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How to build greener cities?

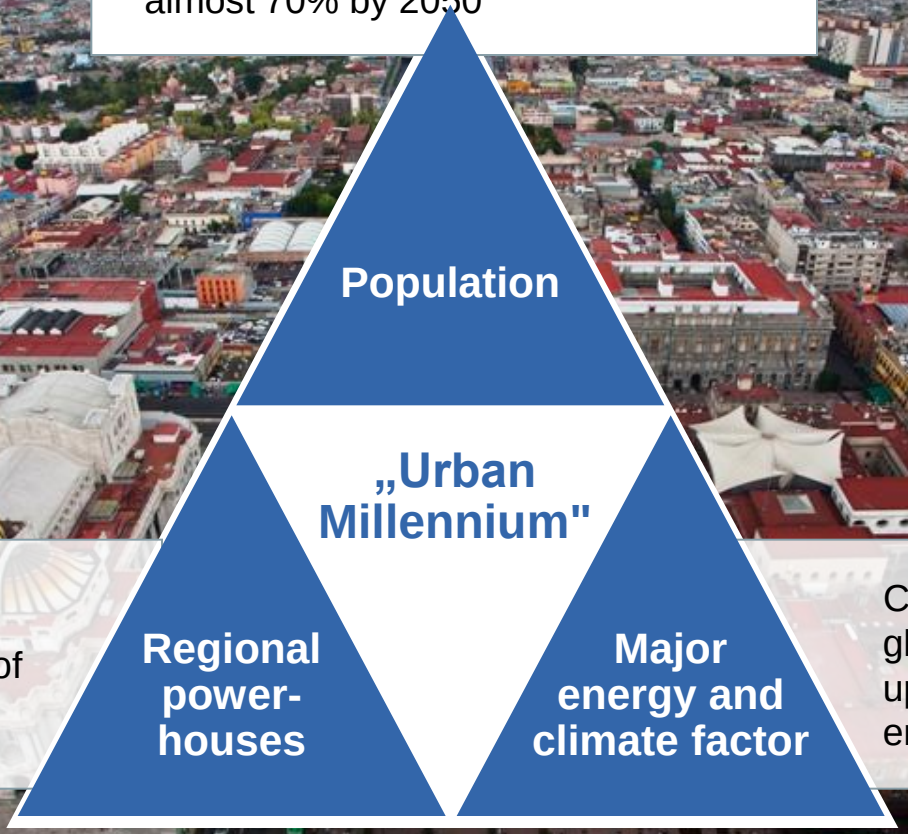
Stefan Denig

Global Cities Center of Competence

Rio+20

Why cities matter

- In 2009 more than half the world‘s population lived in urban areas
- This figure is expected to climb to almost 70% by 2050



600 urban centers generate about 50% of global GDP

Cities account for 67% of global energy demand and up to 70% of worldwide GHG emissions

Over the past few years, Siemens has conducted various studies on the topic of urban sustainability

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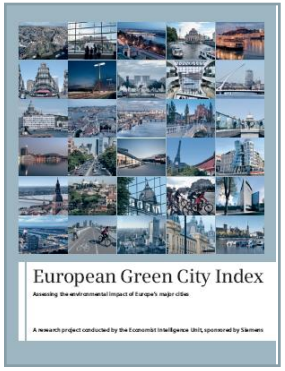
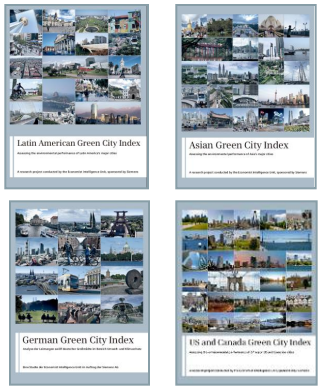
Megacities

