Chemical Oceanography CO_2 Sequestration

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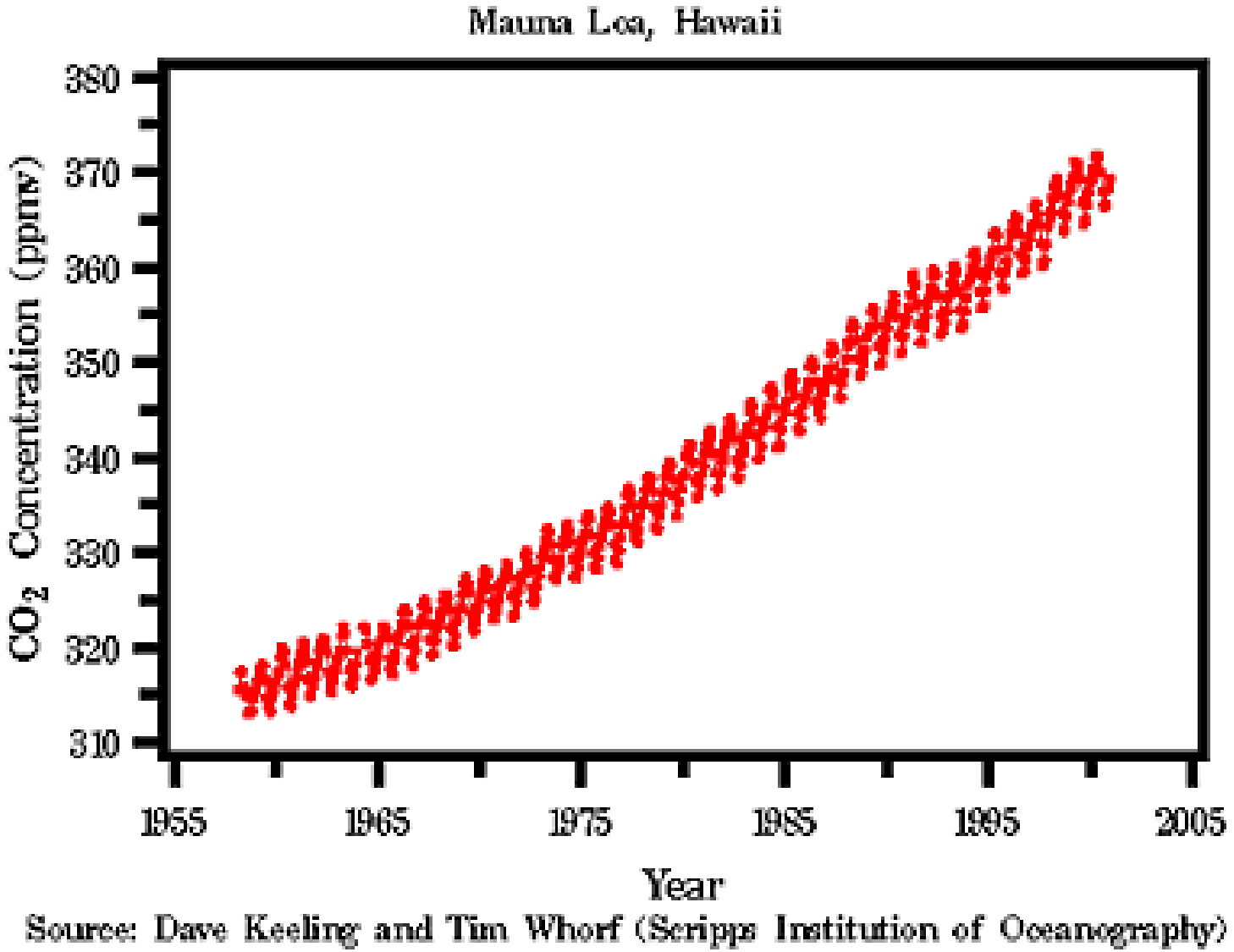
CO_2 Sequestration Defined

- Storing or permanently immobilizing CO_2 in some form to remove it from the atmosphere or prevent it from entering the atmosphere
- General schemes include
  - Converting to Biomass (either terrestrial or oceanic as discussed previously IRONEX)
  - Capture and store
    - In geologic formations
    - In the deep ocean

Atmospheric CO_2 Levels on the Rise



Source: Dave Keeling and Tim Whorf (Scripps Institution of Oceanography)

CO_2 Emissions Can Be Reduced By Several Means

- Conservation and efficiency improvements
- Substitute high carbon fuels (i.e. coal) with low carbon fuels (i.e. natural gas)
- Renewable energies

1. Wind
2. Solar
3. Biomass
4. Geothermal
5. Ocean thermal, ocean tides, ocean waves

- Nuclear energy

CO_2 Emissions By Sectors USA 2004

	Mt CO_2/y	%
Electric power plants	2300	36
Transportation	1860	29
Residential	1225	19
Commercial	1035	16
Total	6420	100

Emissions From Large Stationary Sources

Table SPM.1. Profile by process or industrial activity of worldwide large stationary CO_2 sources with emissions of more than 0.1 million tonnes of CO_2 ($MtCO_2$) per year.

