

# **Sustainable Energy Implementation**

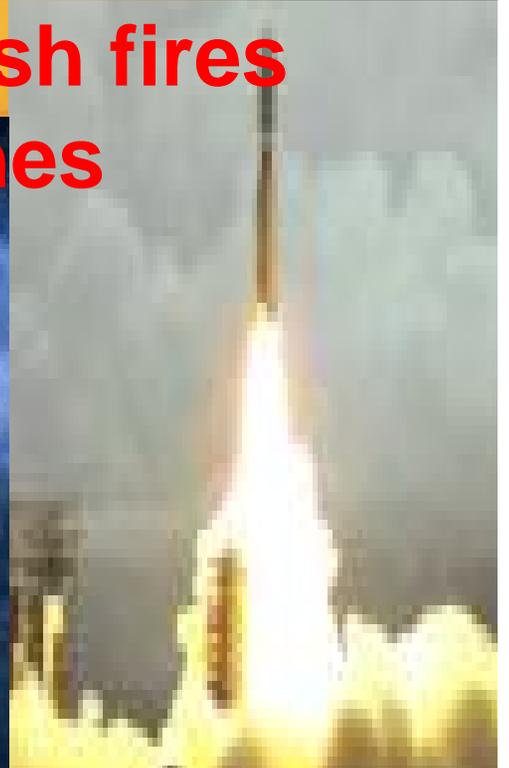
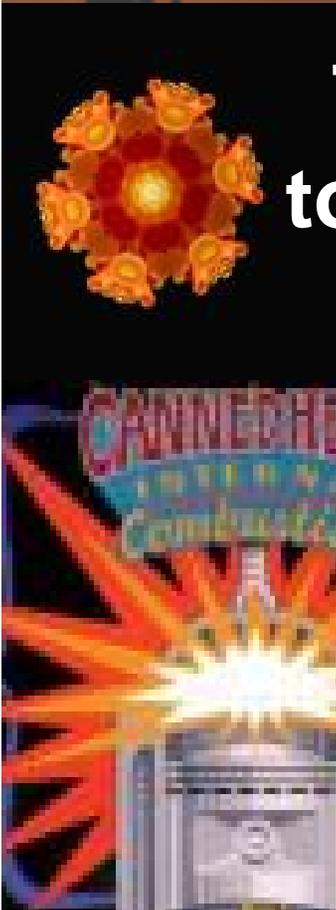
**Challenge of the 21st Century  
and 3rd Millennium**

