Sustainable Energy Implementation

Challenge of the 21st Century and 3rd Millennium

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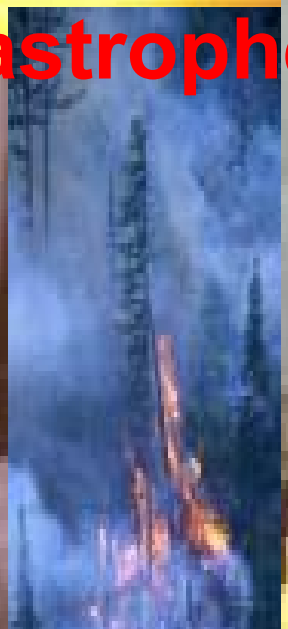
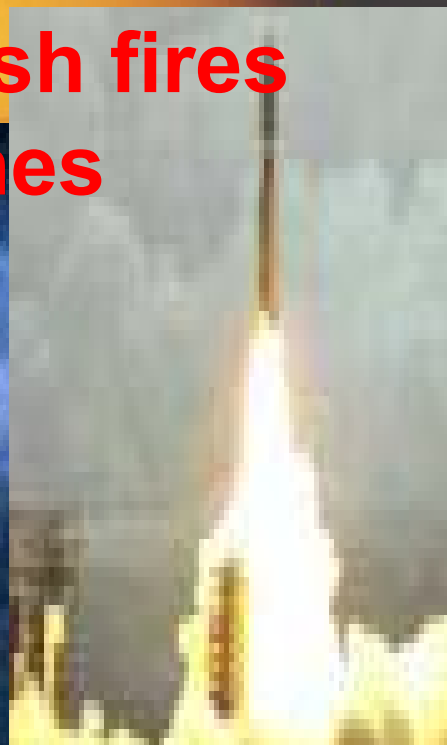
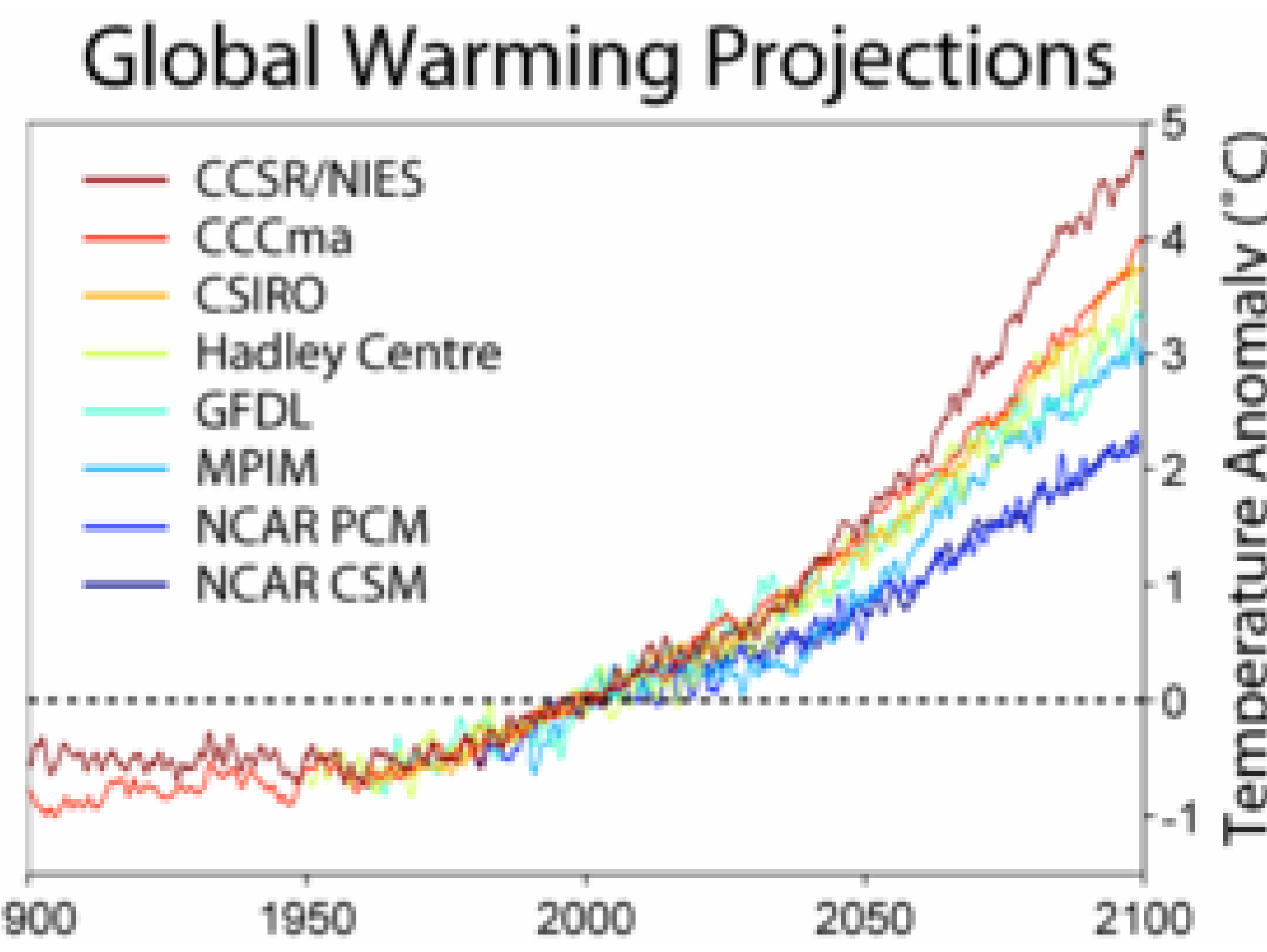
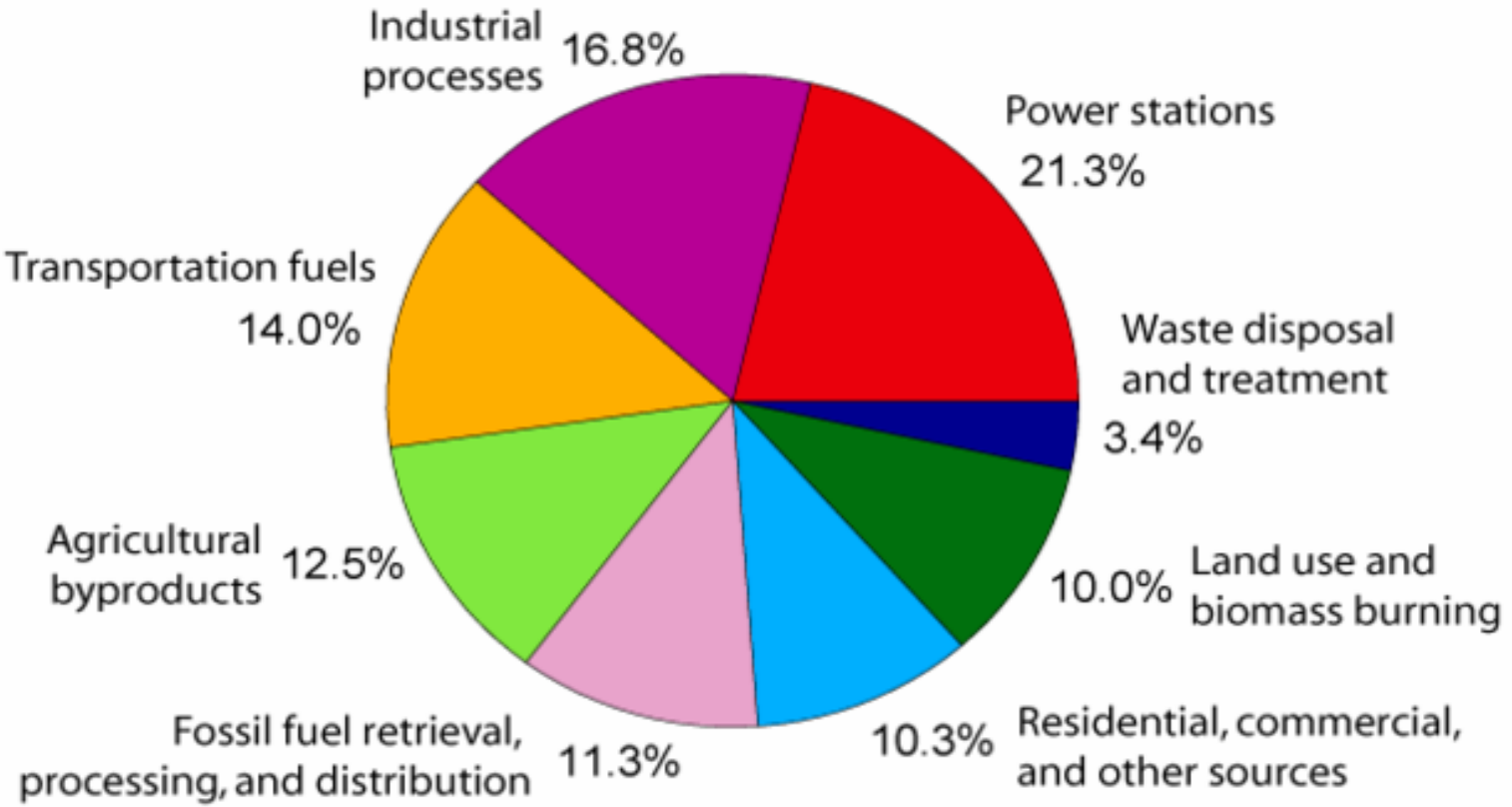
The tragic fire age from fire arms to polluting combustion, bush fires and nuclear catastrophes