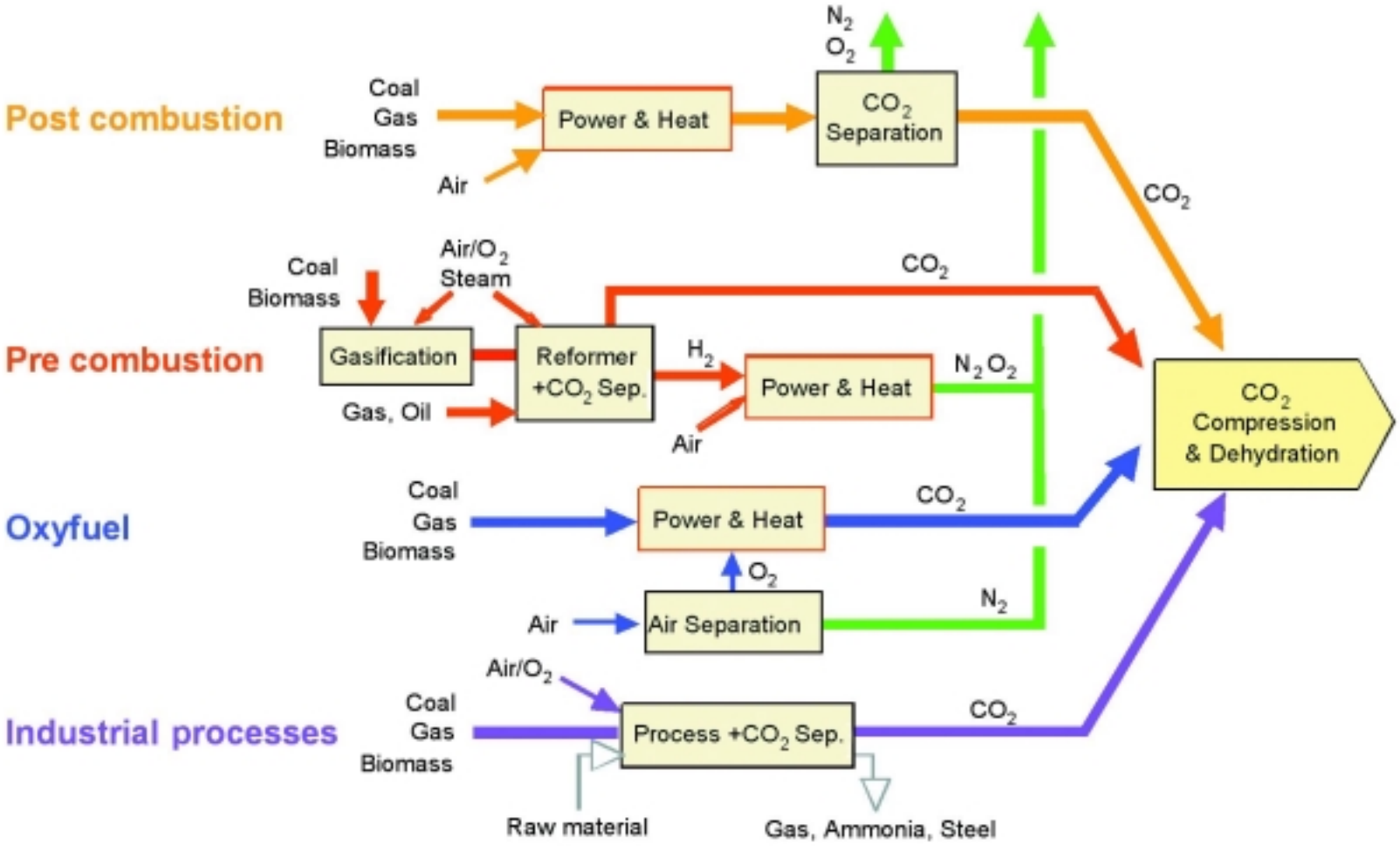
Process	**Number of sources**	**Emissions ($MtCO_2$ yr^{-1})**
Fossil fuels		
Power	4,942	10,539 (78%)
Cement production	1,175	932
Refineries	638	798
Iron and steel industry	269	646
Petrochemical industry	470	379
Oil and gas processing	Not available	50
Other sources	90	33
Biomass		
Bioethanol and bioenergy	303	91
Total	**7,887**	**13,466**

