

State of the Art Environment Netherlands :

- 1) Our generation: Environmental hazards/risks
 - security is still very important
 - environmental problems related to health
- 2) Next generations: sustainable development
 - awareness of exhaustion of resources
 - new (alternative) technology to develop new resources

Environmental development

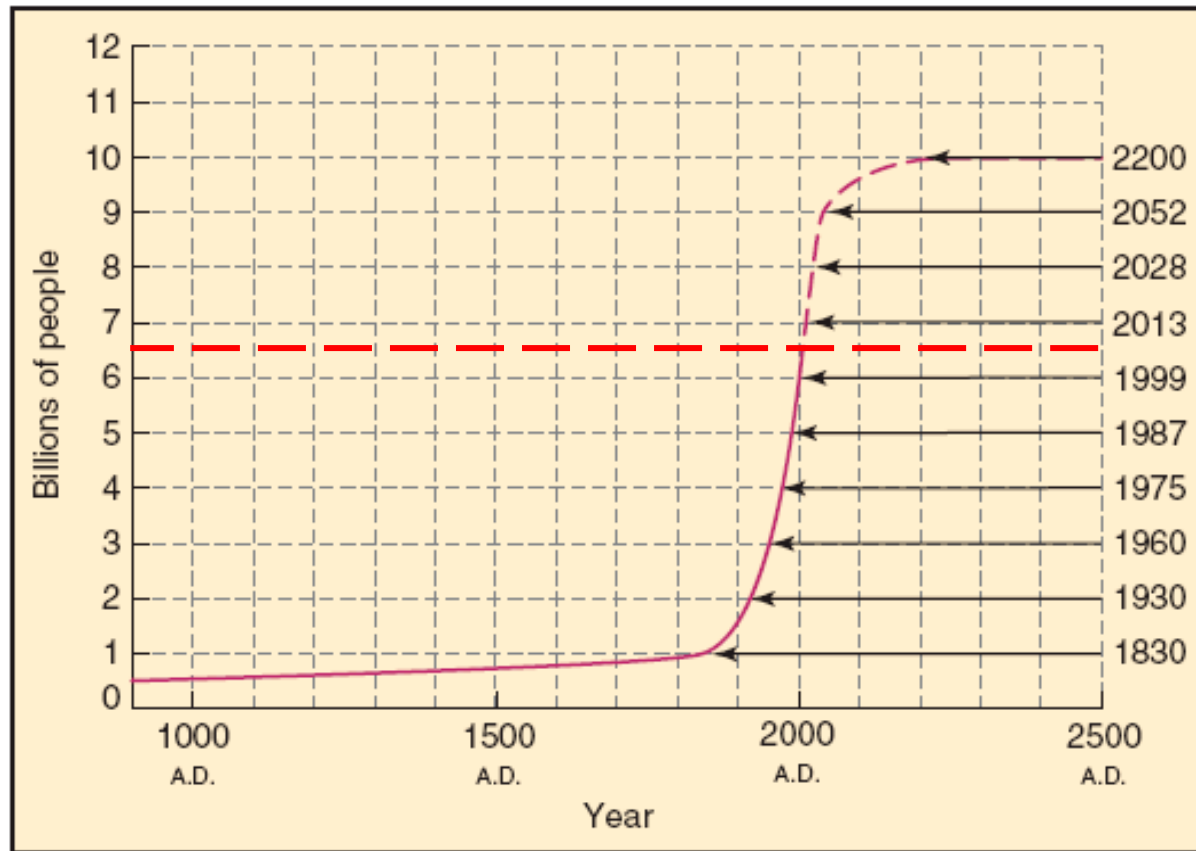
Elements that influence sustainable development: world wide

- Security:
 - a. Conflicts
 - b. food security, save drinking water, energy supply
 - c. floods and droughts → crop loss
 - d. toxicities (health and health care)
- Population growth: six fold in one century
- Economic growth: more consumption per capita.
- Live expectancy: we live considerably longer

Examples Security matters



Population growth and expected growth



Global Environmental issues/problems

Exhaustion natural resources:

- a) not renewable sources of energy and raw materials
- b) no recycling of waste or just down cycling

Decline of ecosystems, loss of bio diversity

- a) pollution: toxic elements
- b) temperature rise
- c) direct anthropogenic interventions (dams, forests)

Land degradation

- salinity and alkalinity,
- soil erosion,
- loss of soil fertility and/or water holding capacity

Deforestation

Global Atmospheric Changes:

- a) air pollution and smog
- b) breach in the ozone layer
- c) global warming

State of the art in the Netherlands: **the 7 V's**

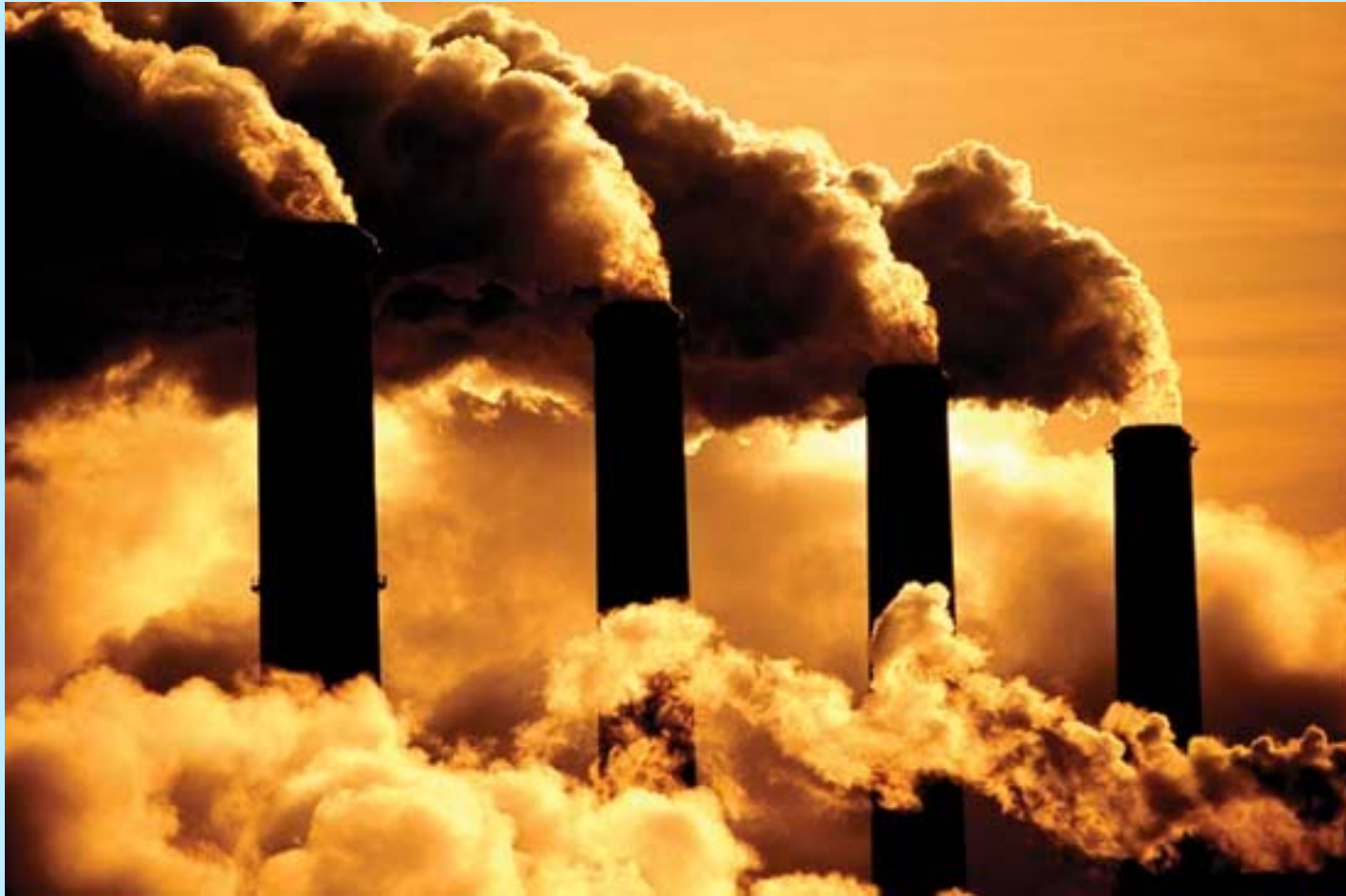
Verspilling	Waste of energy and (raw) materials	<ul style="list-style-type: none"> - no recycling but down cycling - Inefficiency
Verspreiding	Emissions to <ul style="list-style-type: none"> - air, - groundwater, -surface water 	<ul style="list-style-type: none"> - polluted discharges (effluent) - no prevention (curative) - weak law enforcement
Verzuring	Acidification (acid rain, deposition)	Emission of: <ul style="list-style-type: none"> - smoke gases (industry) - exhaust gases (traffic) - emission of ammonia
Verresting	Eutrofication (N , P) Mono cultures (nettles), algae	<ul style="list-style-type: none"> - P&N in discharge effluents - Leaching of P&N arable land
Verdroging	Drought Groundwater depletion → floods down stream	<ul style="list-style-type: none"> - drainage agricultural land - winning of groundwater - Urbanization
Verwijdering	Disposal (without recycling or only downward recycling)	<ul style="list-style-type: none"> - no waste segregation → - no or insufficient recycling
Verstoring	Disturbances of nature	Noises, bad smells

