

Sustainable Cities

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Sustainable Cities

- Half of humanity – 3.5 billion people – live in cities today.
- By 2030, almost 60 per cent of the world's population will live in urban areas.
- 95 per cent of urban expansion in the next decades will take place in developing world.
- 828 million people live in slums today and the number keeps rising.
- The world's cities occupy just 2 per cent of the Earth's land, but account for 60-80 per cent of energy consumption and 75 per cent of carbon emissions.
- Rapid urbanization is exerting pressure on fresh water supplies, sewage, the living environment, and public health.

Percentage urban and location of urban agglomerations with at least 500,000 inhabitants, 2014

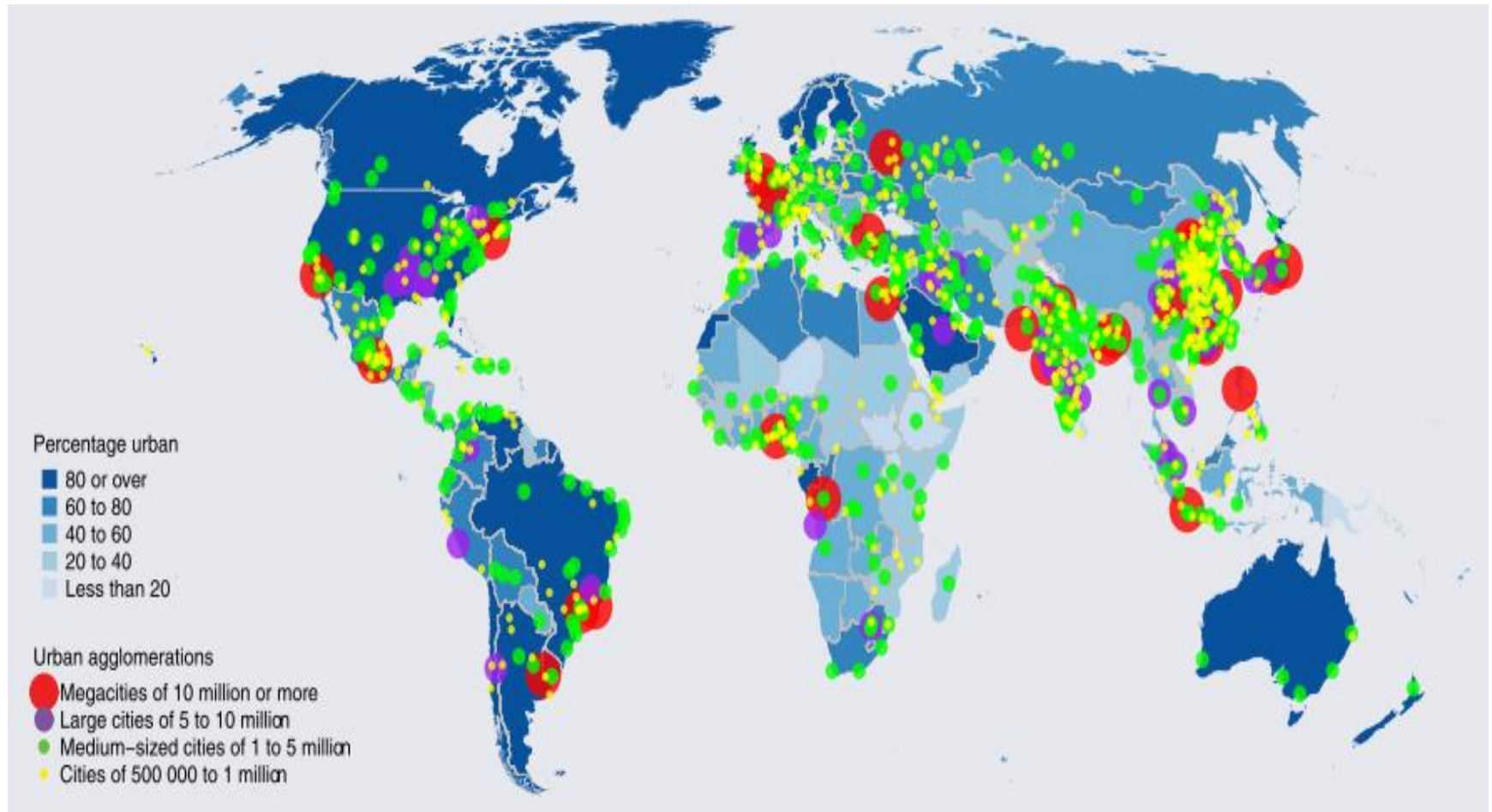


Figure 8.

