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Disruptions in the Environment and Climate Change

Yongsung Cho
Dept. Food & Resource Economics,
Korea University

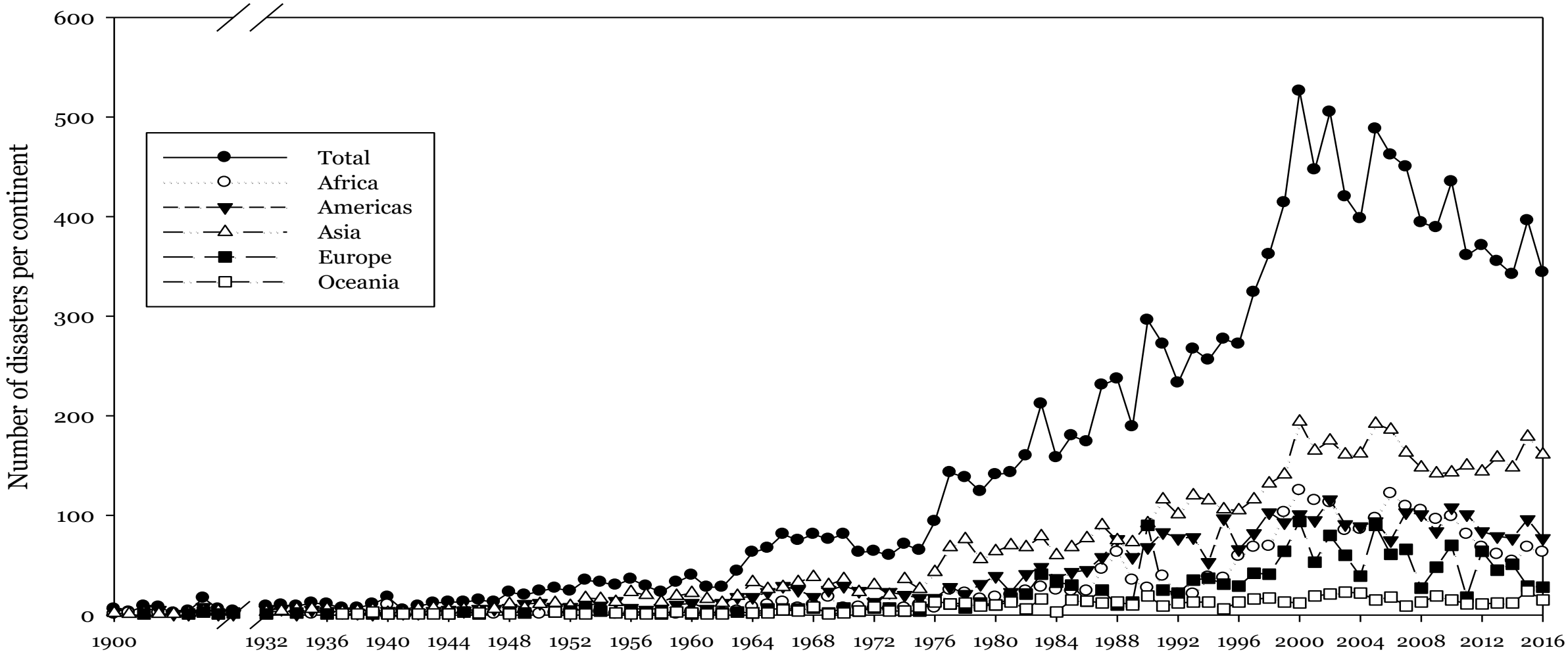
Questions

1. What are the **key drivers** of disruption and **how** they **affect** the environment & climate change?

2. How would we describe the **nature** of this disruption?

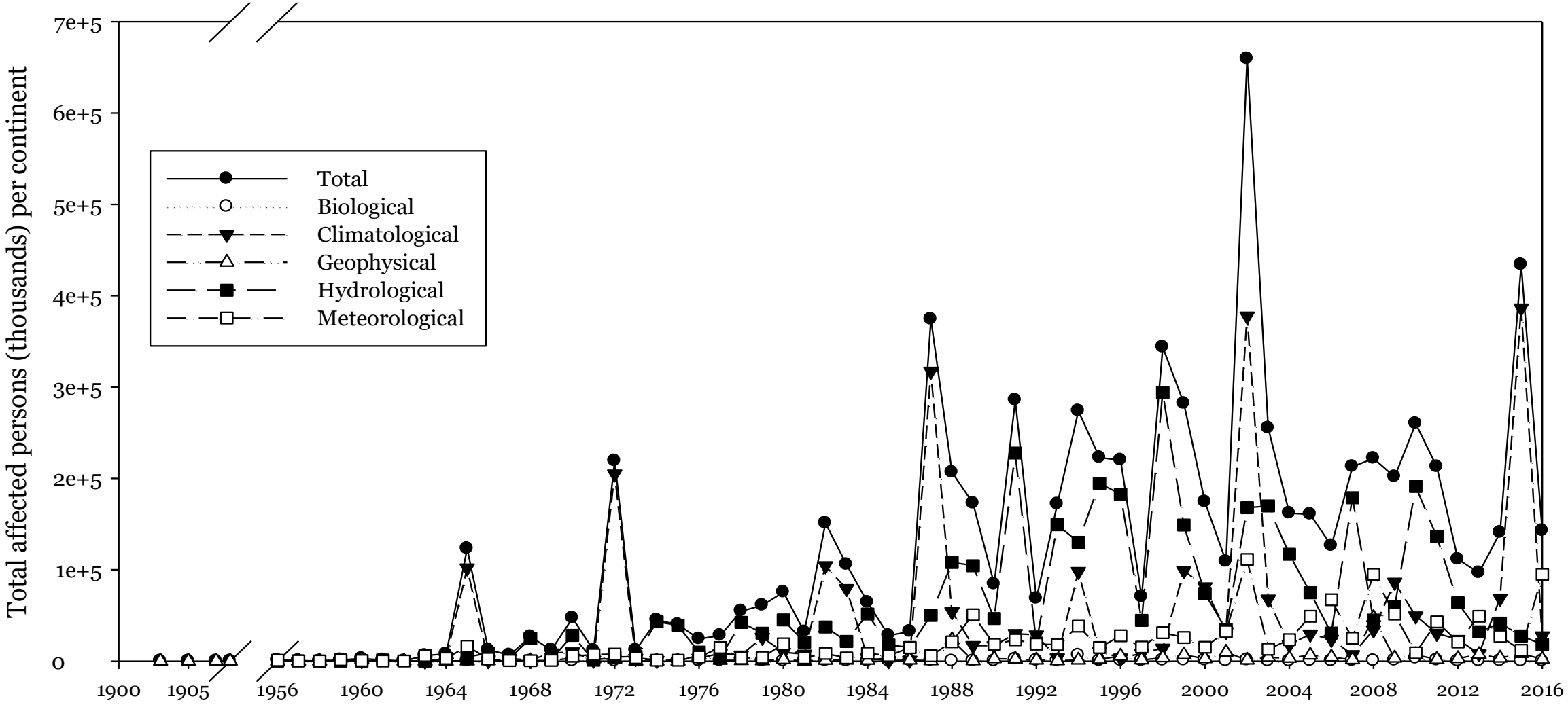
