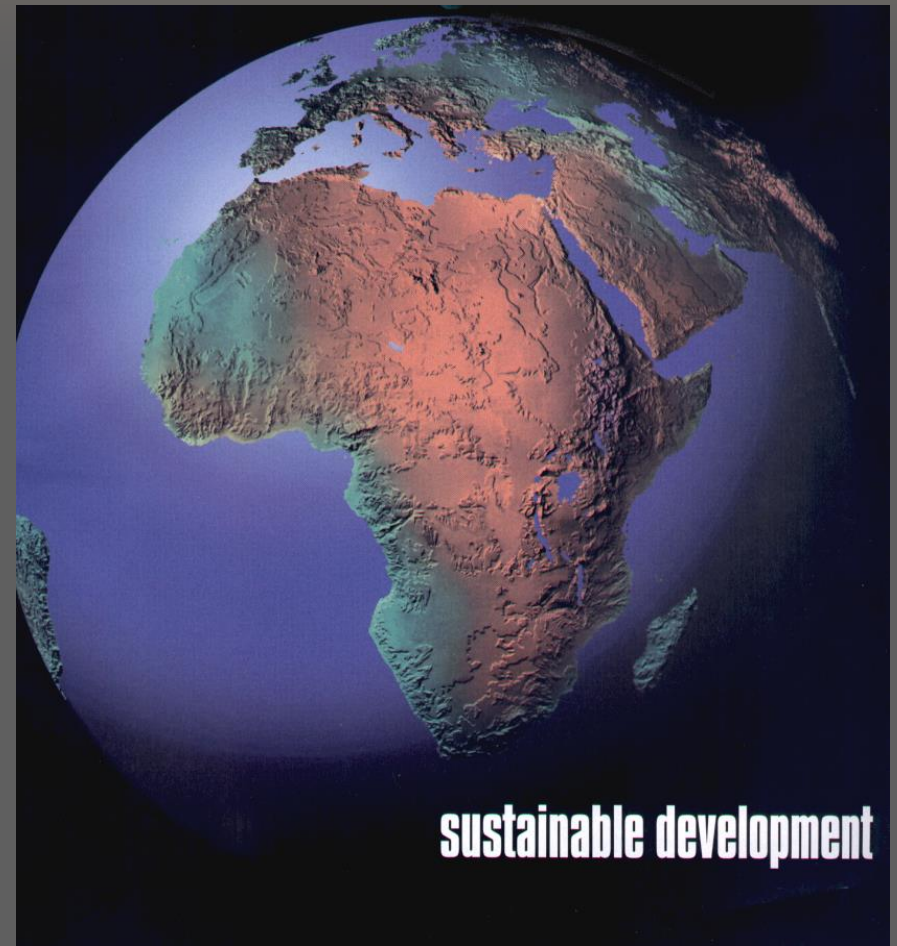




Sustainable Cities – Are they
achievable?

The planet is not inanimate. It is a living organism. The earth, its rocks, oceans, atmosphere and all living things are one great organism. A coherent holistic system of life, self-regulating, self-changing.

James Lovelock, Gaia



Sustainable Development

- ⇒ “ Sustainable development is not an option that will go away – sustainable development is the only way forward”
- ⇒ Economy – better living standards – high quality design
 - Rhodri Morgan AM, former First Minister for Wales

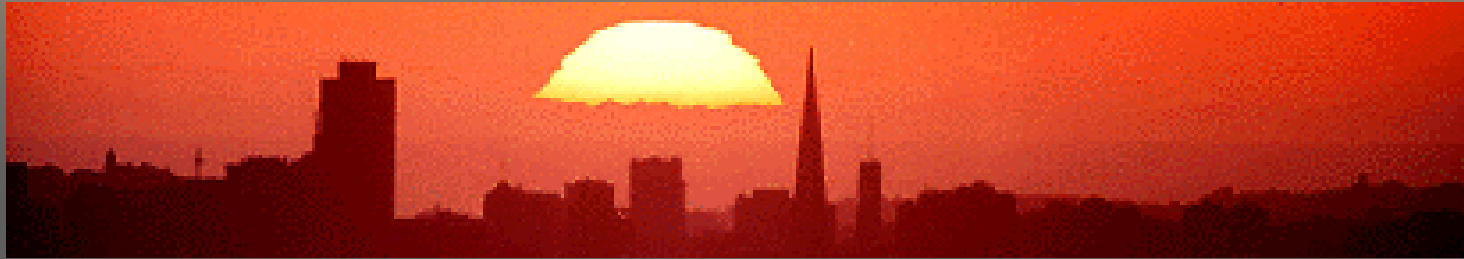


Cities

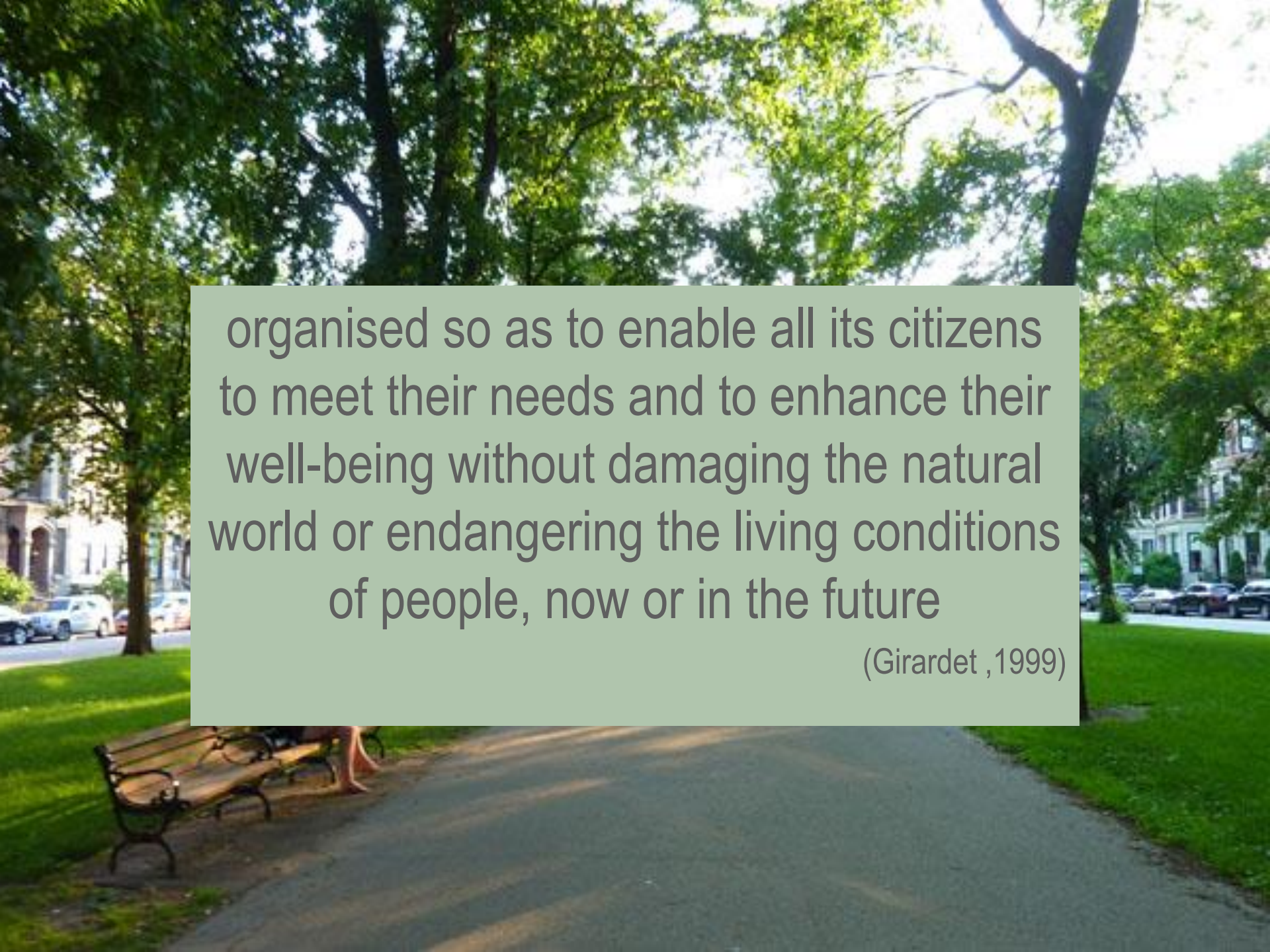
“It is particularly ironic that the battle to save the world's remaining healthy ecosystems will be won or lost, not in tropical forests or coral reefs that are threatened, but on the streets of the most unnatural landscapes on the planet”

