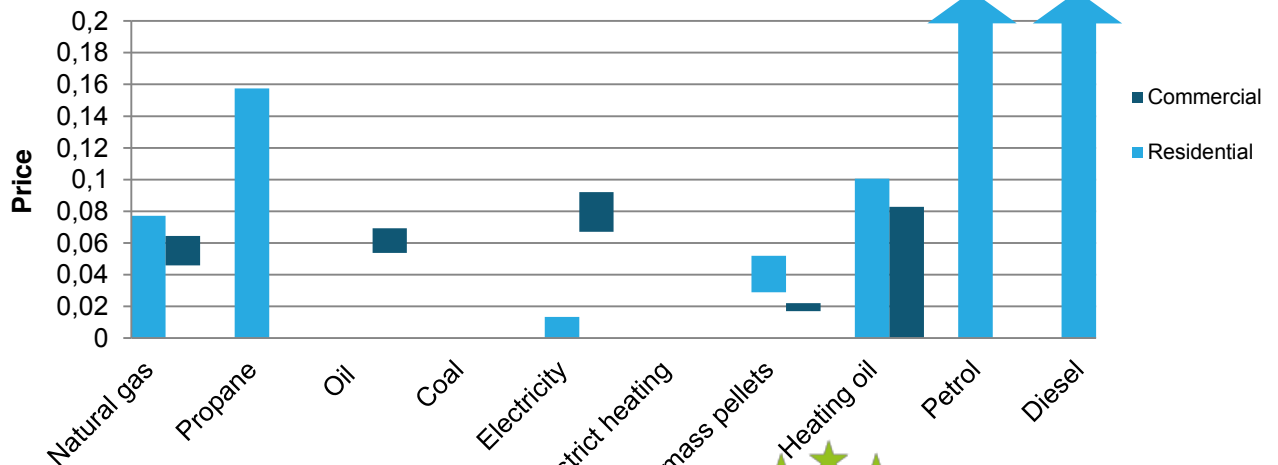
Total city-wide emissions

7,500,000

metric tonnes of CO_2 equivalent (CO_2e) per year
2006

Breakdown of carbon emissions

Transport 26%

Waste Industry and Waste Management 37%

District Heating 3%

Services 14%

Residential 20%
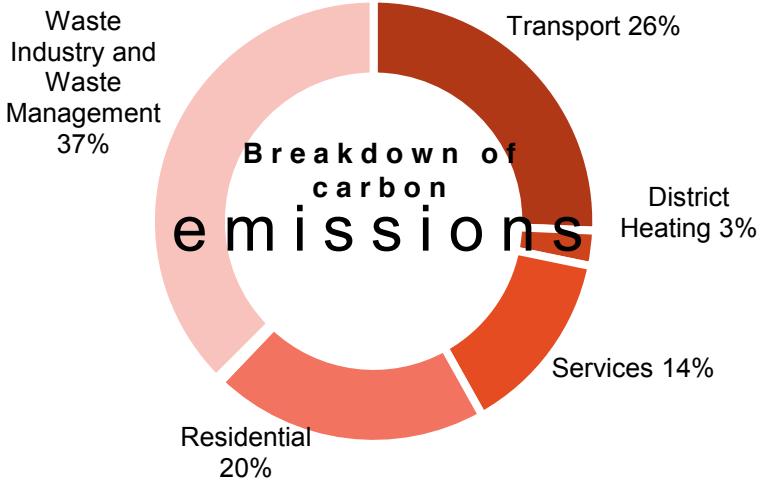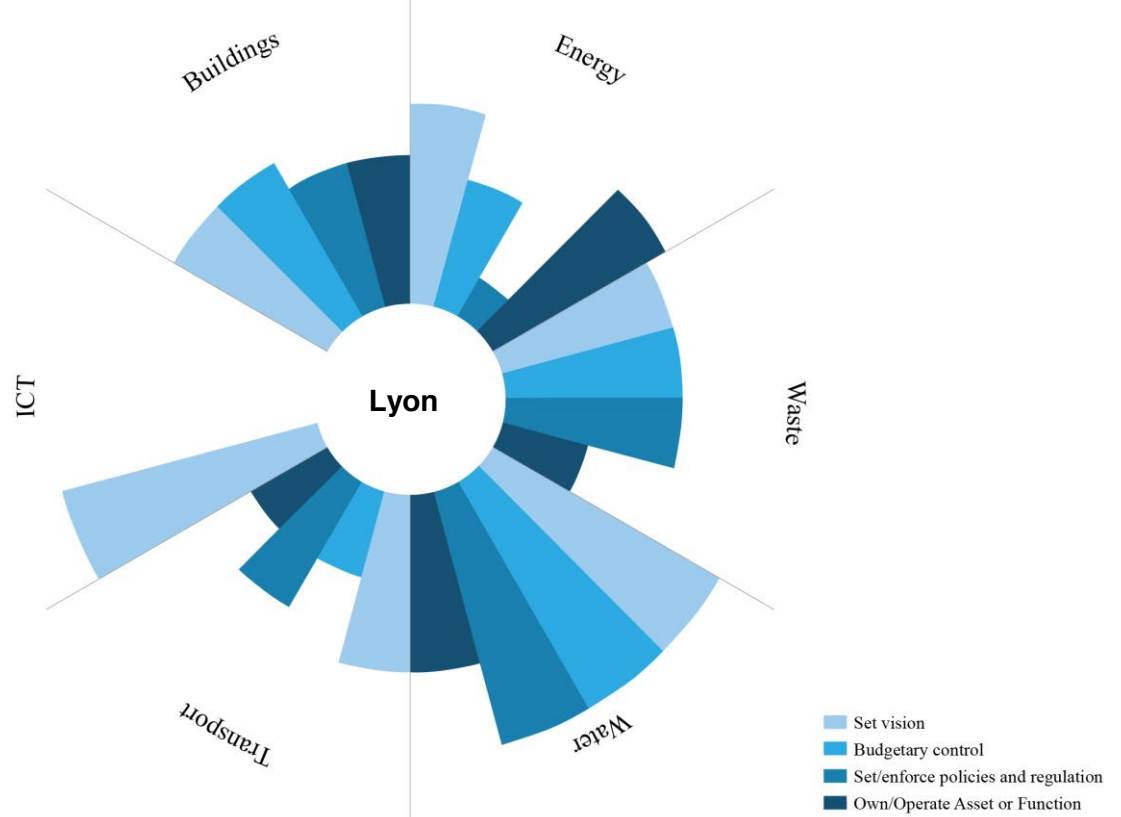