3. What should be done to increase **resilience** against these disruptions?

Total number of reported natural disasters between 1900-2016



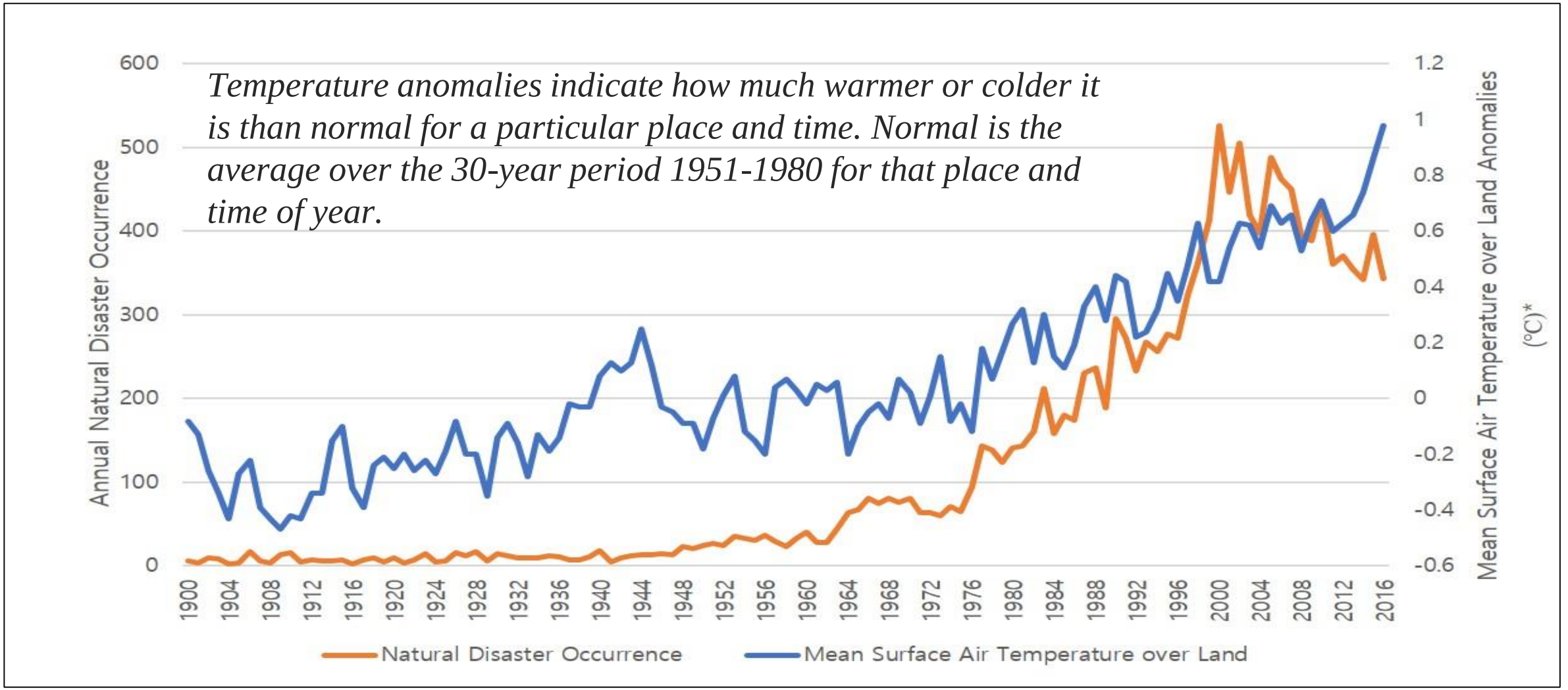
Source: EM-DAT: The Emergency Events Database – Universite catholique de Louvain (UCL) - CRED, D. Guha-Sapir – www.emdat.be, Brussels, Belgium ; Emergency Events Database (EM-DAT), The International Disaster Database (Centre for Research on the Epidemiology of Disasters – CRED)