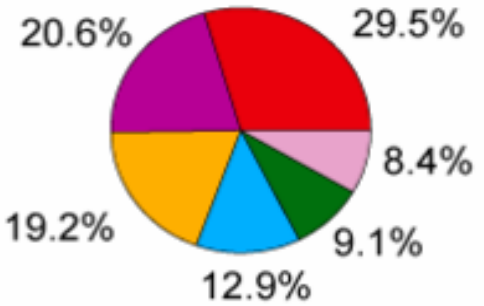




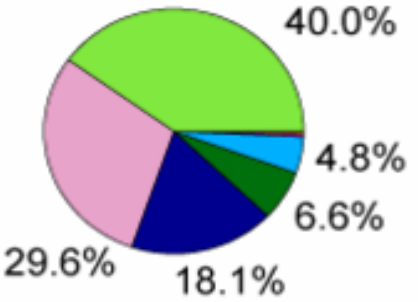

Global Warming Projections
CCSR/NIES
CCCma
CSIRO
Hadley Centre
GFDL
MPIM
NCAR PCM
NCAR CSM
5
4
3
2
1
0
-1
Temperature Anomaly (°C)
900
1950
2000
2050
2100

Annual Greenhouse Gas Emissions by Sector

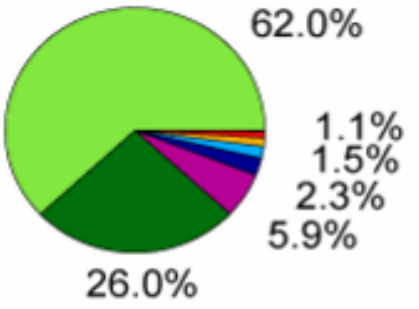




Carbon Dioxide
(72% of total)