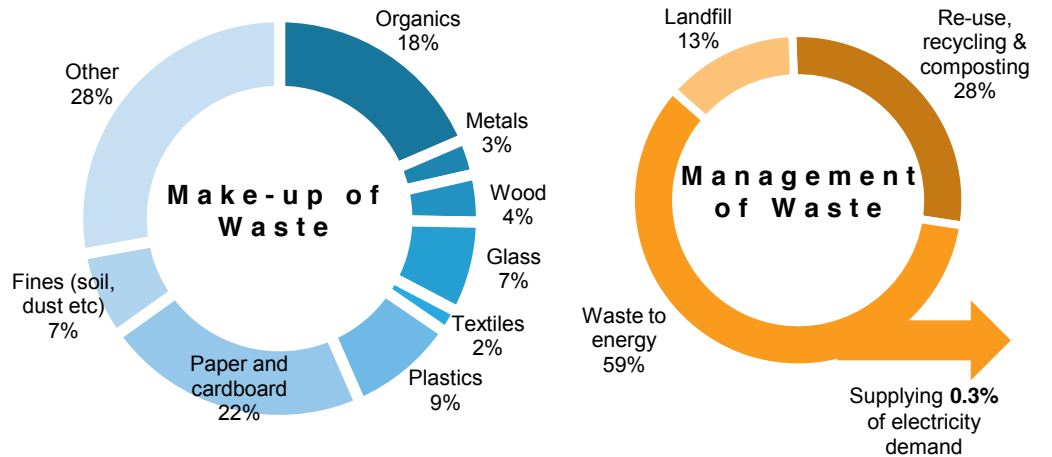
GHG REDUCTION TARGET

Lyon aims to reduce overall GHG emissions by

20%

by 2020

(based on a 2000 baseline)

POWERS

Buildings

Energy

ICT

Lyon

Waste

Transport

Water

- Set vision
- Budgetary control
- Set/enforce policies and regulation
- Own/Operate Asset or Function

