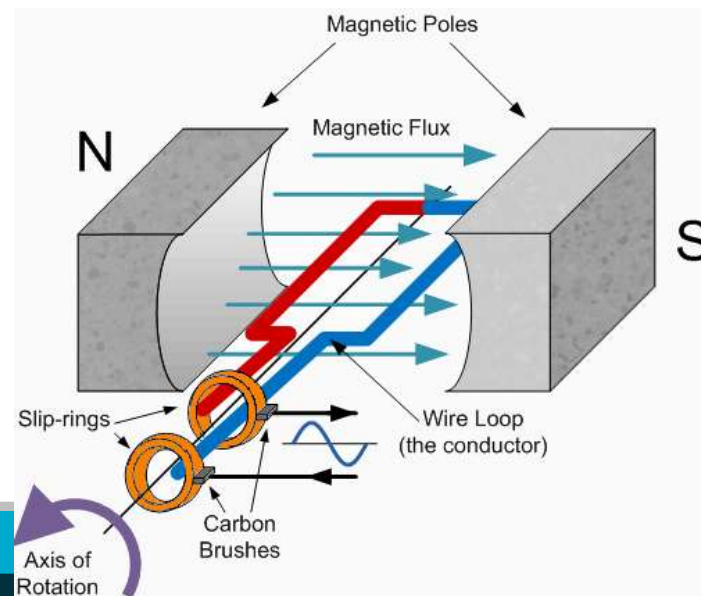


Overview of greenhouse gas emissions and the contribution from energy generation

- Electricity generation
- Greenhouse gas emissions by sector
- Contribution from electricity generation
- Discussion of the benefits of mitigating concentrated point source emissions rather than from the atmosphere (i.e. energy required for gas separation)

Electricity generation – getting the electrons

- The **most common** method is to use a **generator**
 - Mechanical energy is converted to electrical energy by rotating a coiled conductor (typically wound copper wire) inside a magnetic field
 - By rotating the coil its magnetic environment is constantly changing and this induces a voltage (Faraday's law)
- **Other options** include the direct conversion of either solar radiation or chemical energy to electrons using **photovoltaics** or **fuel cells** respectively