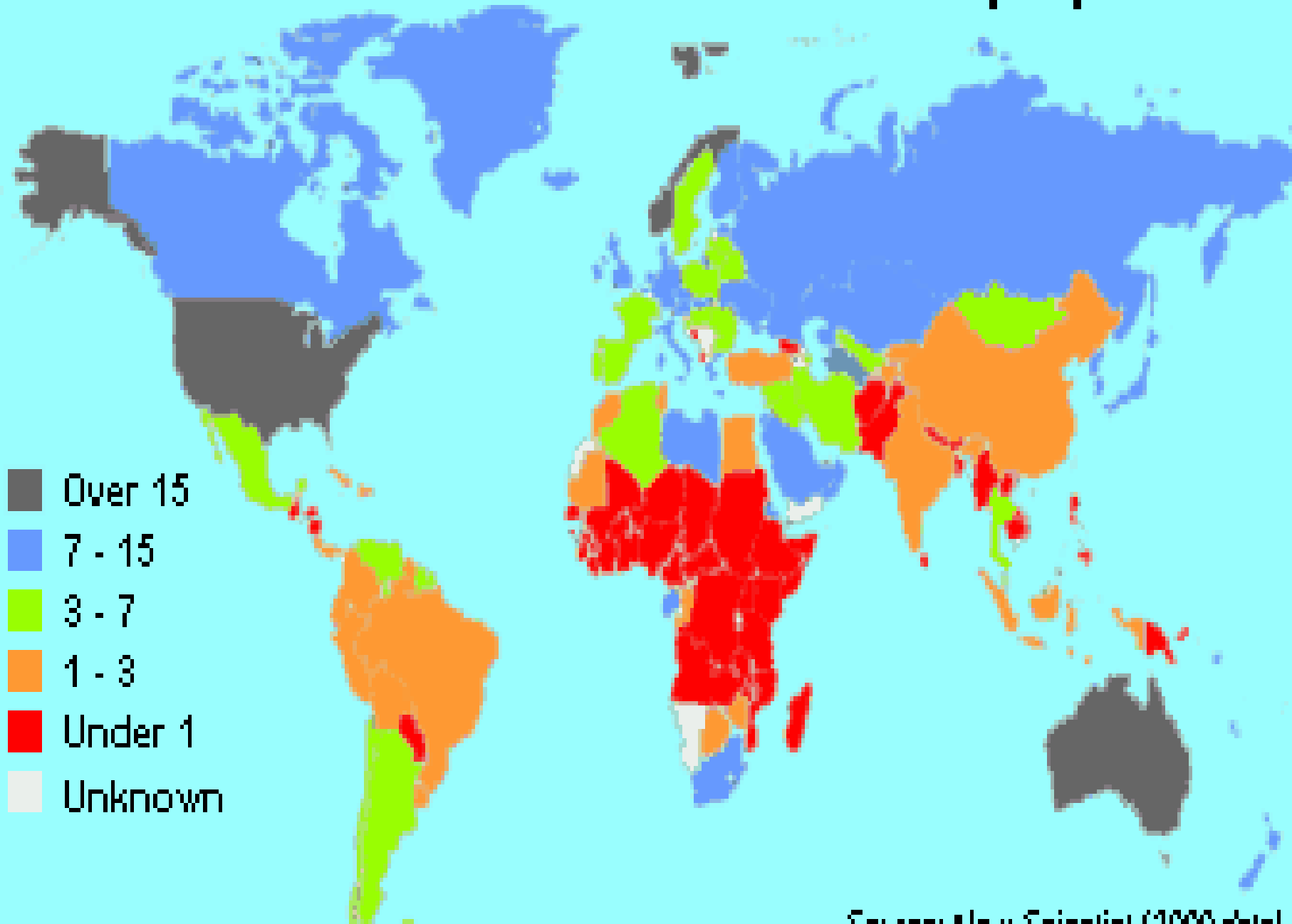


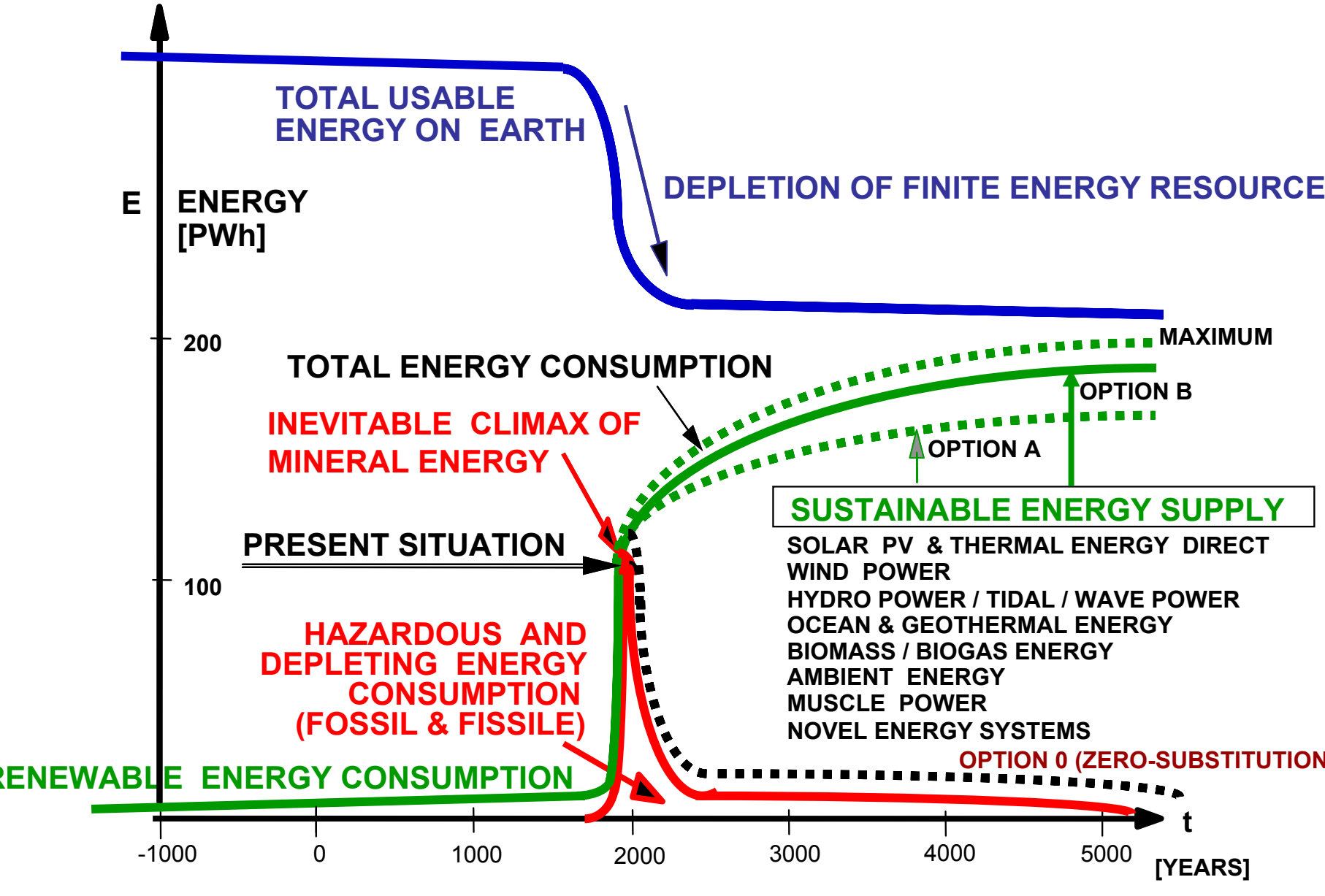
Methane
(18% of total)



Nitrous Oxide
(9% of total)