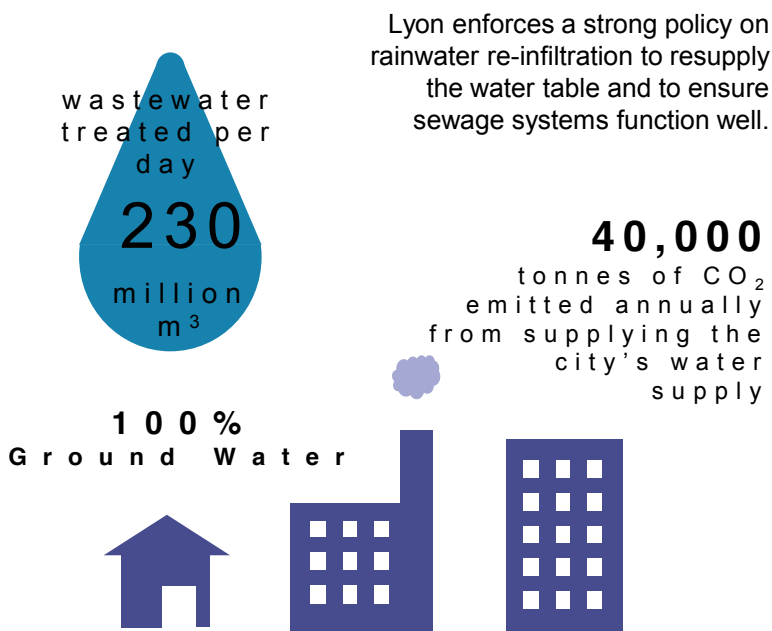## WASTE

Make-up of Waste

Organics 18%

Other 28%

Metals 3%

Wood 4%

Glass 7%

Fines (soil, dust etc) 7%

Textiles 2%

Paper and cardboard 22%

Plastics 9%

Management of Waste

Landfill 13%

Re-use, recycling & composting 28%

Waste to energy 59%

Supplying **0.3%** of electricity demand

WATER

wastewater treated per day

230

million m³

Lyon enforces a strong policy on rainwater re-infiltration to resupply the water table and to ensure sewage systems function well.

40,000

tonnes of CO_2 emitted annually from supplying the city's water supply

100% Ground Water

Water metering is mandatory for all domestic, industrial & commercial users

TRANSPORT

9,000

people are subscribed to Lyon's official car share scheme

20%

use it once a week

Modal Split

Other 2%

Cycling 2%

Taxi 2%

Private motorized transport 34%

Walking 40%

Rail/Metro/Tram/ Buses 20%

Intermodal ticketing system

Lyon's Transport Targets

- reduce car use in favour of modes through parking policy and road space sharing
- establishing strong lines of public transport
- improving flow and regularity of major bus routes
- establishing a intermodal transport pass

TRANSFORM TRANSFORMATION AGENDA FOR LOW CARBON CITIES

Vienna, Austria
TRANSFORM CITY 2013

Population: **1,738,589**

Area km²: **414**

GDP €bn: **72.1**

KEY FACTS

Population 1.7 m
10% increase 2002 – 2012

Millions — 1971, 1991 (-7%), 2013 (+13%), 2030 (+8%), 2050 (+6%)
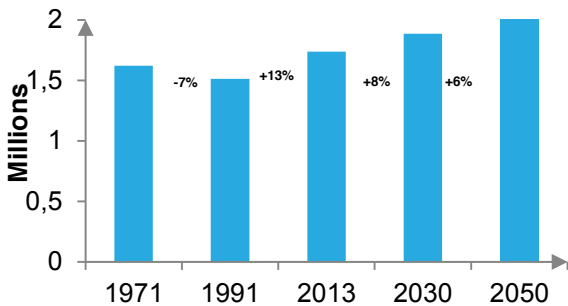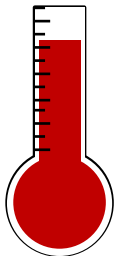
Temperature range
Max 38.3°C *08 Jul '57*

Min -26.3 °C *11 Feb '29*

Climate
673 mm average rainfall per year
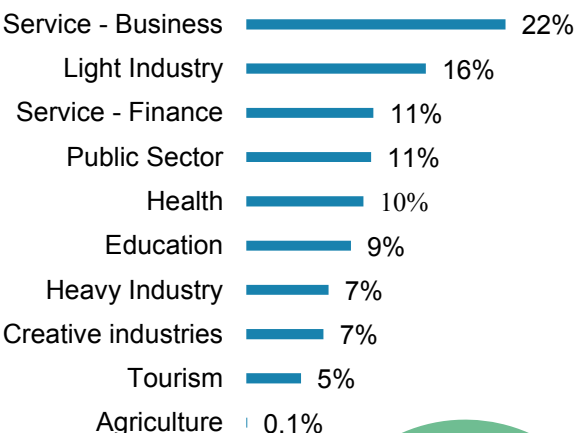
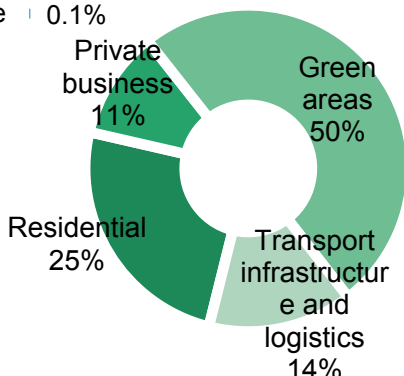11 °C average temperature