(United Nations, 2007:1)

Definitions:



- a means by which environmental impacts can be reduced and allows society to live more lightly on the land
- cities that meet the goals of sustainable development
- communities and lifestyles that incorporate ecology and more ecologically responsible forms of living and settlement
- another term for green urbanism



organised so as to enable all its citizens
to meet their needs and to enhance their
well-being without damaging the natural
world or endangering the living conditions
of people, now or in the future

(Girardet ,1999)

Let's look at some facts...

- ➡ Between 1950 and 1990 populations of the world's cities increased ten-fold, from 200 million to more than 2 billion
- ➡ Today every other person on earth already lives in a city



1913

10%



2014

50%



2050

75%



Urbanisation

- **Population growth**
- **Pollution**
- **Resource degradation**
- **Waste generation**
- **Patterns of consumption / production**
- **Inadequate urban management – knee jerk reaction**

➡ Urban location offer better chances of long-term sustainability as they concentrate half of the earth's population on less than 3% of its land area. Dispersal of population and economic activities would likely make matters worse. UN also suggest that urbanisation provides few incentives for large families and hence may itself act as a powerful factor in fertility decline. (UN, 2008)



Urban Populations

- ⇒ 1800 – 2 cities with a population of over 1 million – London and Peking
- ⇒ By 1990 – the world's largest 100 cities accommodated a total of 540 million
- ⇒ Europe – 80% urban



Factors leading to urban growth

- ⇒ National economic development – primary vs tertiary industry
- ⇒ Economic globalisation
- ⇒ Expansion of urban-centred transport systems
- ⇒ Migration from rural areas, seeking better employment and services

Urban Populations

- ⇒ It is estimated that today 57 cities are home to more than 5 million people - 44 in the developing world
- ⇒ Today the planet hosts 19 cities with 10 million or more people
- ⇒ Mega cities; smaller cities' impact also





Trading Places : (population for the ten largest cities in the world) (millions)

	1980	1990	2000	2010
1	Tokyo 21.9	Tokyo 25.1	Tokyo 26.4	Tokyo 26.4
2	New York 15.6	New York 16.1	Mexico City 18.1	Bombay 23.6
3	Mexico City 13.9	Mexico City 15.1	Bombay 18.1	Lagos 20.2
4	São Paulo 12.5	São Paulo 15.1	São Paulo 17.8	São Paulo 19.7
5	Shanghai 11.7	Shanghai 13.3	New York 16.6	Mexico City 18.7
6	Osaka 10.0	Bombay 12.2	Lagos 13.4	Dhaka 18.4
7	Buenos Aires 9.9	Los Angeles 11.5	Los Angeles 13.1	New York 17.2
8	Los Angeles 9.5	Buenos Aires 11.2	Calcutta 12.9	Karachi 16.6
9	Calcutta 9.0	Osaka 11.0	Shanghai 12.9	Calcutta 15.6
10	Beijing 9.0	Calcutta 10.9	Buenos Aires 12.6	Jakarta 15.3
16	London 7.7			