Global urban population growth is propelled by the growth of cities of all sizes

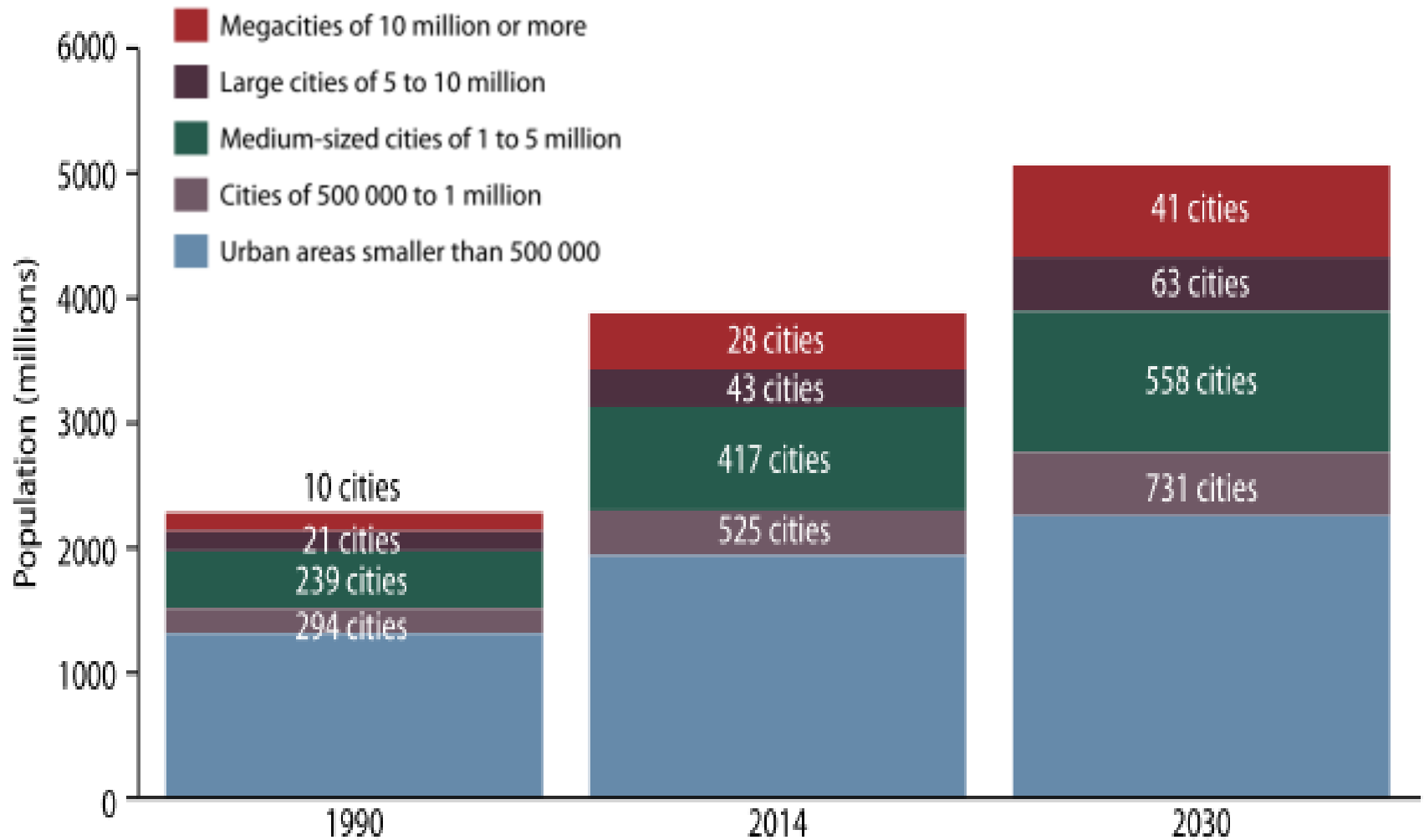