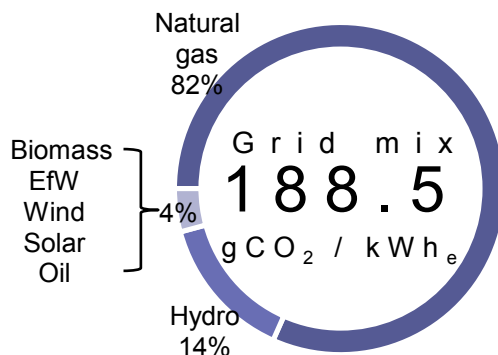### City budget
€ 7,029 per capita

Economy
€ 72 billion GDP

€ 42,600 GDP per capita

Service - Business	22%
Light Industry	16%
Service - Finance	11%
Public Sector	11%
Health	10%
Education	9%
Heavy Industry	7%
Creative industries	7%
Tourism	5%
Agriculture	0.1%

City land use
- Green areas 50%
- Residential 25%
- Transport infrastructure and logistics 14%
- Private business 11%

ENERGY

Grid mix
188.5 gCO₂ / kWhₑ

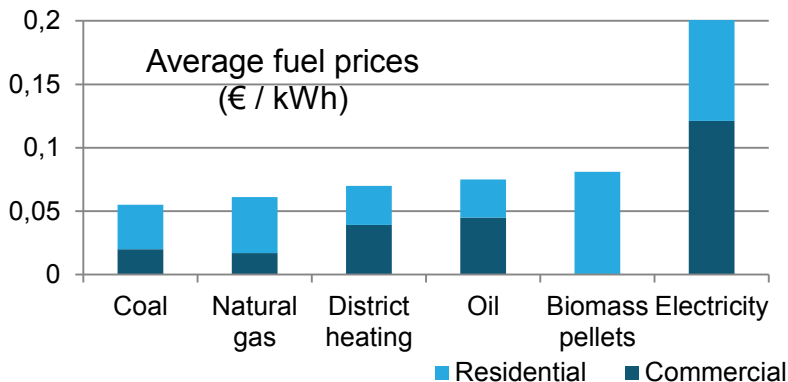- Natural gas 82%
- Hydro 14%
- Biomass, EfW, Wind, Solar, Oil 4%

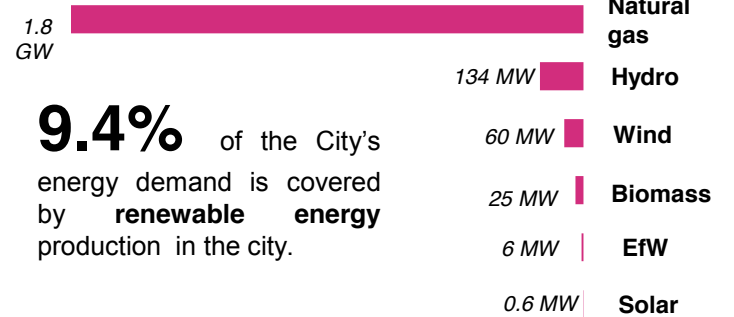### Primary energy consumption of Vienna
46,627 GWh / yr *(2010)*
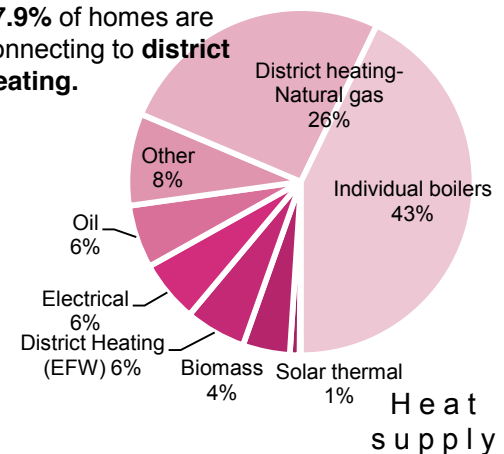
Vienna consumes **8,294 GWh** per year of electricity.