Total number of people affected by natural disasters between 1900-2016



Source: EM-DAT: The Emergency Events Database – Universite catholique de Louvain (UCL) - CRED, D. Guha-Sapir – www.emdat.be, Brussels, Belgium

Natural disaster occurrence and global mean surface air temperature



Source: 1) Natural disaster occurrence: EM-DAT – Universite catholique de Louvain (UCL) - CRED, D. Guha-Sapir – www.emdat.be, Brussels, Belgium; 2) Mean temperature: NASA GISS – https://data.giss.nasa.gov/

Question 1: What are the **key drivers** of disruption and **how** they **affect** the environment & climate change?

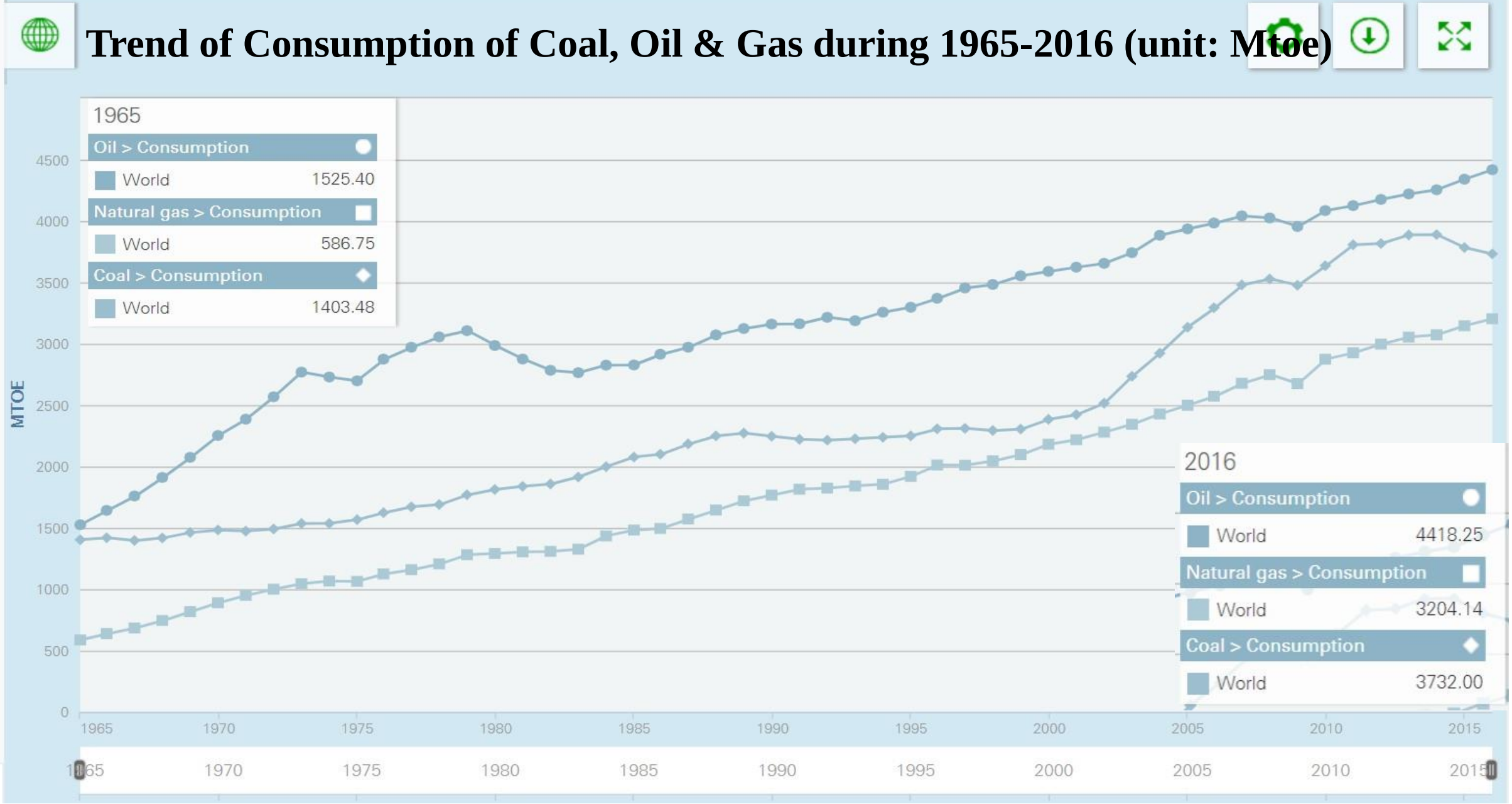
- There are many factors to disrupt the environment such as extraction of resources(mineral), development, deforestation, waste, burning, poverty, education (perception) etc

