

Tokyo Forum for Clean City and Clean Sky, May 22, 2018, Tokyo

Global and Regional View of Asian Air Pollution

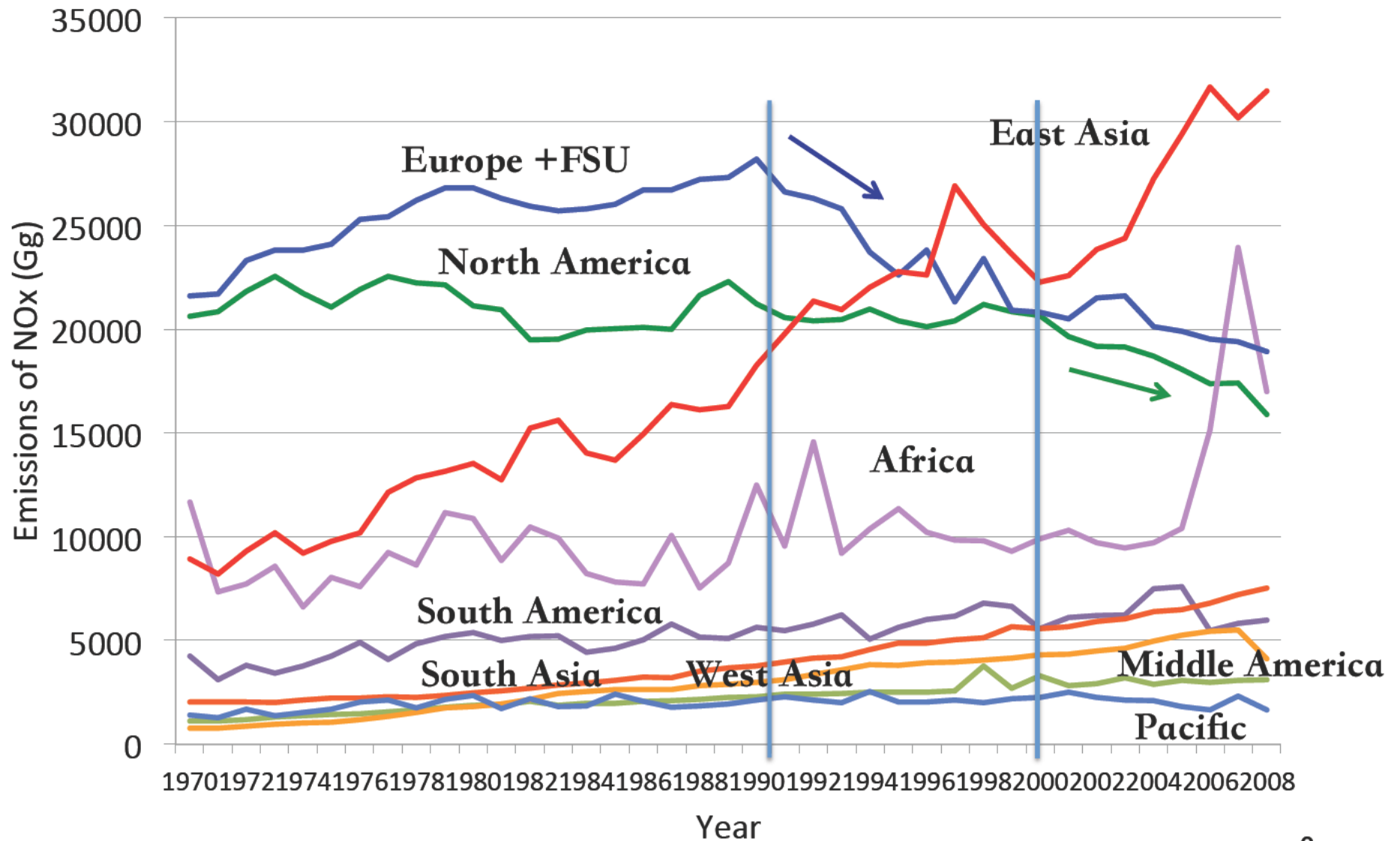
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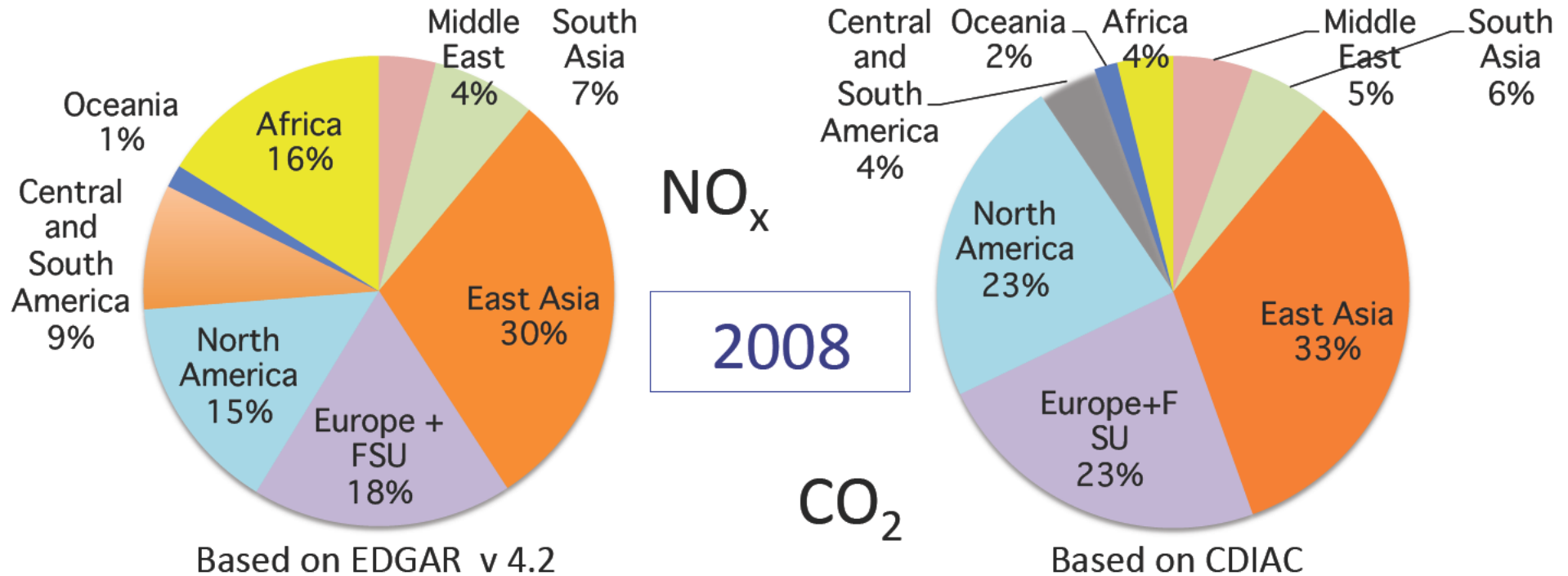