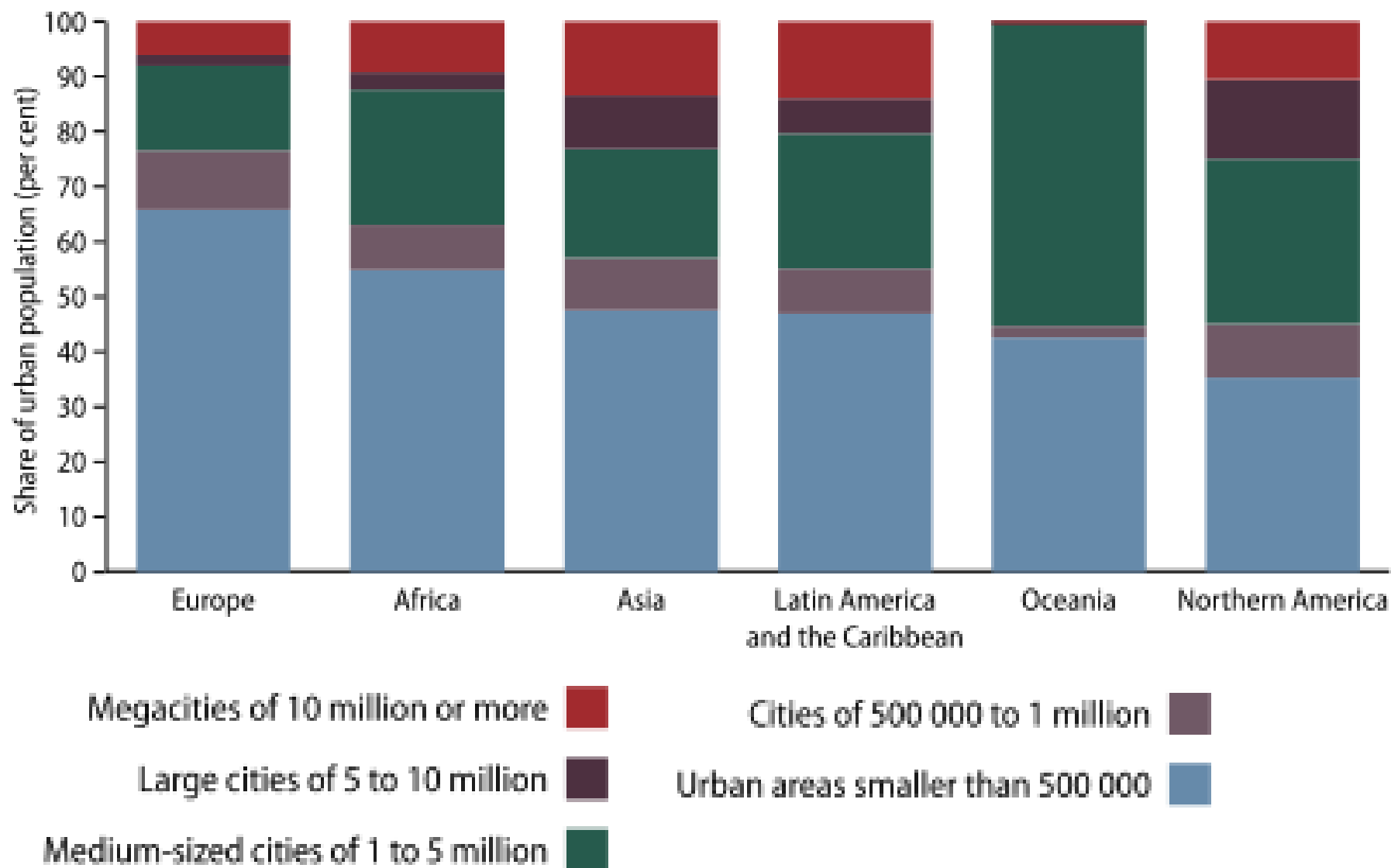
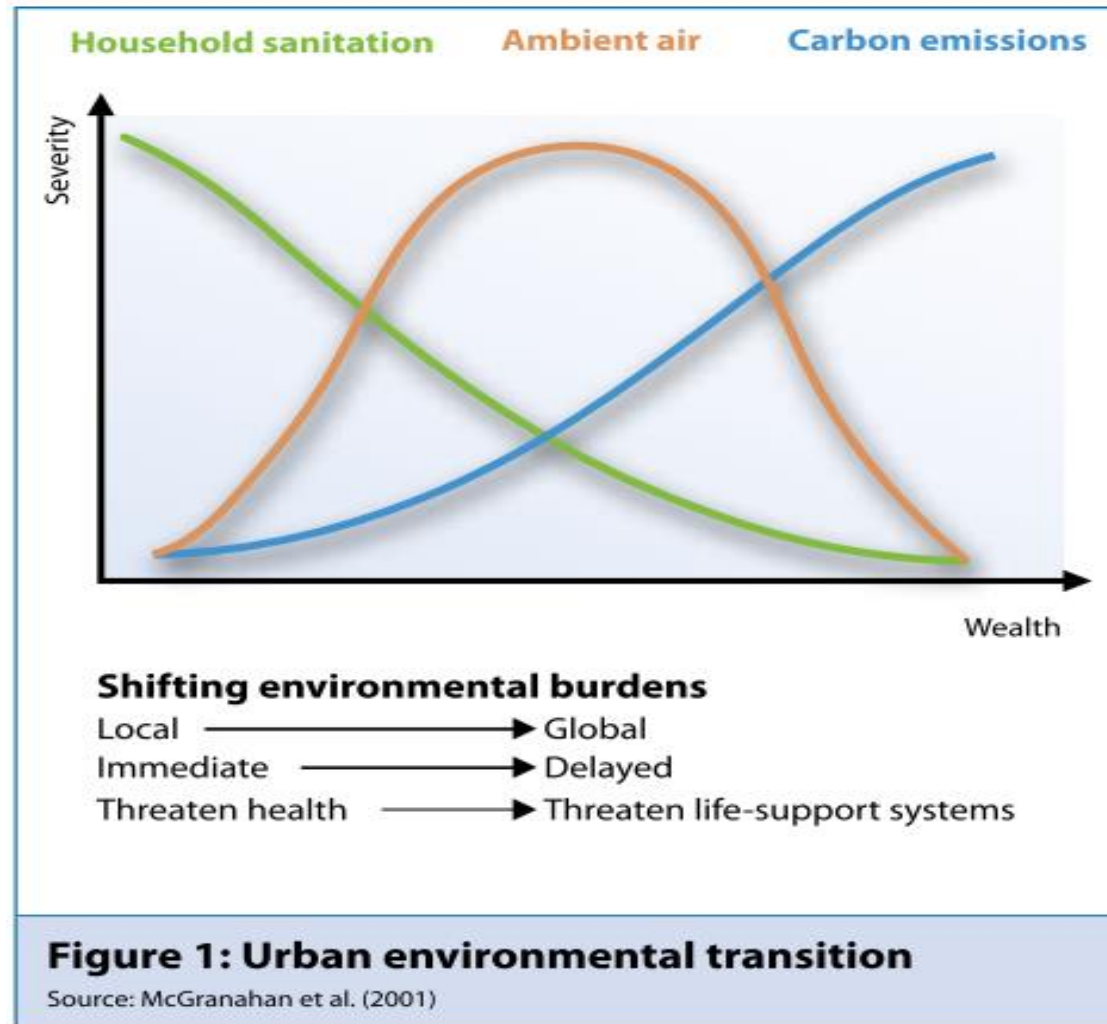


