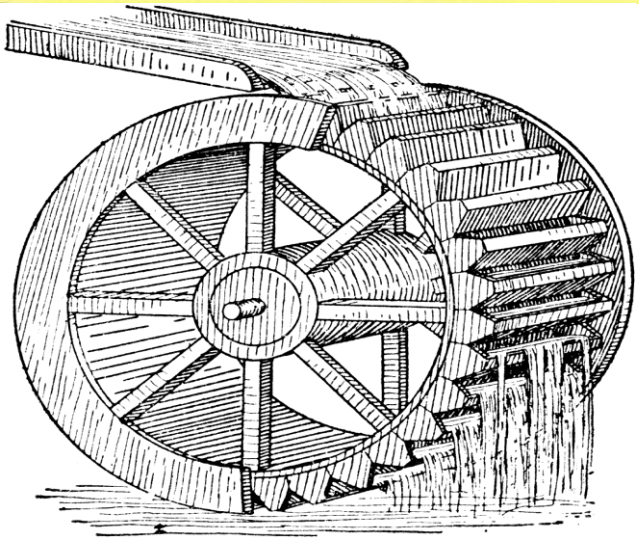
Renewable energy sources

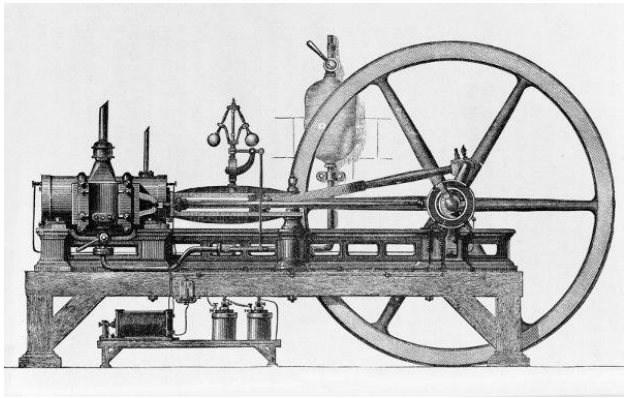
Introduction

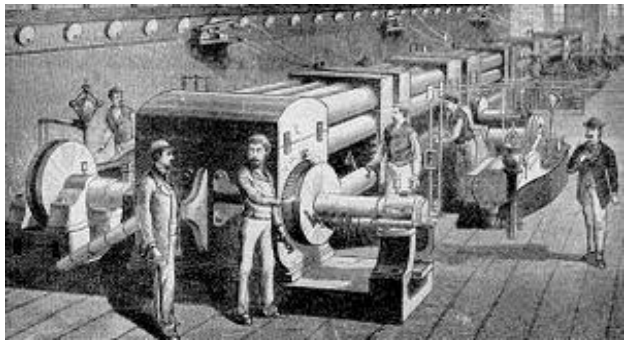
- ~1–2 million years ago: **Fire** is invented in Mesopotamia.
- ~27 BCE: **Water wheels** in ancient Rome by Vitruvius.
- 1712: English engineer **Thomas Newcomen** (1663/4–1729) makes the first practical steam engine at Dudley, England. **James Watt** (1736–1819) later makes it much more efficient.
- 1840s: **James Prescott Joule** (1818–1889) shows that energy cannot be created or destroyed.



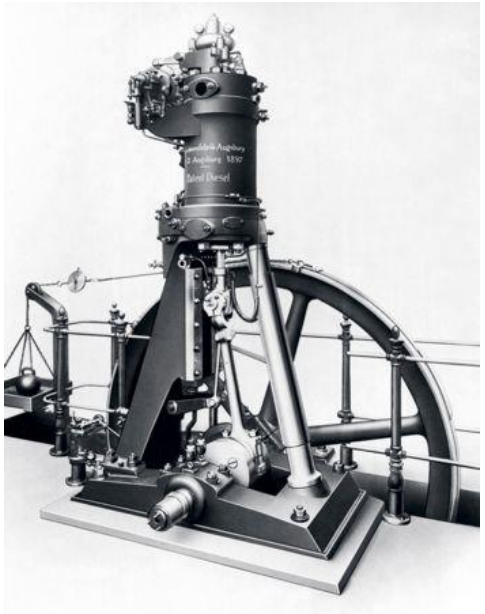
Introduction

- 1860s: Early gasoline engines are developed by French engineers Jean Joseph Etienne Lenoir (1822–1900) and Alphonse Beau de Rochas (1815–1893) and German engineer Nikolaus August **Otto (1832–1891).**