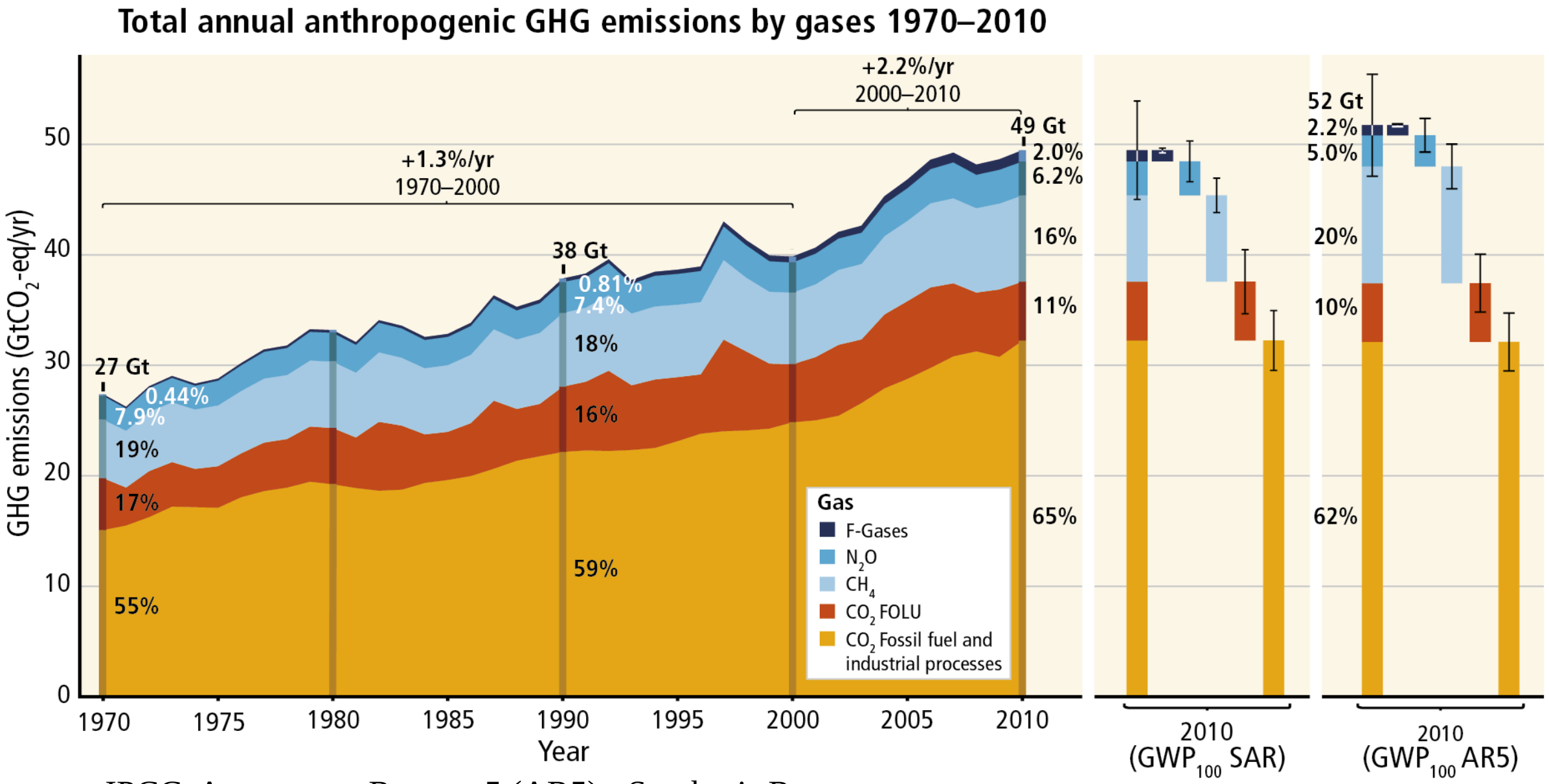
- Among them, burning fossil energy (coal, oil, gas) make many different environmental problems :
  - ***Local air pollution*** : SOx, NOx, Fine Dust
  - ***Reginal air pollution*** : Acid Rain, Ozone layer, Yellow sand
  - ***Global pollution*** : Climate Change (global worming)

Question 1: What are the **key drivers** of disruption and **how** they **affect** the environment & climate change?

- Especially, **excessive use of fossil energy** is main source of accelerating climate change
  - Energy per capita (unit: t/capita)
    - 1.13 in 1965 ➔ 1.79 in 2016
  - CO2 per capita (unit: t/capita)
    - 2.43 in 1965 ➔ 4.50 in 2016
  - Population
    - 3,026 million in 1960 ➔ 7,324 million in 2015 ➔ 9,957 million in 2060

Trend of Consumption of Coal, Oil & Gas during 1965-2016 (unit: Mtoe)





IPCC, Assessment Reports 5 (AR5) - Synthesis Report

Question 2: How would we describe the **nature** of this disruption?

- Global, Accumulating, Accelerating, Magnifying
- Impacts of disruption (climate change) are same, but Damages of disruption are different.
  - The level of climate change impacts in ***developing countries*** (or countries that are not prepared to adapt to climate change) will be **greater**, although impacts of climate change (i.e., drought, flood, shortage of water) are same to developed countries and developing countries.