Environmental themes in the Netherlands

1. Air pollution: smog, dry and wet acid depositions
2. Pollution and or eutrophication of surface water
3. Soil and groundwater contamination/pollution
4. Solid waste: mainly disposal and down recycling and less recycling
5. Bio-diversity (ecological connection zones and corridors)
6. Drought and floods
7. Global warming: emission reduction CO₂

THEME 1: Smog and acid depositions.

Serious Emissions



Smog



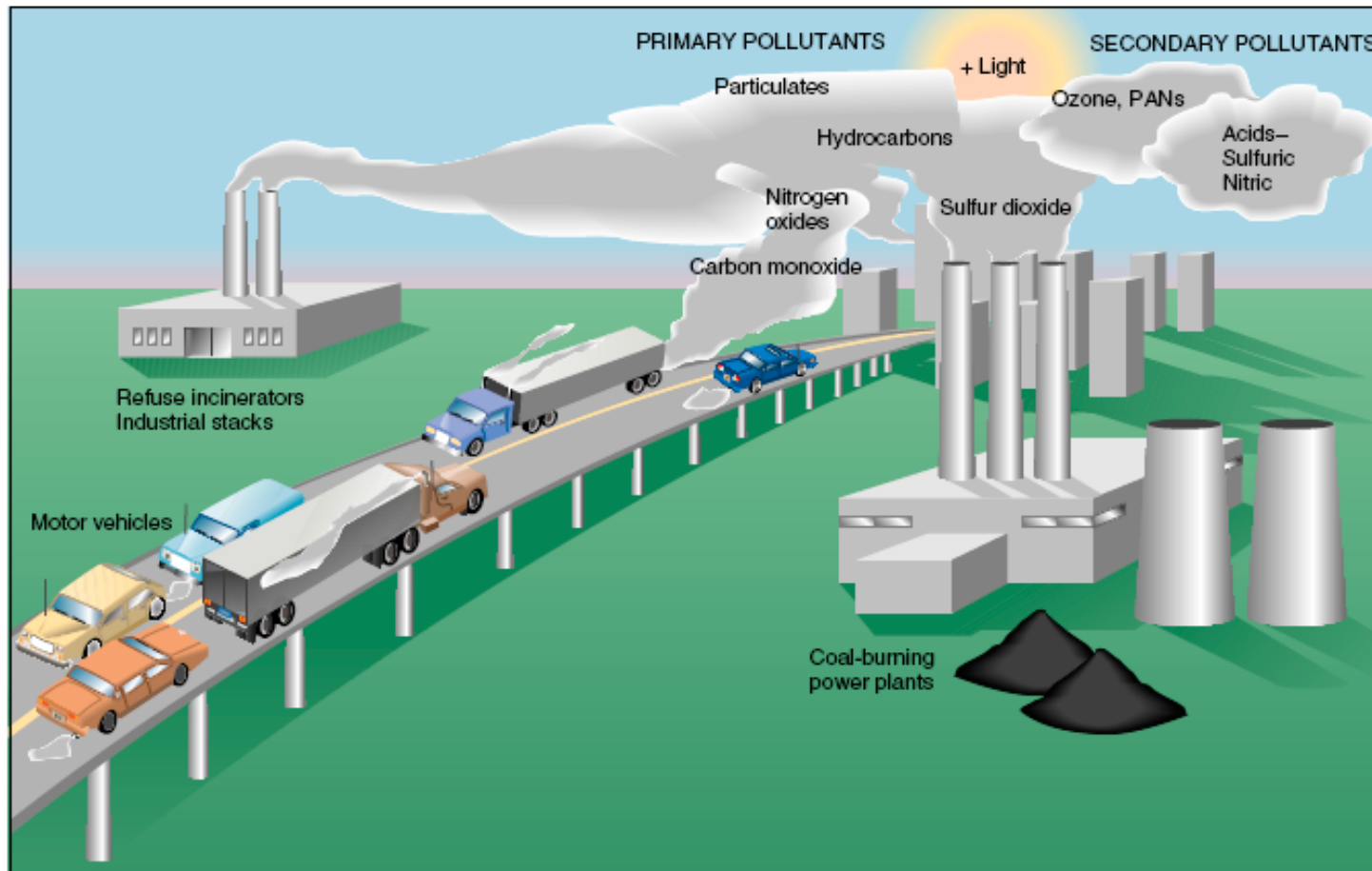
(a)




(b)

Figure 21-4 Los Angeles air. A typical episode of photochemical smog. (a) Early in the morning, the air is clear. (b) Midmorning of the same day, the air is hazy with smog.

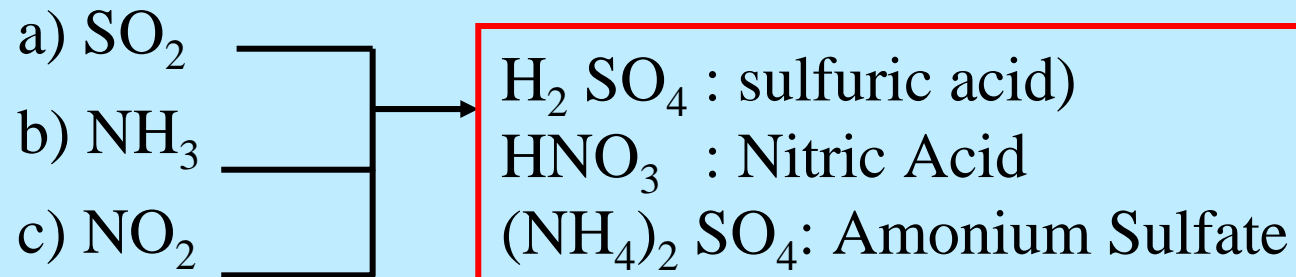
Air pollution schematic



 **Figure 21-6** The prime sources of the major air pollutants.

Dry and wet acid depositions →

Emission of



SO_2 → from coal burning containing sulfur

NH_3 → from intensive livestock production

Reaction → AmoniumSulfate → dry deposit → rainfall → soluble in water → transforms into Sulfate (SO_4) and Nitrate (NO_3) and lots of H^+ → pH goes down to 4,0: leaching heavy metals etc.