**Gustav R. Grob**

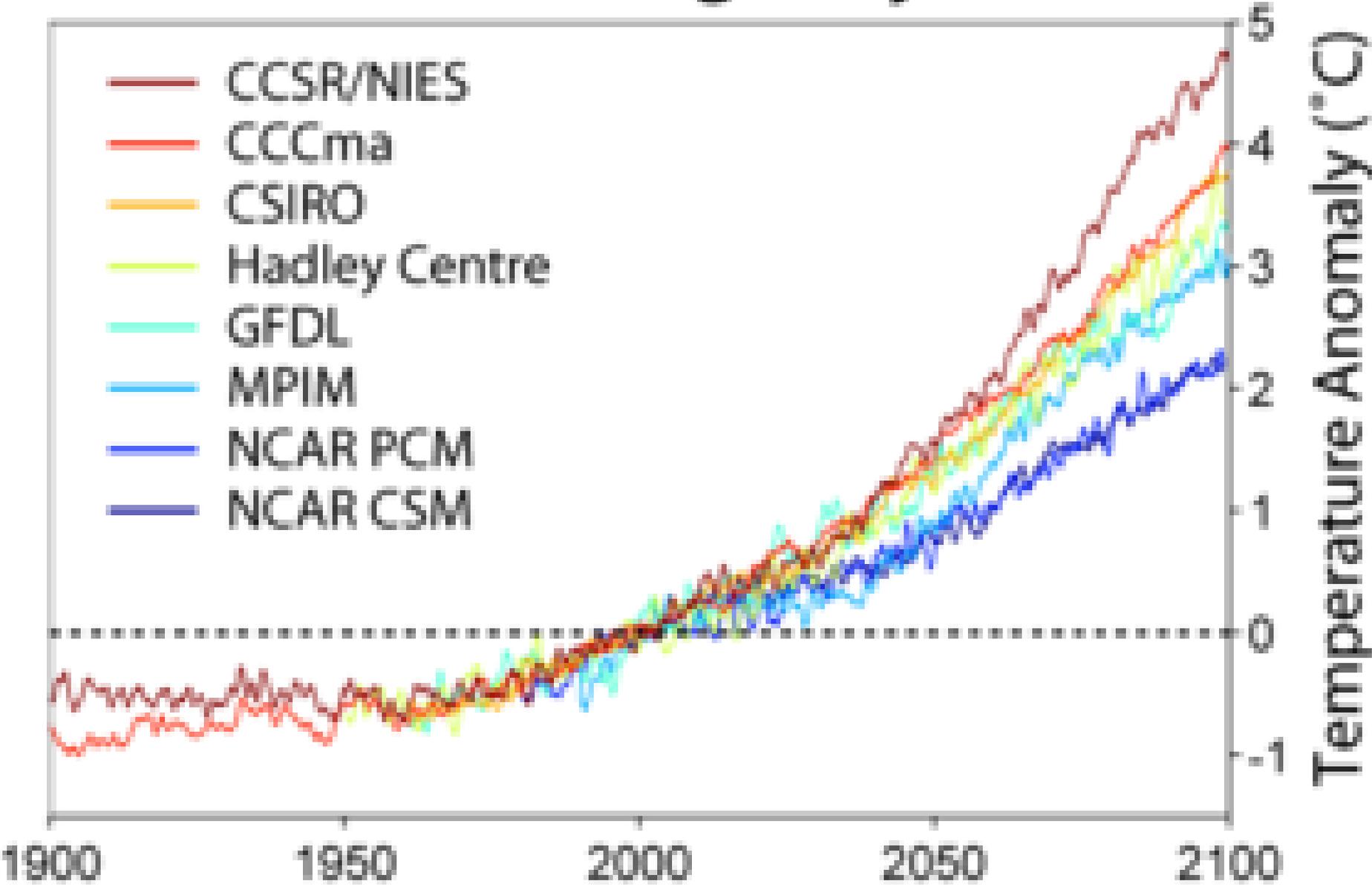
**International Sustainable Energy Organization ISEO  
Chairman ISO Committee on Energy Systems Analyses**