Below 30th place



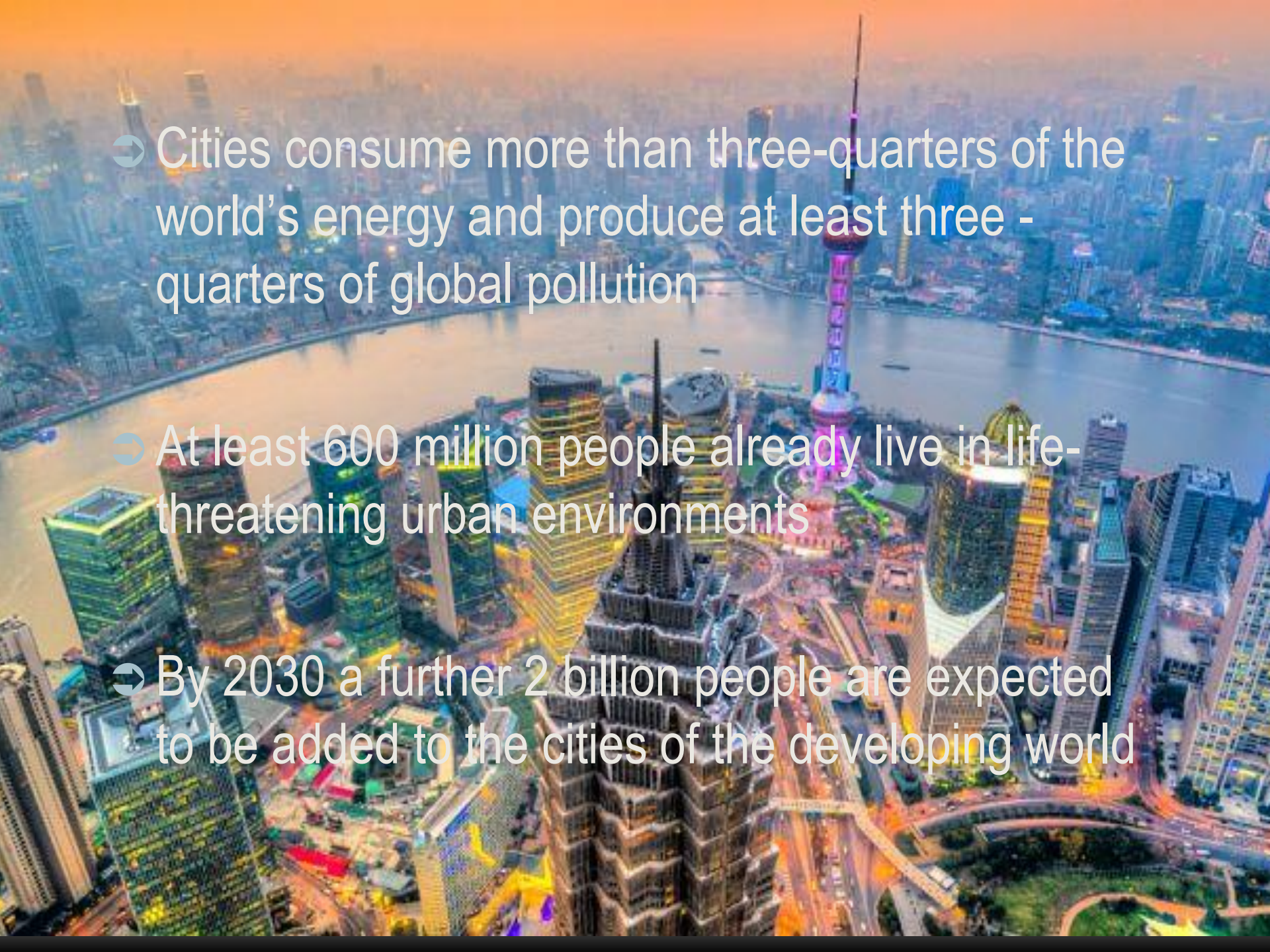
Tokyo, Japan

- >2016 population: 38,140,000
- >Annual growth since 2000: 0.6%
- >Pct. of Japan's population: 30.1%
- >2030 estimated population:
37,190,000



Delhi, India

- >2016 population: 26,454,000
- >Annual growth since 2000: 3.2%
- >Pct. of India's population: 2.0%
- >2030 estimated population:
36,060,000



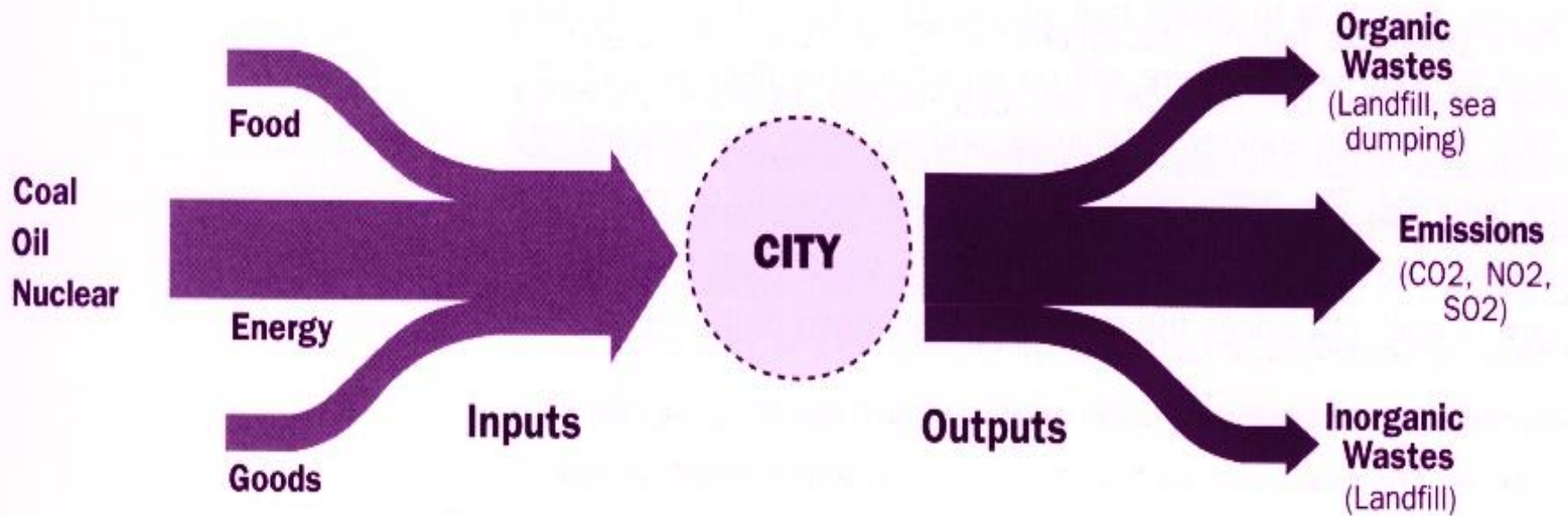
⇒ Cities consume more than three-quarters of the world's energy and produce at least three-quarters of global pollution

⇒ At least 600 million people already live in life-threatening urban environments

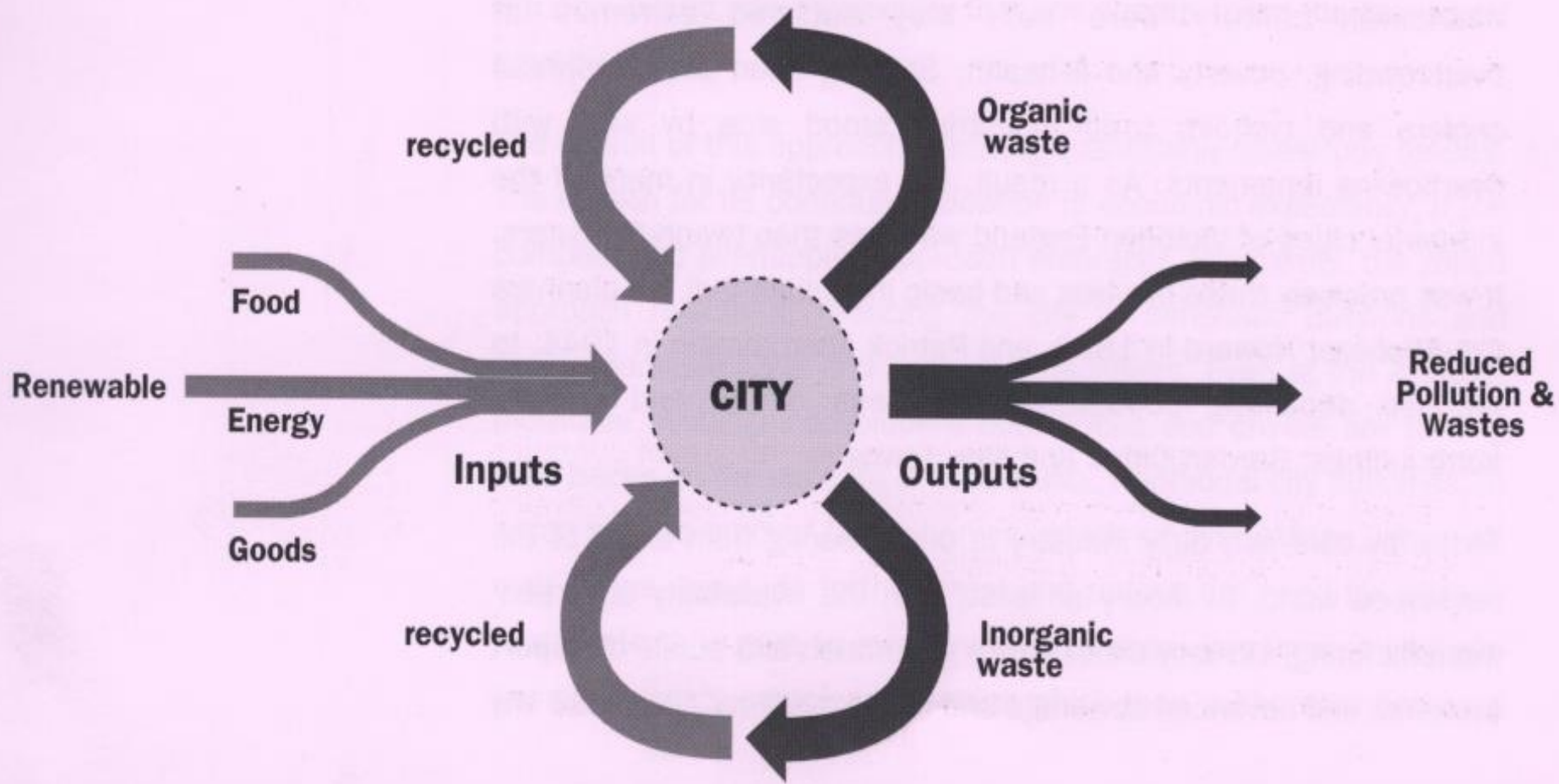
⇒ By 2030 a further 2 billion people are expected to be added to the cities of the developing world