Figure 10.

Population distribution by city size varies across major areas in 2014



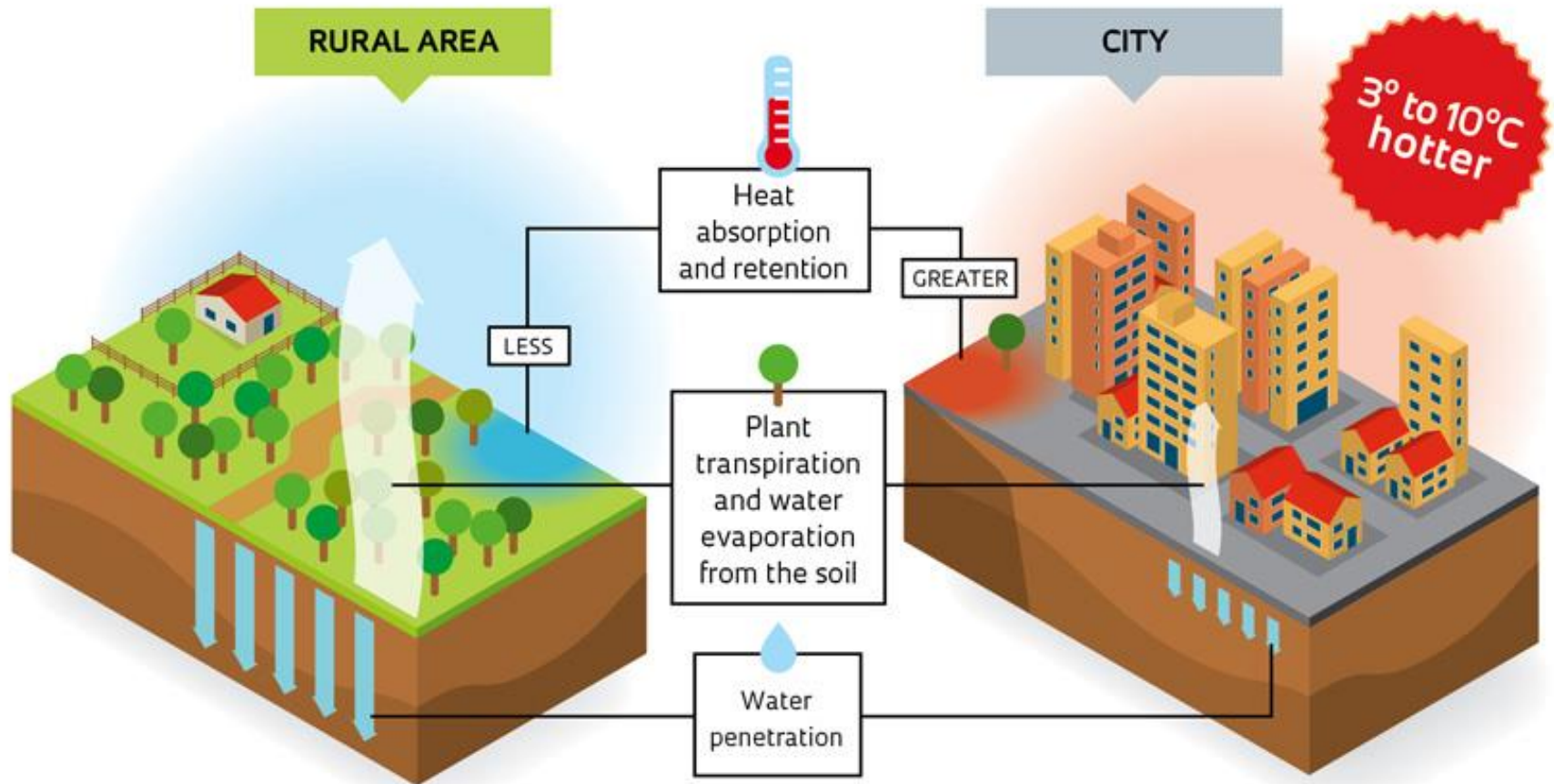
Urbanization and the Environment



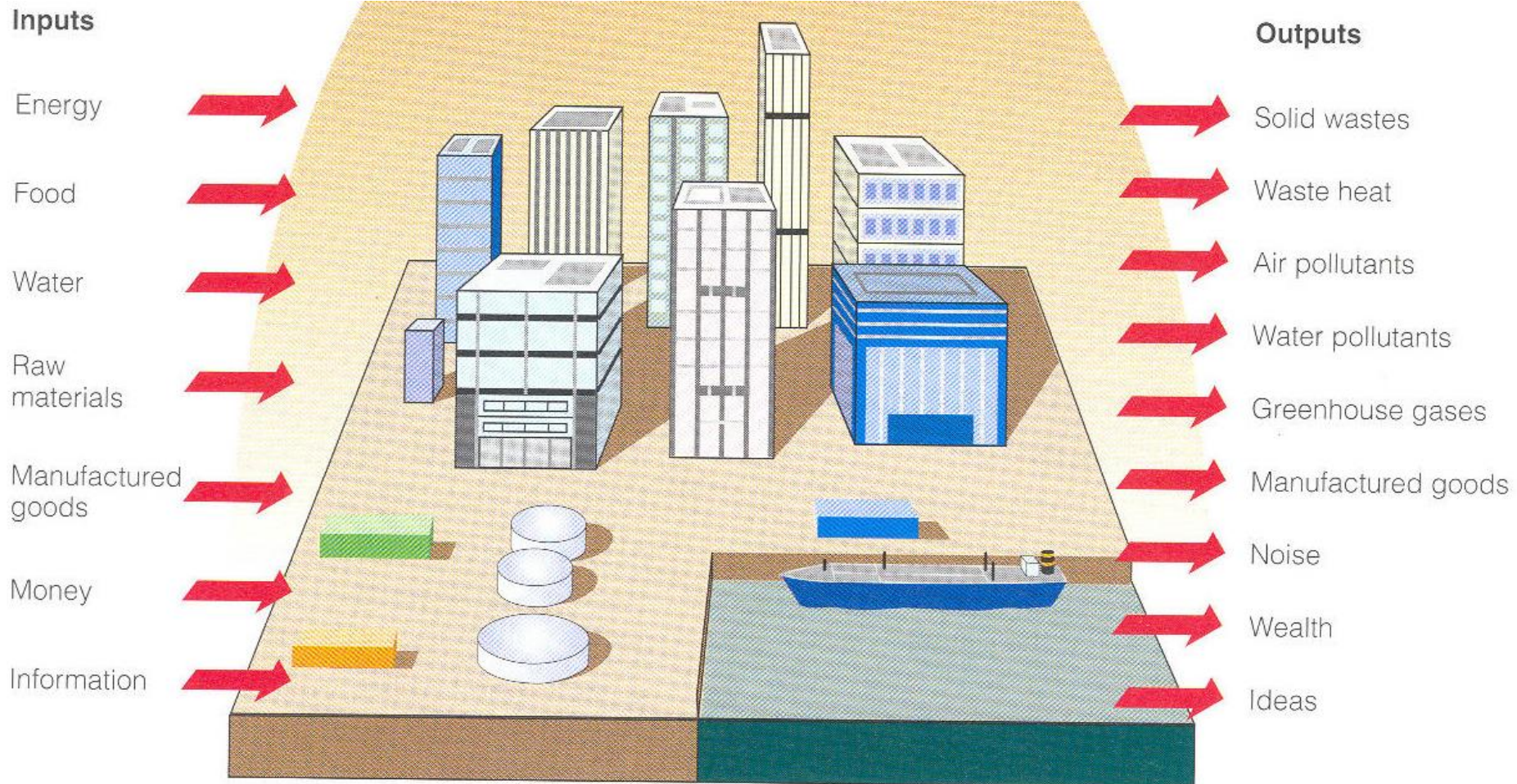
UNEP : Cities – investing in energy and resource efficiency
http://eprints.lse.ac.uk/47894/1/Rode_Cities_2011.pdf