Emission Trends of NO_x by Continent (1970-2008)



Based on EDGAR v 4.2

Emissions of NO_x and CO₂ by Continent



Akimoto et al., AE, 2015.

- Serious Urban and Regional Air Pollution in East Asia
- Hemispherical Air pollution and Global Climate Change due to Emissions in Asia

What are the most important air pollutants?

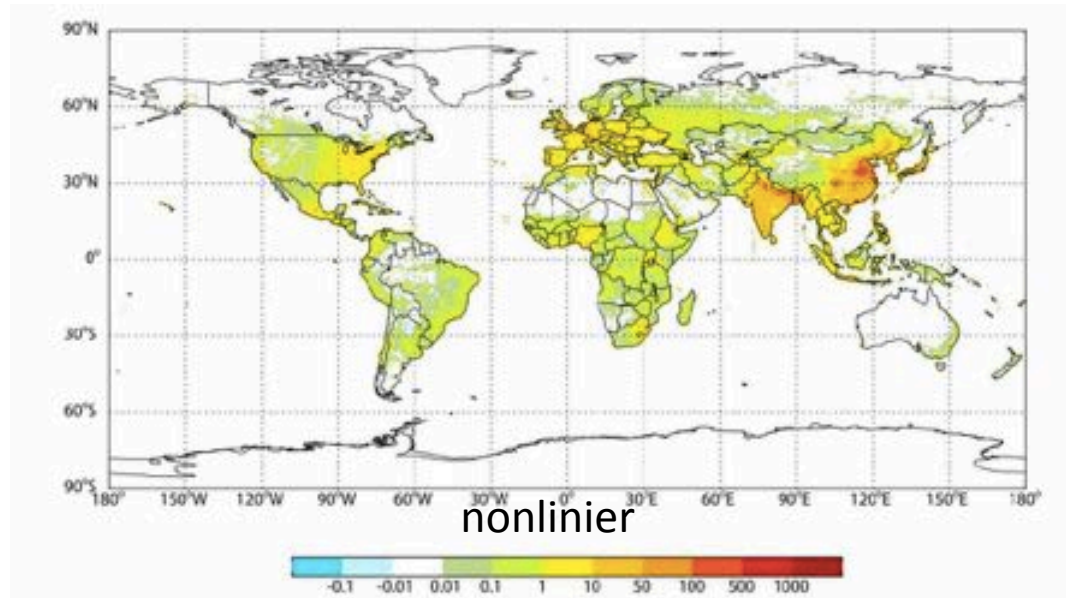
In an initial developing stage of economy
SO₂, CO, coal ash, mechanical dust
“Primary pollutants”

In the next phase of economic development
Haze: PM_{2.5}
Photochemical Smog: Ozone (O₃), Oxidants
“Secondary pollutants”