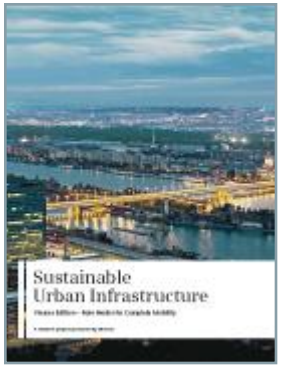
London

Munich

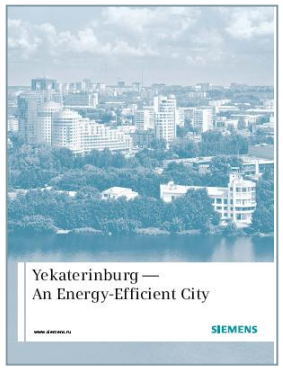




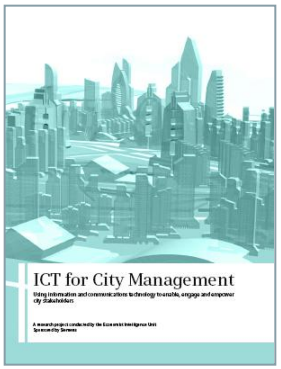
Green City Index series



Vienna

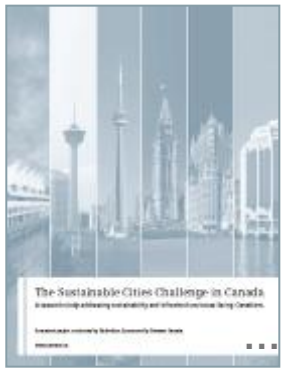


Yekaterinburg



ICT

Trondheim



Canada

The Green City Index: More than 120 cities evaluated cities around the world

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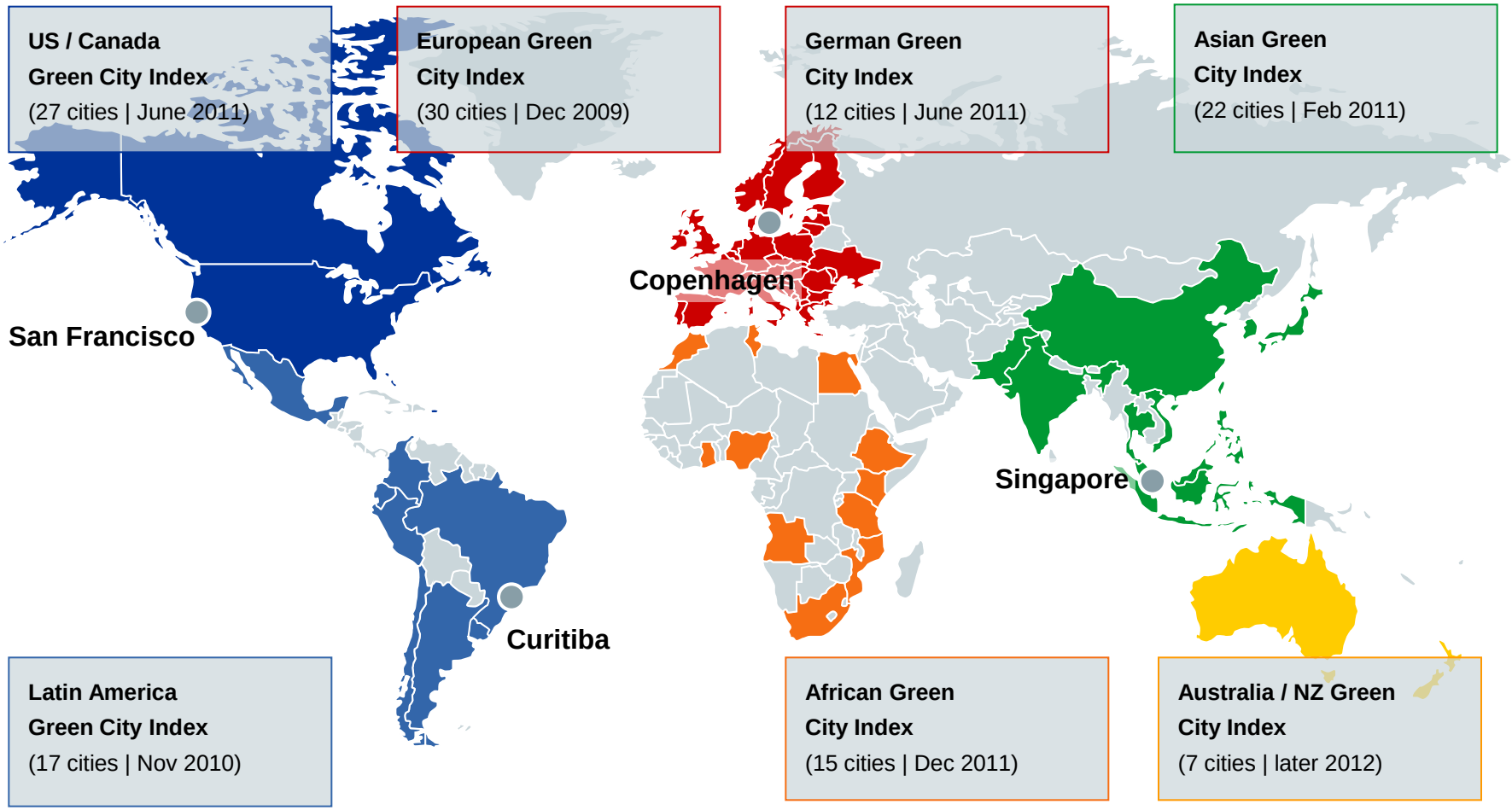

How sustainable are cities worldwide?
The Green City Index series provides answers…

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Objective

- Comparison of **major cities in Europe, Asia/Pacific, Africa, and the Americas** in terms of their environmental performance and policies
- Aid understanding for **strengths and weaknesses** of each city and their performance against peers
- Forster **best practice sharing**

How this is achieved?

- **Independently researched** project by the EIU
- **Transparent methodology,** developed in consultation with international urban sustainability experts from leading city networks, UN, World Bank, etc.
- Set of quantitative and qualitative indicators in **various environmental categories**
- **Unique scope** of research project

Economist Intelligence Unit | The Economist

- Independent research and advisory firm with more than 40 offices worldwide
- Well known for their country analysis on more than 200 markets
- High reputation for its research and indices

Exemplary methodology from the US and Canada Green City Index

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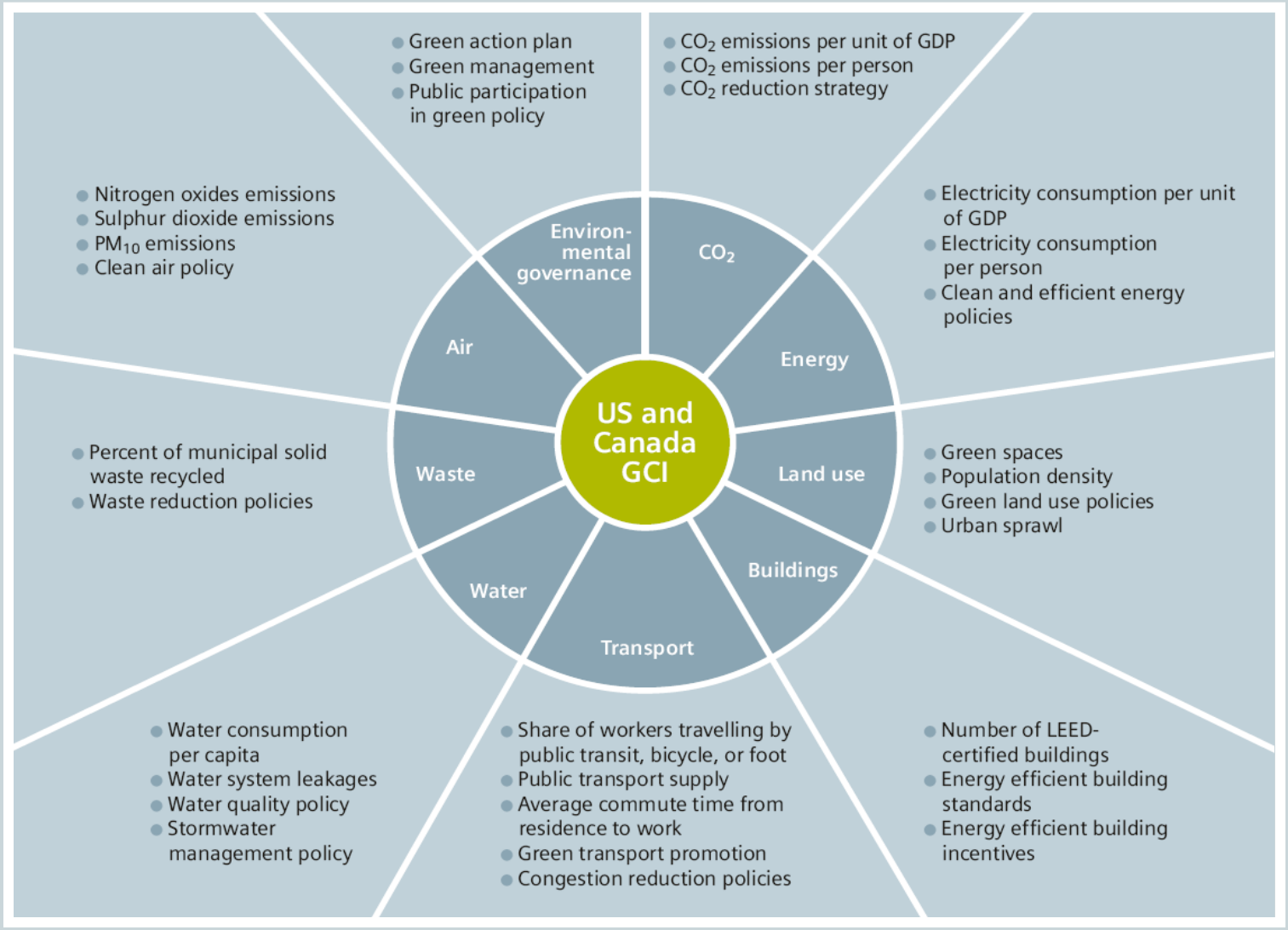
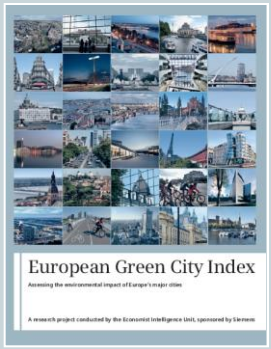
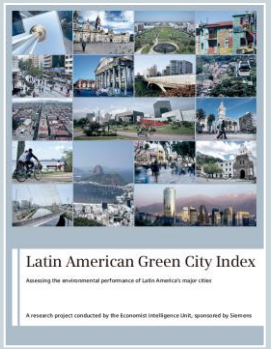
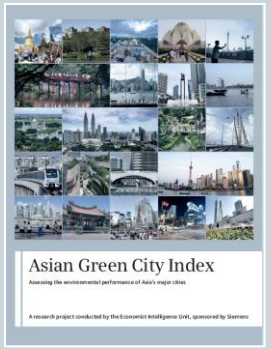
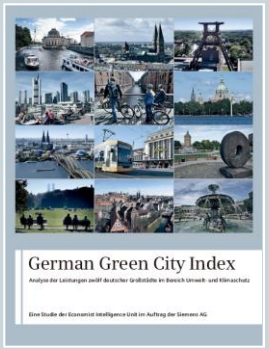