Acidification of surface waters (ponds) and natural lands/forests →

Die-off of

→ aquatic life

→ flora/fauna of heath land

→ Die-off of pine tree forest

Effect of acidity to pine forest (Eighties)



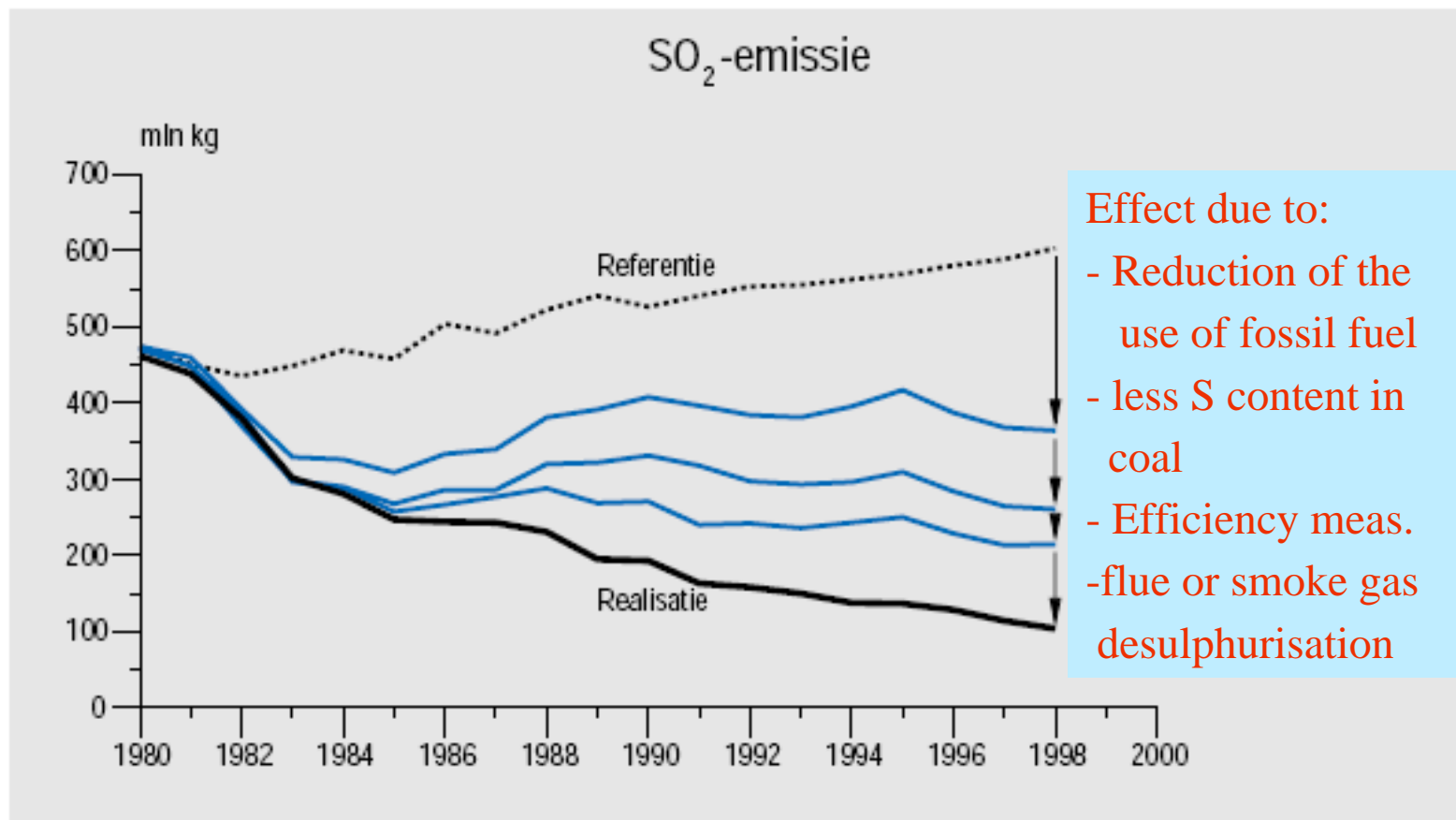
Measure to avoid acidification

- Cleaning of gasses from SO_x
- Adding acid to livestock houses:



- Injection instead of spraying liquid manure

Attenuation Acidification by reduction of SO₂-emission:



Figuur 4.3.2 Bijdrage verschillende maatregelen aan de reductie van de SO₂-emissie in Nederland, 1980-1998.

Reduction of Ammonia emission



Open spraying liquid animal manure



Injection into the soil of liquid animal manure

Reduction SO_2 and NH_3 \rightarrow restoration of pine tree forest

THEME 2: Pollution of the surface water

Eutrophication and toxication of the surface water

- **effluent of sewer water purification plants (30 %)**
- **leaching N&P from arable land (animal manure and fertilizers → another 60%)**
- disposals of untreated industrial waste water
- overflow sewer systems to surface water
- urbanization:
 - a) leaching building material (lead, zinc)
 - b) washing: traffic → oil products, tires (zinc) etc.
 - c) drinking water chain → copper