Cities built on only 2% of the world's land surface
use 75% of the world's resources and discharge
similar amounts of waste (Giradet ,1999)

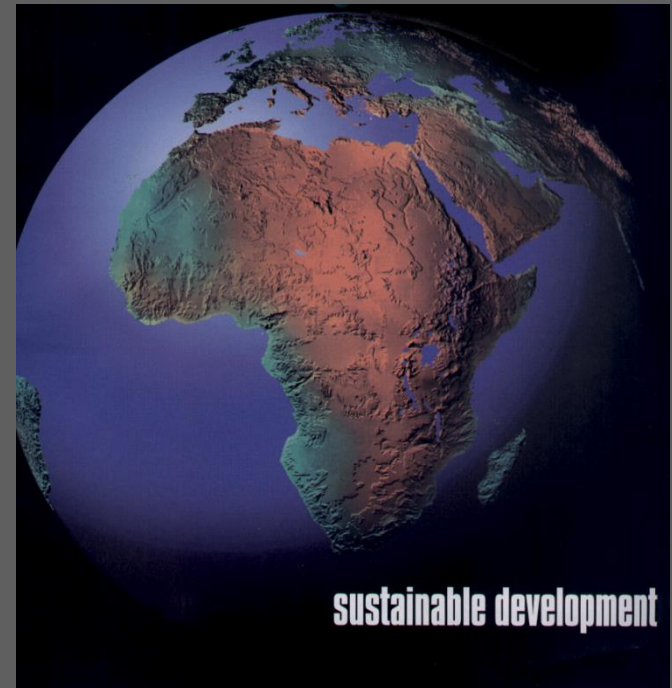


The Metabolism of Cities: Linear Metabolism



The Metabolism of Cities: Circular Metabolism

The Challenge...



How do we balance human activity with current resources?

Population Overload

- ⇒ Expected population will double again by 2060 by to 14 billion
- ⇒ Key problems:
 - Food production
 - Water availability
 - Habitation
 - Energy