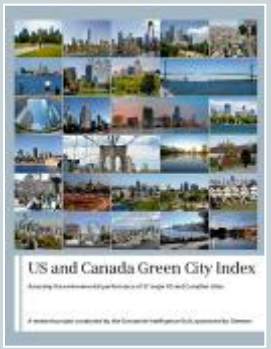
Highlights from the Green City Index research series

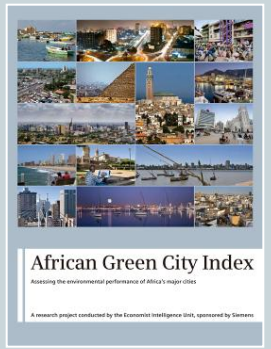












The first study:
The European Green City Index (2009)

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Overall

	City	Score
1	Copenhagen	87,31
2	Stockholm	86,65
3	Oslo	83,98
4	Vienna	83,34
5	Amsterdam	83,03
6	Zurich	82,31
7	Helsinki	79,29
8	Berlin	79,01
9	Brussels	78,01
10	Paris	73,21
11	London	71,56
12	Madrid	67,08
13	Vilnius	62,77
14	Rome	62,58
15	Riga	59,57
16	Warsaw	59,04
17	Budapest	57,55
18	Lisbon	57,25
19	Ljubljana	56,39
20	Bratislava	56,09
21	Dublin	53,98
22	Athens	53,09
23	Tallinn	52,98
24	Prague	49,78
25	Istanbul	45,20
26	Zagreb	42,36
27	Belgrade	40,03
28	Bucharest	39,14
29	Sofia	36,85
30	Kiev	32,33

Examines **30 major European cities** from 30 countries

- West European cities dominate the top half of the Index, due in part to their longer history of environmental awareness
- Strong positive correlation between wealth and environmental performance
- **Copenhagen** leads through its all-round performance across all categories
  - The city's climate change plan sets the ambitious goal to become carbon-neutral by 2025
  - Is aiming to become the "world's best cycle city", with a target of 50% of commuters using cycling by 2015

The Latin American Green City Index (2010)

well below average	below average	average	above average	well above average
Guadalajara Lima	Buenos Aires Montevideo	Medellín Mexico City Monterrey Porto Alegre Puebla Quito Santiago	Belo Horizonte Bogotá Brasília Rio de Janeiro São Paulo	Curitiba

Compares **17 major cities** from 8 countries

- Holistic infrastructure planning is the key to tackling environmental challenges
- Brazilian cities perform very well overall because of their strong environmental policies
- **Curitiba** has a strong track record of a holistic approach
  - Since the 1980s the urban plan has addressed issues such as green areas, waste recycling, and sanitation
  - Concern about environmental issues has become a part of citizens' identities

The Asian Green City Index (2011)

well below average	below average	average	above average	well above average
Karachi	Bengaluru Hanoi Kolkata Manila Mumbai	Bangkok Beijing Delhi Guangzhou Jakarta Kuala Lumpur Nanjing Shanghai Wuhan	Hong Kong Osaka Seoul Taipei Tokyo Yokohama	Singapore

Compares **22 major cities** in Asia

- Huge differences in the development status and performance of Index cities
- Japanese cities demonstrate a strong performance and rank above average overall
- Chinese cities are strong on policy and invest heavily to improve air quality, landscaping and transport
- **Singapore** has consistently strong results across all individual categories
  - Self-government and effective policy implementation, and integrated master planning, are also important contributing factors

Asian Green City Index:
Tipping point in ressource consumption

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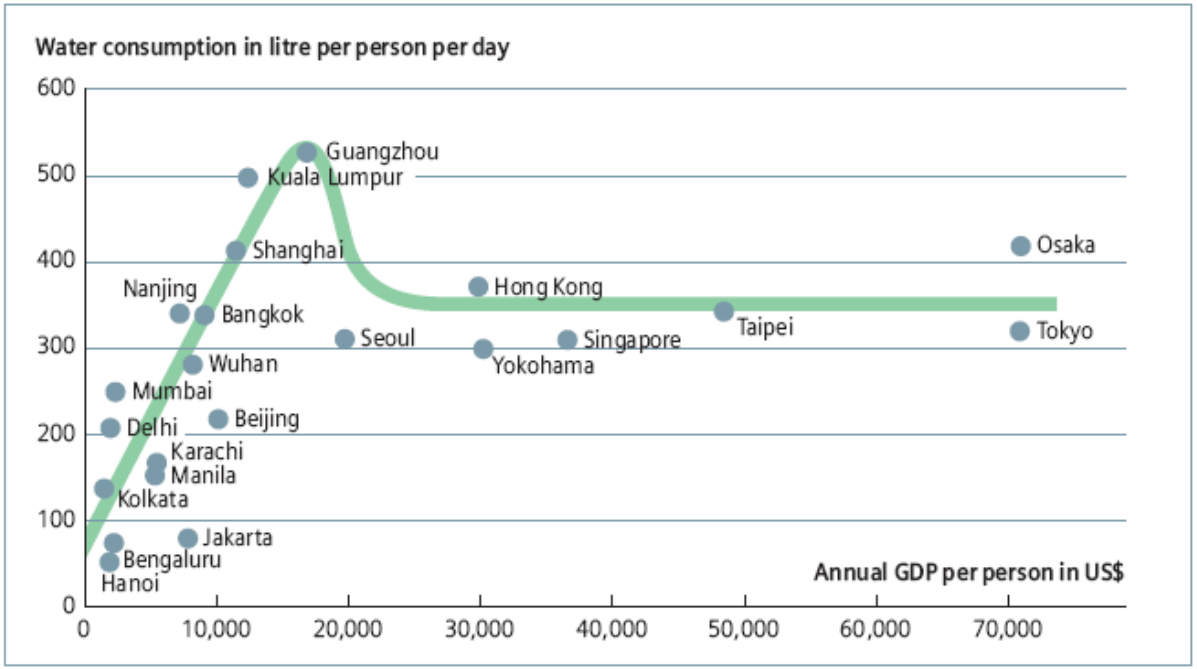
- Up to certain level of income there is a steady rise in resource consumption along with per capita GDP
- However, when income rises above a certain point (at around US$20,000 per person) average consumption declines again