Urban Heat Island

Why the urban heat island effect occurs



Inputs and Outputs of Cities



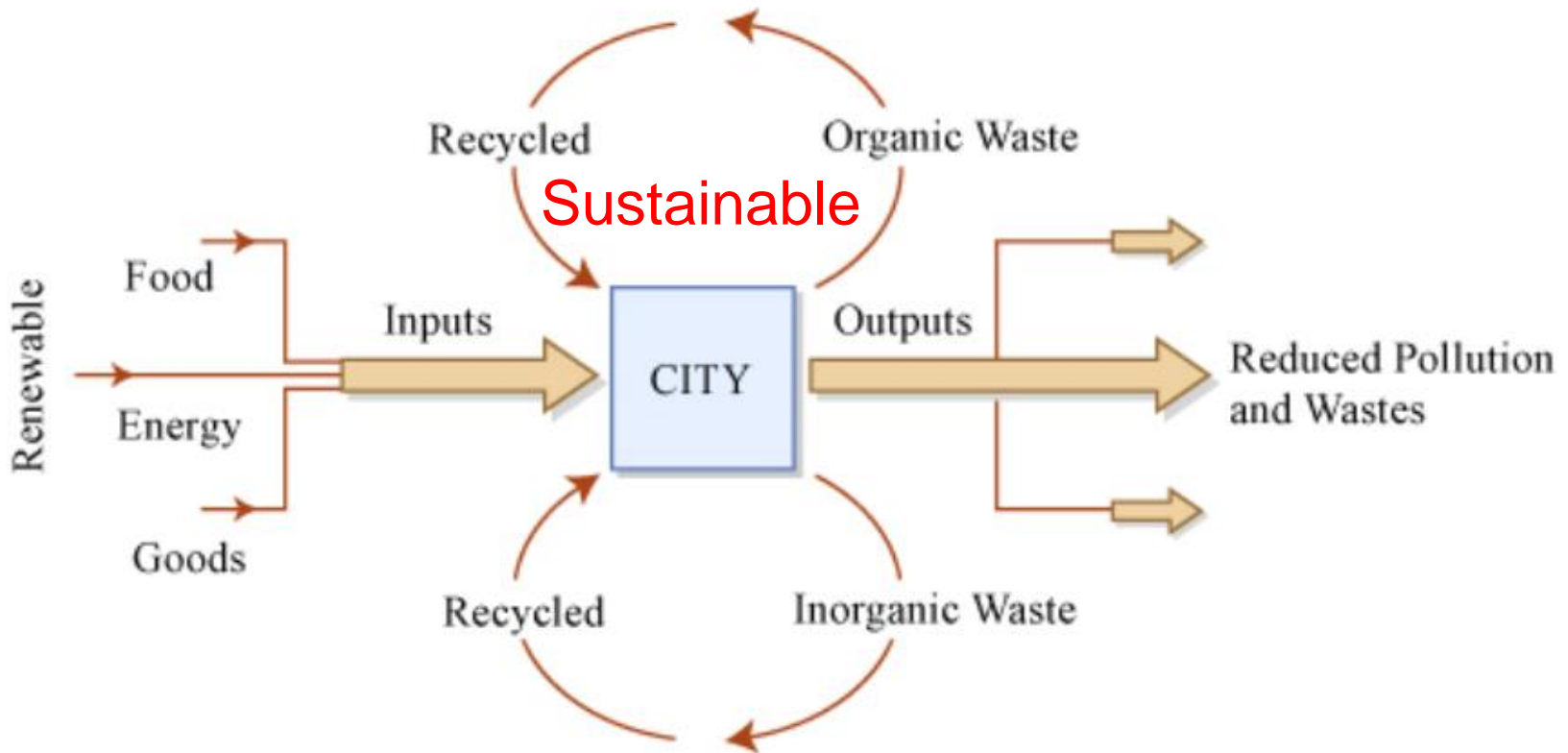
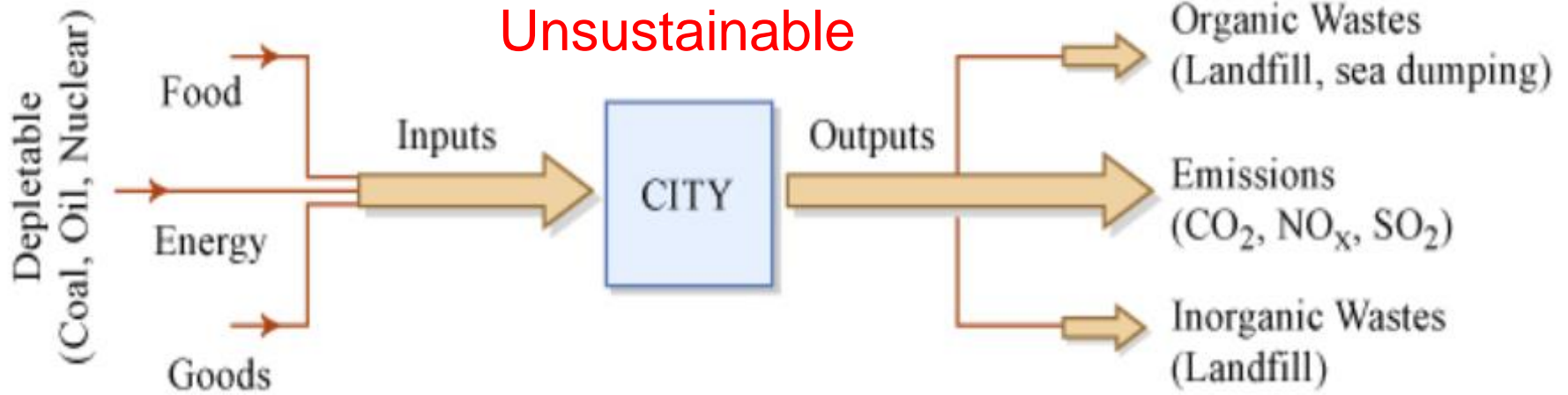
Unsustainable vs. Sustainable City