The City benefits from a relatively low carbon electricity supply, with over 90% electricity being supplied by from natural gas or hydro-power.

Generation assets owned by Vienna

1.8 GW	Natural gas
134 MW	Hydro
60 MW	Wind
25 MW	Biomass
6 MW	EfW
0.6 MW	Solar

9.4% of the City's energy demand is covered by **renewable energy** production in the city.

Average fuel prices (€ / kWh)
Coal, Natural gas, District heating, Oil, Biomass pellets, Electricity
- Residential
- Commercial

37.9% of homes are connecting to **district heating.**

Heat supply
- Individual boilers 43%
- District heating - Natural gas 26%
- Other 8%
- Oil 6%
- Electrical 6%
- District Heating (EFW) 6%
- Biomass 4%
- Solar thermal 1%

WATER

The City of Vienna distributes water by a gravity fed system ; using no pumping energy in supplying almost all major areas.

Vienna's water treatment plant in Simmering achieves purification levels of 98 to 99 per cent. By 2020 a sludge treatment plant will be developed which will provide enough renewable energy to power the plant.

wastewater treated per day
0.54 million m³

It is currently mandated that all buildings shall be on a metered water supply.

Combined
Rainwater and wastewater system

75% Residential | **25%** Commercial

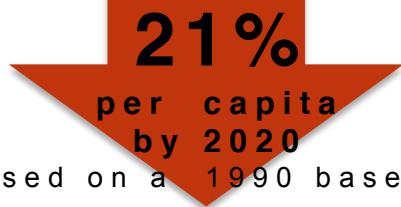**150 litres** Water consumption per capita per day

Total city-wide emissions

9,194,000

metric tonnes of CO$_2$ equivalent (CO$_2$e) per year
2006

188,505

Jobs in sustainability & green energy jobs throughout Austria

GHG REDUCTION TARGET

Vienna aims to reduce overall GHG emissions by

21%

per capita by 2020

(based on a 1990 baseline)

POWERS

Legend:
- Set vision
- Budgetary control
- Set/enforce policies and regulation
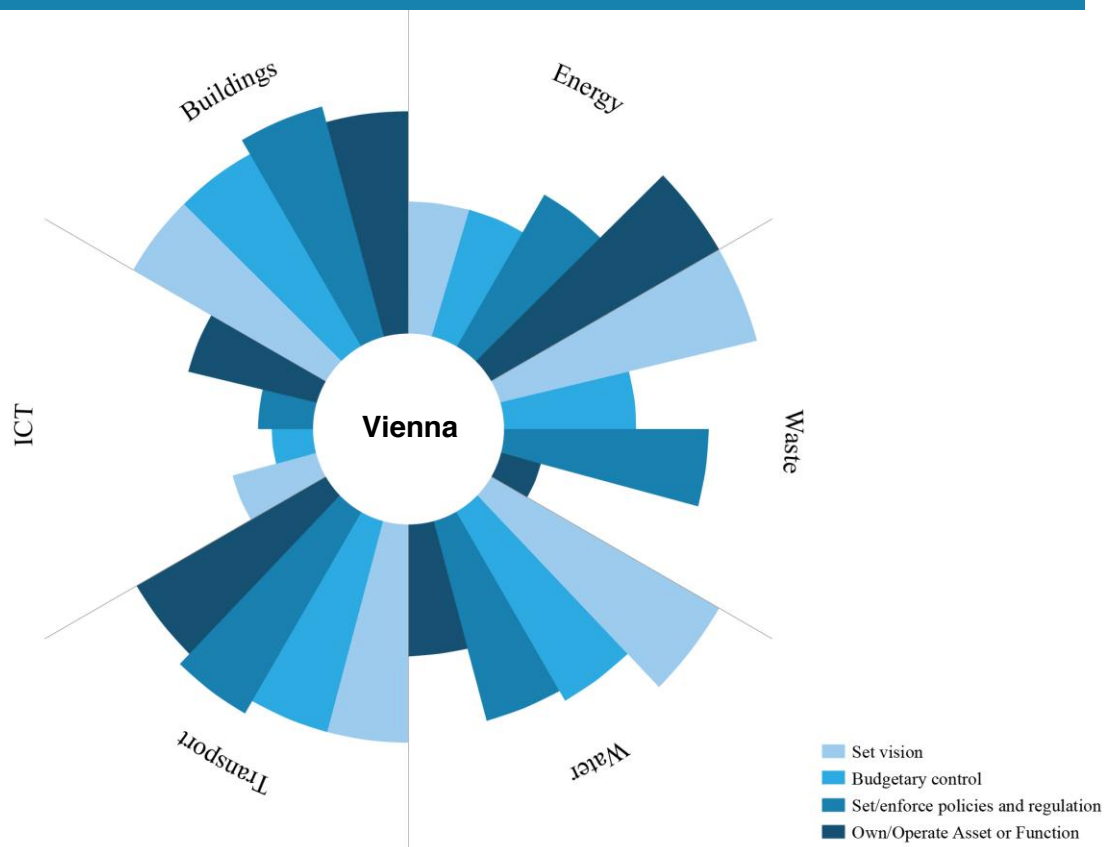- Own/Operate Asset or Function