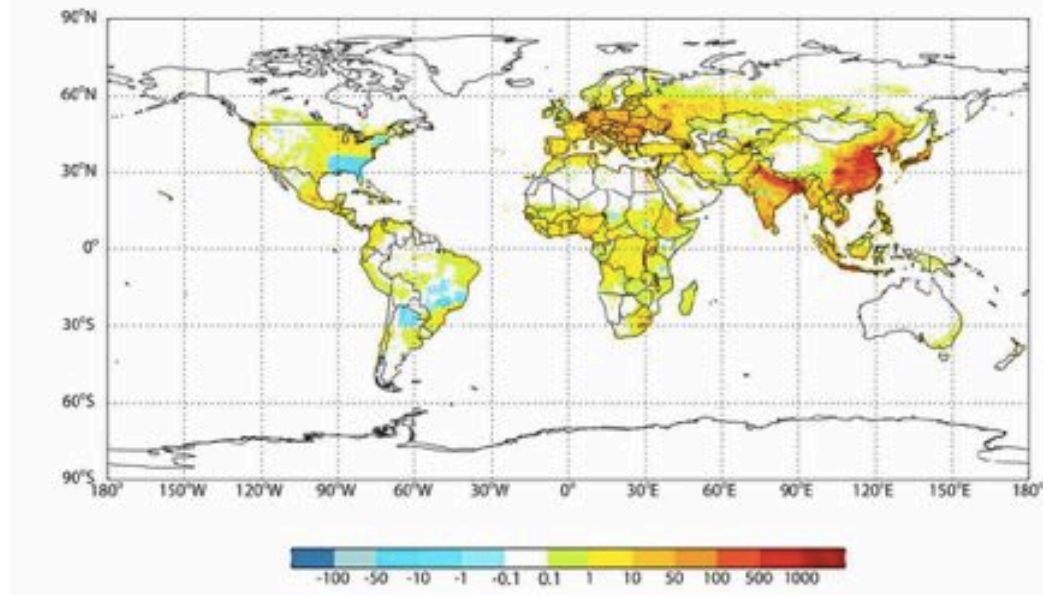
O₃ and PM_{2.5} have the largest impact on human health in most parts of the world including Asia.

Current Premature Mortality in deaths yr^{-1} $(1000 \text{ km}^2)^{-1}$ for O_3 and $\text{PM}_{2.5}$ (Silva et al., 2013)