- **Poorer economies are more vulnerable because a higher share of their population lives in marginalized urban areas with poor infrastructure.**
  - IPCC. 2012. *Managing the risks of extreme events and disasters to advance climate change adaptation: Special report*. Cambridge: Cambridge University Press.

- **Nine of the ten most affected countries between 1996 and 2015 were developing countries in the low to low-middle income country group.**
  - Germanwatch. 2016. *Global climate risk index 2017: Who suffers most from extreme weather events? – Weather-related loss events in 2015 and 1996 to 2015*. Briefing Paper. Berlin: Germanwatch.

- Since the impacts of climate change are different by regions and/or countries, each countries respond climate change differently. For this reason, international climate change negotiations (i.e., Kyoto protocol) to reduce GHG are very difficult.

Climate change

Climate change soon to cause movement of 140m people, World Bank warns

Tens of millions in three regions of the developing world expected to migrate before 2050 unless environment is improved

Fiona Harvey
Environment correspondent

Mon 19 Mar 2018
16.44 GMT

5594

"Climate change will result in a massive movement of people inside countries and across borders, creating "hotspots" where tens of millions pour into already crowded slums.

More than 140 million people in just three regions of the developing world are likely to migrate within their native countries between now and 2050, the first report on the subject has found.

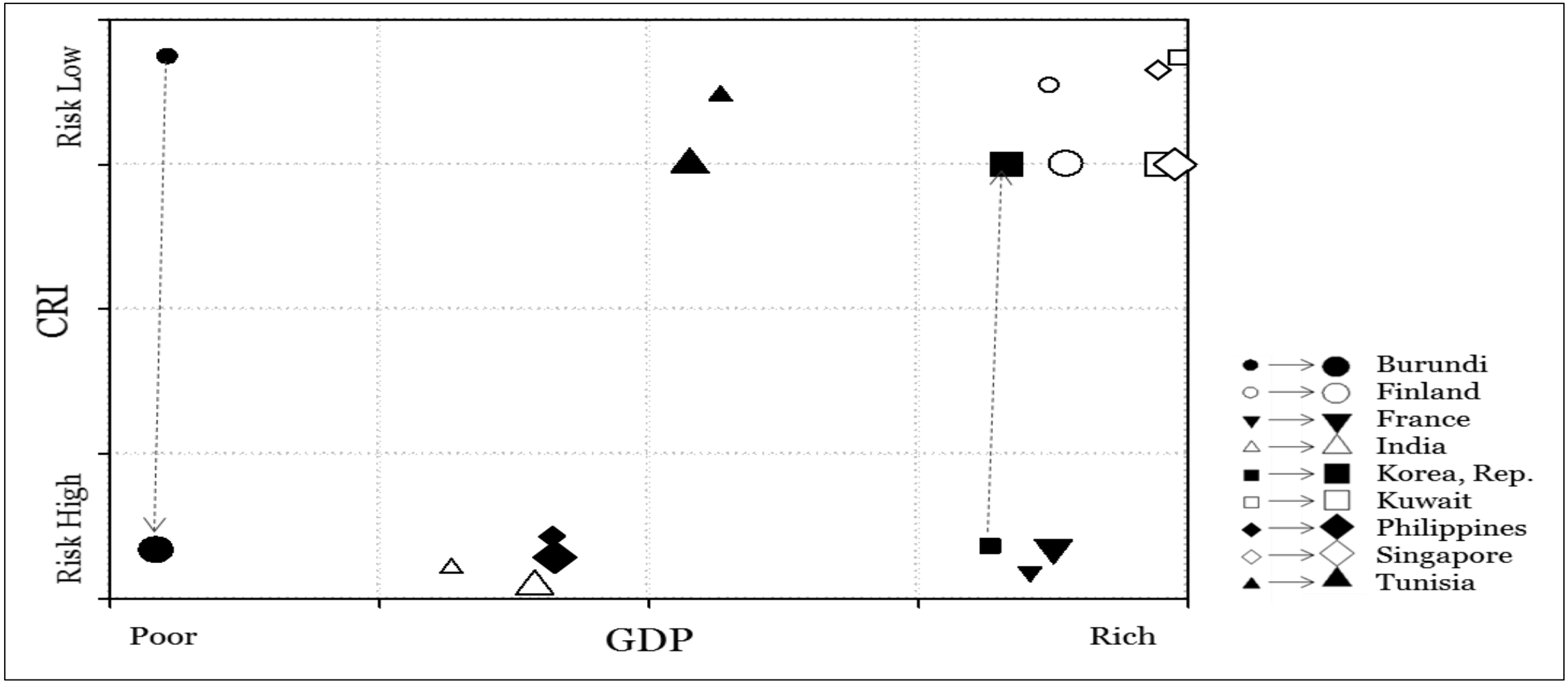
The World Bank examined three regions, which between them account for 55% of the developing world's population. In sub-Saharan Africa, 86 million are expected to be internally displaced over the period; in south Asia, about 40 million; and in Latin America, 17 million."

Source: https://www.theguardian.com/environment/2018/mar/19/climate-change-soon-to-cause-mass-movement-world-bank-warns

Question 3: What should be done to increase **resilience** against these disruptions?