→ ***Example Water:*** *Average water consumption stabilizes among the richest cities*

The US and Canada Green City Index (2011)

Overall

	City	Score
1	San Francisco	83.8
2	Vancouver	81.3
3	New York City	79.2
4	Seattle	79.1
5	Denver	73.5
6	Boston	72.6
7	Los Angeles	72.5
8	Washington DC	71.4
9	Toronto	68.4
10	Minneapolis	67.7
11	Chicago	66.9
12	Ottawa	66.8
13	Philadelphia	66.7
14	Calgary	64.8
15	Sacramento	63.7
16	Houston	62.6
17	Dallas	62.3
18	Orlando	61.1
19	Montreal	59.8
20	Charlotte	59.0
21	Atlanta	57.8
22	Miami	57.3
23	Pittsburgh	56.6
24	Phoenix	55.4
25	Cleveland	39.7
26	St Louis	35.1
27	Detroit	28.4

Compares **27 major US and Canadian cities**

- US and Canadian cities excel worldwide in the areas of water infrastructure, recycling and environmental governance
- Challenges: greenhouse gas emissions and urban sprawl
- **San Francisco** scores best in the Index:
  - Highest recycling rate
  - 2nd longest public transport network
  - Leader in partnering with the private sector on innovative green initiatives

The African Green City Index (2011)

well below average	below average	average	above average	well above average
Dar es Salaam	Luanda	Addis Ababa	Accra	
Maputo	Nairobi	Alexandria	Cape Town	
		Cairo	Casablanca	
		Lagos	Durban	
		Pretoria	Johannesburg	
			Tunis	

Compares **15 major cities** in Africa

- No city performs well above average - all cities face tough challenges
- **North African** cities do nearly as well as **South African** ones in overall performance
- None of the **sub-Saharan** cities (excluding South Africa) except Accra finished better than “average”
- Where fewer people live in informal settlements, the city performs better

Less wealthy cities can outperform their peers with the right policy – prime examples

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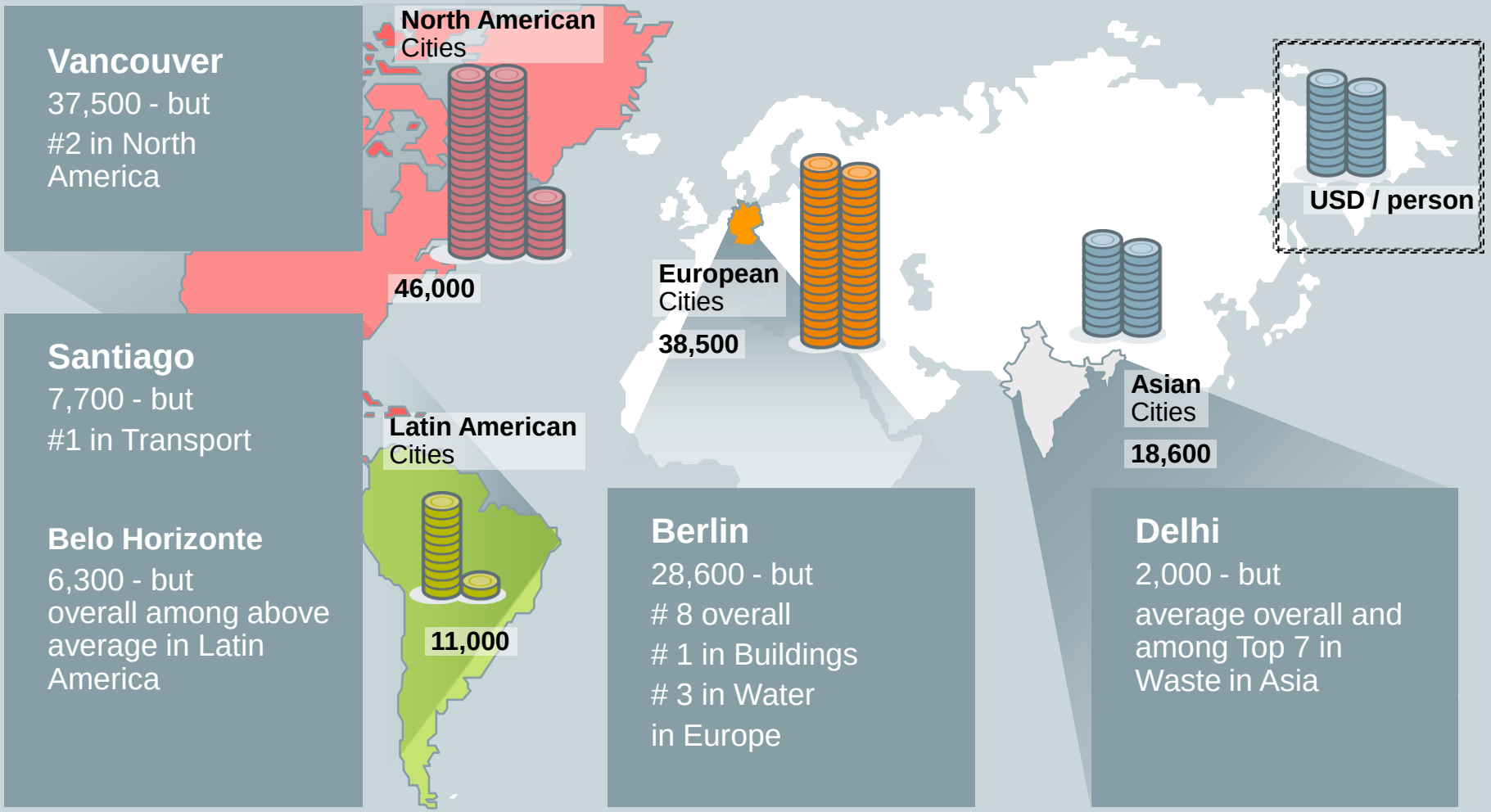
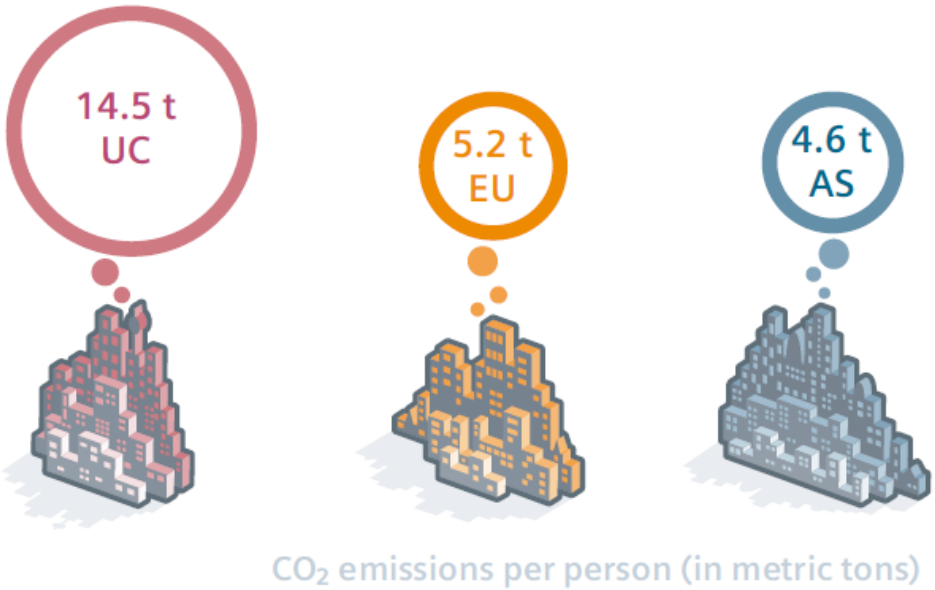