- **1882**: Prolific American inventor Thomas **Edison** (1847–1931) opens the world's first major electricity producing **power plant** in Pearl Street, New York City.
- **1884**: British engineer Charles Parsons (1854–1931) develops the **steam turbine.**
- **1890s:** German engineer Rudolf **Diesel** (1858–1913) develops the diesel engine.



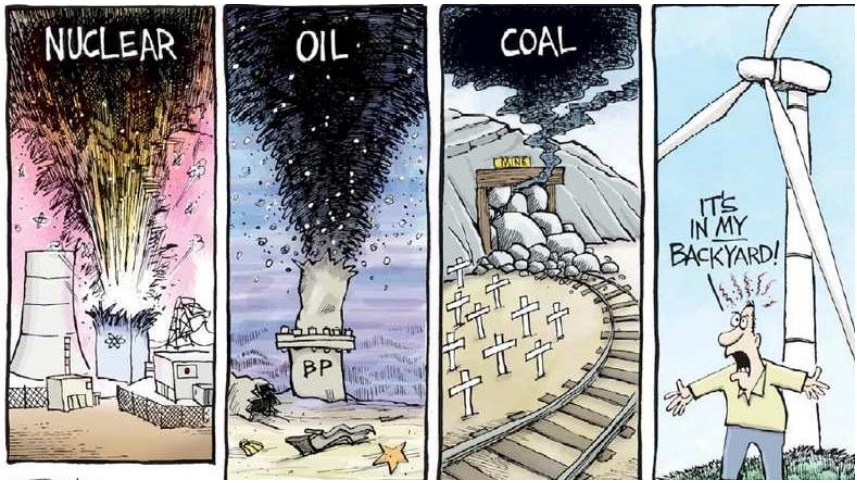
Ill effects of unchecked human activities

- Changes in climate
- Extreme weathers
- Increase in number and intensity of cyclones
- Melting of ice
- Rise in sea level
- Extinction of species
- Increase health hazards