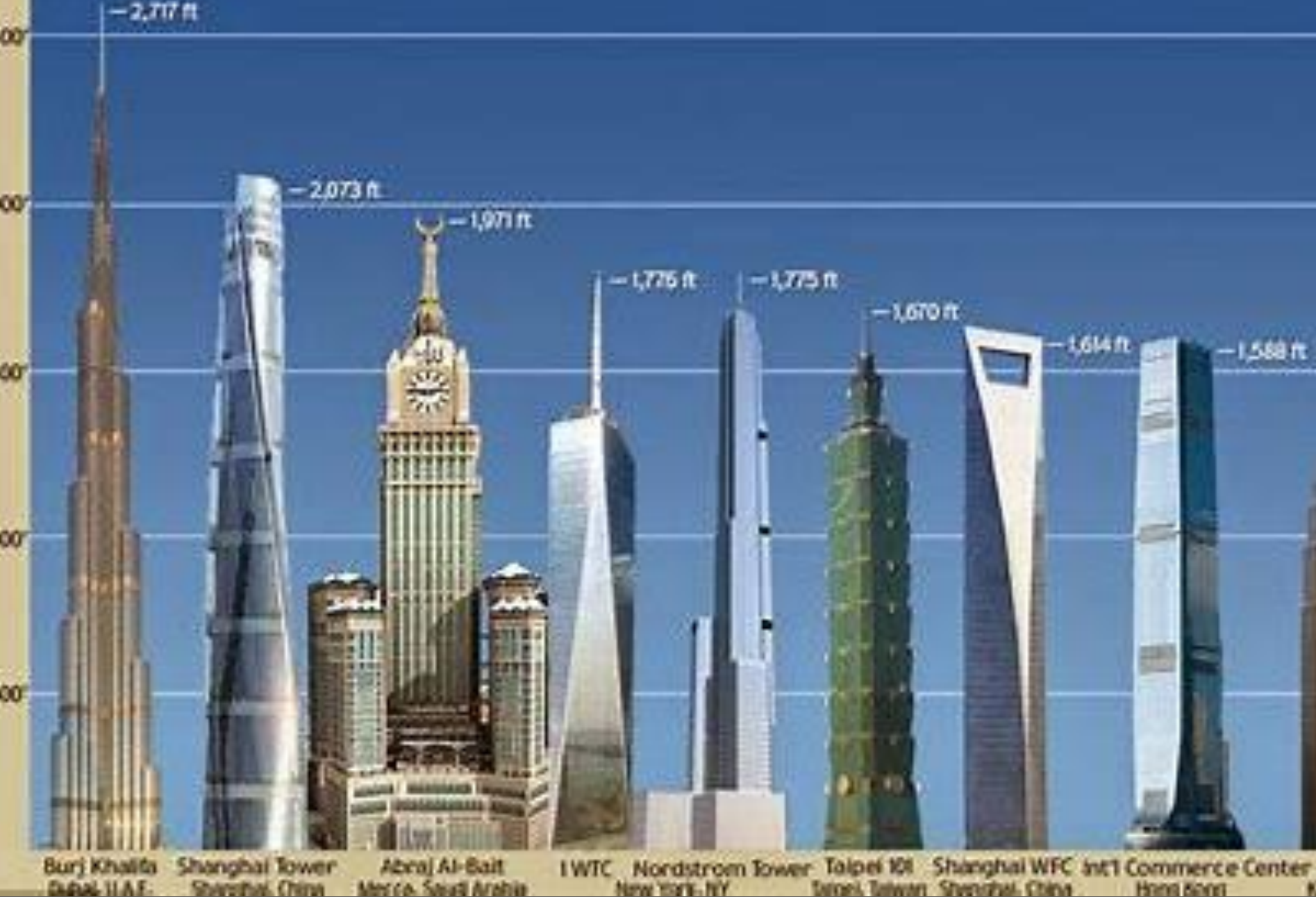


Infrastructure needs

- ⇒ Building boom – skyscrapers
- ⇒ Weight on bedrock (a million tonnes) – earthquakes
- ⇒ Create new farmland – deforestation
- ⇒ Starvation & ↑ food prices
- ⇒ Exports stopped
- ⇒ Turn to oceans for food
- ⇒ Bridges fail; networks close
- ⇒ Water shortages
- ⇒ Homeless

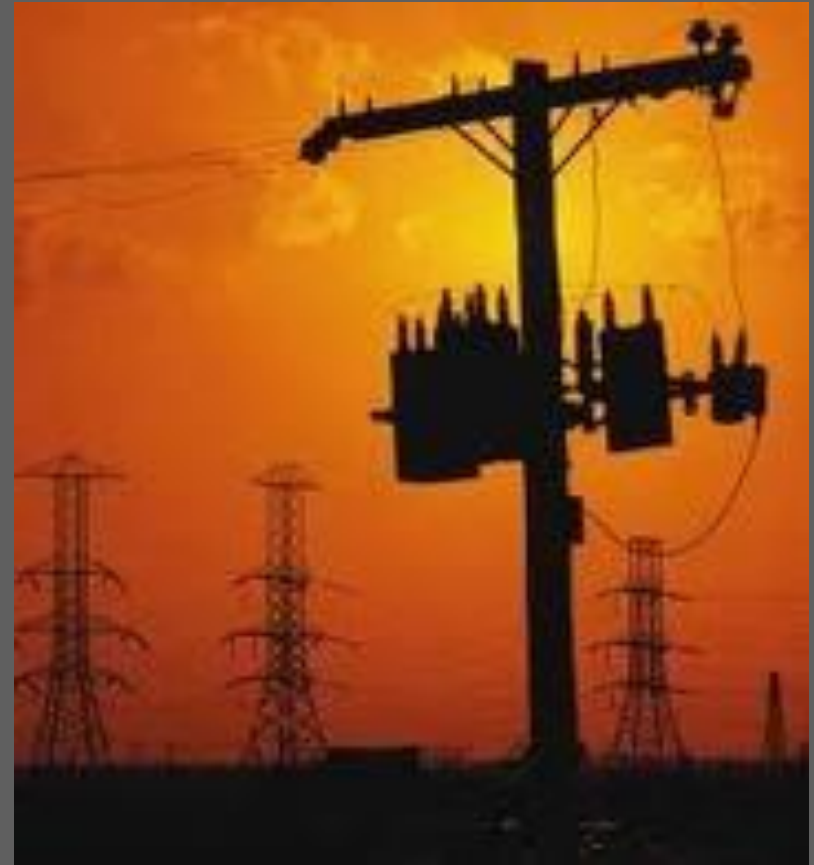






Infrastructure needs

- ⇒ Sewers overflow – disease & vermin (NY currently 3.68bn litres/day through sewers)
- ⇒ Water rationing
- ⇒ GM crops ↑
- ⇒ Fertiliser use ↑
- ⇒ Power cuts
- ⇒ Crime ↑
- ⇒ Pollution rates ↑
- ⇒ Immigration ↑



Infrastructure Needs: 7 yrs later

- ⇒ Cars banned from cities
- ⇒ Construction slows due to water and energy shortages
- ⇒ Desalinisation plants
- ⇒ Aquifers shrinking – foundations erode
- ⇒ Mexico City!



Infrastructure Needs: 10 yrs later

- ⇒ Mass migration - water refugees
- ⇒ Polar icecaps 'captured' and towed to cities
- ⇒ Cities empty – too polluted
- ⇒ Algal blooms
- ⇒ Ruined land through desperate farming methods



Infrastructure Needs: 35 yrs later

- ⇒ Most of US abandoned; mega cities in the North
- ⇒ Billions die hungry
- ⇒ Population stabilises
- ⇒ Woodland takes back unoccupied land
- ⇒ Snow & rain gradually replenish abandoned aquifers



National Geographic (2010)

- ⇒ A look into a bleak, overcrowded future
- ⇒ Already, millions are starving, poverty is increasing and cities are becoming overcrowded!

Cities are the best solution given their efficiencies

Dubai

- 
- ⇒ One of the fastest growing cities on the planet
 - ⇒ many environmental issues due to harsh environment, paucity of local resources such as food, water, and building materials, and the unplanned manner of expansion.

The Dubai Project



An average person in Dubai:

- uses about double the amount of water than the global average
- produces 2.5kg (5lb) of waste a day
- is among the world's worst carbon dioxide polluters

Dubai – the most congested city in the Middle East



How is Dubai attempting to attain a more sustainable future?



Singapore

Since 2005, over 1,650 buildings in Singapore have been made environmentally friendly, and the government is set to do more. Its Sustainable Development Blueprint outlines a number of "green targets" for 2030 including a recycling rate of 70 percent; a 35 percent improvement in energy efficiency; and 80 percent of buildings to be certified green.

Singapore

In contrast to the city's skyscrapers, Gardens by the Bay is part of the Government's strategy to transform Singapore into a "city in a garden"





Gardens by the Bay, Singapore



- ➔ The man-made mechanical forest consists of 18 supertrees that act as vertical gardens, generating solar power, acting as air venting ducts for nearby conservatories, and collecting rainwater. To generate electricity, 11 of the supertrees are fitted with solar photovoltaic systems that convert sunlight into energy, which provides lighting and aids water technology within the conservatories below.



Driverless bus fuelled by photovoltaics





Green spaces throughout Singapore



Green walls
do very well
in Singapore
because of the
humidity

EXERCISE TORRENT 2016

The Republic of Singapore Air Force (RSAF) will convert Lim Chu Kang Road into a runway. During the exercise, the RSAF aircraft will conduct simultaneous launch and recovery operations from Lim Chu Kang Road and the Tengah Air Base runway. Exercise Torrent demonstrates the RSAF's operational capability and readiness to deliver air power for the SAF.



Fighter aircraft will land and take off simultaneously using both Lim Chu Kang Road and the Tengah Air Base runway.

MOBILE AIR TRAFFIC CONTROL TOWER

This enables air traffic controllers to control aircraft launch and recovery. It can be raised to four metres above ground level to give the controllers a good view of the runway.