Selected comparisons: CO_2 emissions

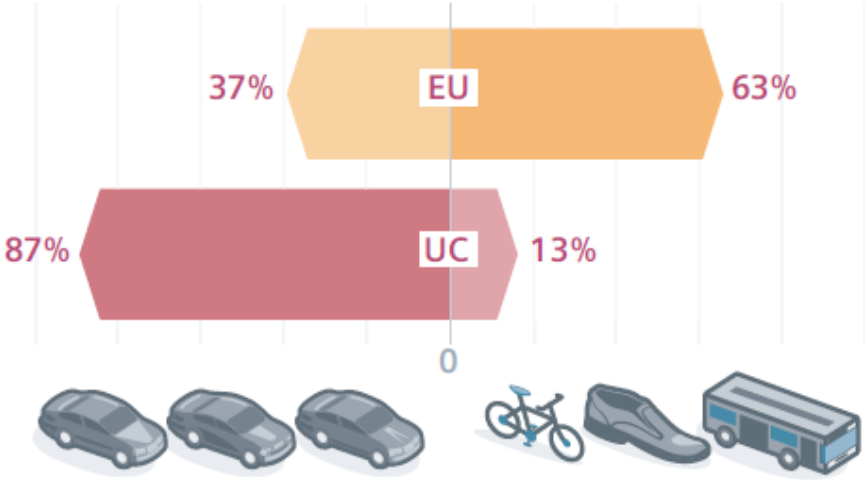


CO_2 emissions per person (in metric tons)

CO_2 Emissions

The US & Canada Index cities have higher per capita CO_2 emissions than Europe and Asia combined.

Selected comparisons: Transport

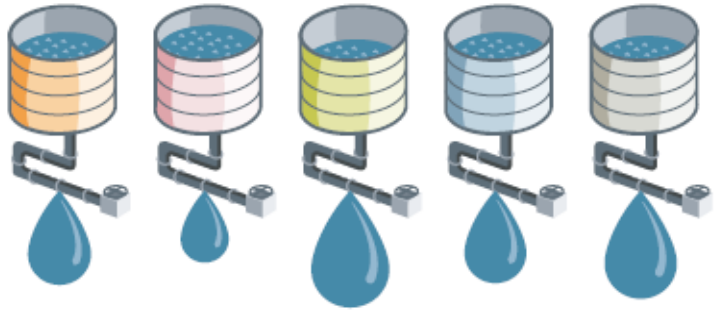


Share of workers traveling by car vs by public transport/bicycle/foot in %

Modal Split

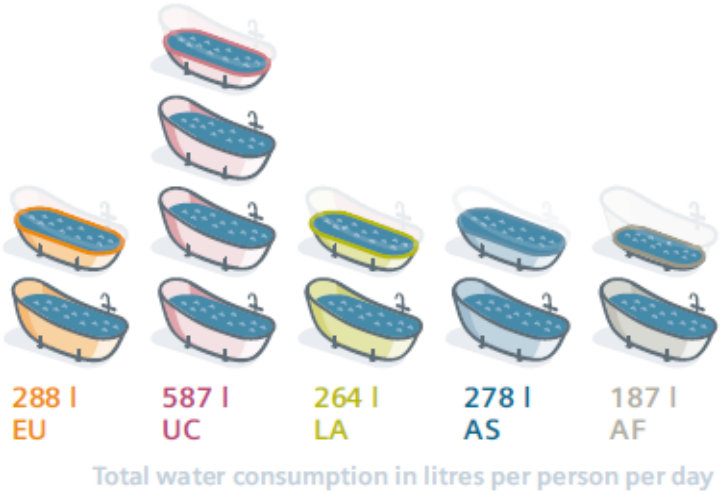
Far more US & Canada Index city residents travel to work by car than in European Index cities.

Selected comparisons: Water



Water System Leakage

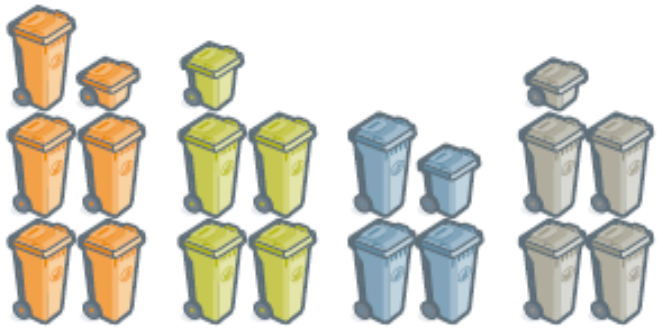
Latin American Index cities lose the most water across the five regions. US & Canada cities lead the rest on this metric.