Conventional fuel sources

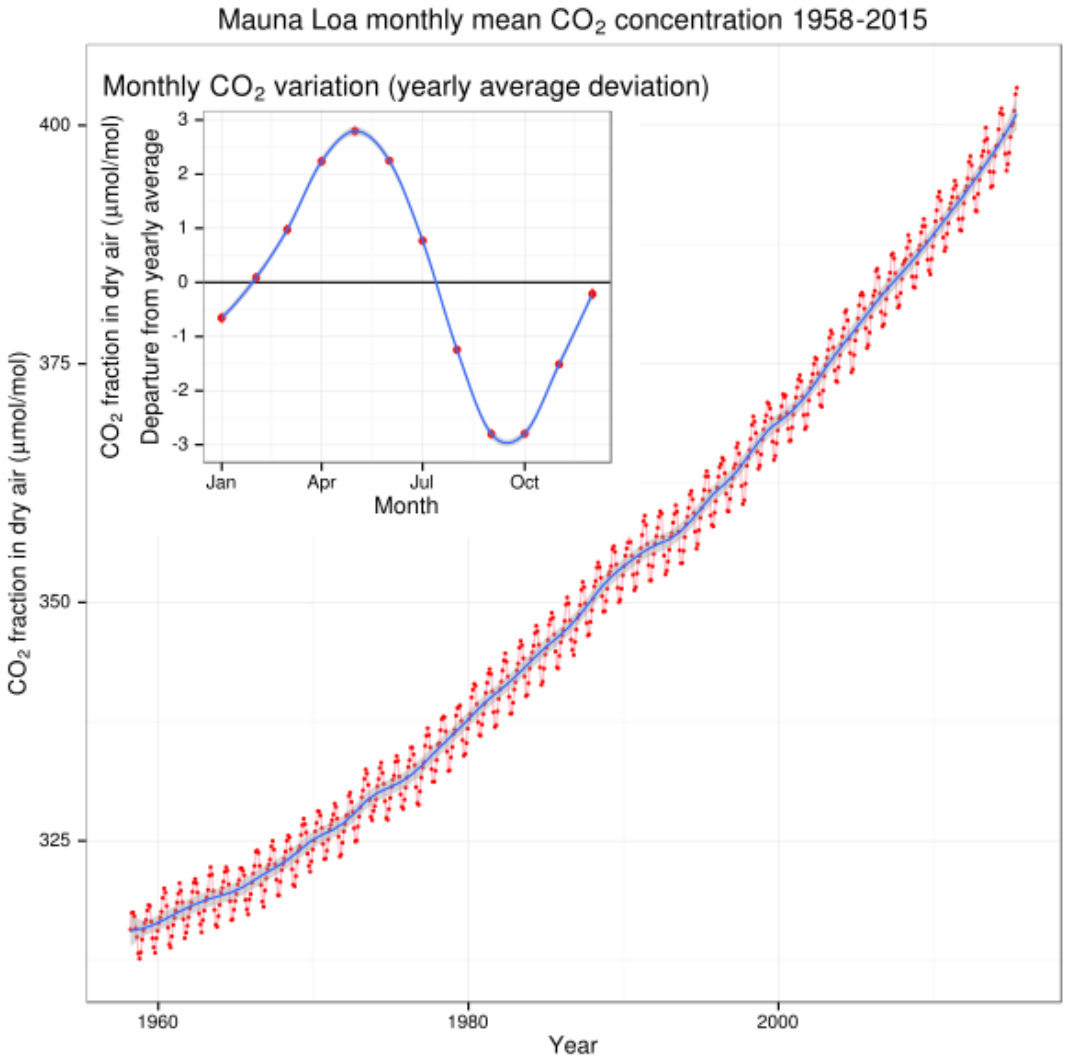
- ✓ High energy densities
- ✓ Well established Infrastructure
- ✓ Affordable running cost

- ➢ Depletion of fossil fuels
- ➢ Environmental hazards
- ➢ Health hazards



Killing curve

- Charles David Keeling
- Mauna Loa Observatory in Hawaii
- Global Warming



Energy scenerio

- Power sector in **India**
  - Installed capacity (271 GW)
    - Thermal (189 GW)
      - Coal (165 GW)
      - Gas (23 GW)
    - Nuclear (5.7 GW)
    - Renewable (77 GW)
      - Hydraulic (41 GW)
      - Wind (23 GW)
      - Solar (3.7 GW)
  - Per capita consumption 1010 kWh/year

Syllabus

- Energy scenario of India and World, Need of Renewable Energy sources
- Solar energy, extra-terrestrial and terrestrial radiations, radiation geometry, variation of insolation and its measurement, computation of solar radiation on horizontal and tilted surfaces, solar flat plate collectors, their configuration, material of construction and general characteristics, concentrating collectors, receiver systems, heliostat, optical losses, types of solar energy storage, solar energy applications.
- Wind energy, analysis of wind speeds, different types of wind turbines, use of meteorological data for site selection, materials of construction, performance characteristics, and applications
- Biomass, energy plantation, biomass gasifiers, types, construction of biogas plants, scope and future
- Tidal, wave and ocean thermal energy conversion plants, geothermal plants, small hydro plants, magneto hydrodynamic plants, fuel cells, use of non-conventional fuels, bio fuels and their applications

Topics

- Trend of growth of RES(Past, Present and Future)
- RES power sector in India
- CSPP prospects and trend
- Life cycle pollution analysis of RES and comparison with conventional sources
- Energy storage at domestic level
- Energy storage at utility scale
- History and growth of PV technology
- Electric vehicle in Indian scenario
- Wave energy and Tidal energy for Gujarat


Thank you!