Eutrofication: see Jerome Eggen

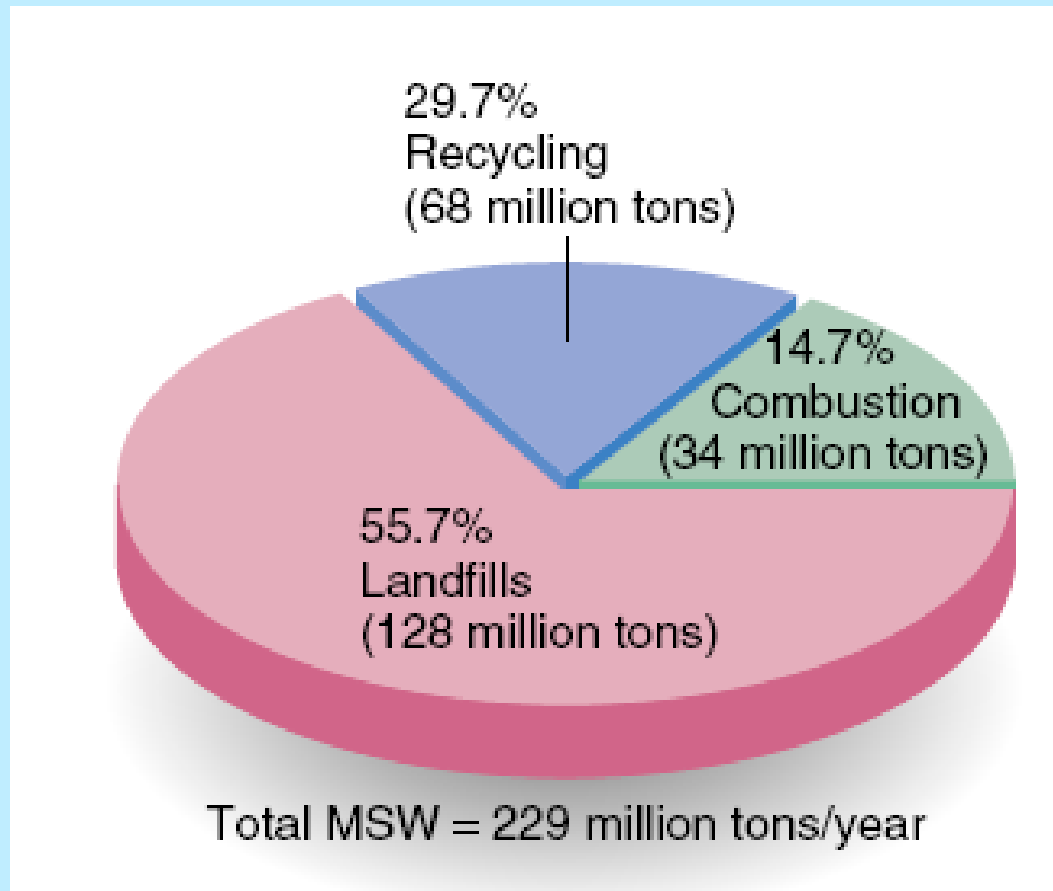
THEME 3: Soil contamination

1981: **“Lekkerkerk”** affair. A town district was build on a very poisonous landfill location, just covered by a thin layer of clean sand

Bennie Gorissen will go in more detail on soil contamination.

THEME 4: SOLID WASTE

Disposal of solid waste to landfills, combustion and recycling, *in the United States: 2001*

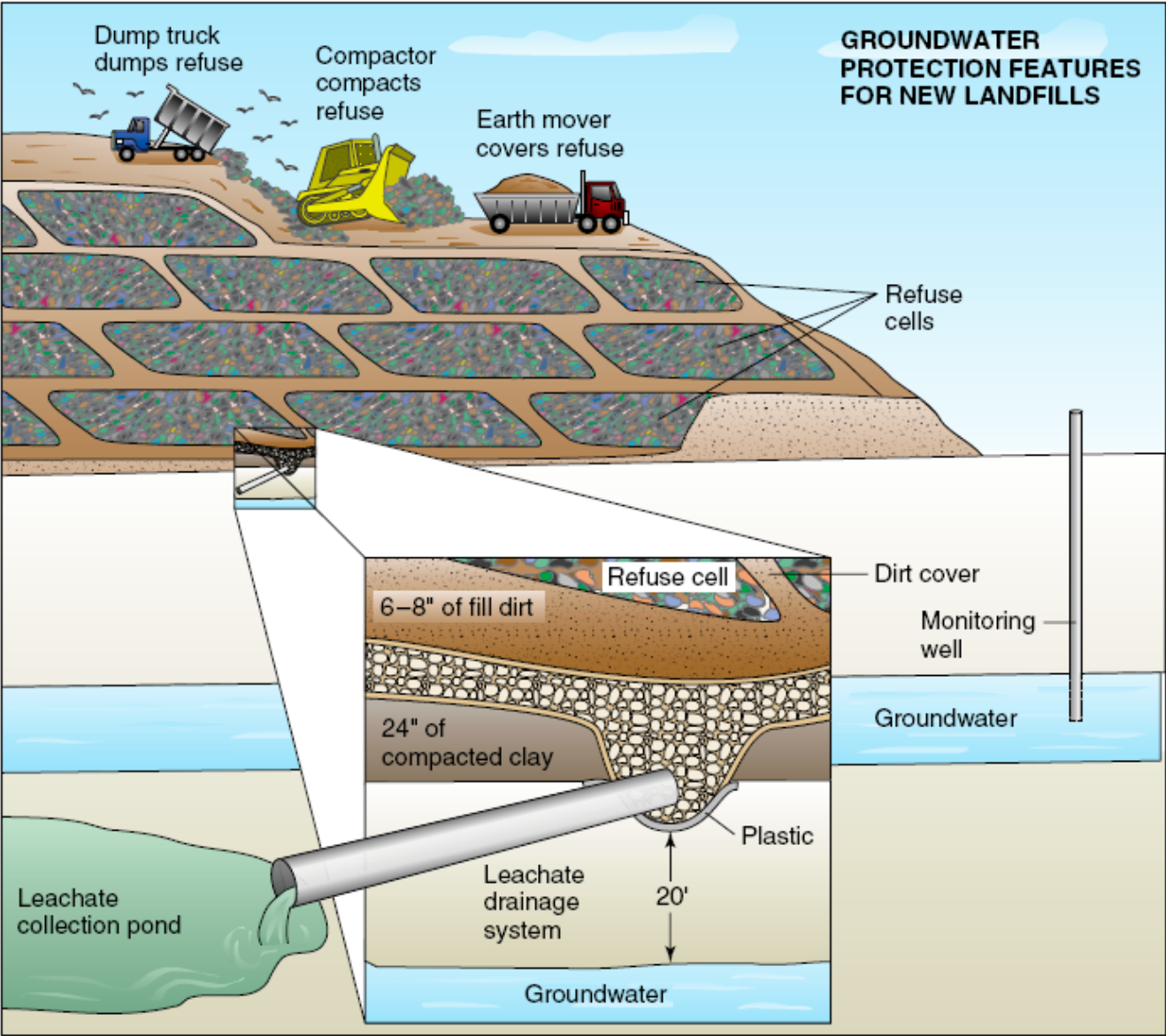


Source: Data from EPA, Office of Solid Waste, *Municipal Solid Waste in the United States: 2001 Facts and Figures*. October 2003.)

Waste dump or illegal landfill



Features of a modern landfill



Waste removal and incineration



Waste removal

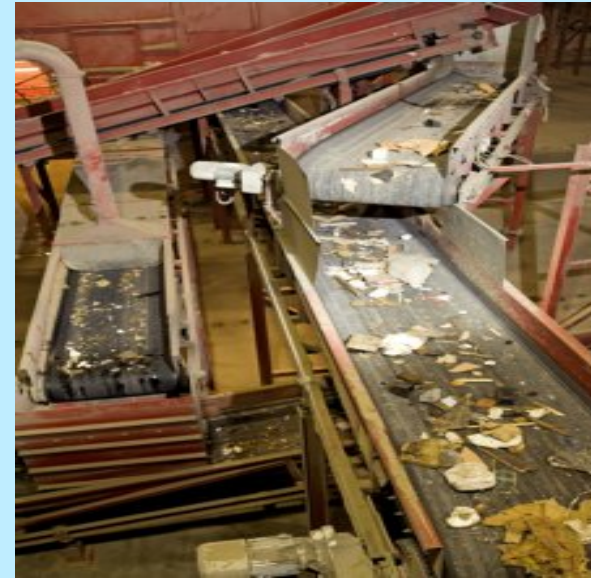


Waste incineration

Waste separation at the source



Waste segregation and sorting systems



Solid waste reduction

- Source reduction: less packing materials,
- reuse (bottles)
- recycling: primary and secondary recycling

Why Recycle? Recycling leads to a saving of energy and materials → **less pollution, less energy**

- **paper and paperboard**
- **wood**
- **metals**
- **plastics**
- **glass**
- **organic matter/manure**

THEME 5: Bio-diversity

Loss of bio-diversity is caused by:

- fragmentation of natural areas (barriers)
- insufficient protection of sensitive natural areas/species
- soil and surface water pollution, air pollution
- noise disturbance
- increasing soil fertility and shrinkage of seepage zones,

Solutions:

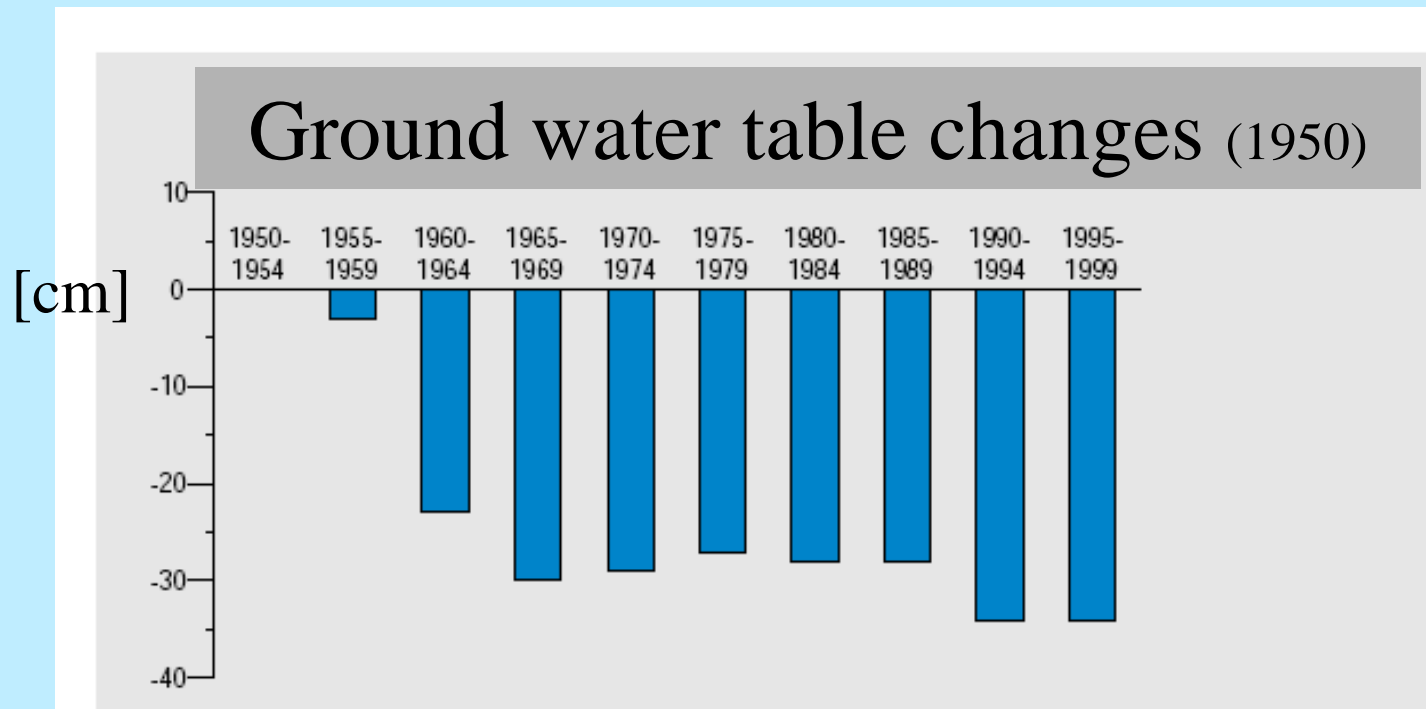
- design of connection zone, fish way/ladder
- creation of more natural banks along rivers, lakes
- protection measure in case of rare species
- soil, water and pollution, see previous THEMES
- creation of noise abatement zones, wildlife sanctuary

Projects

Fauna:

- Beaver
- Some butterflies
- Salmon
- White Stork

THEME 6-a: Droughts → A lowering of depth of the ground water table, reference 1950



Figuur 5.4.11 Gemiddelde verlaging grondwaterstand in Nederland sinds 1950 (Bron: NITG-TNO).

- Drainage of agricultural lands
- Ground water extractions
- Urbanization

THEME 6-b: Floods and flash floods

Cause of flooding and flash floods

Well drained land in the upstream part of the catchment area
Urbanisation: rain sewer overflow to the surface water

Recently and near future: Effects of global warming:

- a) More rainfall during the winter season
- b) Less rain in the summer period but rainfall with a higher intensity (lots of rain in relative short periods)
- c) Increase of sea level opposing the discharge river flow (back water effects)

- Advanced hydrologic prediction services (use of models)
- Evacuation in time of the population

Limburg 1993 and 1995

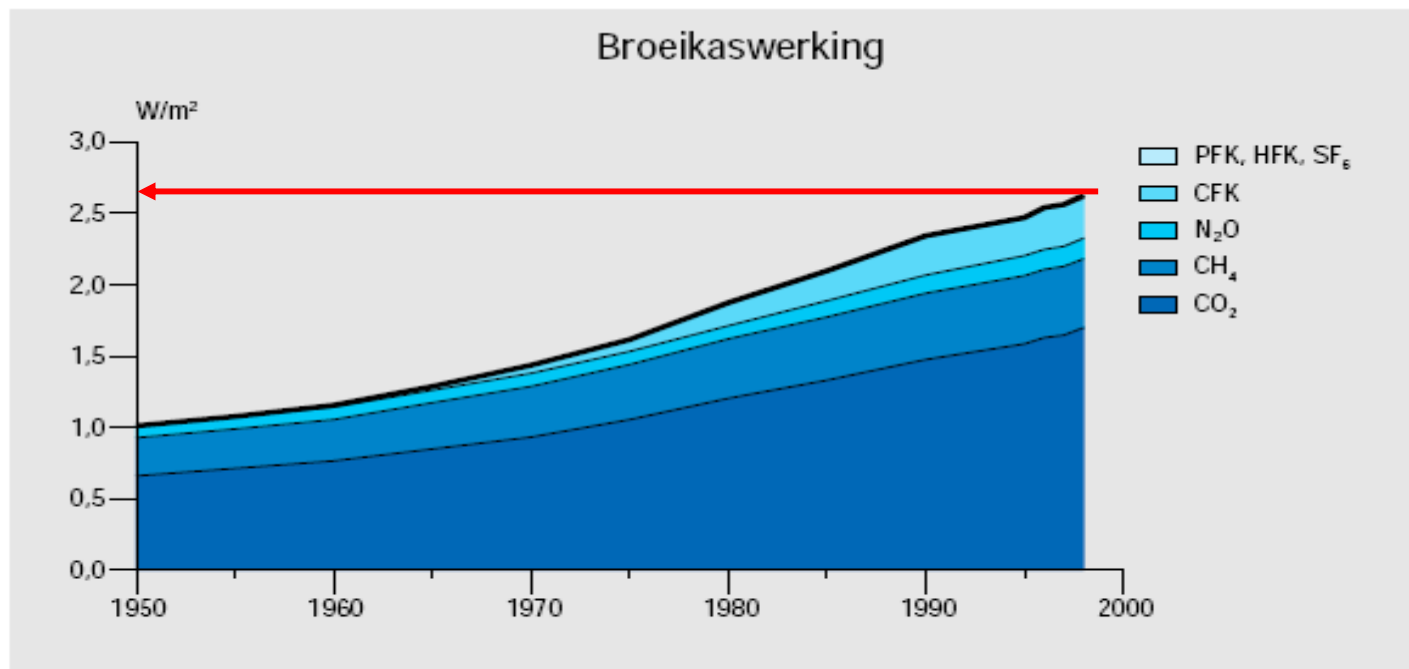
Limburg 1993

Evacuation of 12.000 people



THEME 7: Global warming

- Emission of greenhouse gases (from 1,0 to 2,7 W/m²)
- CO₂ is the most important green house gas next methane gas, N₂O etc.