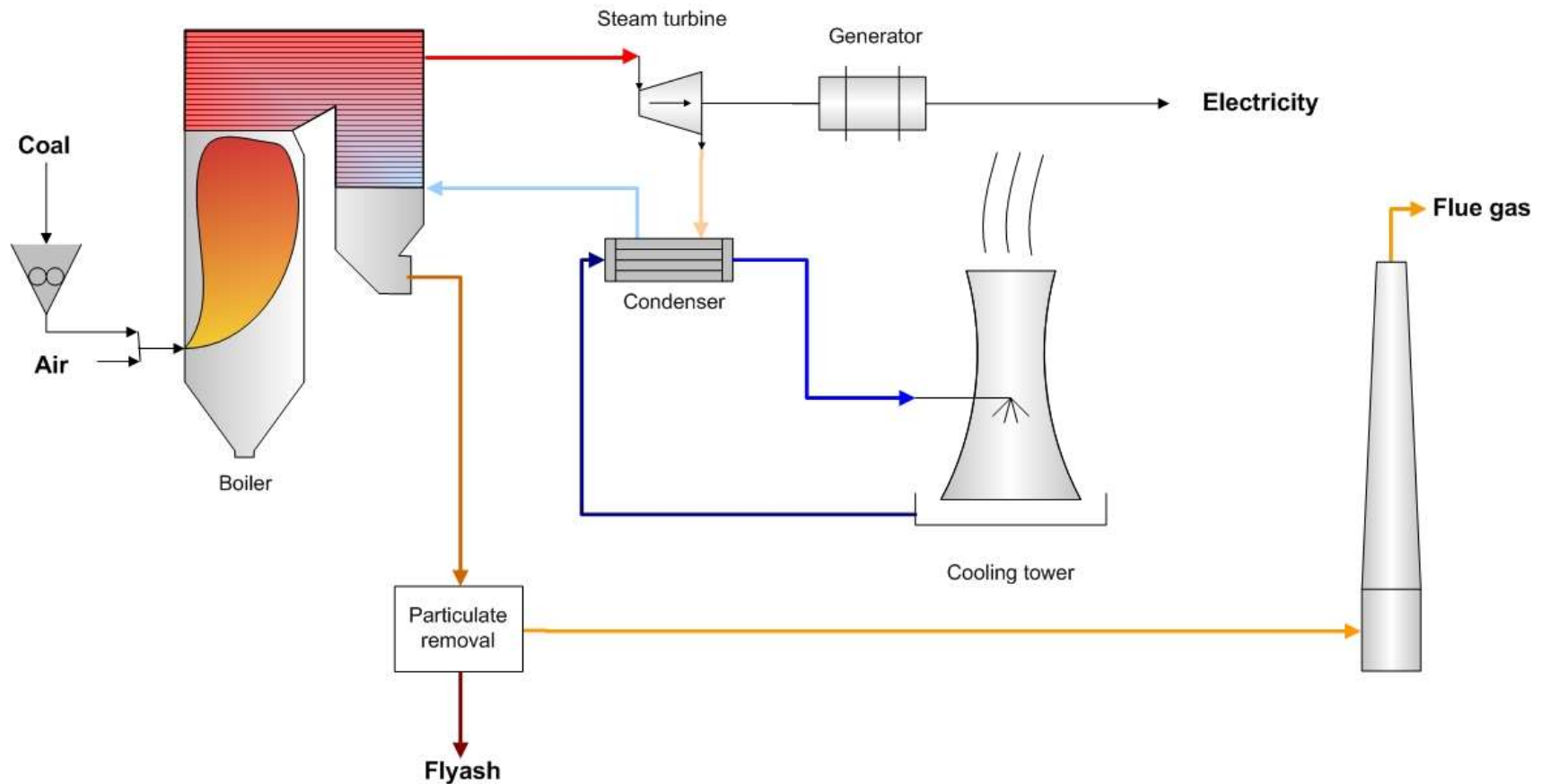


Electricity generation – mechanical energy sources

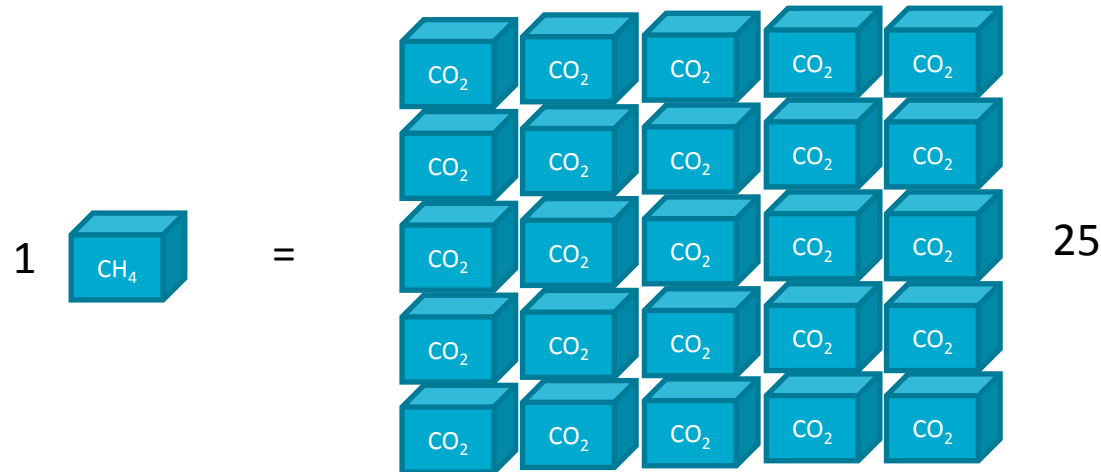
- The **vast majority** of electricity generation is done using **turbines** to drive the generator
 - Steam turbine – steam is expanded through the turbine to turn the blades
 - Gas turbine – a fuel (e.g. petrol, CH_4 , H_2) is combusted and the resulting hot gases expanded through the turbine to turn the blades
 - Wind and water turbines
- Piston engines are used in smaller applications