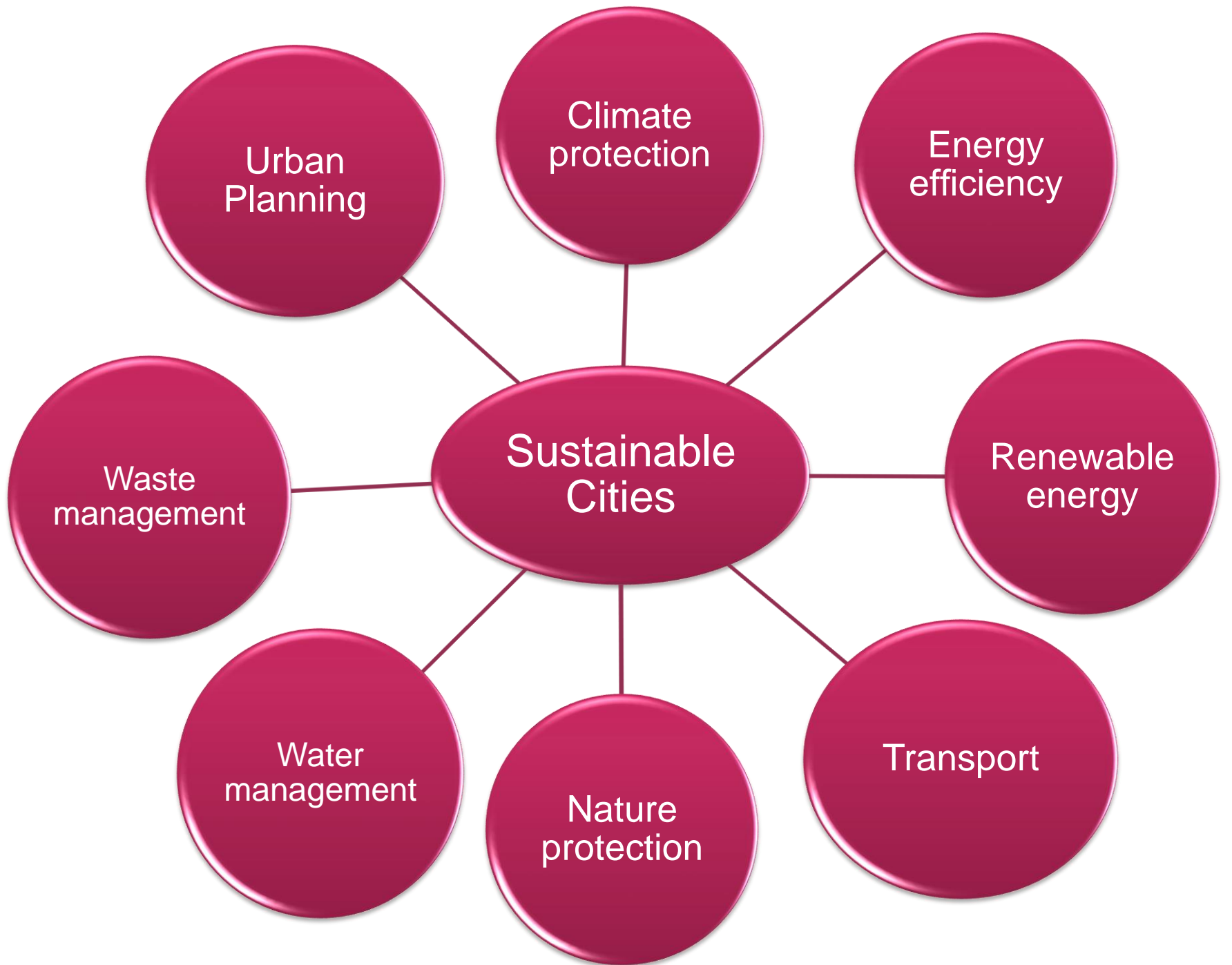
Unsustainable City

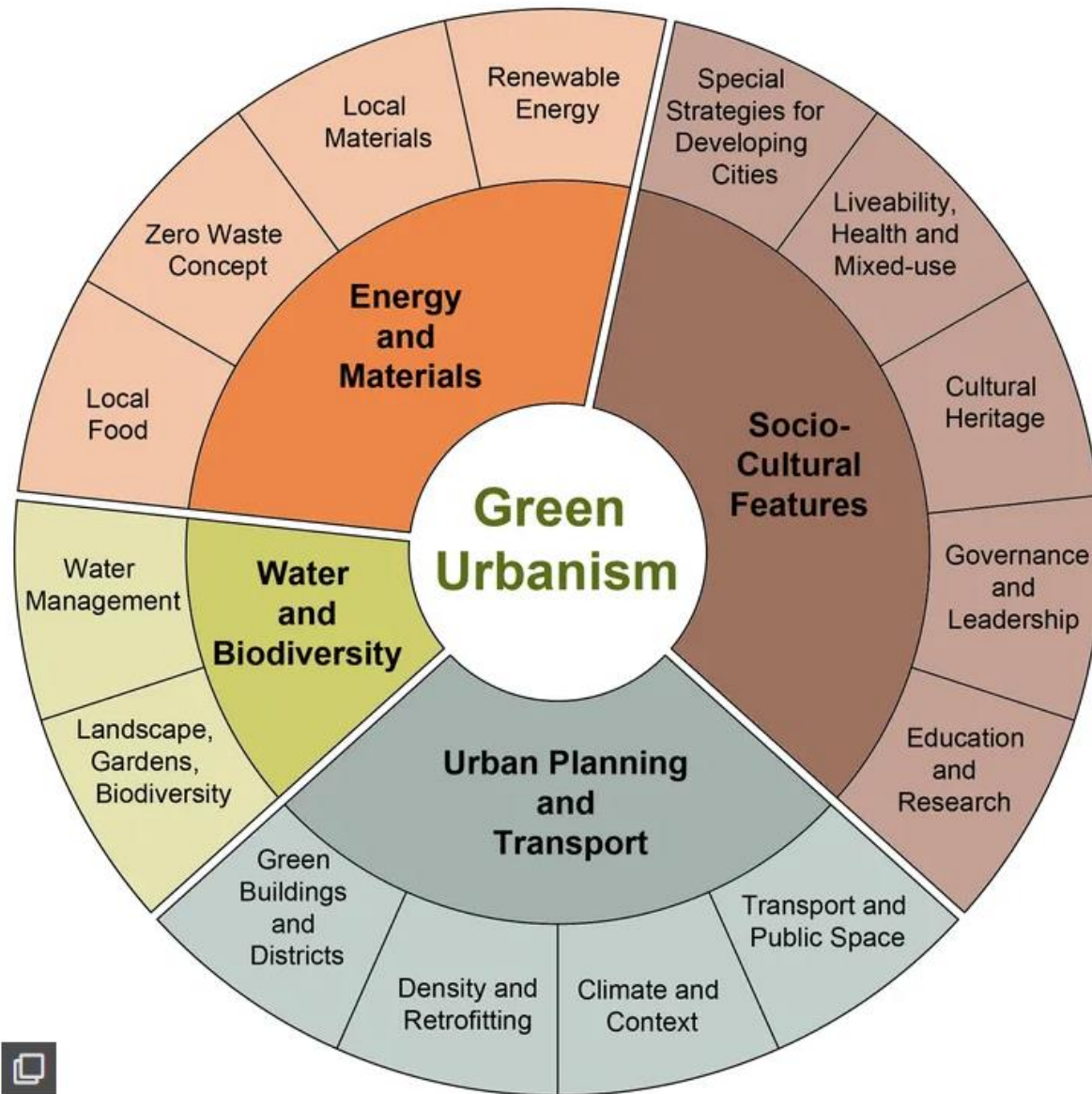
- High level of inputs.
- Not satisfying people's needs
- Producing large amounts of waste and pollution.