- Greenhouse gas abatement
  - Carbon pricing (i.e., carbon tax, carbon emission trading)
- Technology transfer
  - Fuel switching, increase of renewable energy
- Financial support
  - Increase of capacity for climate change **adaptation**
- Implementation of Paris Agreement

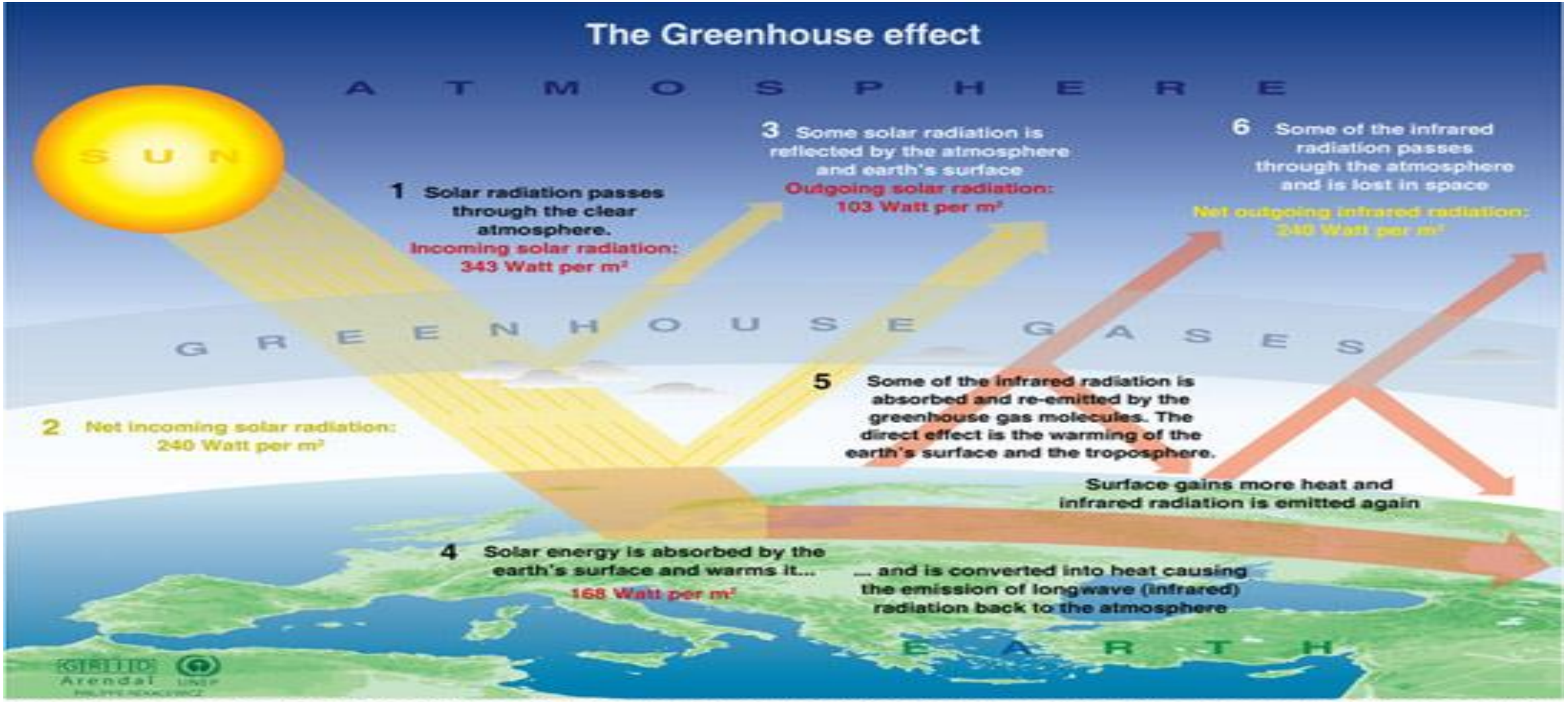
Changes in CRI rank in relation to GDP rank during 1995 - 2015



Note that Climate Risk Index (CRI) reported by the Germanwatch, and Rank 1 being the most vulnerable nation out of 180 countries.

Thank you.