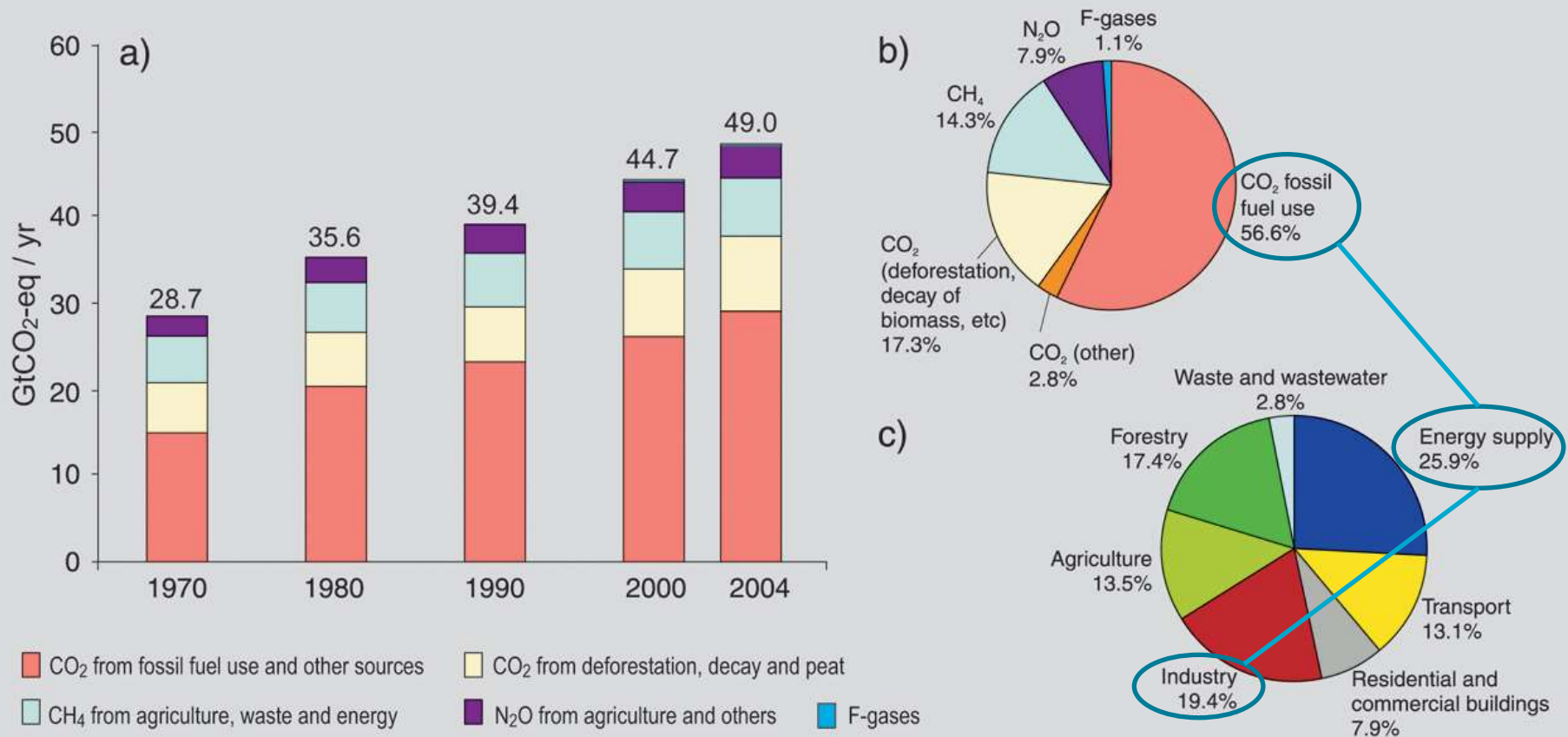


Electricity generation – a typical Australian coal fired power station



- GreenHouse Gas – GHG
 - A gas in the atmosphere that absorbs and emits radiation in the infrared range – H_2O , CO_2 , CH_4 , N_2O , O_3
- Anthropogenic – from human activity
- CO_2 -eq – CO_2 equivalent
 - The amount of CO_2 that would cause the same warming as gas X over the same time (typically 100 years)