CO_2 Capture Technologies

Ways of capturing CO_2 before it is released to the atmosphere:

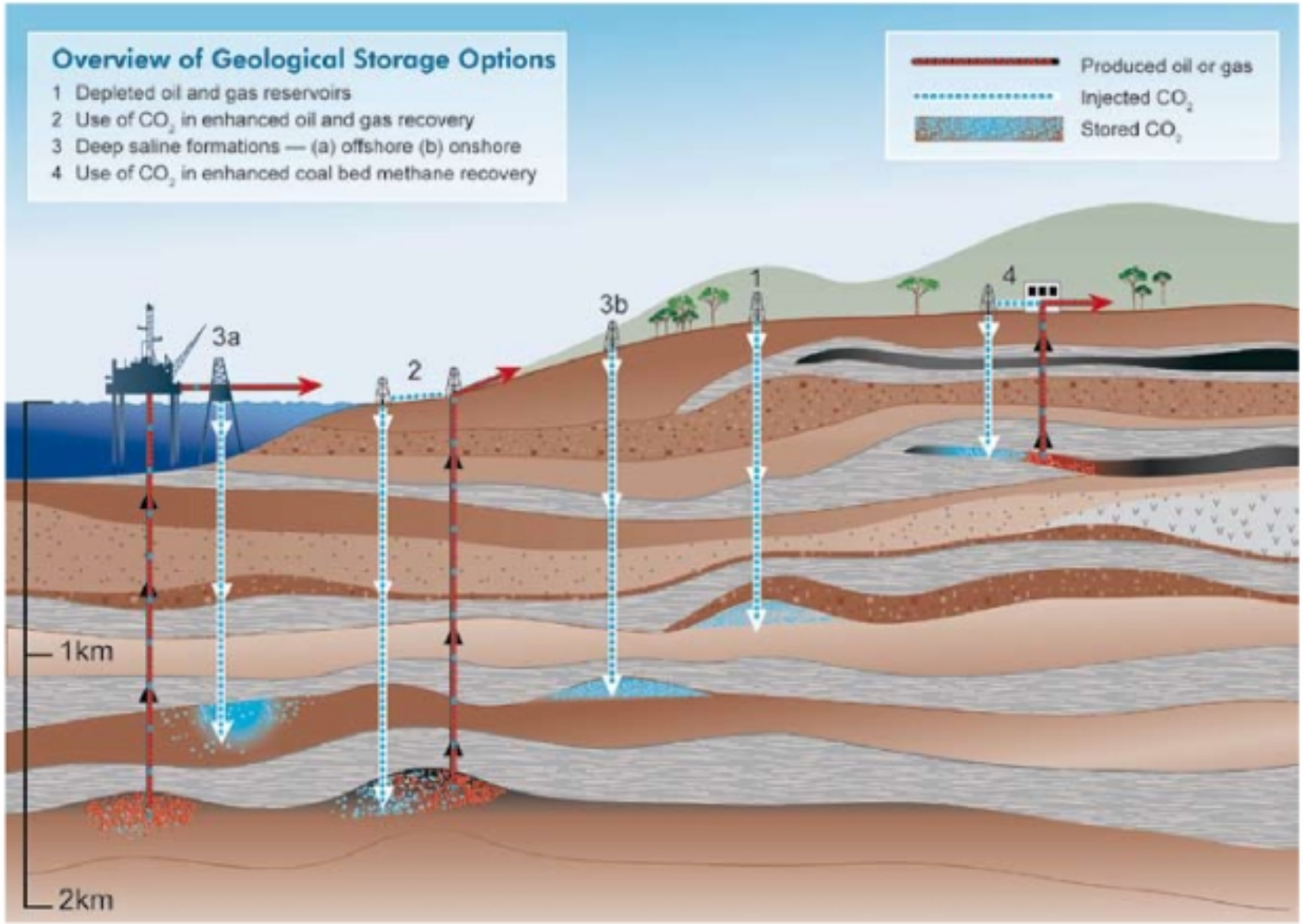
- Chemical absorption
- Physical absorption
- Coal gasification with physical absorption
- Oxyfuel combustion