yscho@korea.ac.kr

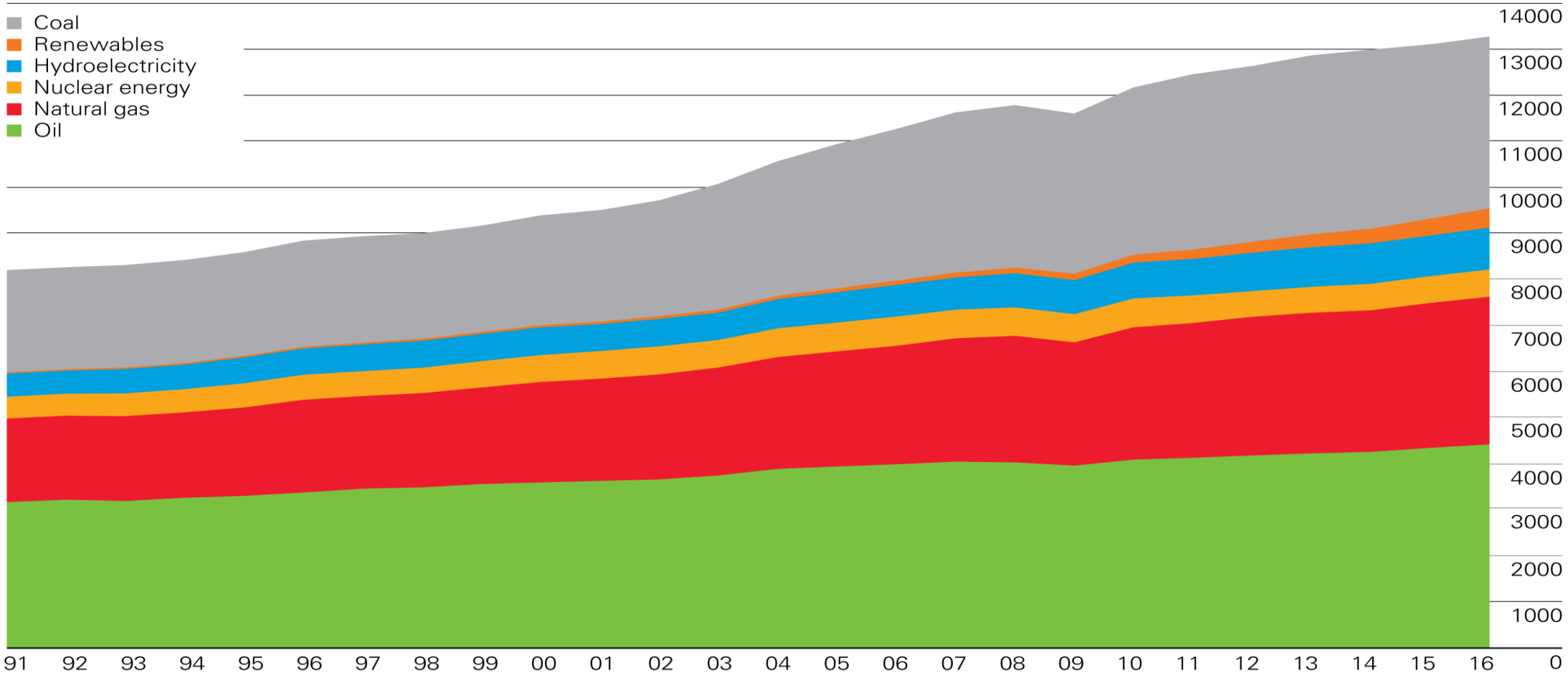


Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

The greenhouse effect describes how certain gases in our atmosphere increase the temperature on Earth's surface by preventing some of the energy radiating from the planet's surface from being lost into space (UNEP/GRID-Arendal).