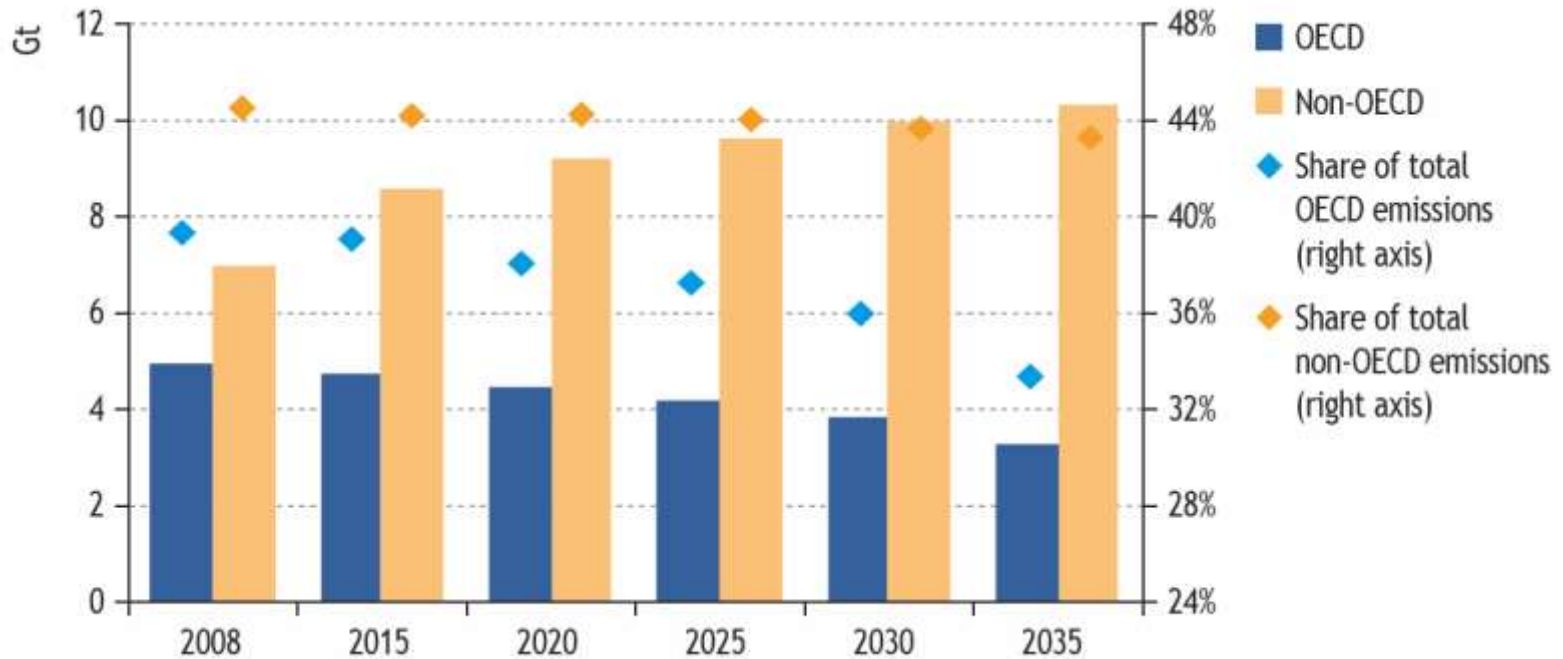




a) Global annual GHG emissions from 1970 – 2004. b) Share of anthropogenic GHGs in 2004 (CO₂-eq). c) Share of different sectors in total anthropogenic GHG emissions in 2004 (CO₂-eq).