ICT

The City of Vienna is constantly expanding the ICT services for its citizens. The ICT strategy is based on the business strategy of the City of Vienna. ICT supports in particular the two cornerstones of administrative modernization: **customer focus** and **efficiency**.

2% do not have broadband

84 %

of homes have an internet connection
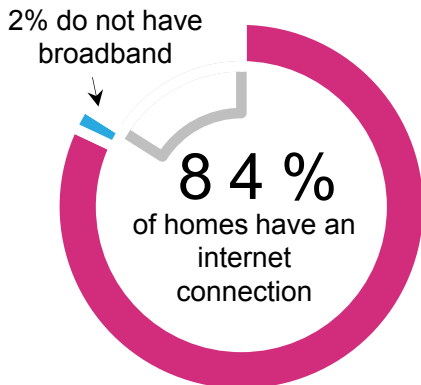
The city also has an intermodal e-ticketing system in place and over 400 wireless hotspots.

99%

of homes to have **super-fast broadband** by 2020

WASTE

Make-up of Waste

- Organics 41%
- Paper and cardboard 18%
- Plastics 10%
- Textiles 3%
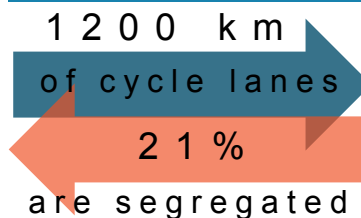- Glass 5%
- Wood 3%
- Metals 3%
- Other 17%

Vienna's waste goals:

- Reducing waste generation
- Increasing re-use
- Treatment and landfilling of waste within the city boundaries
- Increasing the material recycling rate
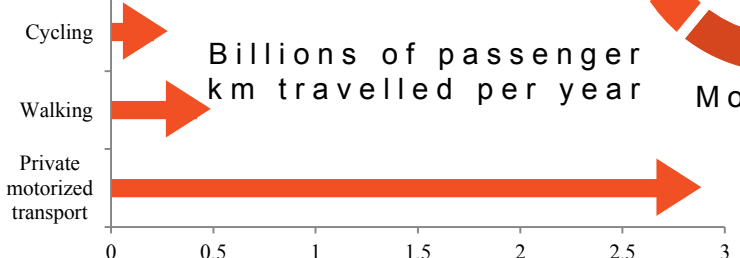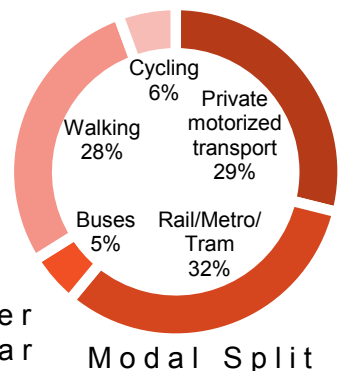- Increasing the efficiency of waste incineration

Management of Waste

- < 1 % of waste to landfill
- Recycling / composting 32%
- Waste to energy 61%
- Other 6%