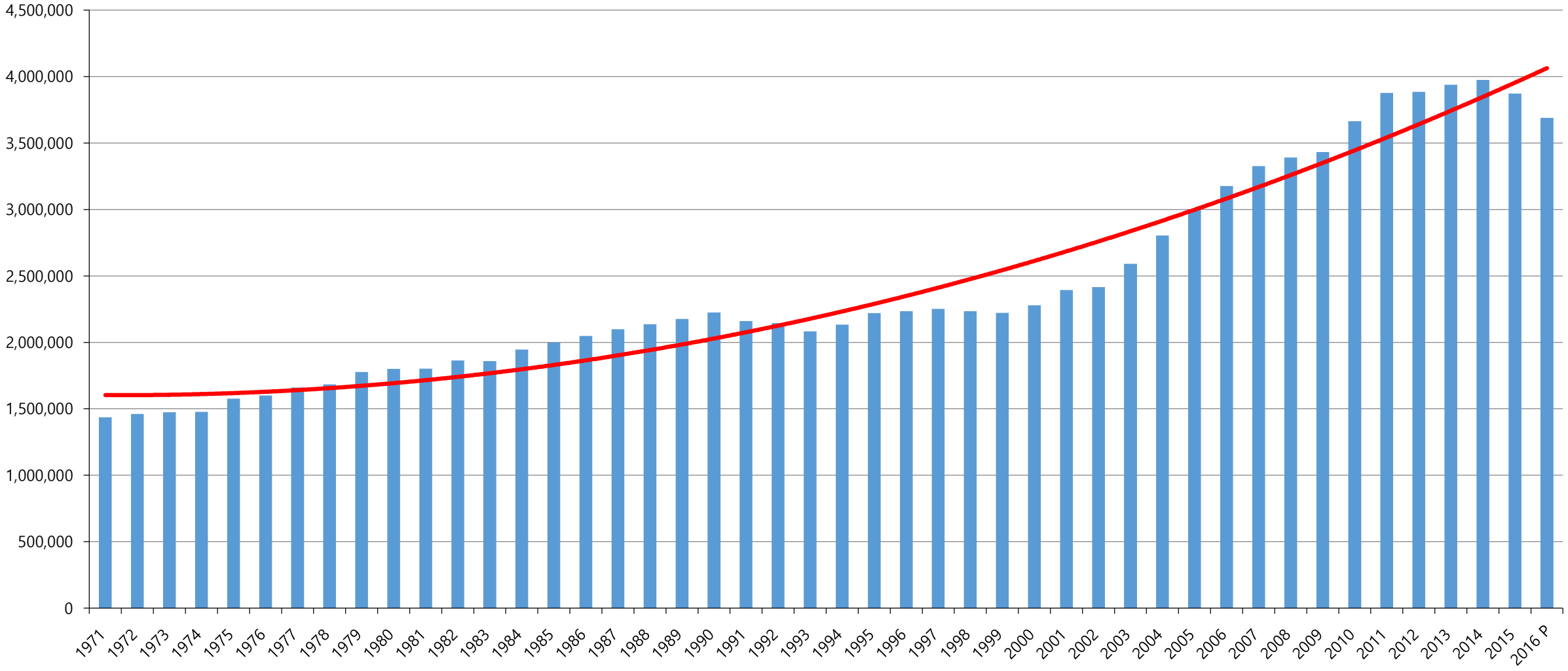
Primary energy world consumption

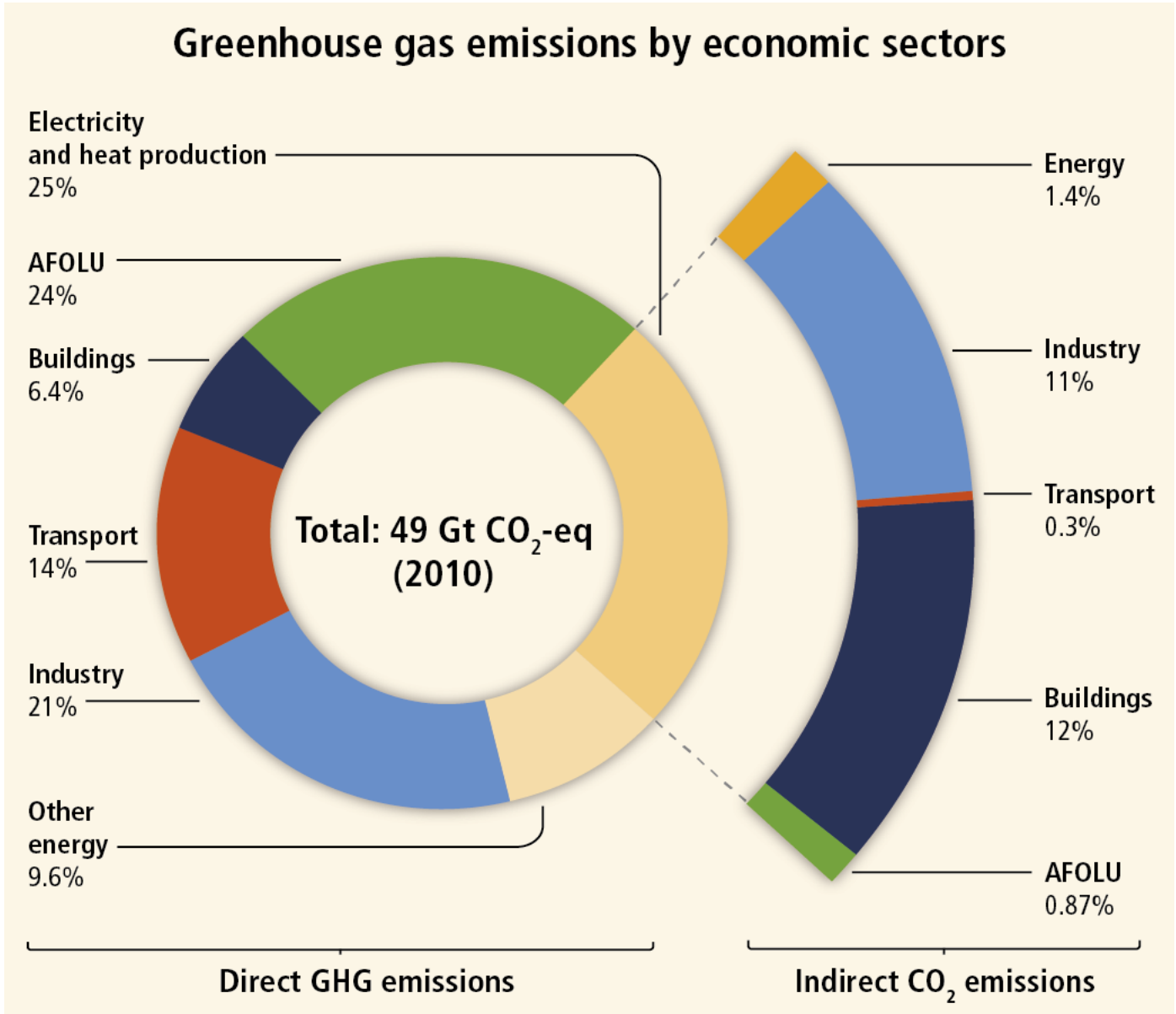
Million tonnes oil equivalent



BP Statistical Review of World Energy 2017

Coal, peat and oil shale: Production (ktoe)




Greenhouse gas emissions by economic sectors
Electricity and heat production 25%
AFOLU 24%
Buildings 6.4%
Transport 14%
Industry 21%
Other energy 9.6%
Total: 49 Gt CO_2-eq (2010)
Energy 1.4%
Industry 11%
Transport 0.3%
Buildings 12%
AFOLU 0.87%
Direct GHG emissions
Indirect CO_2 emissions