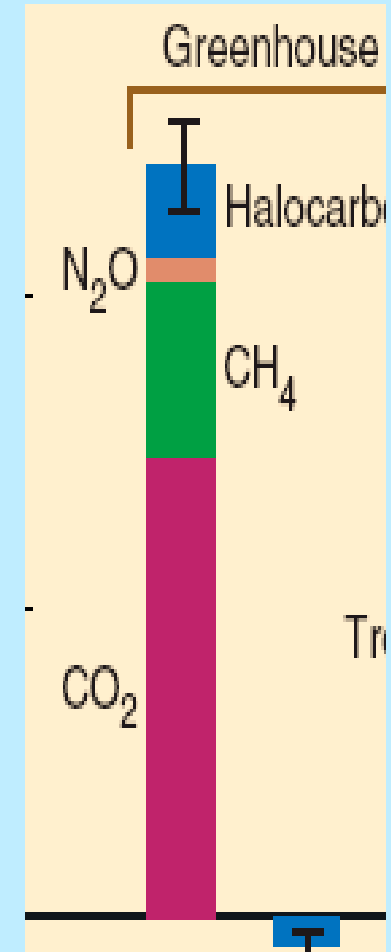
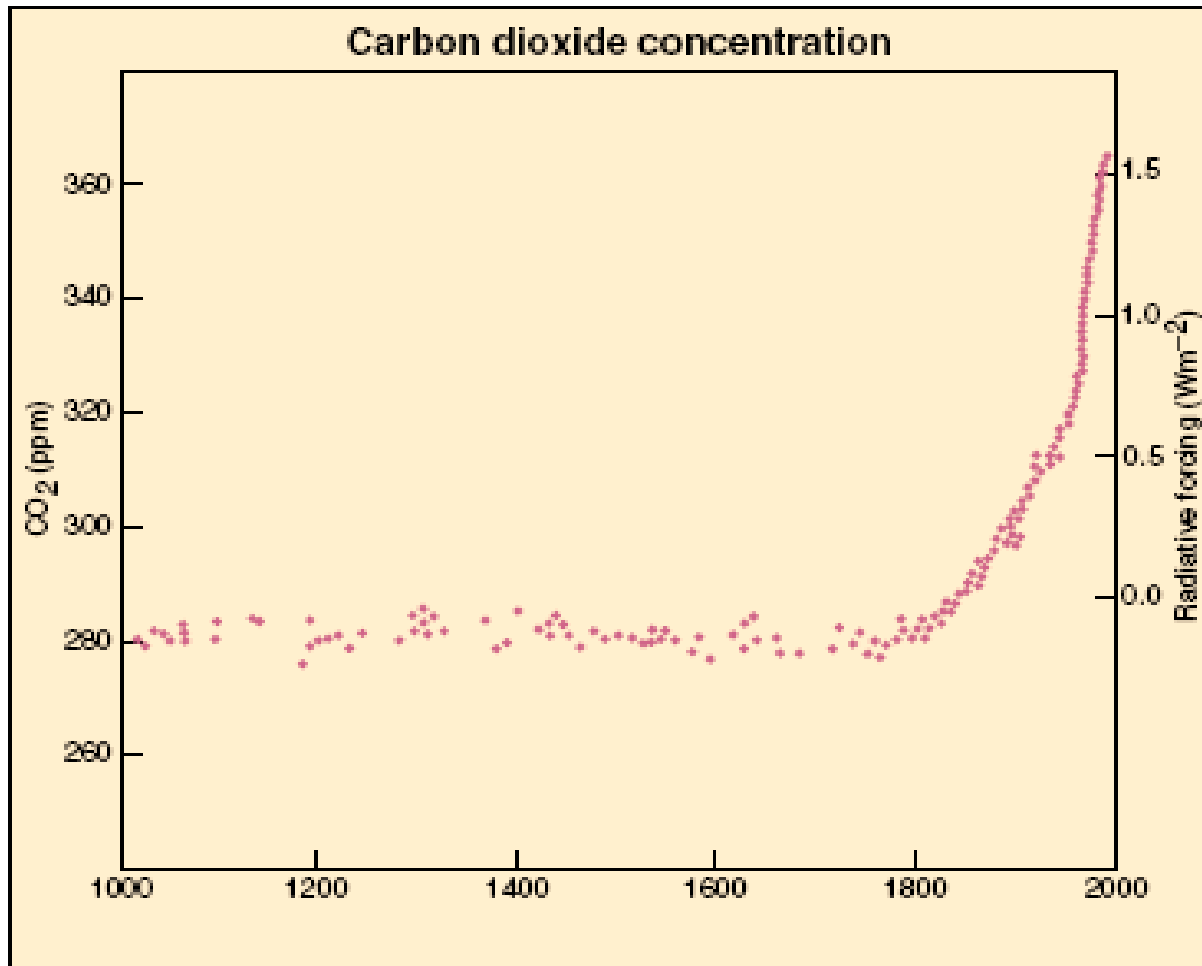
Figuur 3.4.2 Broeikaswerking van de belangrijkste broeikasgassen berekend op basis van concentratiemetingen (IPCC, 1990), 1950-1998.