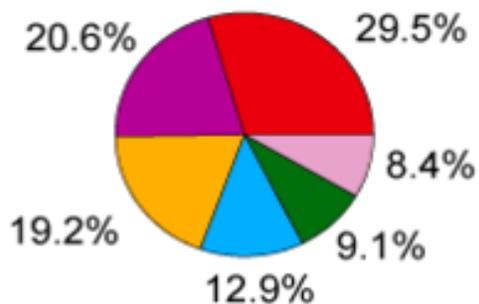
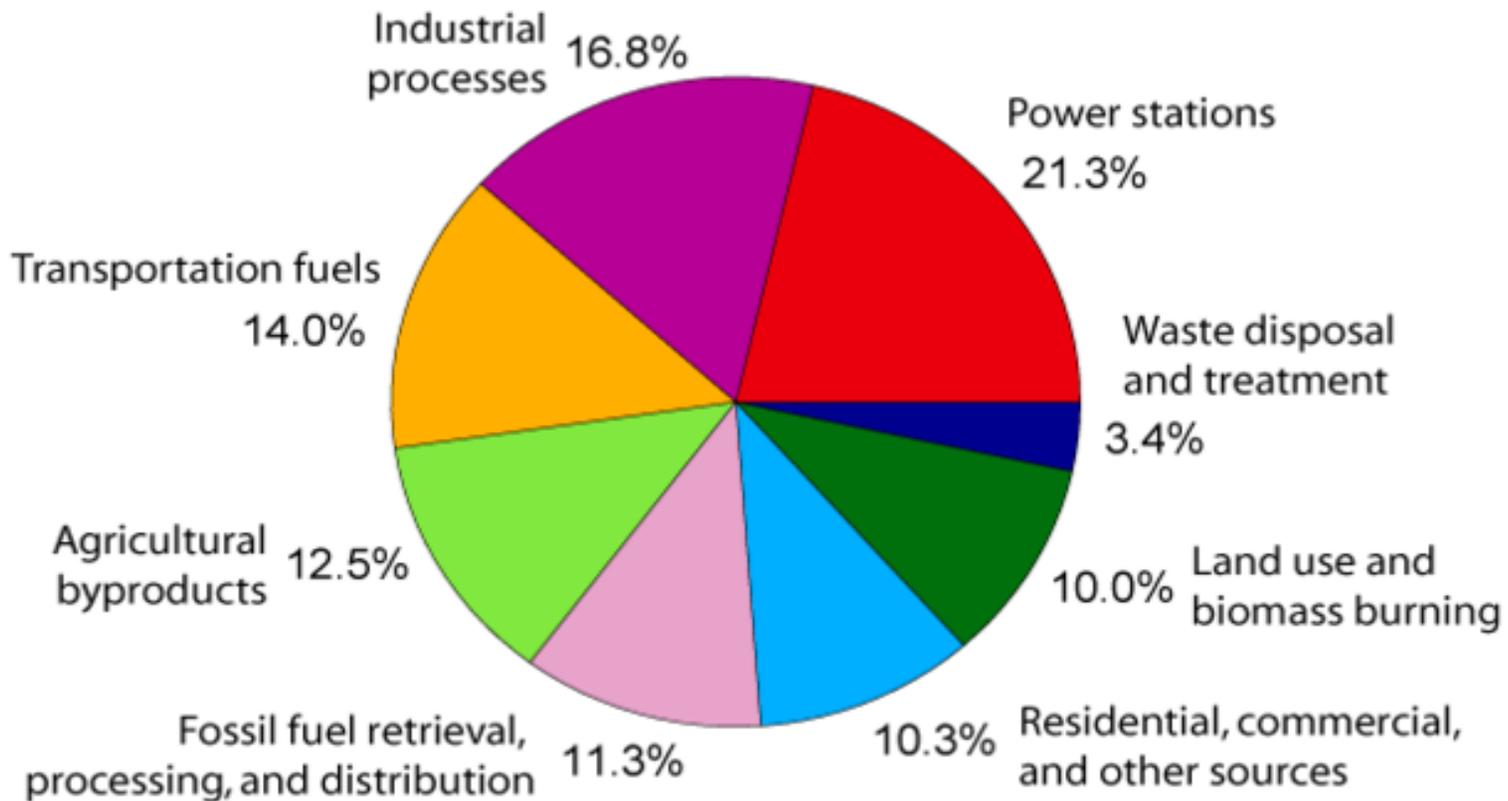
The tragic **fire age** from **fire arms**  
to polluting **combustion**, **bush fires**  
and **nuclear catastrophes**



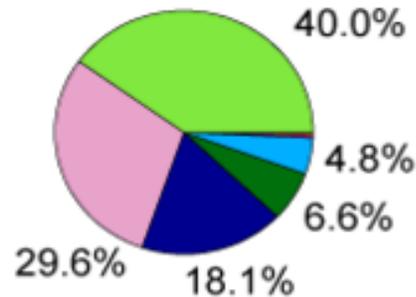
# Global Warming Projections



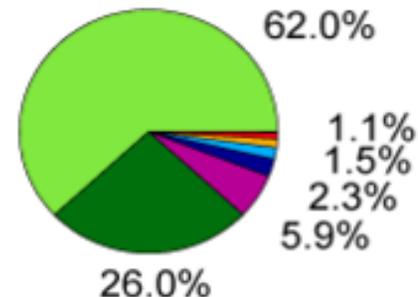
# Annual Greenhouse Gas Emissions by Sector