Carbon Dioxide emissions - annual tonnes per person

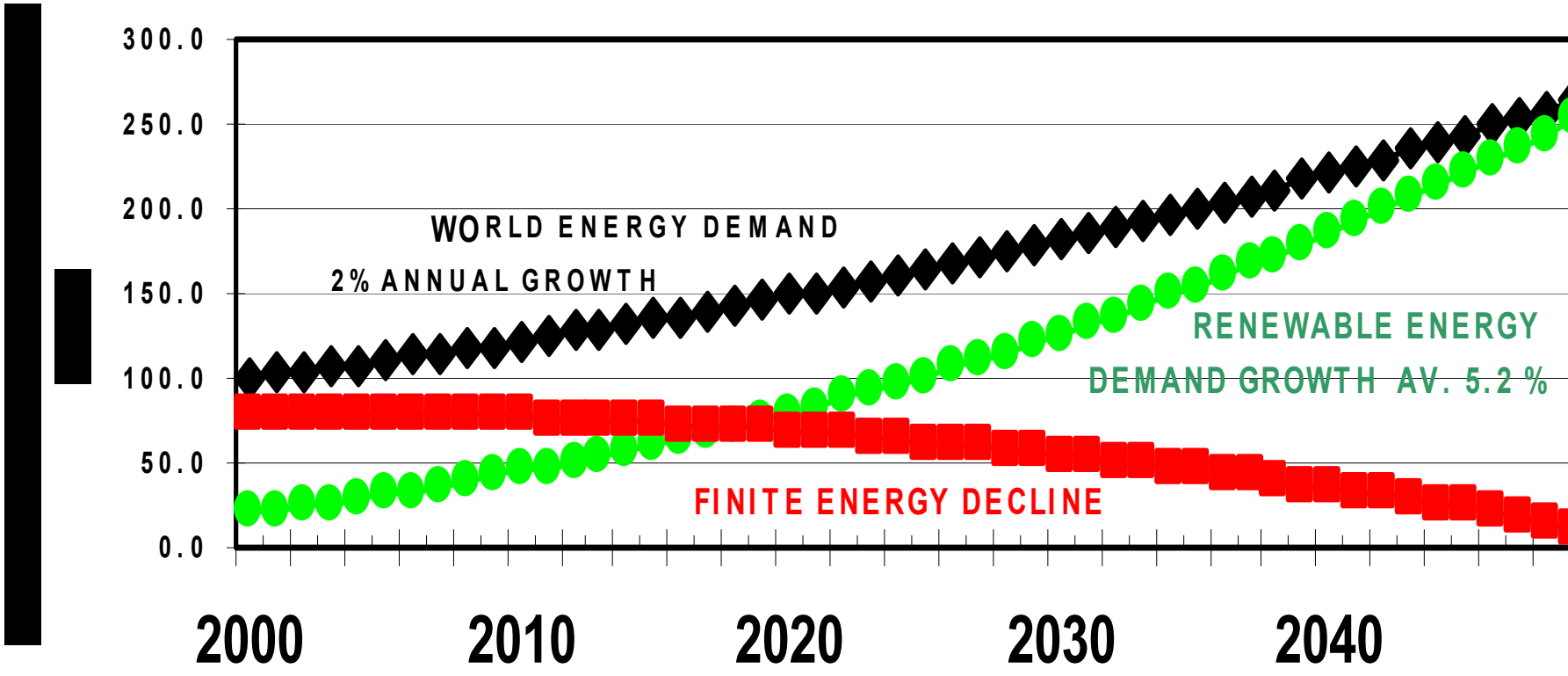




ENERGY HISTORY & FORECAST

SOURCE : ISEO

WORLD ENERGY SCENARIO 2000 - 2050



Source for Finite Energy Data: ASPO at www.peakoil.net & Kyoto Protocol

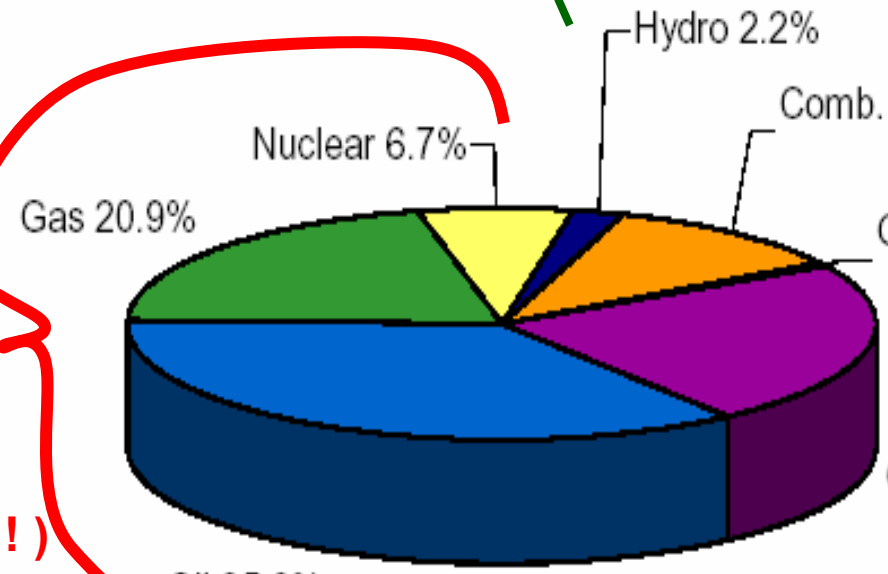
Share of Total Primary Energy Supply* in 2002

World

Renewable Energies only 13,5 %

according to IEA-OECD

- over 20 %
in reality



Mineral

ergies 86.5 %

Combustion

tion, Depletion !)