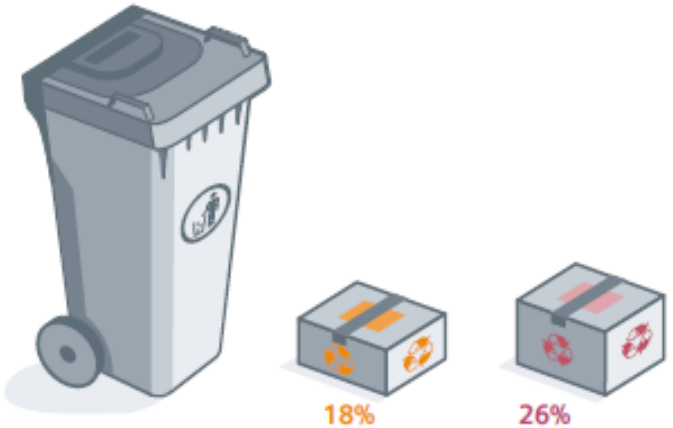
Water Consumption

The US & Canada Index cities consume by far the most water among the five regions.

Selected comparisons: Waste



Annual waste generated per capita in kg



Share of waste recycled in %

Waste Production

European Index cities produce the most waste per capita, followed closely by Latin American and African cities.

Recycling Rates

On average, US & Canada Index Index cities outperform European Index cities when it comes to recycling.

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Our experience: how cities can be successful

A holistic approach

- Strong mayors with overall strategy and long-term planning
- Eliminate silo thinking
- Civic engagement
- Benchmarking & learning from each other

Wealth is important – but at the early stages of development the right policies matter more

The right technology and technology partnerships – Long term planning and relations

Financing

- Cost-efficient solutions with reasonable payback times are available
- Increase income while reducing emissions

Sustainable city development creates jobs & increases competitiveness

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Green House Gas Abatement
Case study: London

The biggest contribution to London's abatement potential comes from buildings

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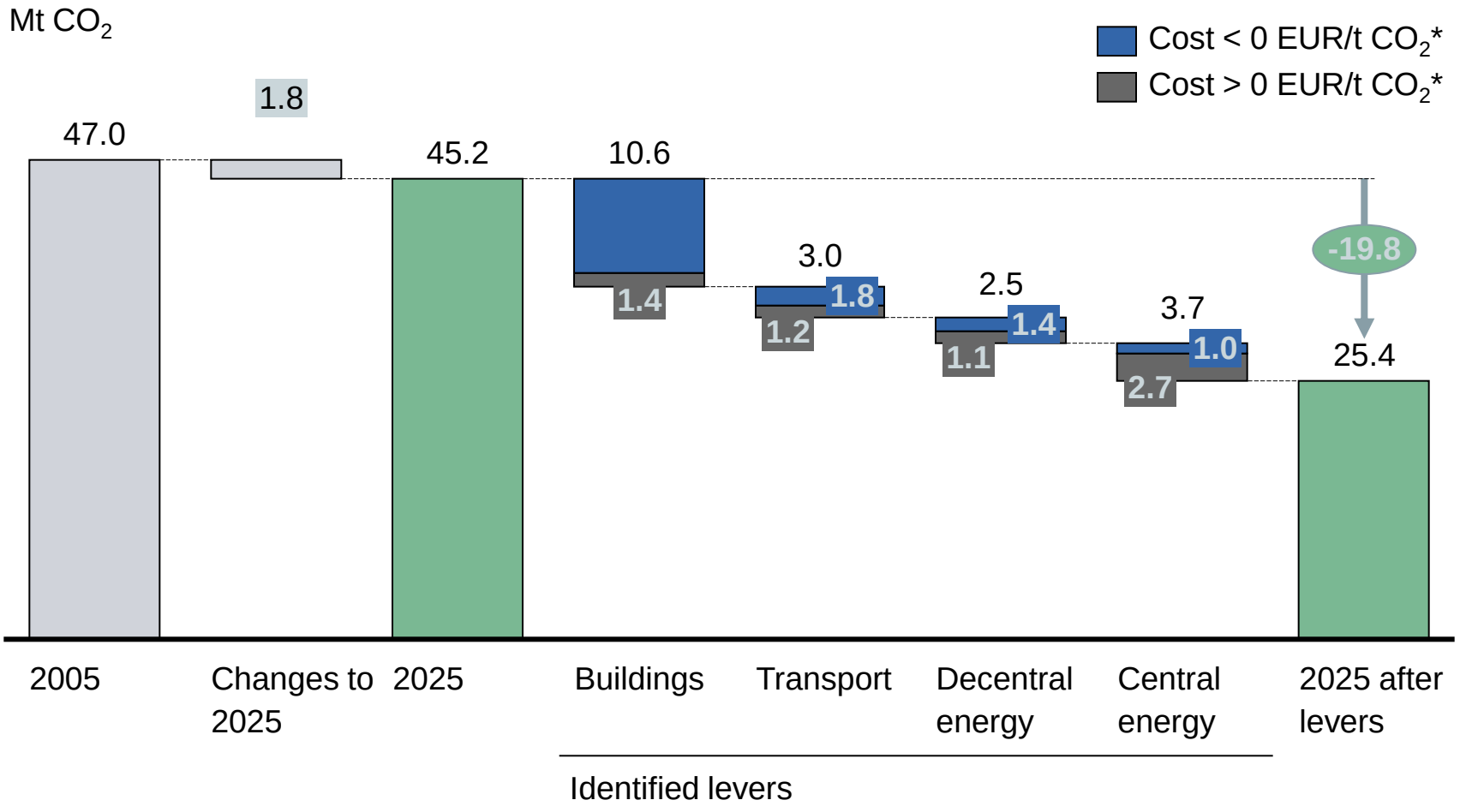

The majority of technologies pay back the required up-front investment through energy savings