**Carbon Dioxide**  
(72% of total)

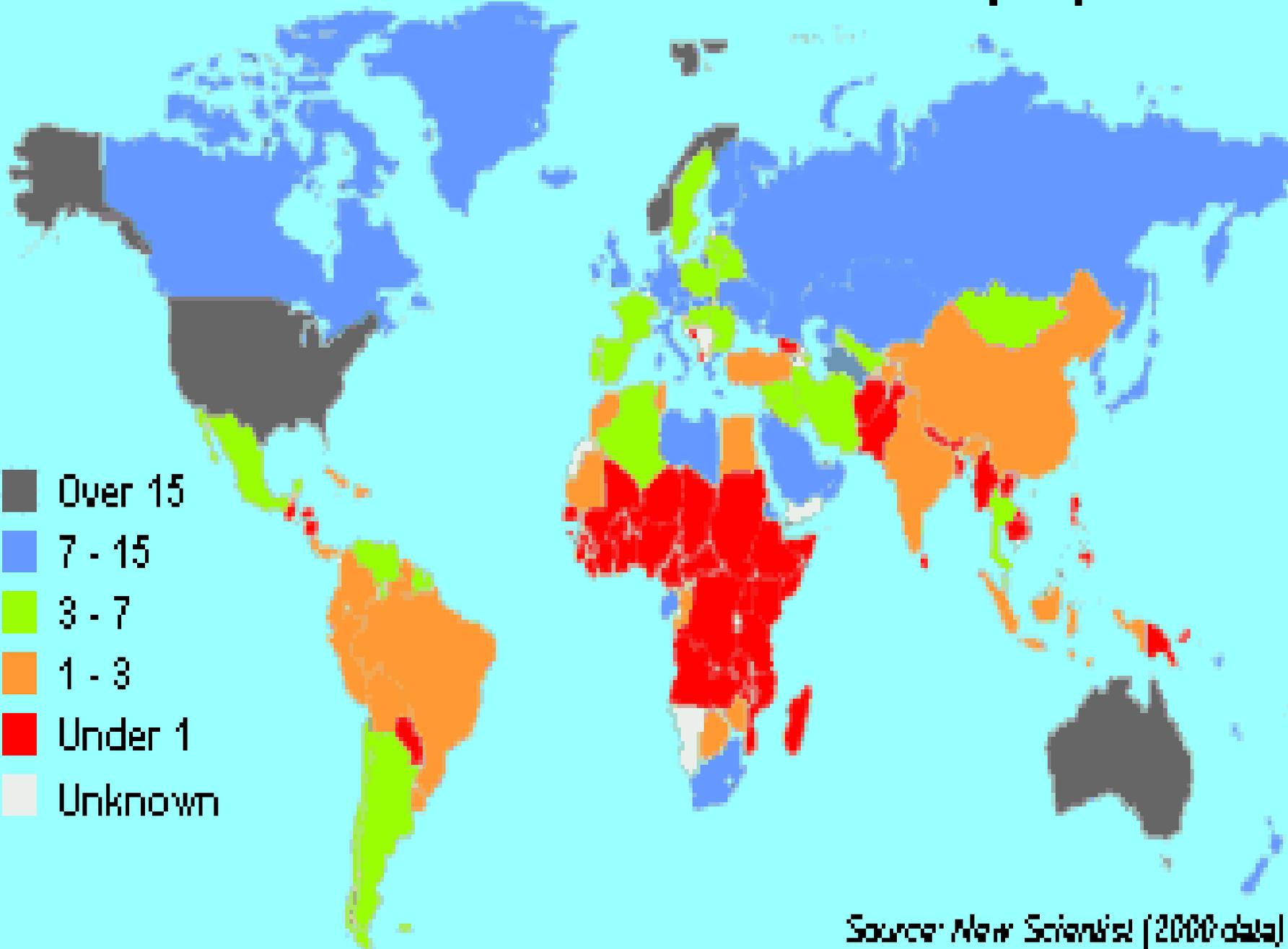


**Methane**  
(18% of total)

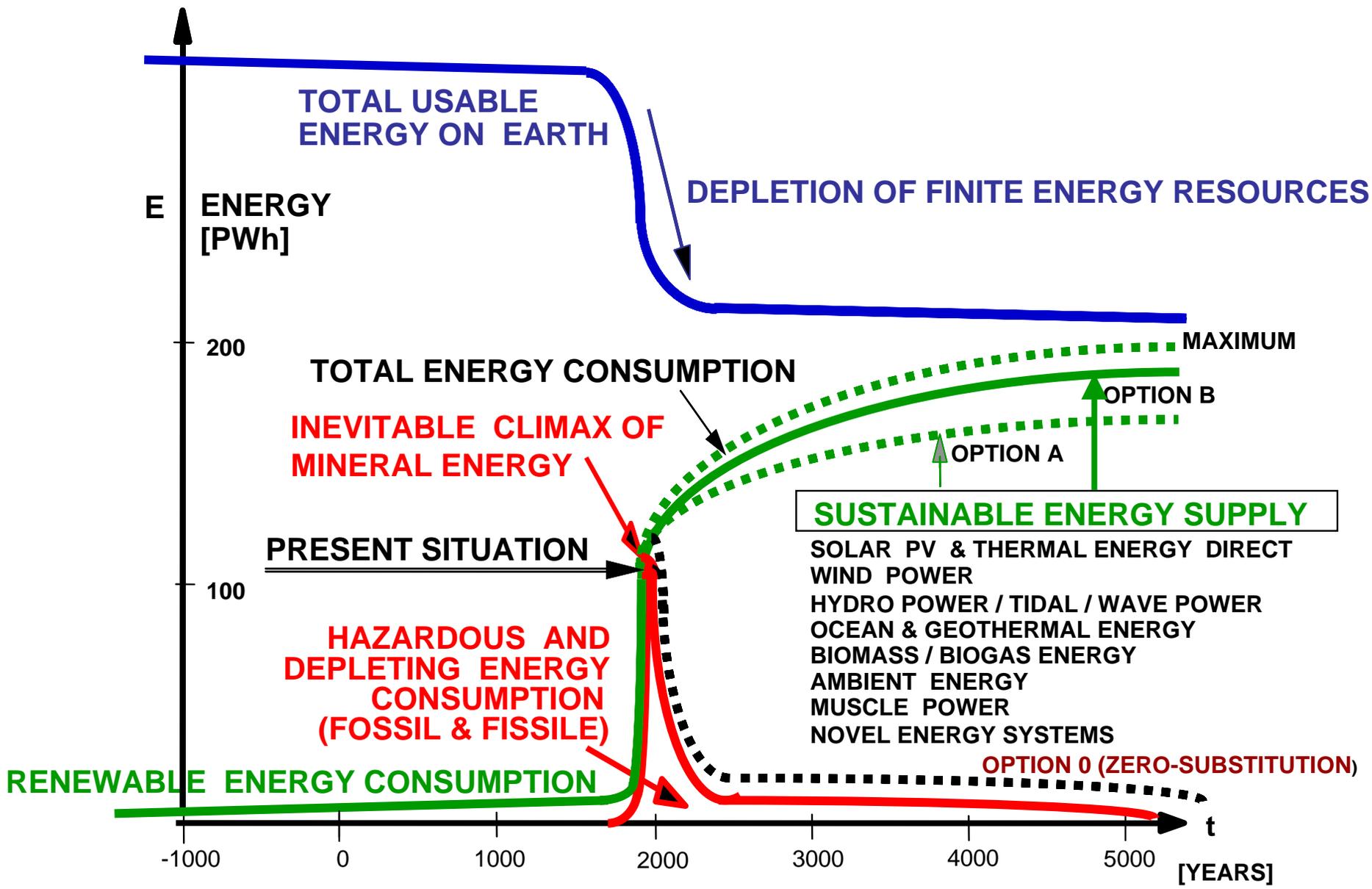


**Nitrous Oxide**  
(9% of total)

# Carbon Dioxide emissions - annual tonnes per person



Source: New Scientist (2000 data)