Supplying **1.2%** of electricity demand

TRANSPORT

1200 km
of cycle lanes

21 %
are segregated

Vienna's 2003 Transport Master Plan is the City of Vienna's strategic transport concept, setting clear transport policy priorities while also leaving room for local, regional and global developments.
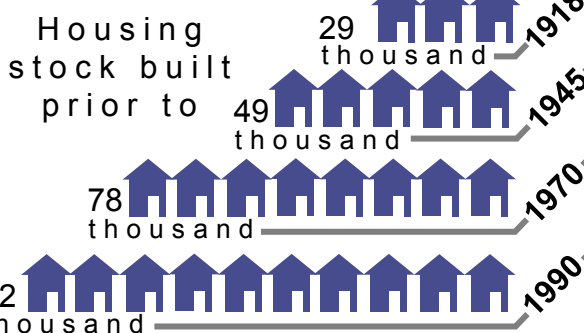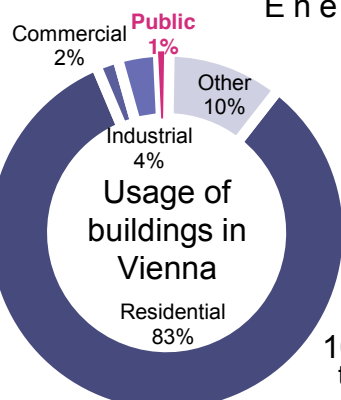
Transport Master Plan was developed within a cooperative consulting process, with the active participation of several departments both within and outside Vienna City Administration. Local citizens were also involved in an involvement and information process.

Billions of passenger km travelled per year

- Cycling
- Walking
- Private motorized transport

(axis: 0, 0,5, 1, 1,5, 2, 2,5, 3)

Modal Split

- Cycling 6%
- Private motorized transport 29%
- Walking 28%
- Rail/Metro/Tram 32%
- Buses 5%

BUILDINGS

Energy use in buildings

- Room heating & Air conditioning 68 %
- Industry 17 %
- Lighting & ICT 8 %
- Motors 7 %

Usage of buildings in Vienna

- Commercial 2%
- Public 1%
- Other 10%
- Industrial 4%
- Residential 83%

Housing stock built prior to

- 1918 — 29 thousand
- 1945 — 49 thousand
- 1970 — 78 thousand
- 1990 — 102 thousand

TRANSFORM TRANSFORMATION AGENDA FOR LOW CARBON CITIES

Blank report

City, Country

Main copy
- Arial font
- 10-14 pt
- Left justified

GRAPHICS

Millions

1 | 0,75 | 0,5 | 0,25 | 0

-20% +13% +8% +4%

1970 1990 2013 2025 2050

500

0
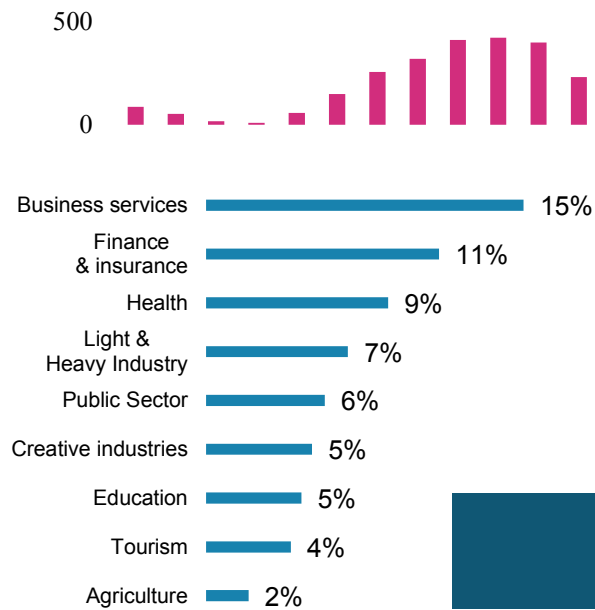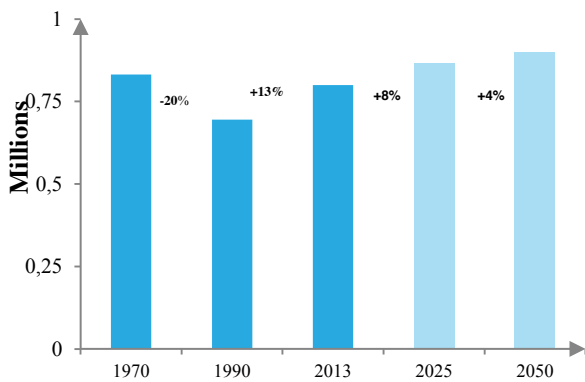
Housing stock built prior to

[VALUE] thousand _date_

Business services — 15%
Finance & insurance — 11%
Health — 9%
Light & Heavy Industry — 7%
Public Sector — 6%
Creative industries — 5%
Education — 5%
Tourism — 4%
Agriculture — 2%