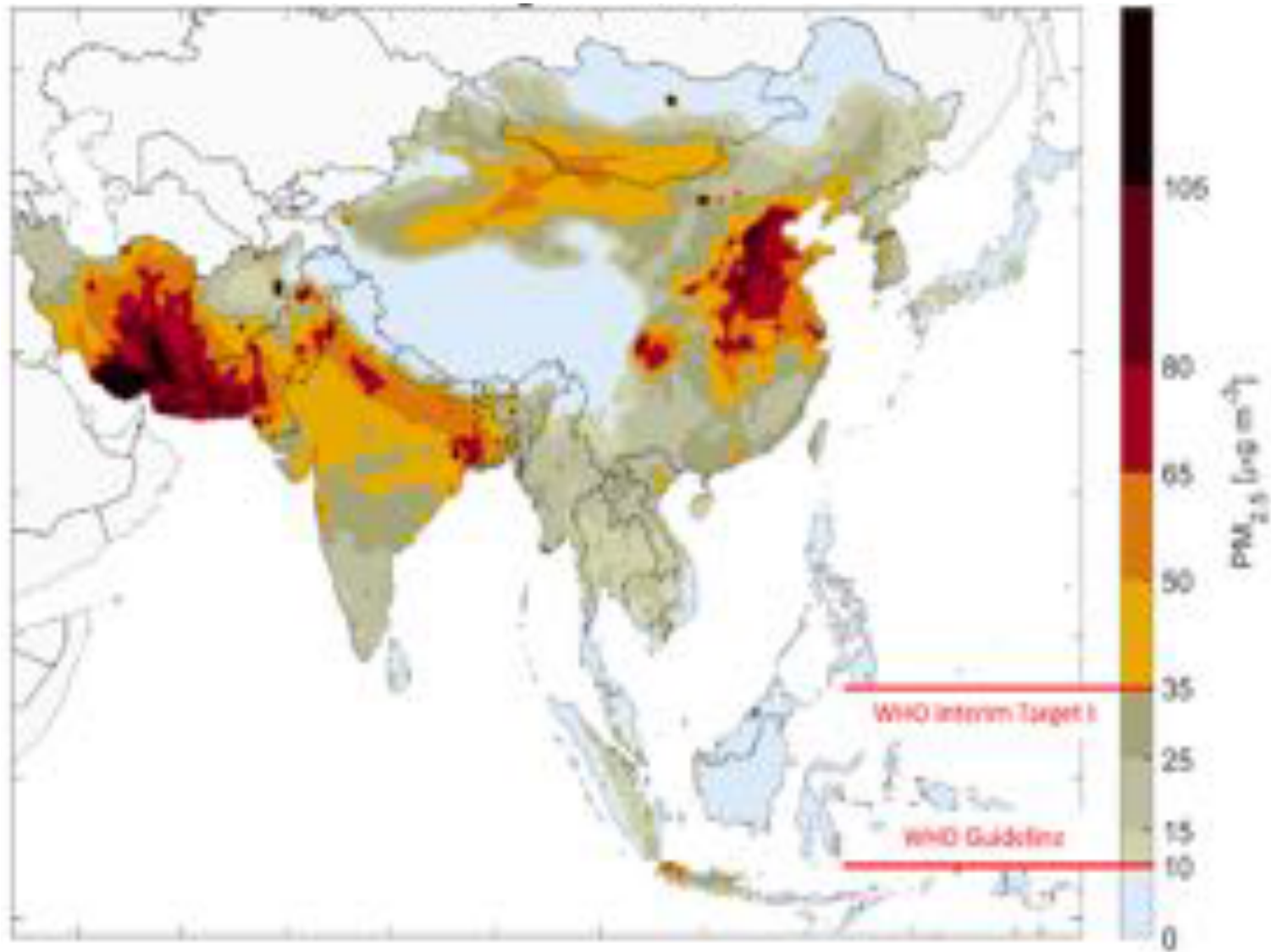
O_3



$\text{PM}_{2.5}$

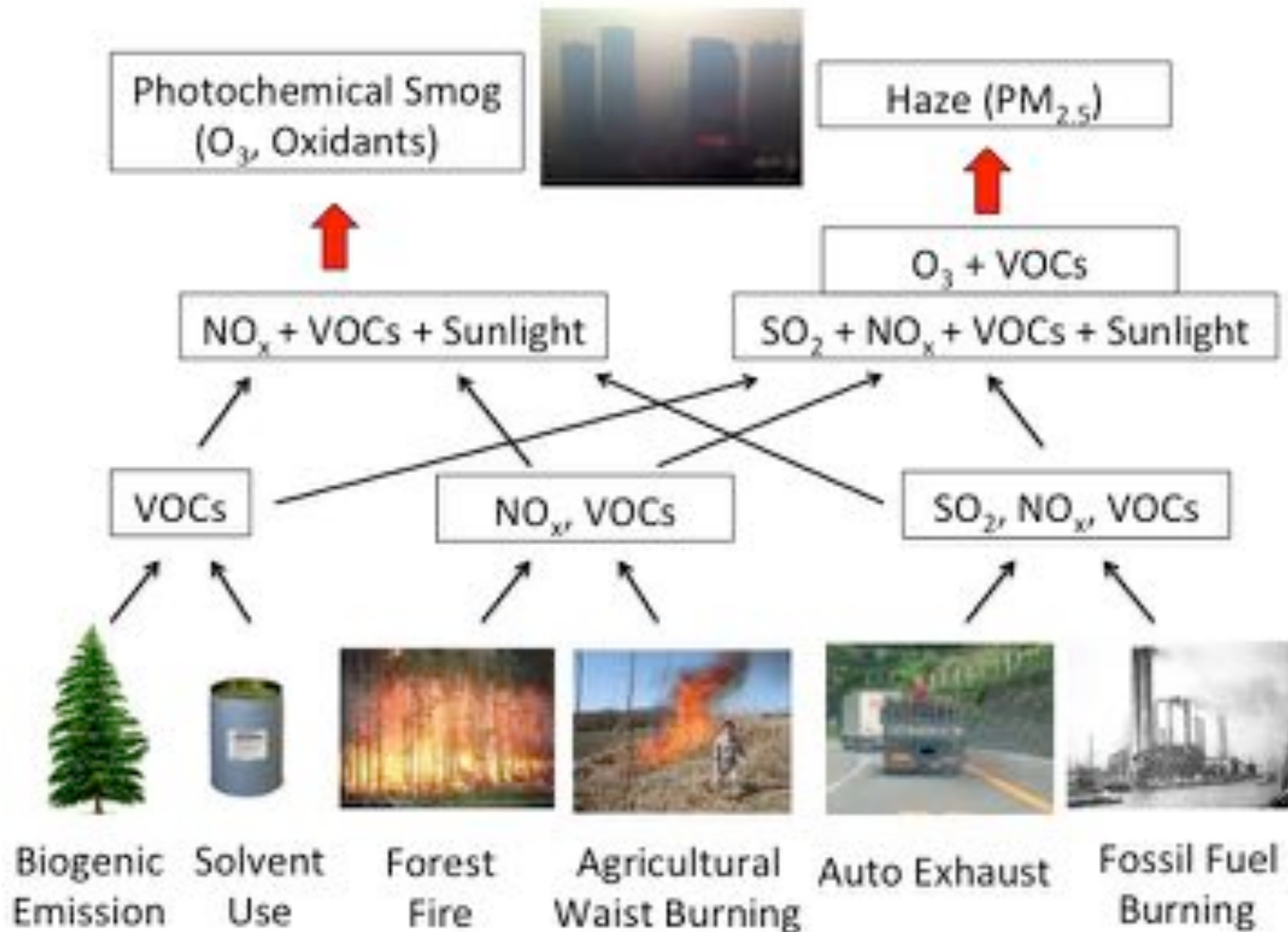


Ambient levels of PM_{2.5} in Asia in 2015



Source: GAINS 2017

Schematic Diagram of Formation of O₃ and Secondary PM_{2.5}



“Primary air pollutants” are proportional to the emission strength under the same meteorological conditions.

Control policy is rather straightforward if the source apportionment can be made.

“Secondary air pollutants” are not proportional to the emission strength of precursors.

Control policy requires a careful analysis based on sophisticated air quality models composed of chemistry and transport.

For example, $PM_{2.5}$ concentration is not simply proportional to SO_2 , NO_x , and VOC emissions.

For Future Mitigation Policy of Air Pollution Perspective on the Link of Air Quality and Climate Change is very important.