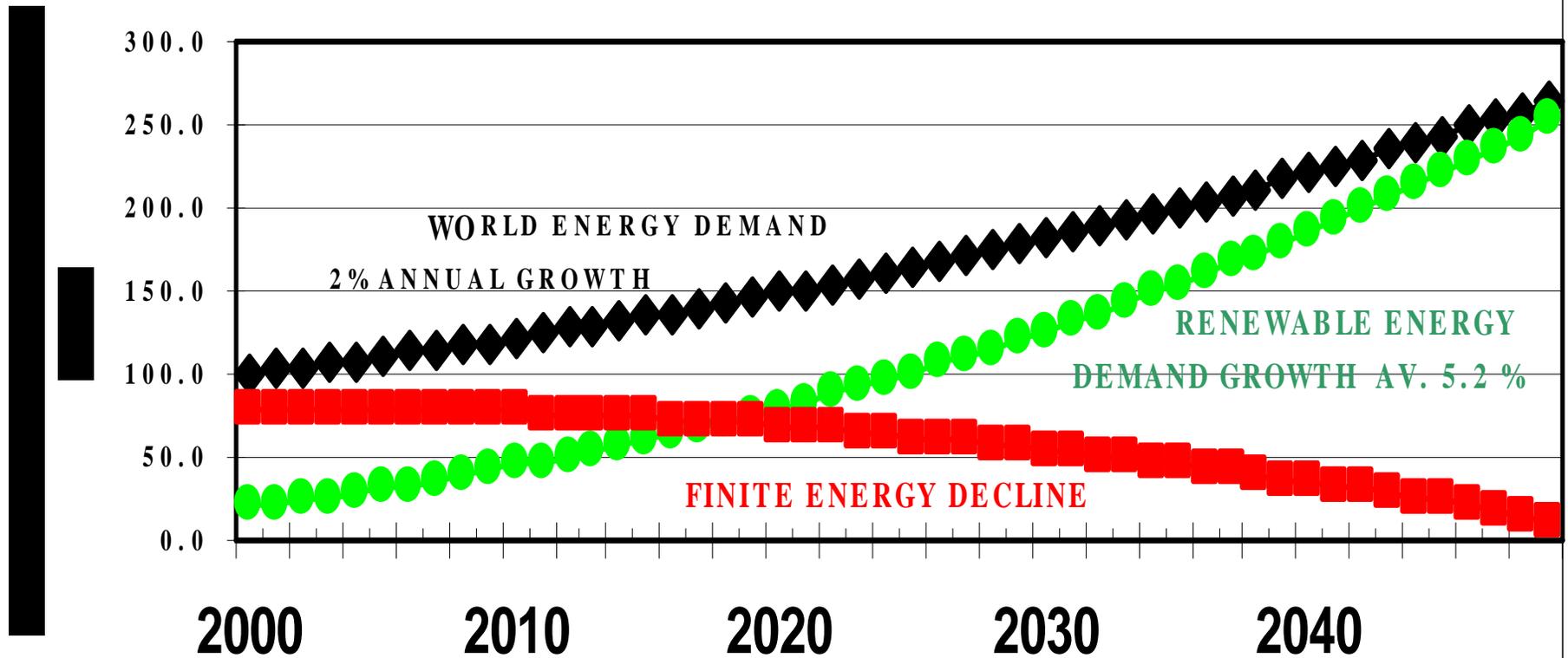


SOURCE : ISEO

## ENERGY HISTORY & FORECAST



# WORLD ENERGY SCENARIO 2000 - 2050



Source for Finite Energy Data: ASPO at [www.peakoil.net](http://www.peakoil.net) & Kyoto Protocol