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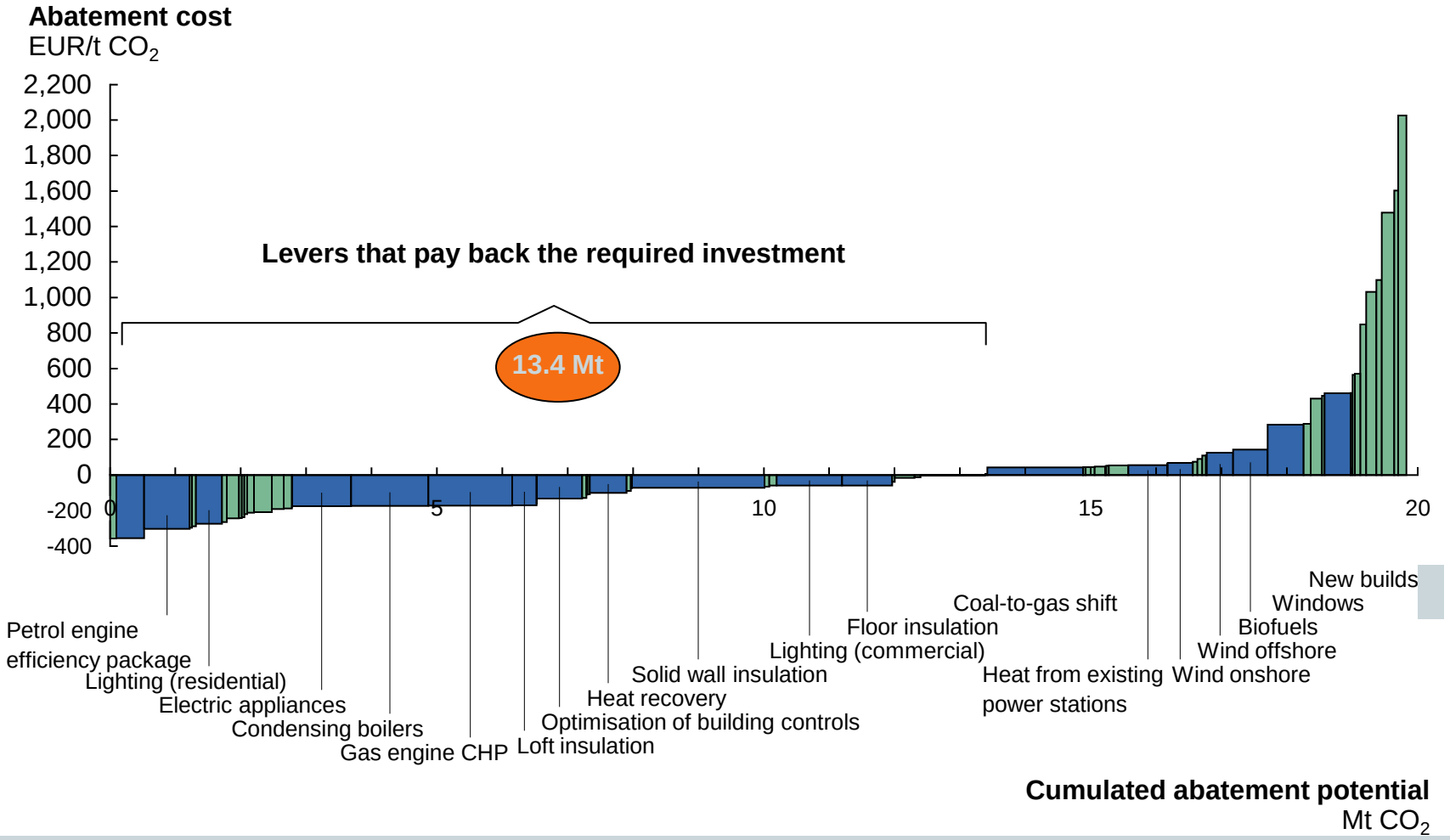
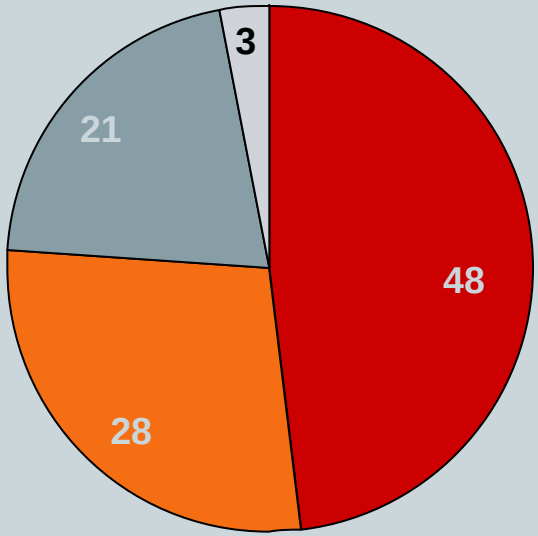
Greenhouse gas abatement cost curve for London 2025 (decision maker perspective)

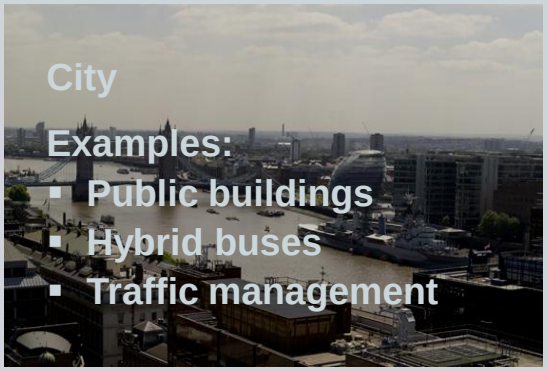


Around 75% of abatement potential lies in the hands of individuals or businesses who make technological choices

Total: 19.8 Mt CO_2



In %



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Technological solutions are available

Solution:
Energy generation & transmission - Efficiency can be greatly increased

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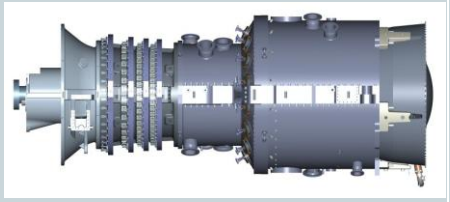
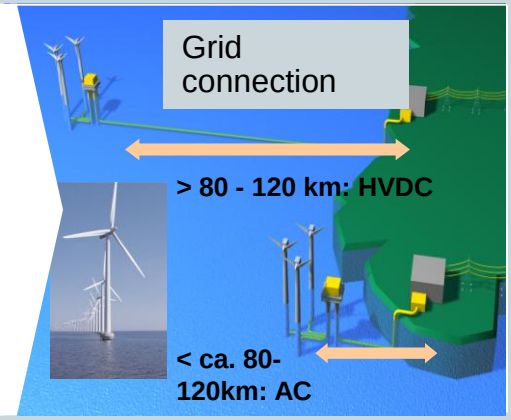
World‘s largest and most efficient gas turbine

- World’s most efficient gas turbine currently being installed in Irsching, Germany
- Combined-cycle power plant with this gas turbine will have an efficiency of over 60% – world record
- In comparison with a coal-fired power plant (average efficiency 38%), it saves 2.8 million tons of CO_2 per year



Efficient long-distance power transmission crucial in the future

- HVDC technology offers low energy losses in long distance power transmission, e.g. from offshore wind parks
- Opens up large renewable power potential worldwide
- As of 2010, a 5000 MW link in China will deliver electricity generated by eco-friendly hydropower over 1,400 km to Guangzhou



Solution:
Energy consumption – Huge potential for energy savings

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Transport: New trains use 30% less energy than Oslo's current trains

- Less energy needed by feeding braking energy back into power grid and by using mostly aluminum for the lightweight body design
- Comprehensive disposal concept: 95% of each train can be utilized (85% through recycling, 10% through burning)
- Over their entire lifecycle the trains burden the environment with just 2.6 grams of CO_2 per kilometer traveled and per ton of vehicle weight – a very low value for metros