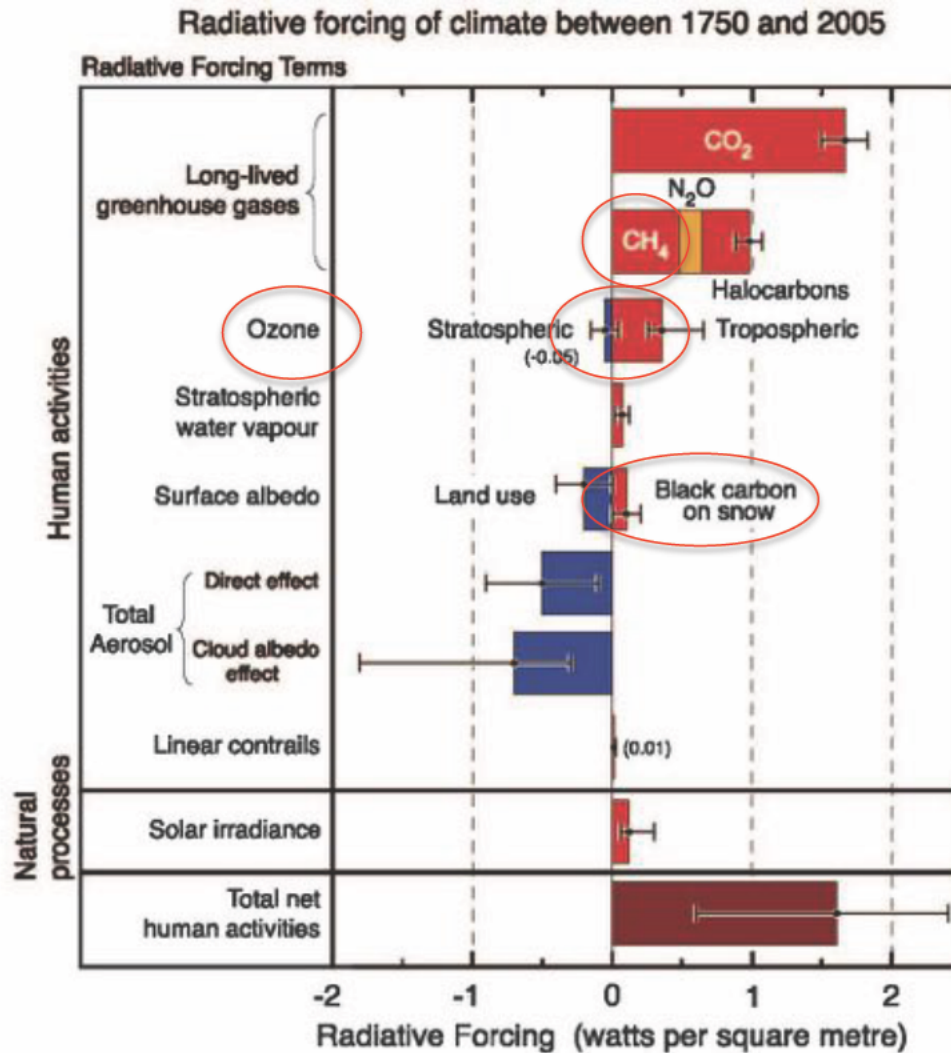
Agenda 2030 for Sustainable Development Adopted at UN Summit 2015