Emission and immobilisation of CO₂

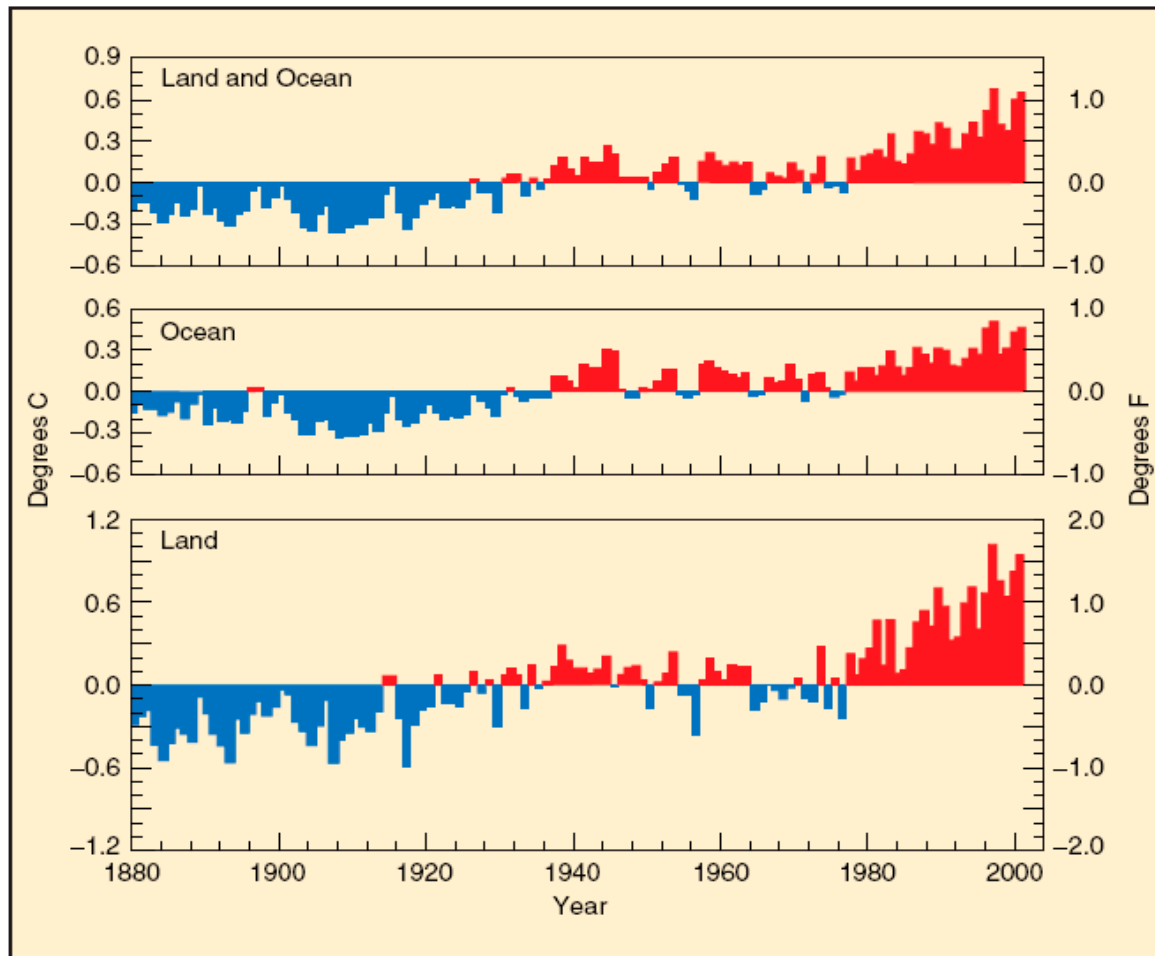


Many think that they can continue by eventually paying the “poor” for not cutting down their forests and which allow them to continue with CO₂ emission

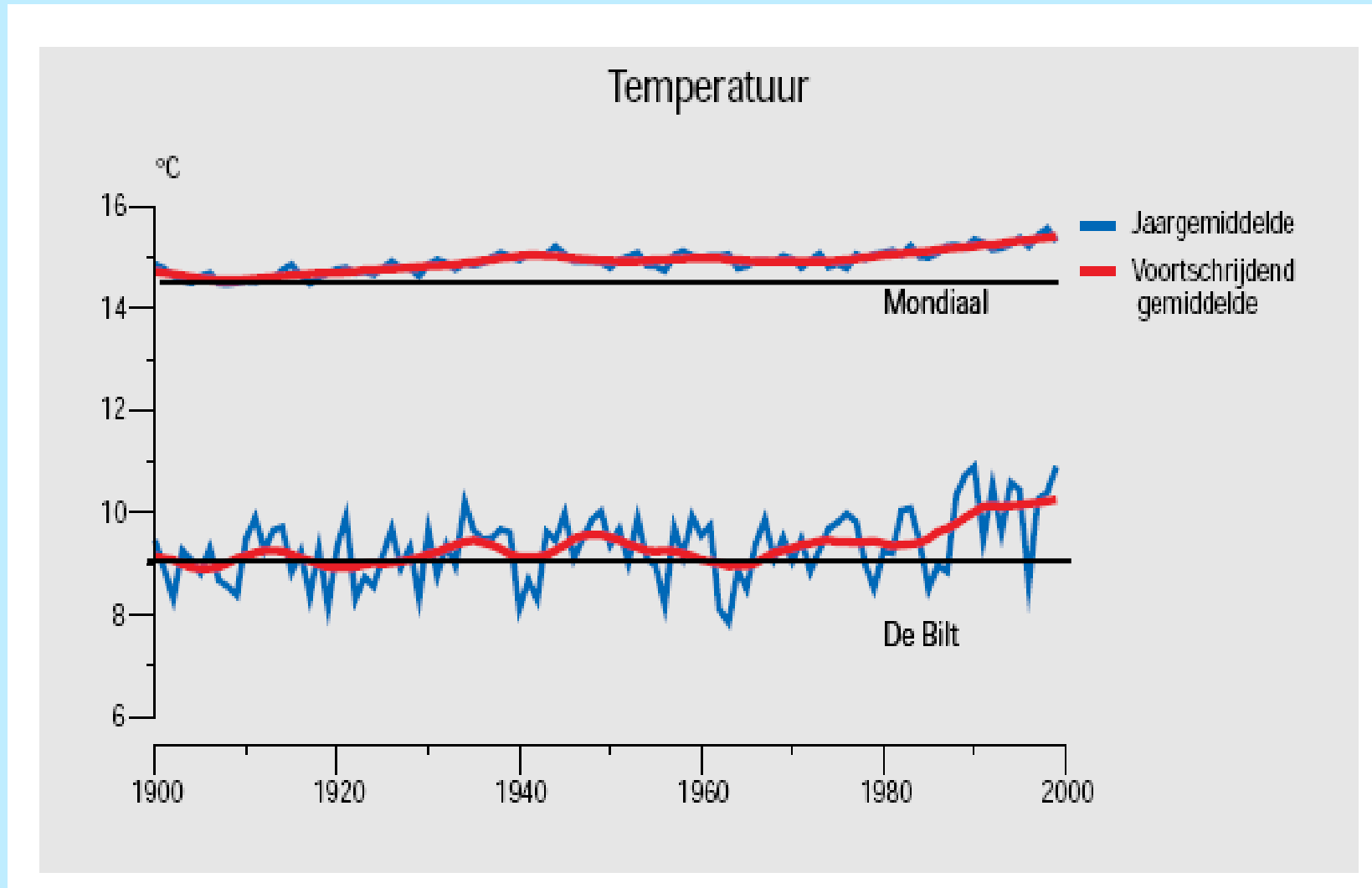
The importance of carbon dioxide as it has risen since the early 1800's.