MOBILE ARRESTOR GEAR (MAG)

This mechanical system rapidly decelerates an aircraft during landing. It is used for short or temporary runways, or in the unlikely scenario where the aircraft has difficulty stopping on its own due to aircraft fault. The MAG comprises a hookwire and energy-absorbing systems set-up on each side of the road.

48
hours
to convert

110
personnel
involved in
conversion

2.5km X 24m runway



38 Solar Portable Airfield Lighting System

This self-sustaining solar-powered runway lighting system guides pilots when visibility is poor.



14 Distance-to-Go Markers

These mark out the distance left in thousands of feet to the end of the runway.



4 Precision Approach Path Indicators

These help to guide pilots by indicating designated angles and altitudes as they approach the runway.



Road fixtures to be removed

- 153 lamp posts
- 58 road signs
- 14 traffic lights
- 1.2km of guard rails
- 12 bus stops



LIM CHU KANG RD B31B









These are the world's most sustainable cities

Based on Sustainable Cities Index 2016

1. Zurich, Switzerland
2. Singapore
3. Stockholm, Sweden
4. Vienna, Austria
5. London, UK
6. Frankfurt, Germany
7. Seoul, South Korea
8. Hamburg, Germany
9. Prague, Czech Republic
10. Munich, Germany

Source: Arcadis and the Centre for Economic and Business Research

Vancouver



Vancouver is attempting to become the world's greenest city by 2020.

Greenest City Action Team

- ⇒ by 2020, create 20,000 new green jobs and become a centre for green business
- ⇒ by 2020, all new industrial/ municipal construction to be carbon-neutral, improve efficiency of existing buildings by 20%
- ⇒ by 2020, plant an additional 150,000 trees so every resident lives within 5 minutes of a beach, park, greenbelt or other open space
- ⇒ by 2020, beat WHO's clean air standards
- ⇒ by 2020, reduce carbon footprint of food production by 33% - focus on organic, local food product

Greening the roofs of Vancouver



Vancouver



- ⇒ Aims to get 100% energy from renewable sources by 2050
- ⇒ the lowest greenhouse gas emissions per person of any major North American city.

Vancouver: Neighbourhood Energy systems



- most suitable in dense urban areas.
- produces heat at an energy centre.
- distribution pipes - residential, commercial, and institutional buildings to meet their hot water and space heating requirements.

Cities like forests perhaps?

- ⇒ Greening the city
- ⇒ Air cleansers
- ⇒ Psychological well-being
- ⇒ Restoring, replenishing and nurturing urban ecology



William McDonough – ecological architect

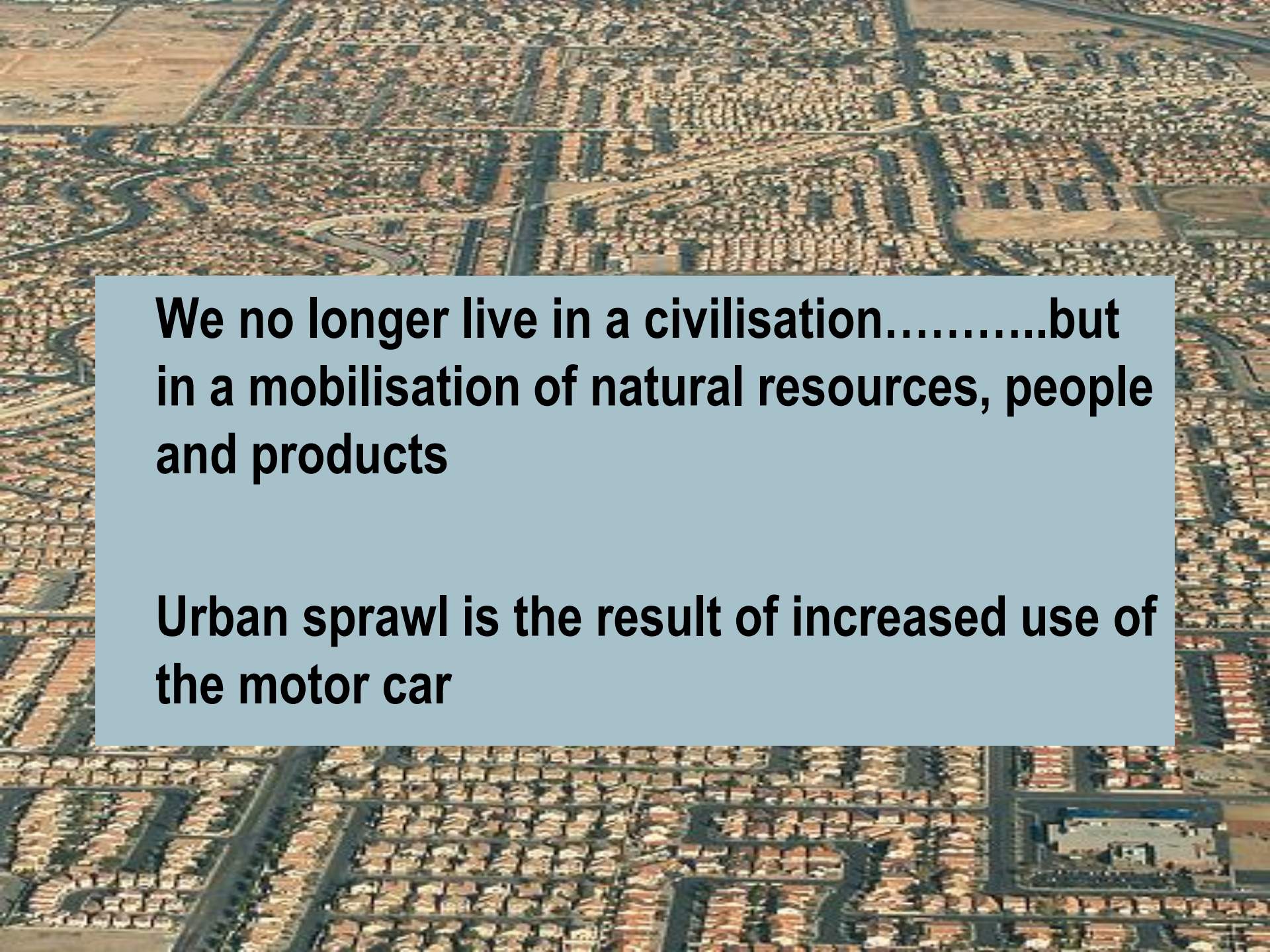


Paris was one of the first modern cities to introduce trees





Central Park, New York



**We no longer live in a civilisation.....but
in a mobilisation of natural resources, people
and products**

**Urban sprawl is the result of increased use of
the motor car**

Transport – Quality of Life?