17 SDGs



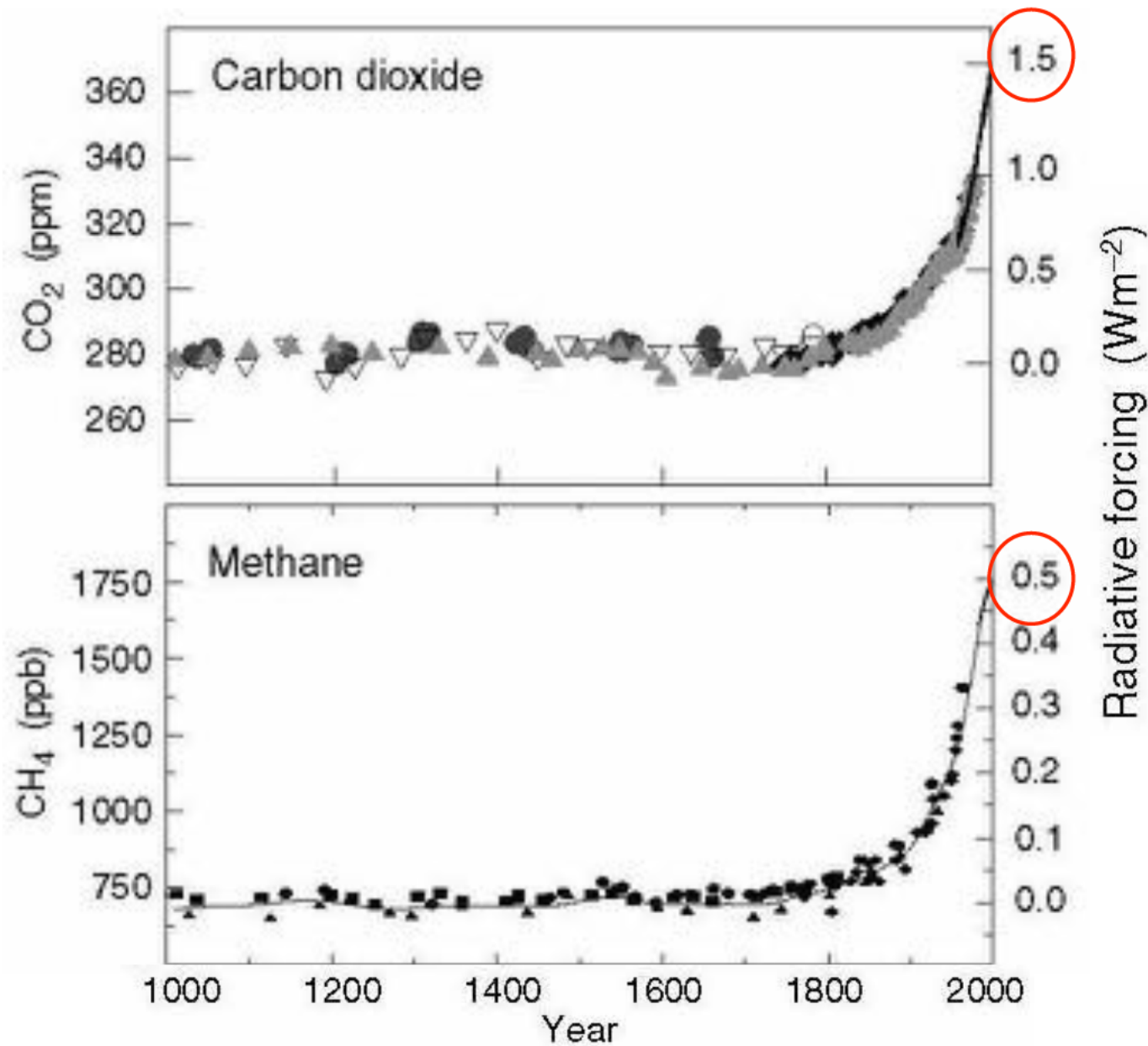
What Species have caused global warming/climate change?