Overview of CO2 capture processes and systems

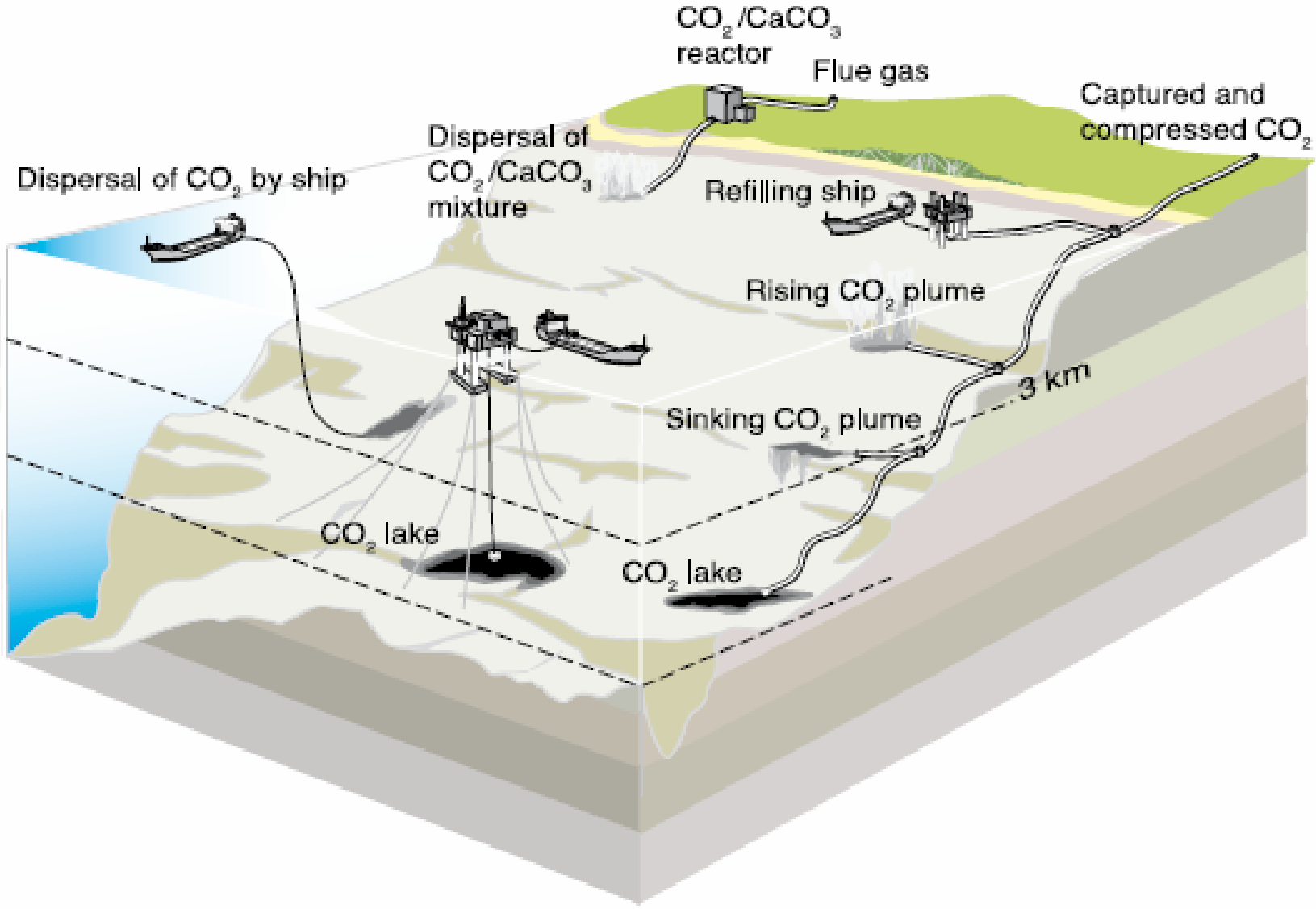


SRCCS Figure TS-3

Geologic Sequestration



Ocean sequestration options



Source: IPCC Special Report on CC&S, 2005

Problems with Ocean Sequestration Scenarios for CO_2

- High Costs - exclusive of capture
- Proximity of Sources to Ocean
- Ecological Effects
  - Physical Impact of Immiscible Liquid
  - Chemical Impacts
    - pH
    - Carbonate hot spots
- Long Term Uncertainty
  - Chemical Effects
  - Lake Nyos Syndrome
- London Convention 1972