IPCC, *Climate Change 2007 Synthesis Report*. IPCC, Geneva, Switzerland, 2007, pg 36.

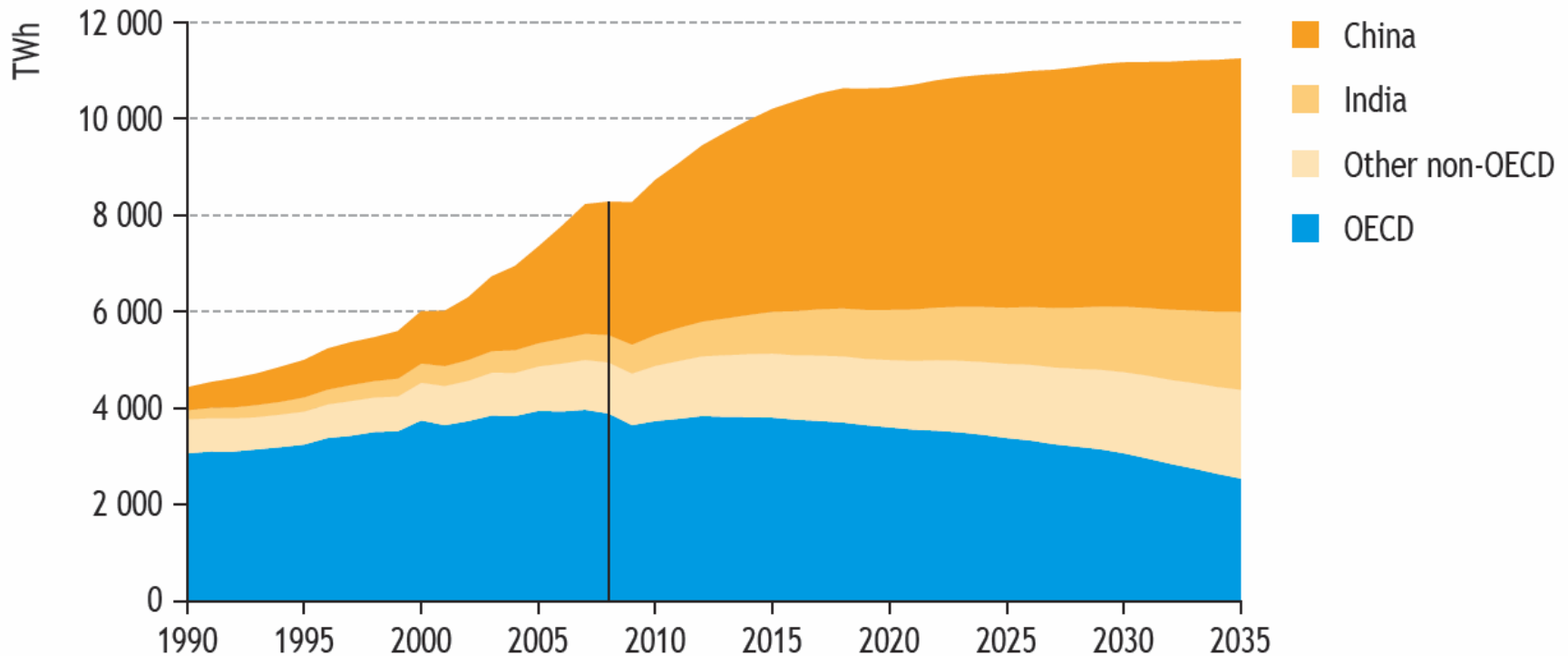
Contribution from electricity generation and heat



- Electricity generation and heat accounts for **41% of CO₂ emissions**
- Projections to **2035** correspond to a **75% increase** in electricity production with OECD and all European countries adopting CO₂ emission limits

OECD/IEA, *World Energy Outlook 2010*. IEA, Paris, France, 2010, pg 224.