⇒ Heavy motor traffic means:

- Poor air quality
- Unacceptable levels noise
- Local community
- Societal costs

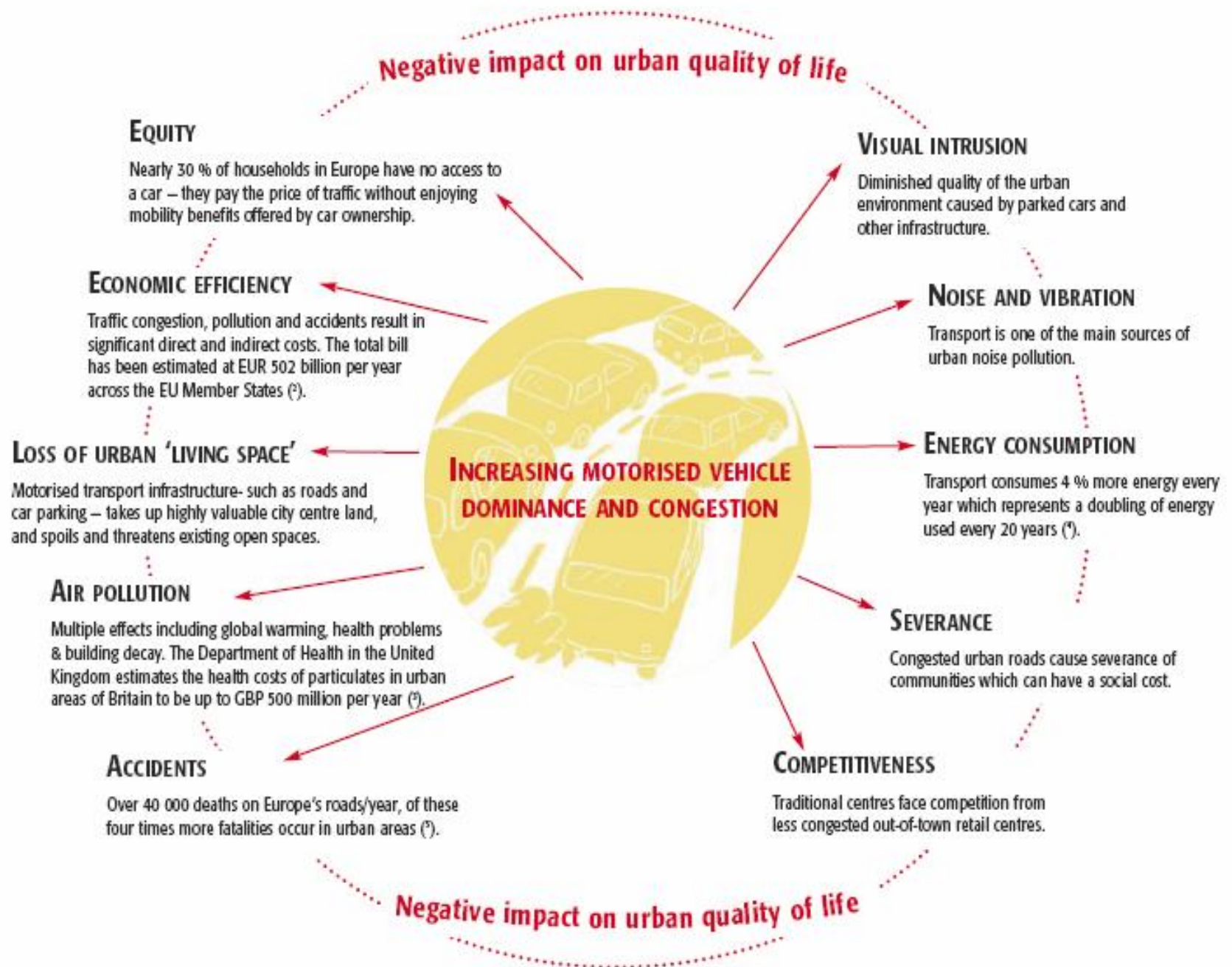
⇒ Traffic techniques and measures



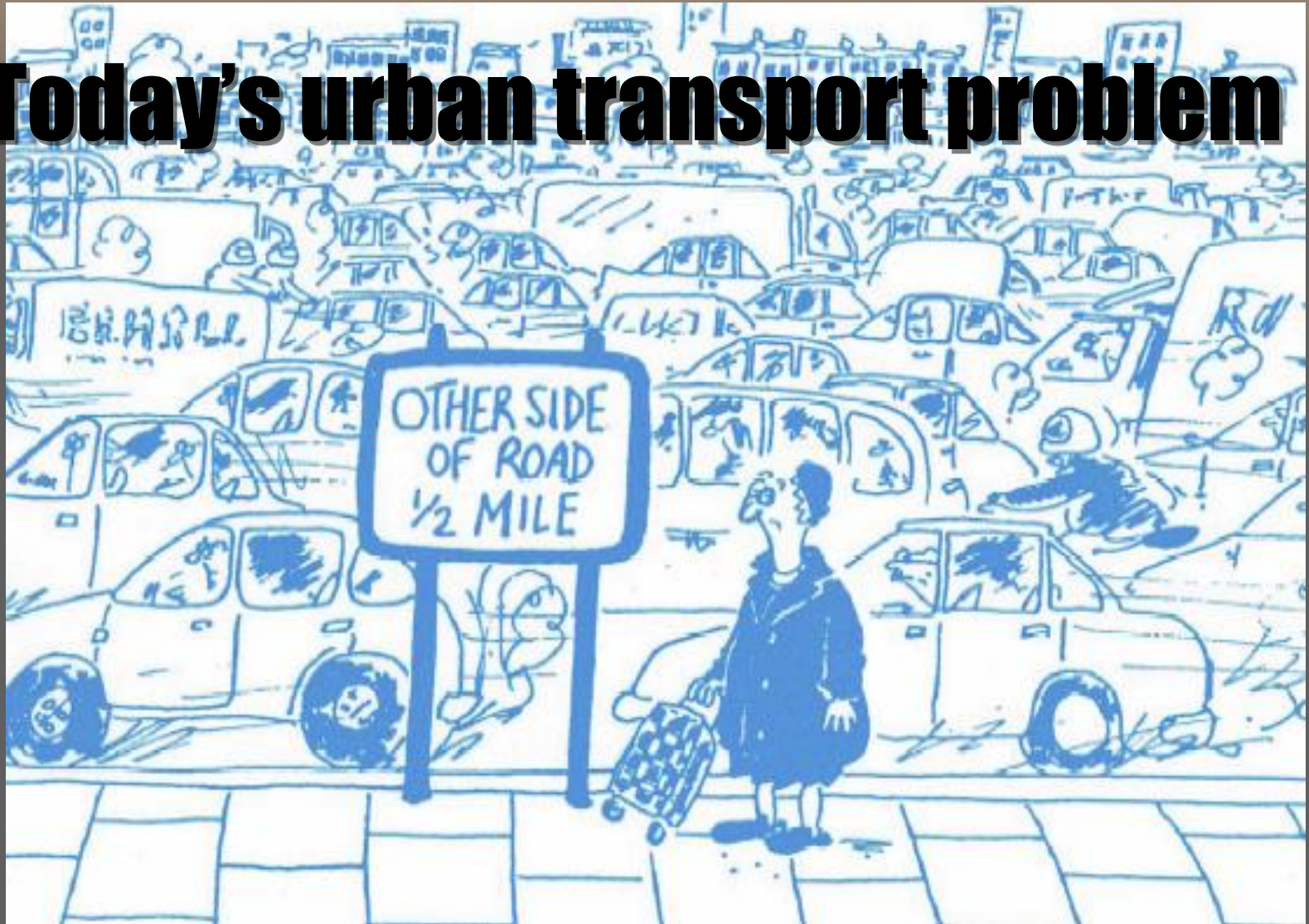
New York –
congested and not
pedestrian friendly!