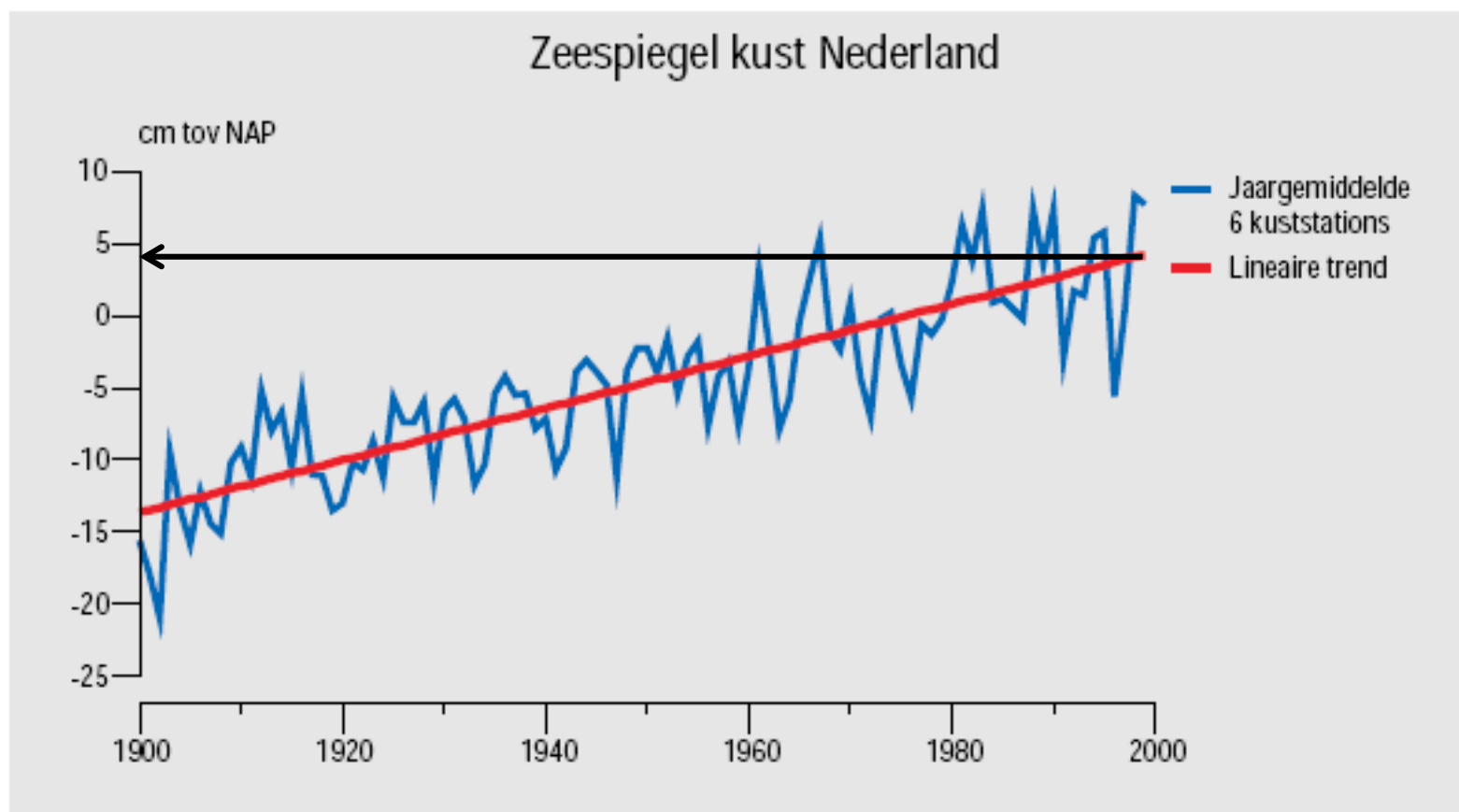
Global temperature



Temperature rise: Mundial and De Bilt (Netherlands)



Sea level rise [18 cm] Netherlands 1900 - 2000



Figuur 3.5.2 De zeespiegelstand aan de Nederlandse kust, gemiddeld over zes kuststations, 1900-1999 (Bron: RIKZ).

Impacts of climatic change

1	Increased warming	Temperatures (1–6°C) by 2100. Heat waves will become more intense and frequent especially in urban area
2	Different regional impacts on temperature and sea level rise	Temperature and precipitation change and more variability will occur. Areas are getting wetter while others will suffer from droughts. Europe: - Winter: more rainfall, lower temperature → less frost - Summer: less rainfall but heavier showers
3	Water concerns	More floods, droughts. Snow melting (gletsers), water quantity and quality
4	Ecosystems	Disappearance of Alpine meadows Coral reefs will be threatened by the higher sea level Drowning of mangrove forest Snow caps will disappear: Kilemanjaro, Alpine, Greenland, South Pole etc.
5	Agriculture	Possible higher potential yields Flooding fertile land in delta areas Siltng (salinisation) Droughts
6	Infrastructure	Sea level rise will damage the coastal infrastructure Country inward damage the river system and – infrastructure.

Type of Energy

Fossil Fuels (main contributor to global warming!)

- Crude oil → petrol, diesel, Kerosine
- Natural gas

Both reserves are declining: (50 to 80 years)

- Oil shales (*wax-like in sedimentary rock*) and sands (bitumen, tar-like) → These reserves are expensive to exploit
- Coal (reserves for a period of a 100-150 years)

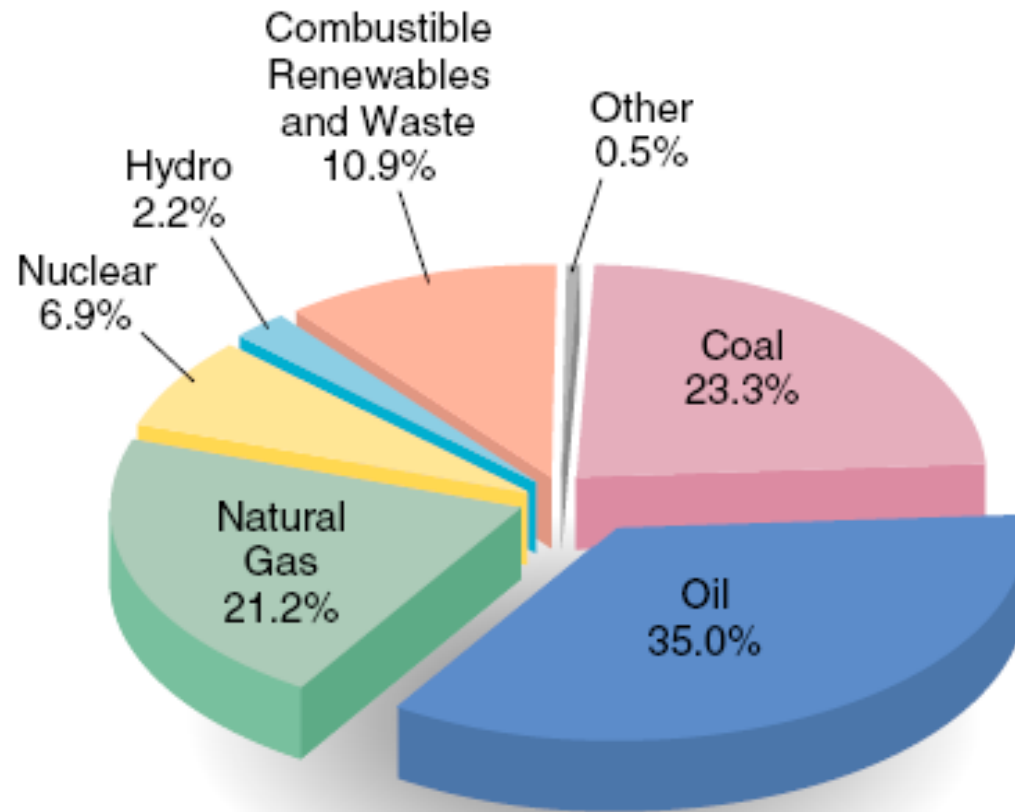
Other sources are:

- nuclear power → nuclear hazards:
- renewable energy →
 - a) solar energy
 - b) wind energy
 - c) hydro power (tidal, reservoirs)
 - d) biomass energy (biogas, ethanol, biodiesel)

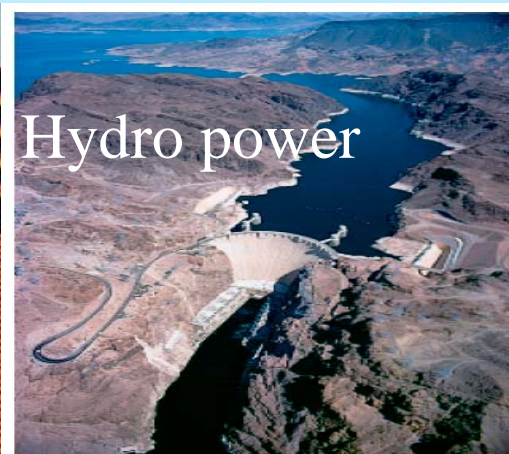
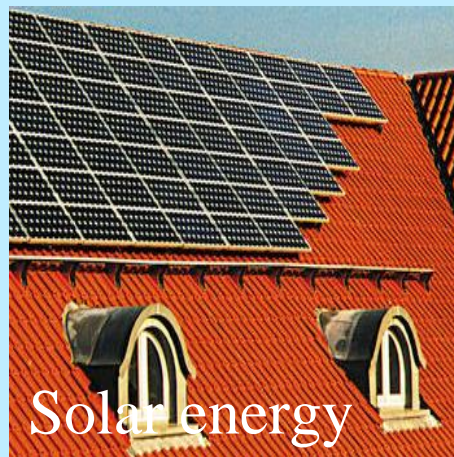
Global primary energy supply.

(Source: International Energy Agency, 2003.)

80% are still from fossil sources



Alternative energy sources





Muchas gracias