Sustainable City

- Reduced level of inputs.
- Satisfying people's needs (good quality of life).
- Reduced waste and pollution levels.





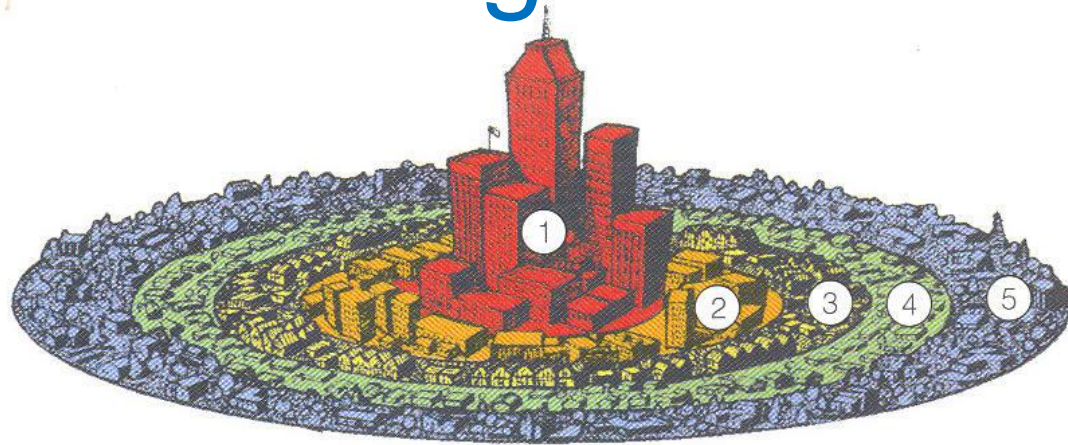
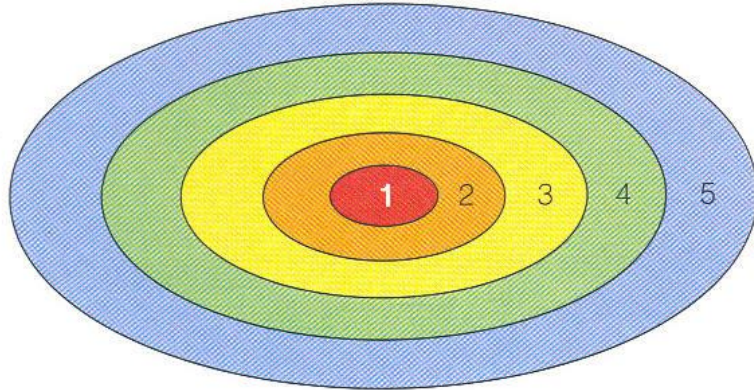


Steffen Lehmann's Green Urbanism wheel with indicators to measure sustainable design.

<http://architectureau.com/articles/beyond-parametricism-transforming-the-city-with-sustainable-design/>

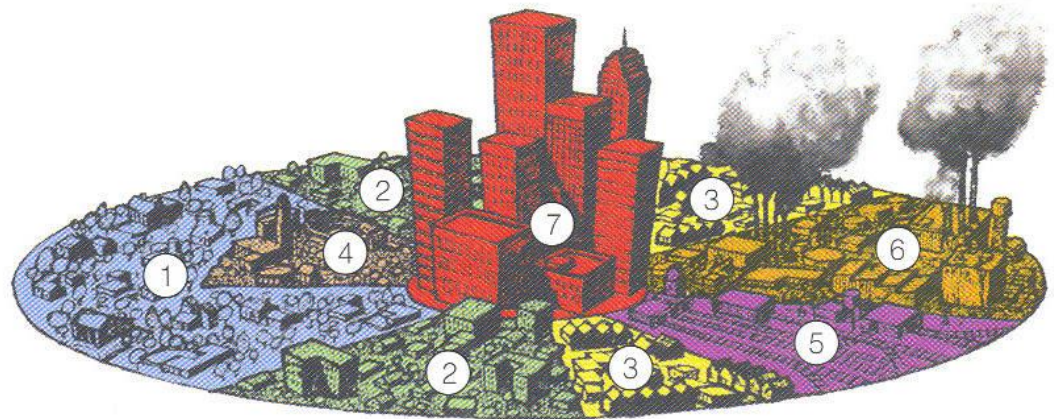
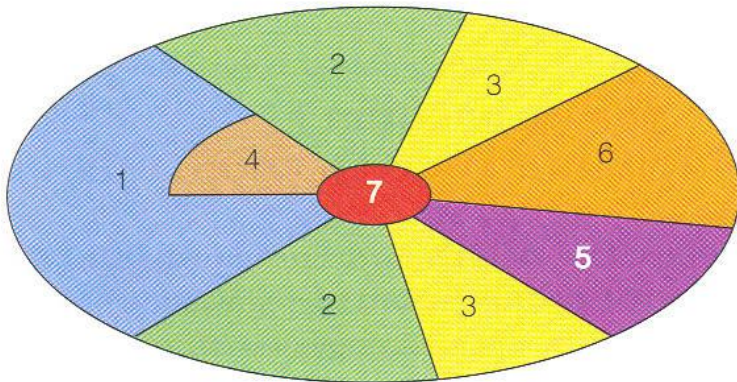
Urban Planning

Concentric Circle Model





















- 1 Central business district (CBD)
- 2 Deteriorating transition zone
- 3 Workers' homes
- 4 Middle-class suburbs
- 5 Commuters' zone

