

Environmental Impacts of Energy Production

Dr. M. Subramanian

Associate Professor
Department of Chemical Engineering
Sri Sivasubramaniya Nadar College of Engineering
Kalavakkam – 603 110, Kanchipuram (Dist)
Tamil Nadu, India
subramanianm@ssn.edu.in



Introduction

- The amount of energy consumed per capita – standard of living. Demand for energy increases accordingly
- Most of our energy is currently produced from fossil fuels – increase of CO₂ production
- Increase of CO₂ – global warming, climate changes
- Current reserves of fossil fuels: Oil - 40 years, Gas - 60 years, Coal - 120 years
- The alternatives are expensive at present – little economic incentive to reduce consumption of fossil fuels

Environmental Impacts

- Production and consumption of almost any type of energy have environmental impacts.
- Harvesting of fuel-wood, in particular, contributes to deforestation, soil erosion, and desertification.
- Use of fuel-wood as an energy source can also contribute to the accumulation of CO₂, the main greenhouse gas, both because burning fuel-wood produces CO₂, and because deforestation destroys an important CO₂ sink.
- Use of biomass in traditional stoves exposes the users, mainly women and children, to high levels of indoor air pollution.
- The environmental consequences of energy production and use also adds on to waste management.

CO₂ Release due to Fossil Fuel Consumption

- Global combustion of fossil fuels and other materials places almost 7 billion tons of carbon, in the form of carbon dioxide (CO₂), into the atmosphere each year.
- On average, Earth's oceans, trees, plants and soils absorb about *one-half* of this carbon. The balance remains in the air and is responsible for the annual increase.

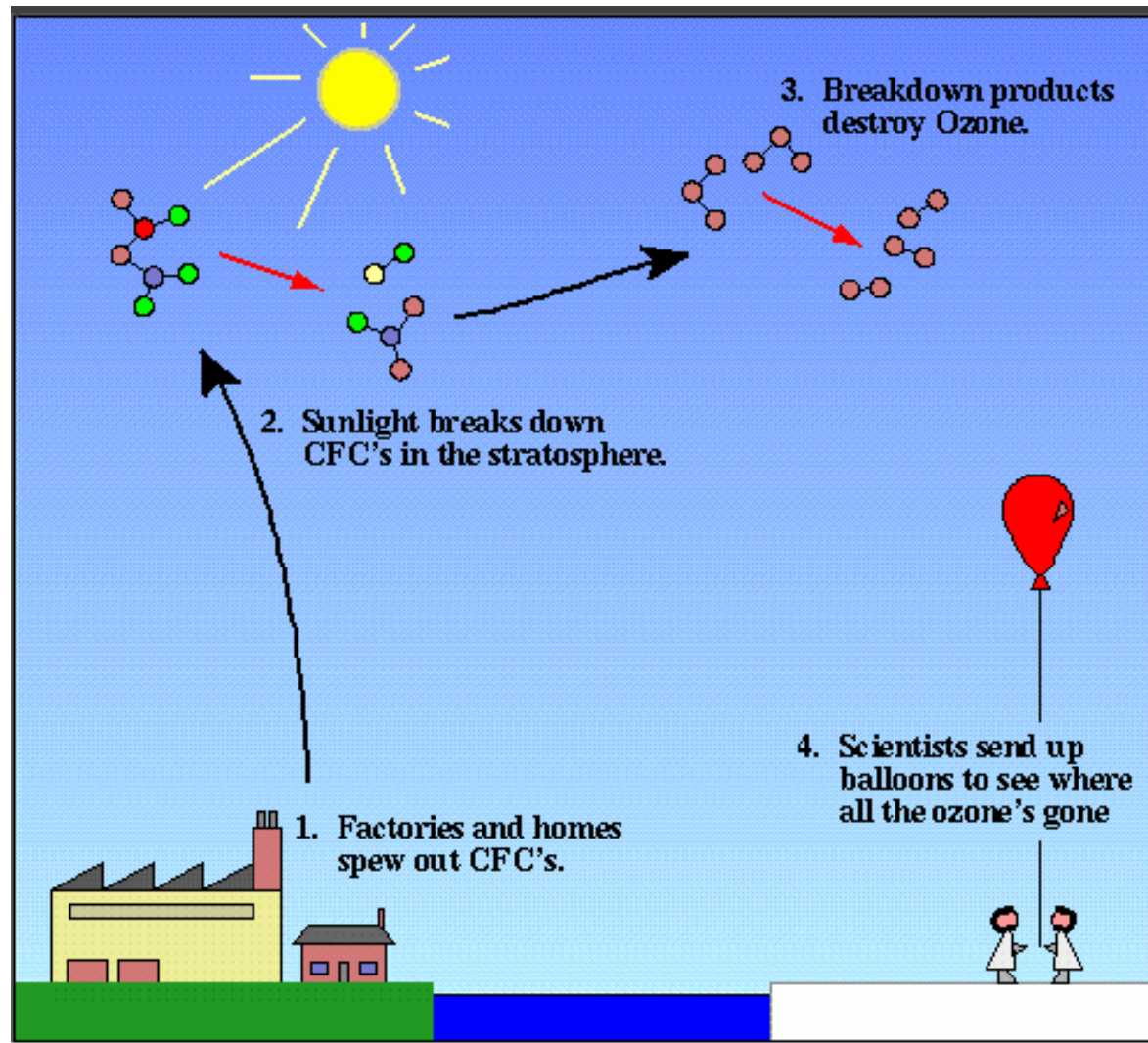
Environmental issues of Global significance