Industrial motors: the most underestimated energy saving lever

- Motors account for 65-70% of total industrial energy consumption
- By using energy-saving motors, frequency convertors and optimizing overall systems, energy consumption can be reduced by 10-50% per unit
- Investment pays for itself in less than two years
- Worldwide, 600 mn tons of CO_2 can be saved per year

Solution:
Energy consumption – Huge potential for energy savings

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Buildings: Performance contracting models pay for them self

• New intelligent buildings systems help reduce energy costs and CO2 emissions by 20-30%

• The capital expenditure required to optimize the energy consumption is directly financed by the cost savings achieved

• Siemens has equipped a total of 6,500 buildings around the world, realizing guaranteed savings of more than one billion EUR and reducing CO2 emissions by •about 2.4 million tons

Lighting: Energy saving lamps use 80% less energy

• Lighting accounts for 19% of power demand worldwide

• Life of energy saving bulbs is up to 15 times longer than life of conventional bulbs; LED's life is up to 50 times longer

• Switching to energy-saving lamps and LED's could reduce annual CO2 emissions by 450 mn tons worldwide

THE Crystal

A Sustainable Cities Initiative by

SIEMENS

Urban Sustainability Centre to open in summer 2012

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The Building is Walking the Talk

The Crystal will demonstrate excellence in sustainable construction through the intelligent integration of building structure, fabric and services as a series of coordinated active systems working together.


Natural daylight


Exposed thermal mass


Self shading


Passive solar design


Recycled steel


High-performance glazing


Industrial by-product cement


Rainwater harvesting


Water-efficient appliances


Solar water heating


Sustainable drainage strategy


Photovoltaics


Water-efficient landscaping


Ground-source heating

These systems will be optimised using an advanced Building Management System


Building Management System

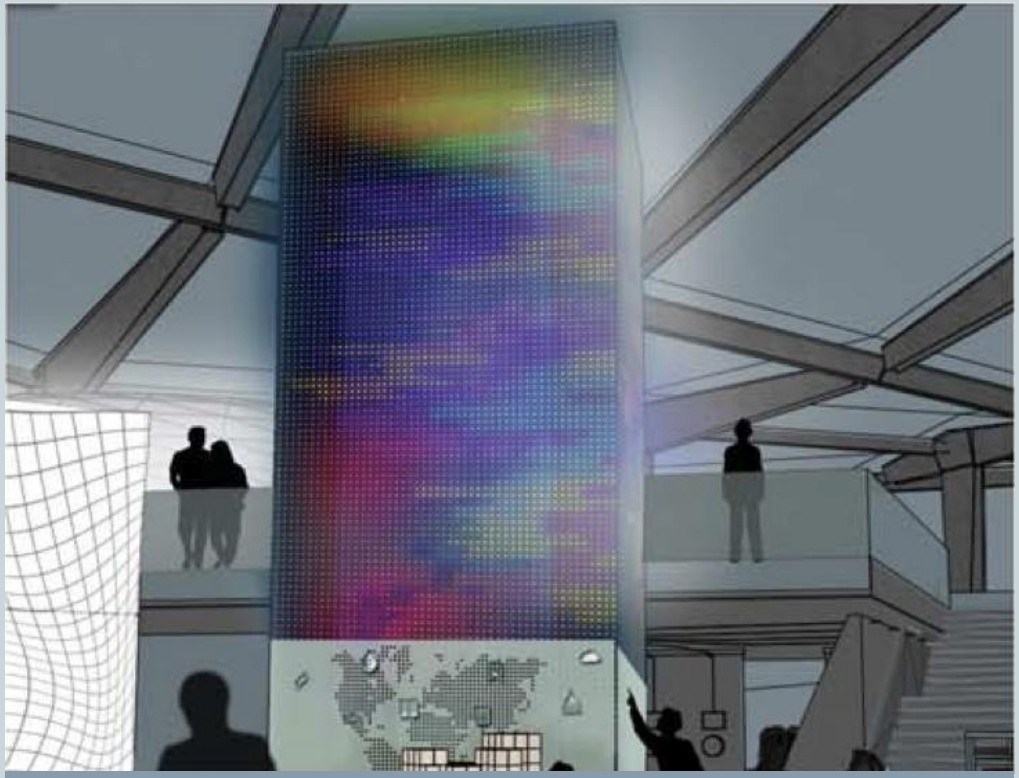

Metering


Energy-efficient lighting


Green screen


Education

Exhibition zones follow urban sustainability topics



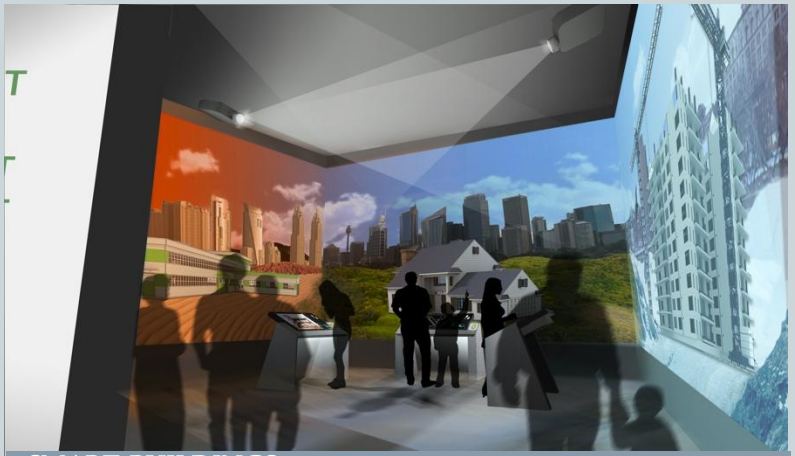
CREATING CITIES

SAFE & SOUND

WATER IS LIFE

Exhibition zones follow urban sustainability topics

KEEP MOVING



SMART BUILDINGS

HEALTHY LIFE

Exhibition zones follow urban sustainability topics

GO ELECTRIC

CLEAN & GREEN

LIGHTING

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Back up

Interesting comparisons between the different Green City Indexes

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	Africa	Europe	Asia	Latin America	US and Canada
CO_2 emissions from electricity consumption (per capita)	984 kg	-	-	202 kg	-
Electricity consumption (per person)	6.4 GJ	-	-	-	52.2 GJ
Population density (people / km²)	4,600	3,900	8,200	4,500	3,000
Green spaces per person	74 m²	-	39 m²	255 m²	-
Water consumption (per capita and day)	187 liters	288 liters	278 liters	264 liters	590 liters
Water leakages	30%	23%	22%	35%	13%
Waste (per capita and year)	408 kg	510 kg	380 kg	465 kg	-
Superior public transport network	0.07 km/km²	-	0.2 km/km²	0.1 km/km²	-