Radiative Forcing by IPCC Referenced to 1750

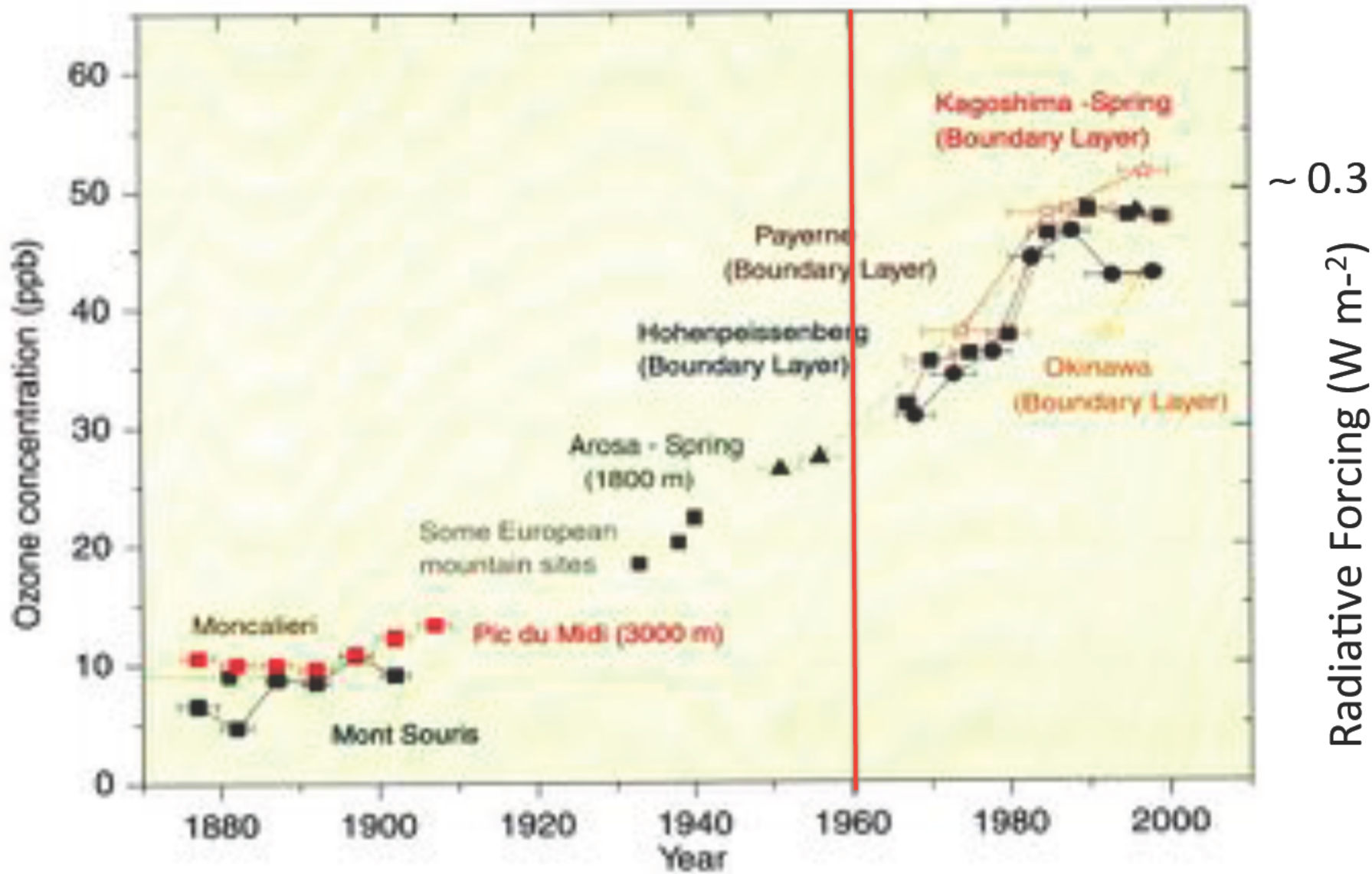


IPCC-AR4 2007

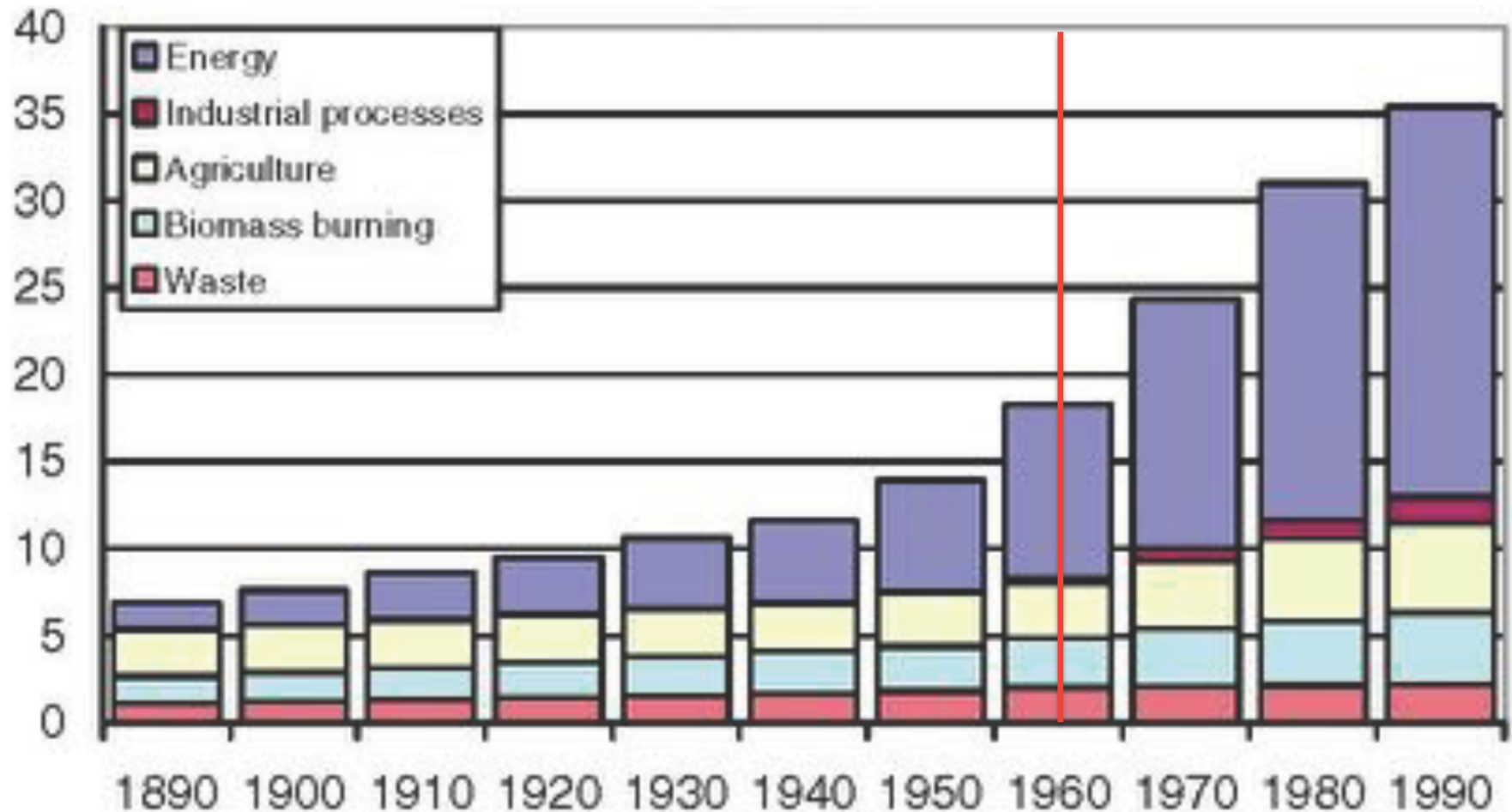
Global Atmospheric Concentrations and Radiative Forcing of CO₂ and CH₄ (IPCC AR3, 2001)