Max

Min

Total city-wide emissions

[V A L U E]

metric tonnes of CO_2 equivalent (CO_2e) per year
[REF YEAR]
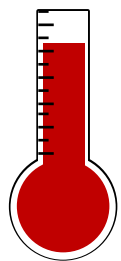
- **Dividing line**
- 2.5pt
- R127 G127 B127

TEXT
- **Headline text**
- 14 pt, Arial capitals
- 3 pt expanded character spacing

- **Headline box**
- 1.2 cm height
- R24 G130 B174

City
- **Banner title**
- 24 pt
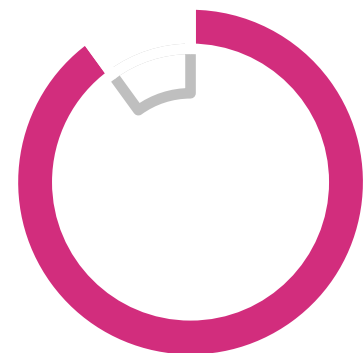- R240 G80 B35

TRANSFORM TRANSFORMATION AGENDA FOR LOW CARBON CITIES

GHG REDUCTION TARGET

[CITY] aims to reduce overall GHG emissions by

[TARGET]%
By [TARGET YEAR]

(based on a [YEAR] baseline)

DOUGHNUT DIAGRAMS

Re-use, recycling & composting 35%

Waste to energy 65%

Supplying **5%** of electricity demand

- 3 pt white border

Solar, 12 GWh

Hydro, 500 GWh

Other, 86 GWh

Biomass, 164 GWh

Wind, 82 GWh

POWERS

Buildings   Energy

ICT   City   Waste

Transport   Water

- Set vision
- Budgetary control
- Set/enforce policies and regulation
- Own/Operate Asset or Function
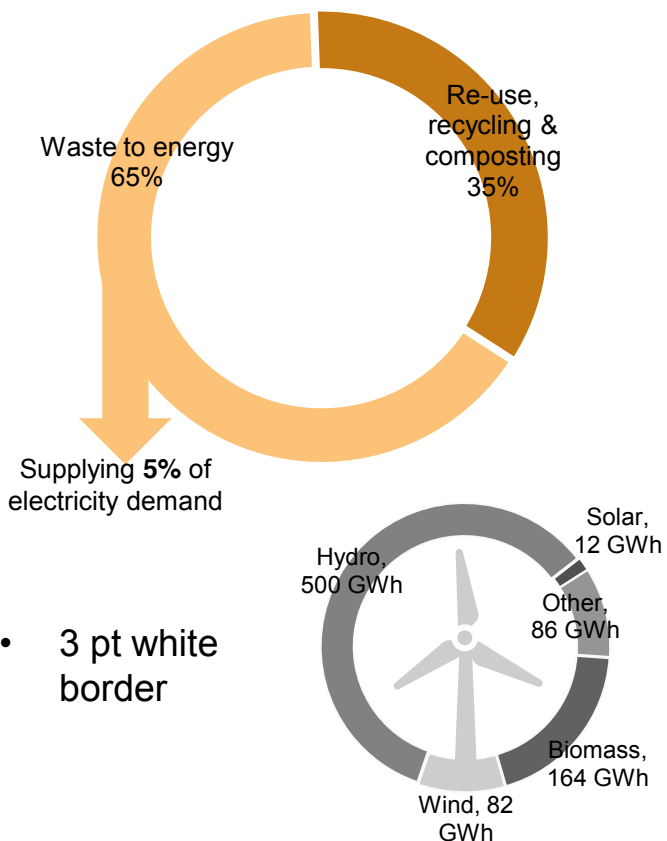
- Graphic created using Adobe illustrator
- Responses were averages across each sector
  (i.e. average of responses for 'city roads', buses' and 'rail' gives a score for 'transport')
- Each sector has four types of influence:
  - set vision;
  - own/operate asset or function;
  - set/enforce policy/regulation; and
  - budgetary control.

FUEL PRICE DIAGRAMS

Average fuel prices (€ / kWh)

Electricity

Heat from district heating

- Residential
- Commercial

Rail/ Metro/...

Buses

Private motorized...

0   0,5   1   1,5   2   2,5

Billions of passenger km travelled per year

Combined

Rainwater and wastewater system

[VALUE]km

of cycle lanes

[Value]%

are segregated

Intermodal ticketing system

TRANSFORM TRANSFORMATION AGENDA FOR LOW CARBON CITIES