- Ozone Layer Depletion
- Global Warming
- Loss of Biodiversity
- Air and water pollution
- Land Degradation

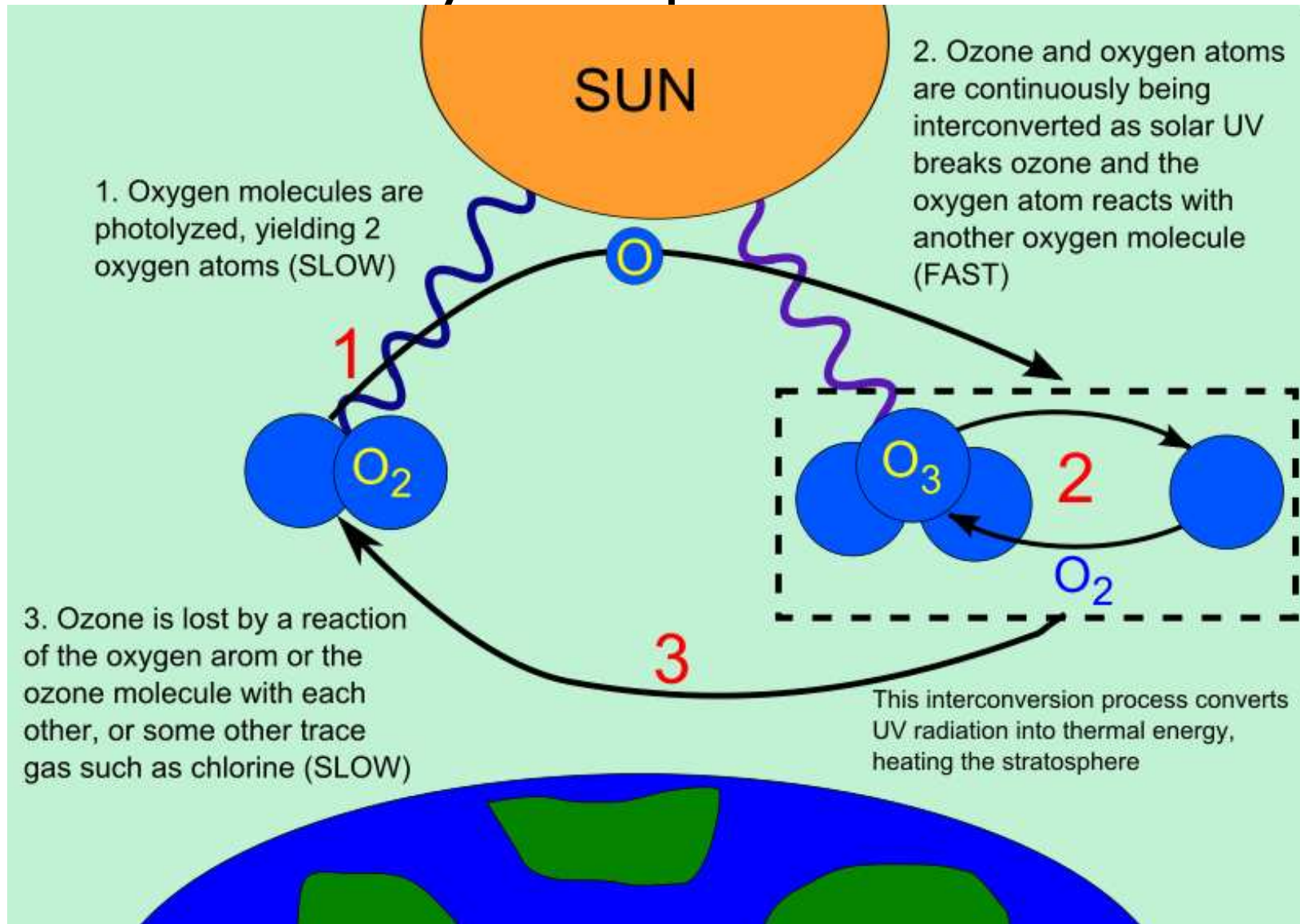
Ozone Layer Depletion

- Ozone is a natural gas that exists in large quantities in the **stratosphere**, which is one of the upper layers of the Earth's atmosphere.
- There, ozone works to protect life on earth by absorbing ultraviolet (UV-B) rays and other harmful rays from the sun.
- Ozone layer and lies between **15 & 50 kilometers up in the earth's atmosphere.**
- Ozone layer depletion is the process of reduction in thickness of the layer due to the presence of CFC's and related compounds.