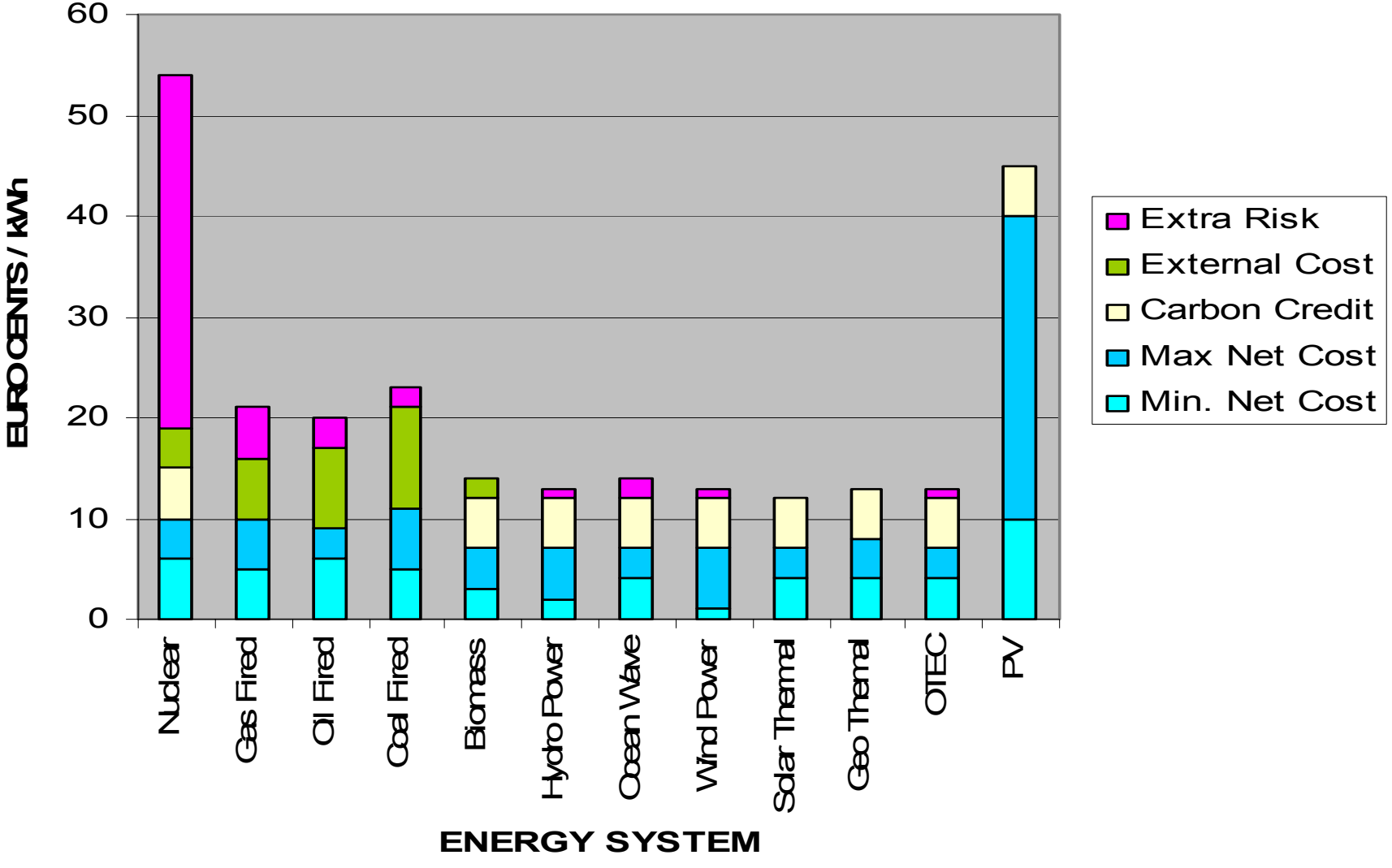
124 PWh

Renewable Energy Option	Immediately Feasible		Theor. Potential
- Bio energy	50	PWh/year	78
- Hydropower	8		14
- Geothermal Electricity Conventional	2		
- Geothermal Electricity / Hot Dry Rock	20		388
- Geothermal Heat	4		
- Wind Power	53		160
- Solar PV Power	6		
- Solar Thermal Power	40		435
- Solar Active Heat	20		
- Solar Passive Heat (Buildings)	10		
- Ocean Energy (Waves and Tides)	15		202
- Heat Pumps	10		50
- Muscle Energy (Food Chain)	1		10
- Novel Energy Technologies (R&D)	100		200
Total RE potential	339	PWh/year	1537

Factors affecting electricity generation cost

- Optimal system (type, size, location, taxes)
- Fuel prices (escalation, emission levies, taxes)
- Carbon Credits (EUR per saved Ton of CO_2)
- External Cost (environment, climate and health)
- Risks of disasters, wars, terror, contamination:
  exposure of power plants to sabotage, tornados, earth quakes or meteorites causing radioactive catastrophes, epidemia, explosions, leaks, spills

TRUE ENERGY COST



Tools for Emission Reduction Incentives and Penalties

- **ISO 13602-1 Energy Systems Analyses Standard**
- **Global Energy Charter for Sustainable Development**
- **International Carbon Credit Mechanisms (Kyoto etc.)**
- **Polluters pay accounting principle (world-wide)**
- **Tax Reforms:**
  more taxes on pollution – less on productive income

Wind Power

Hydropower

Heat Pumps

Clean Vehicles

Solar Energ

Bio Energy

Geothermal Energy

Ocean Energy

Conclusions

- **The polluters pay principle is a MUST**
- **Abundant Renewable Energies are available**
- **All Finite Mineral concepts can be *abandoned***
- **Evolution of Quality of Life becomes possible**

International Sustainable Energy Organisation for Renewable Energy and Energy Efficiency

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Hydropower	Wind Power	Biomass	Geothermal
Solar Energy	Ocean Power	Heat Pumps	Muscle Energy
Clean Transport	Statistics	Efficiency	Education
Architecture	Policy	Legal	Financing