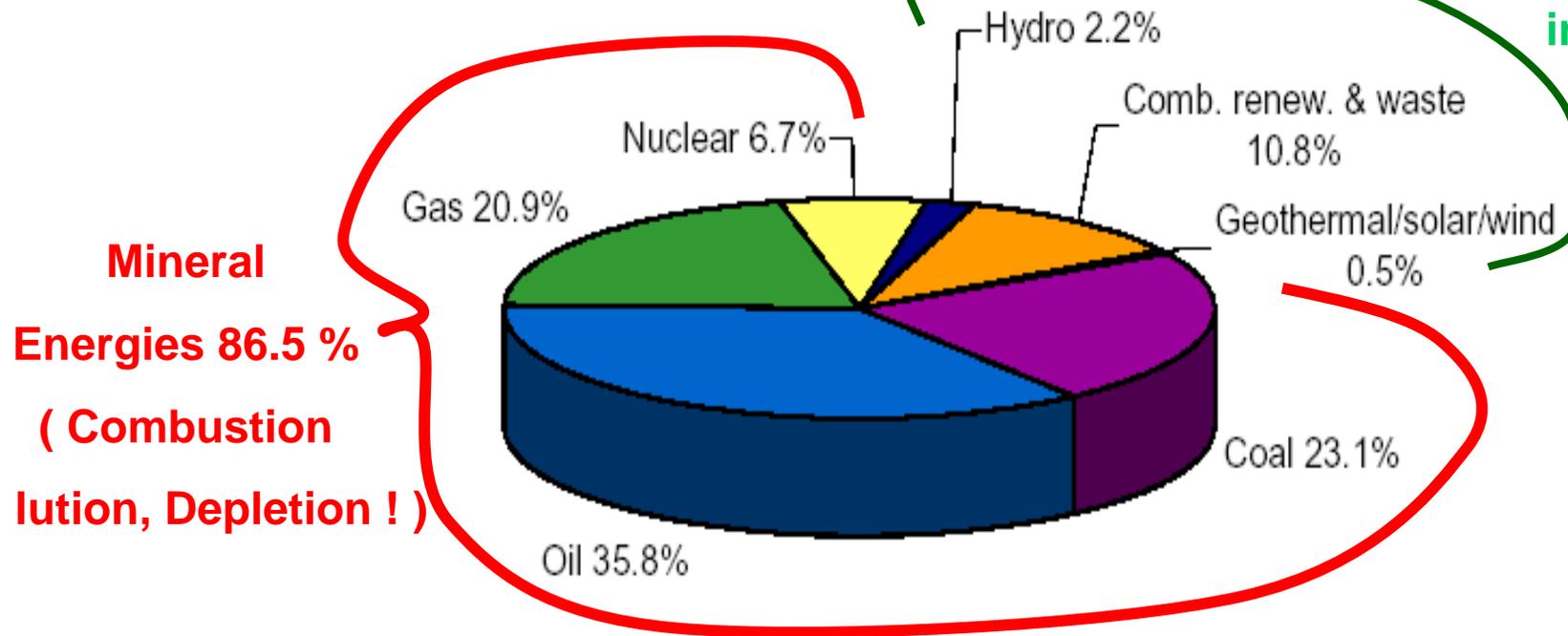
## Share of Total Primary Energy Supply\* in 2002