Ozone Layer Depletion Process

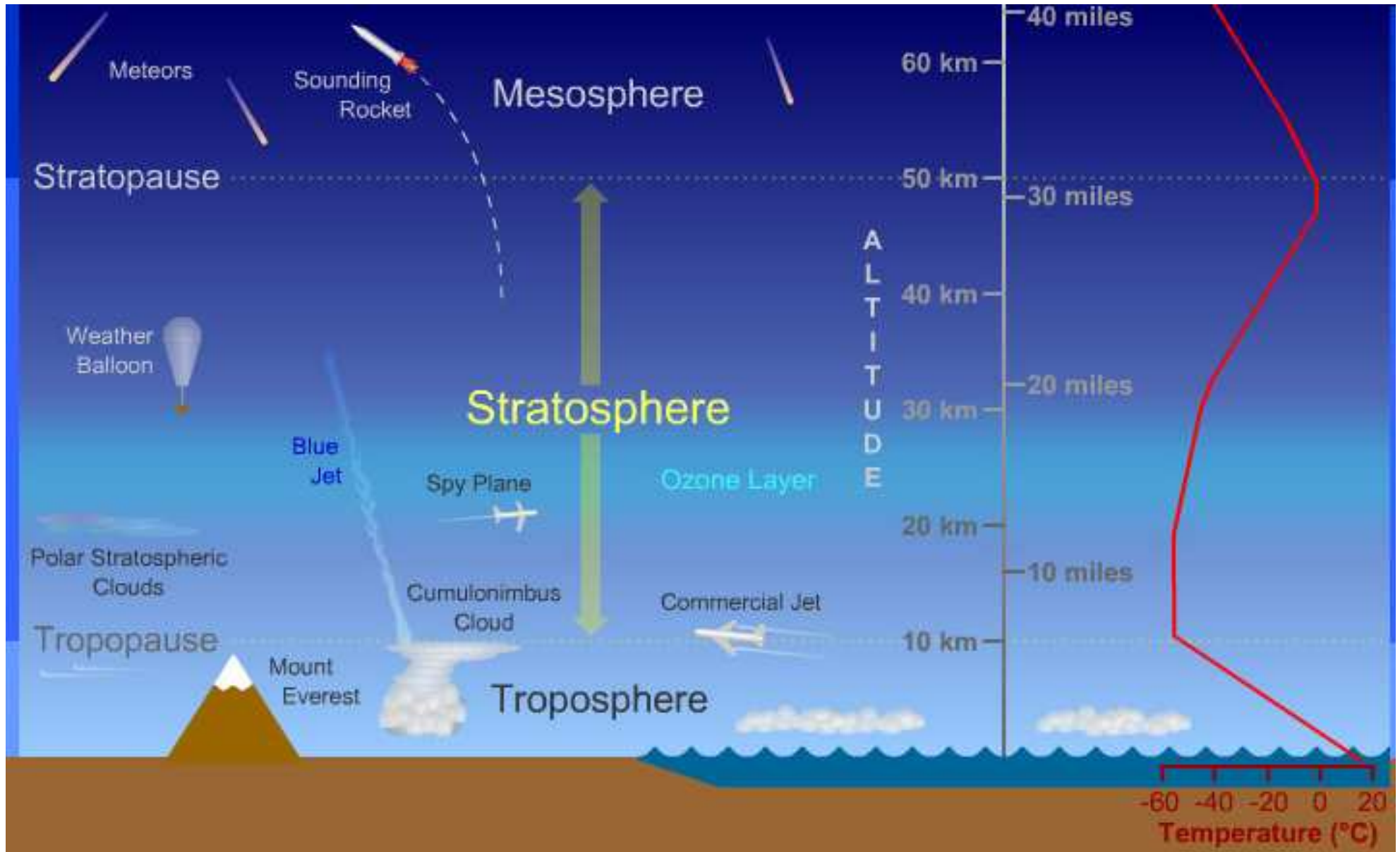


Ozone Layer Depletion Process



About Ozone Layer

- The ozone layer comprises the greater part of the stratosphere between altitudes of 10 and 50 km. The highest concentration of ozone is reached between 15 and 30 km.
- The concentration of ozone molecules is 10 parts ozone per 1 million parts air. Ozone, which is a form of oxygen, forms naturally from the dissociation (splitting) of oxygen molecules by ultraviolet radiation.
- The average thickness of the ozone layer is about 50 km but if compressed by sea-level pressures, it would be only a few centimeters thick.
- The Dobson Unit (DU) is a scale for measuring the total amount of ozone occupying a column of air. One DU is defined as 0.01 mm thickness at zero degrees Celsius and one atmosphere.
- If the ozone layer over the US were subjected to 0 °C and 1 atmosphere it would end up being 3 mm thick or 300 DU.



Impacts of Ozone layer depletion

- Effect on Human and animal health:
 - Increase incidences of eye diseases, skin cancer and infectious diseases.
- Effect on Terrestrial Plants:
 - Physiological and development process of plants affected
- Effect on Aquatic Eco systems:
 - Reduced survival rates of Phytoplankton communities (which form the foundation of aquatic web) and damage to early development of aquatic species.
- Effect on Bio-geo-chemical Cycles:
 - Affect terrestrial and aquatic bio chemical cycles thus altering both sources and sinks of GHG. These changes will contribute to the likely built up of these gases.
- Affect on Air quality
 - Higher photo dissociation rates of key trace gases and faster degradation of polymeric material (plastics) .