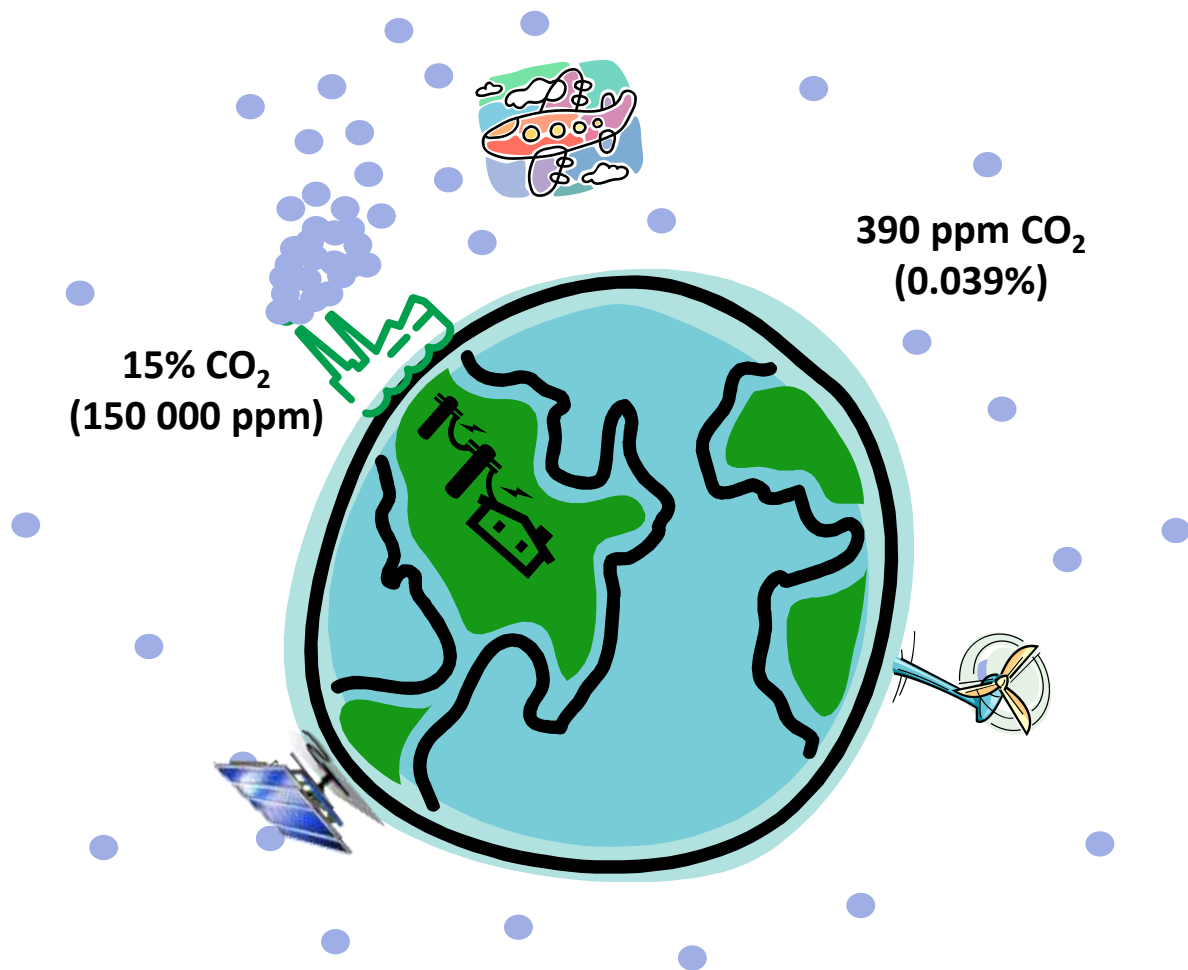
Contribution from electricity generation - coal



- The majority of predicted increases in electricity generation are from coal fired power stations in China and India.