THE MAIN PROBLEMS ASSOCIATED WITH INCREASING URBAN TRAFFIC AND CONGESTION



Today's urban transport problem



A question of common sense?



A sustainable city: integrated transport system



Urban Planning for the pedestrian



- ⇒ Access
- ⇒ Permeability
- ⇒ Clustered approach
- ⇒ Isolation
- ⇒ Safety
- ⇒ Social benefits

Urban Planning for the cyclist

- ⇒ Access
- ⇒ Safety
- ⇒ Continuity
- ⇒ Directness
- ⇒ Comfort
- ⇒ Parking



Urban Planning for public transport operation



Access to stops and stations

- ➡ Walking distance – 400m
- ➡ Route planning
- ➡ Barriers
- ➡ Incentives

Copenhagen - Before

- ⇒ 1962 – medieval square full of cars
- ⇒ Traffic increased
- ⇒ Conditions for pedestrians deteriorated
- ⇒ Buildings suffered from air pollution



And after



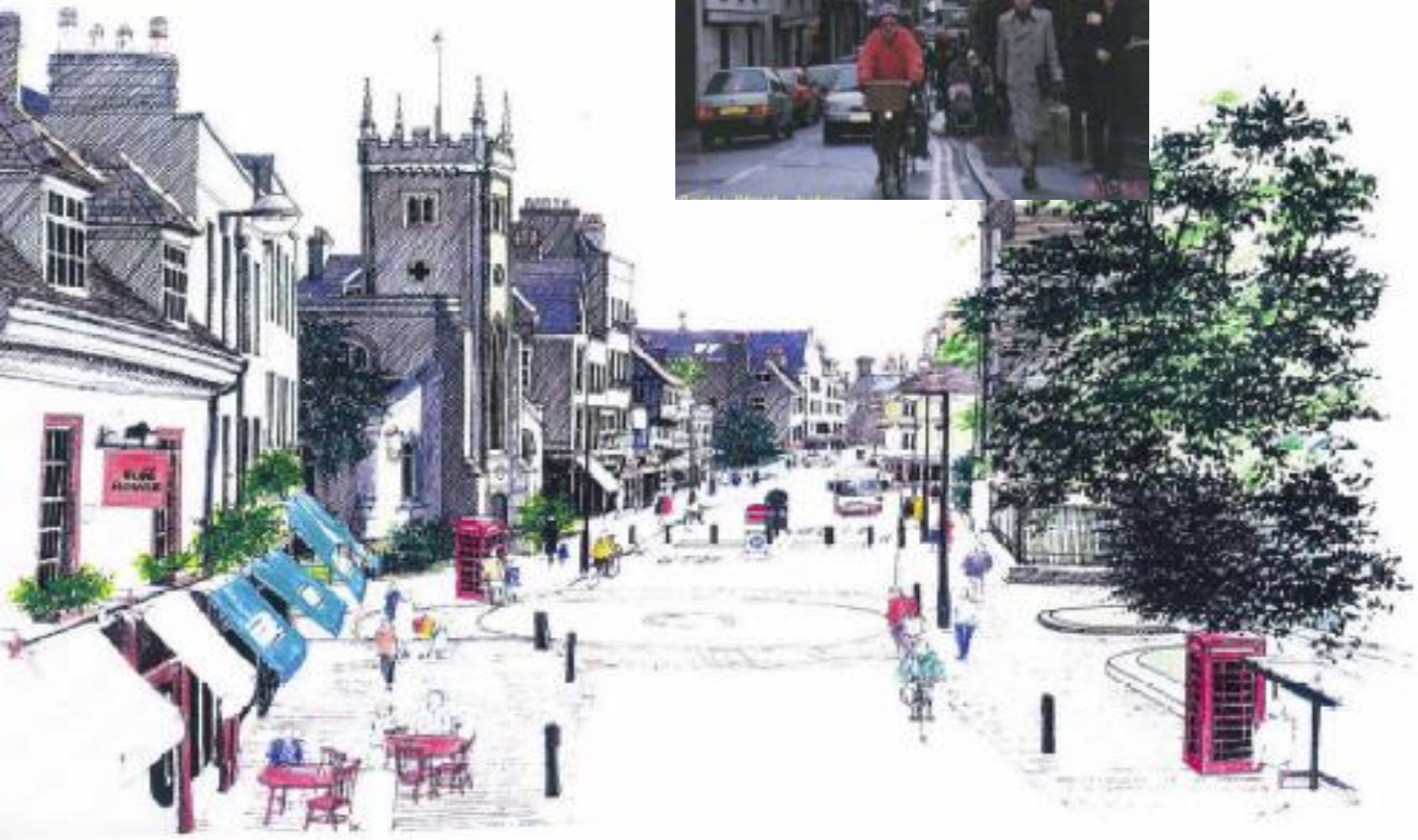
- ➡ 1963 – Pedestrianisation
- ➡ Over 96,000m² of car-free space
- ➡ Street cafes, festivals, outdoor ice skating
- ➡ Gradual change



Cambridge

- ⇒ 3 million tourists
- ⇒ Congestion problem
- ⇒ Air quality – particulates trapped in ‘canyon’ streets
- ⇒ Strategy – to make car use less attractive and improve infrastructure for sustainable modes





Urban Design



- ⇒ Urban design is thus derived from, but transcends, the disciplines of planning and transport, architecture, development economics, landscape design and engineering.

Sustainable construction – Abode Development

- ⇒ Increase density
- ⇒ Make homes affordable
- ⇒ Provide open spaces
- ⇒ Minimise environmental impact
- ⇒ Provide an amenable surroundings



Sustainable construction

- ➡ In 2010 12% of England was urban. By 2020 it is anticipated that this figure will rise to 17% or more.
- ➡ Problem or opportunity?



Further Reading

- ⇒ Reclaiming city streets for people. Chaos or quality of life?
European Commission (2004)
- ⇒ Travel Sickness: The need for a sustainable transport policy for
Britain - Roberts *et al* . (1992)
- ⇒ **Creating sustainable cities, Girardet (1999)**
- ⇒ The State of the World's Cities Report 2001, The United Nation's
Centre for Human Settlement (2001)
- ⇒ **Sustainable Cities, Satterthwaite (1999)**
- ⇒ Sustainable Ecosystems, McCarthy and Battle (2001)

Seminar Questions

- ⇒ Sustainable design offers a way forward for 21st century cities. Discuss
- ⇒ How do we balance human activity with current resources?
- ⇒ How have the world's most sustainable cities achieved their accolades?