Trend of Near Surface Ozone in 1870-2000



Historical Trend of Global NO_x Emission (TgN/yr)



van Aadenne et al., Global Biogeochem. Cycles, 2001

Atmospheric Lifetime of global warming species

CO₂ ~ 100 years
N₂O 150 years

Long-Lived Green House Gas
(LLGHG)

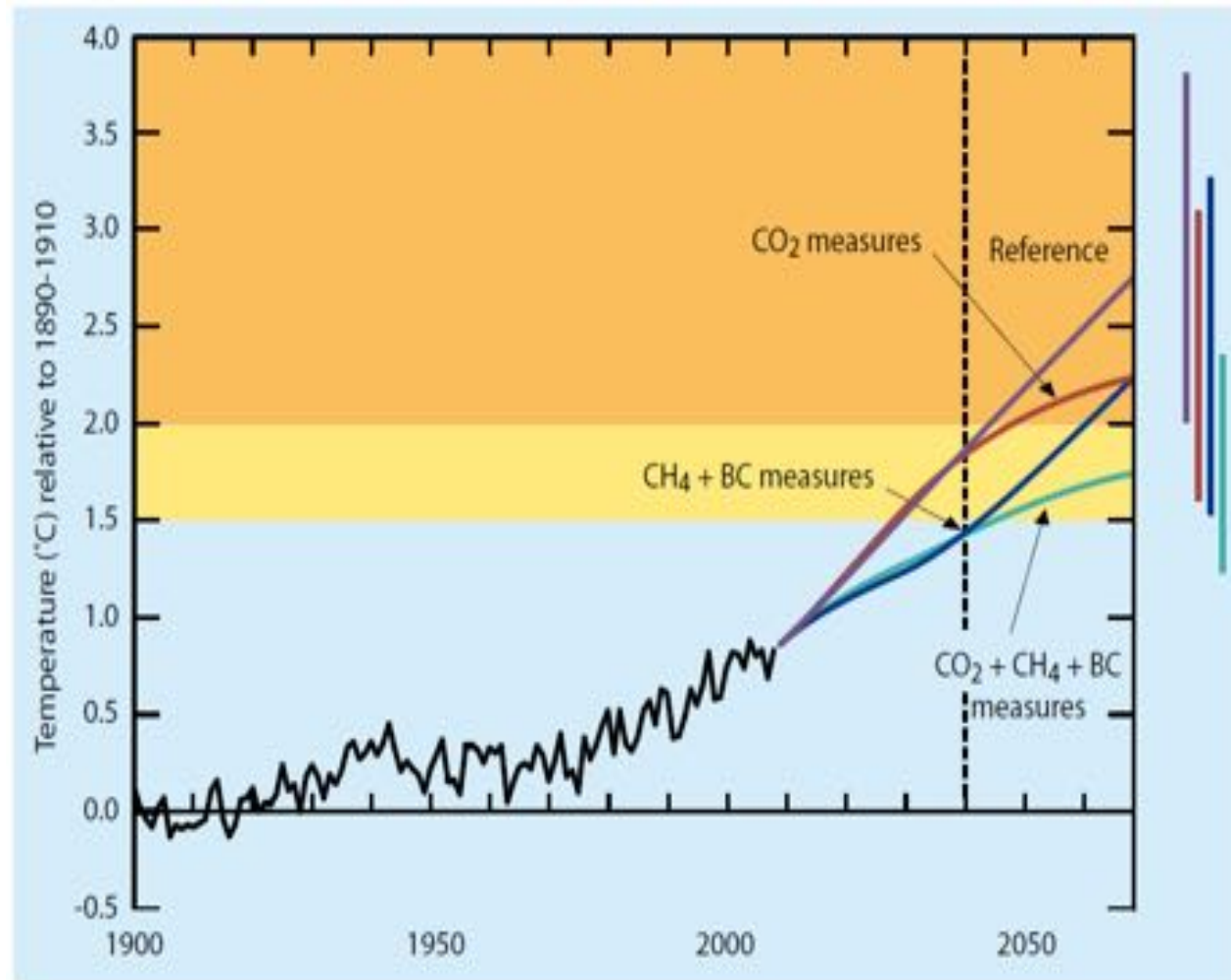
CH₄ 8-10 years
HFCs ~ 10 years

Short-Lived Climate Pollutants
(SLCPs)

O₃ < ~ 1 month
BC < ~ 1 month

Air Pollutants

Importance of SLCPs Co-control for the Mitigation Measure of Climate Change in Mid-term Future



UNEP / WMO (2011), Integrated Assessment of BC and Tropospheric Ozone (2011)

Climate Change is not a Future Issue but a Present Issue

Recent stronger typhoons, more frequent flooding and draught are thought to be due to Climate Change due to Global Warming.

A lot of human life, human health and properties are already lost by climate change.

It is the responsibility of present day policy makers to try to mitigate “mid-term” climate.

SLCP co-control (O_3 and CH_4) is the only way to mitigate “mid-term” climate change.

Concluding Message

It is very important to have Imagination over
Perspective to Achieve:

Low Carbon Society (Zero carbon Society)

Low NO_x Society (Zero NO_x Society)

No Fossil Fuel Combustion Society

All Renewable Energy (by 2050?)

All Electric Car (by 2030?)