Sector Model



- 1 High-rent residential
- 2 Intermediate-rent residential
- 3 Low-rent residential
- 4 Education and recreation
- 5 Transportation
- 6 Industrial
- 7 CBD

Green Infrastructure Benefits and Practices

Benefit	Reduces Stormwater Runoff				Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO ₂	Reduces Urban Heat Island	Improves Community Livability					Improves Habitat	Cultivates Public Education Opportunities
	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding								Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture		
Practice																		
Green Roofs	●	●	●	●	○	○	○	●	●	●	●	●	◐	●	◐	◐	●	●
Tree Planting	●	●	●	●	○	◐	○	●	●	●	●	●	●	●	●	◐	●	●
Bioretention & Infiltration	●	●	●	●	◐	◐	○	○	●	●	●	●	●	◐	◐	○	●	●
Permeable Pavement	●	●	●	●	○	◐	●	◐	●	●	●	○	○	●	○	○	○	○
Water Harvesting	●	●	●	●	●	◐	○	◐	◐	◐	○	○	○	○	○	○	○	●



Yes



Maybe



No

Tree Planting

- Reduces Stormwater Runoff
- Increases Groundwater Recharge
- Reduces Energy Use
- Improves Air Quality
- Reduces Atmospheric CO₂
- Reduces Urban Heat Island
- Improves Community Livability
- Improves Habitat



Central Park, New York City, USA



Permeable Pavement

- Reduces Stormwater Runoff
- Increases Groundwater Recharge
- Reduces Salt Use
- Reduces Urban Heat Island



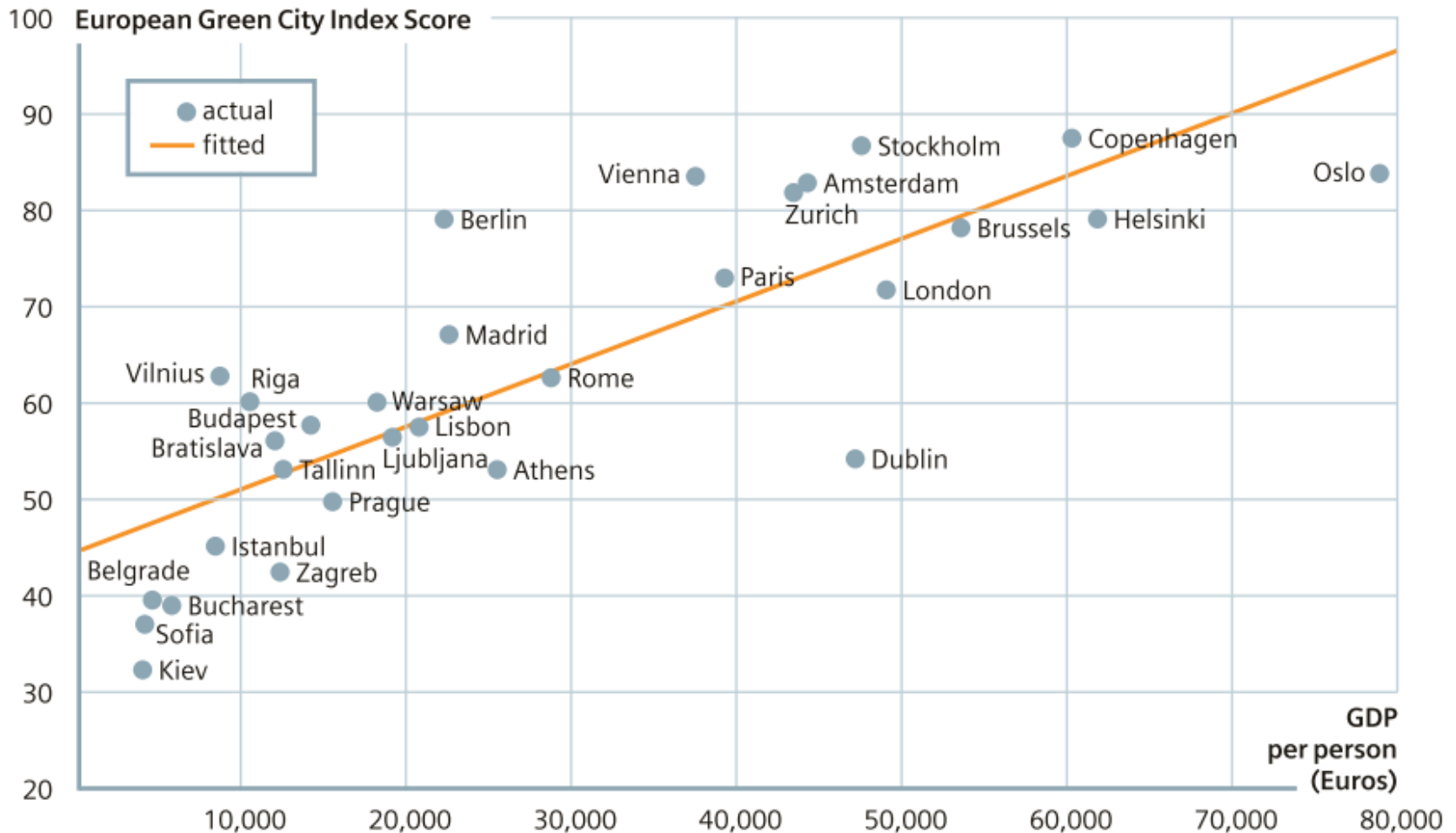
Overall

European Green City Index

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



The link between wealth and environmental performance



European Green City Index Istanbul City Portrait



Population:	12.6 million
GDP per head, PPP:	€ 14,615
CO ₂ emissions per head:	3.25 tonnes*
Energy consumption per head:	36.15 gigajoules*
Percentage of renewable energy consumed by the city:	5.12 %
Total percentage of citizens walking, cycling or taking public transport to work:	54.02 %*
Annual water consumption per head:	68.63 m ³
Share of waste recycled:	3.12 %



* Estimate

<https://assets.new.siemens.com/siemens/assets/api/uuid:fddc99e7-5907-49aa-92c4-610c0801659e/version:1561969692/european-green-city-index.pdf>