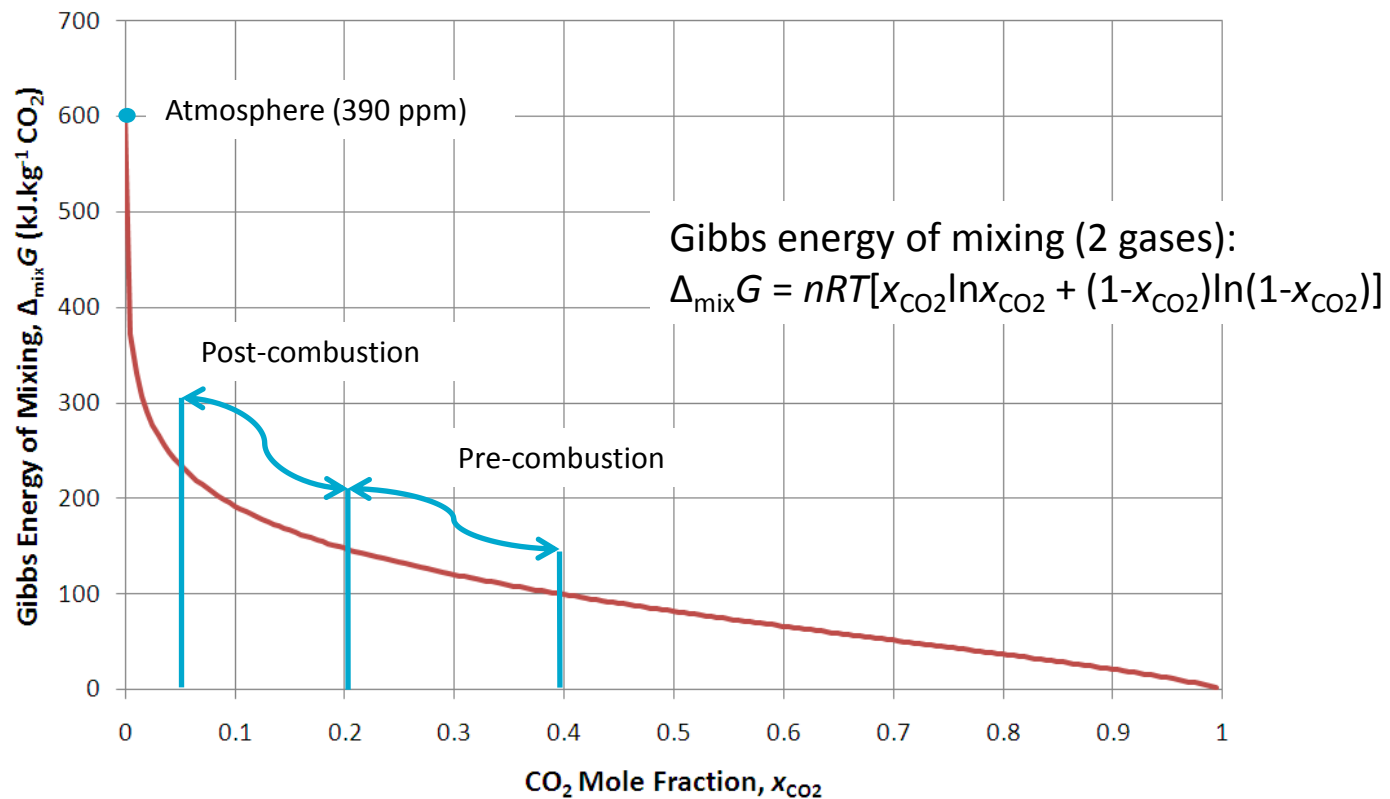
OECD/IEA, *World Energy Outlook 2010*. IEA, Paris, France, 2010, pg 220.

Why capture from a point source?



Why capture from a point source?

- The more concentrated the CO₂, the less energy it takes to separate it from other gases



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