*World*

Renewable Energies only 13,5 %

according to IEA-OECD

- over 20 %  
in reality



**Mineral**

**Energies 86.5 %**

**( Combustion**

**tion, Depletion ! )**

**124 PWh**

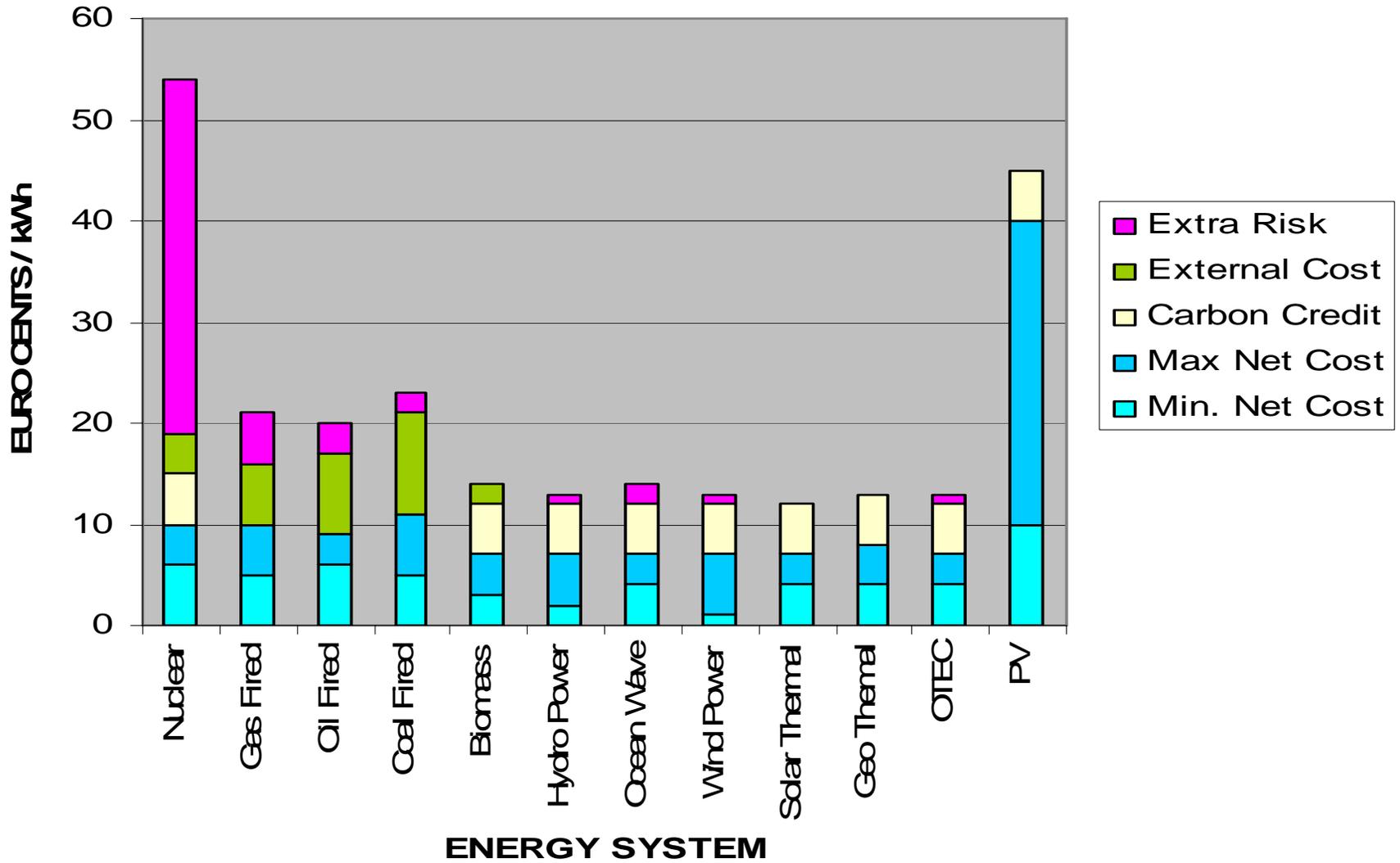
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<u>Renewable Energy Option</u>	<u>Immediately Feasible</u>	<u>Theor. Potential</u>
- Bio energy	50	<u>PWh/year</u> 78
- Hydropower	8	14
- Geothermal Electricity Conventional	2	} 388
- Geothermal Electricity / Hot Dry Rock	20	
- Geothermal Heat	4	
- Wind Power	53	160
- Solar PV Power	6	} 435
- Solar Thermal Power	40	
- 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
- <b>Novel Energy Technologies (R&amp;D)</b>	<u>100</u>	<u>200</u>
<b>Total RE potential</b>	<u>339</u>	<u>PWh/year</u> <u>1537</u>

# 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<sub>2</sub>)
- 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**

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**Wind Power**



**Clean Vehicles**



**Geothermal Energy**



**Hydropower**



**Ocean Energy**



**Heat Pumps**



**Solar Energy**



**Bio 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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## www.uniseo.org

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