ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

Climate change economics

DATE
28th September

VENUE
CPD day

AUTHOR
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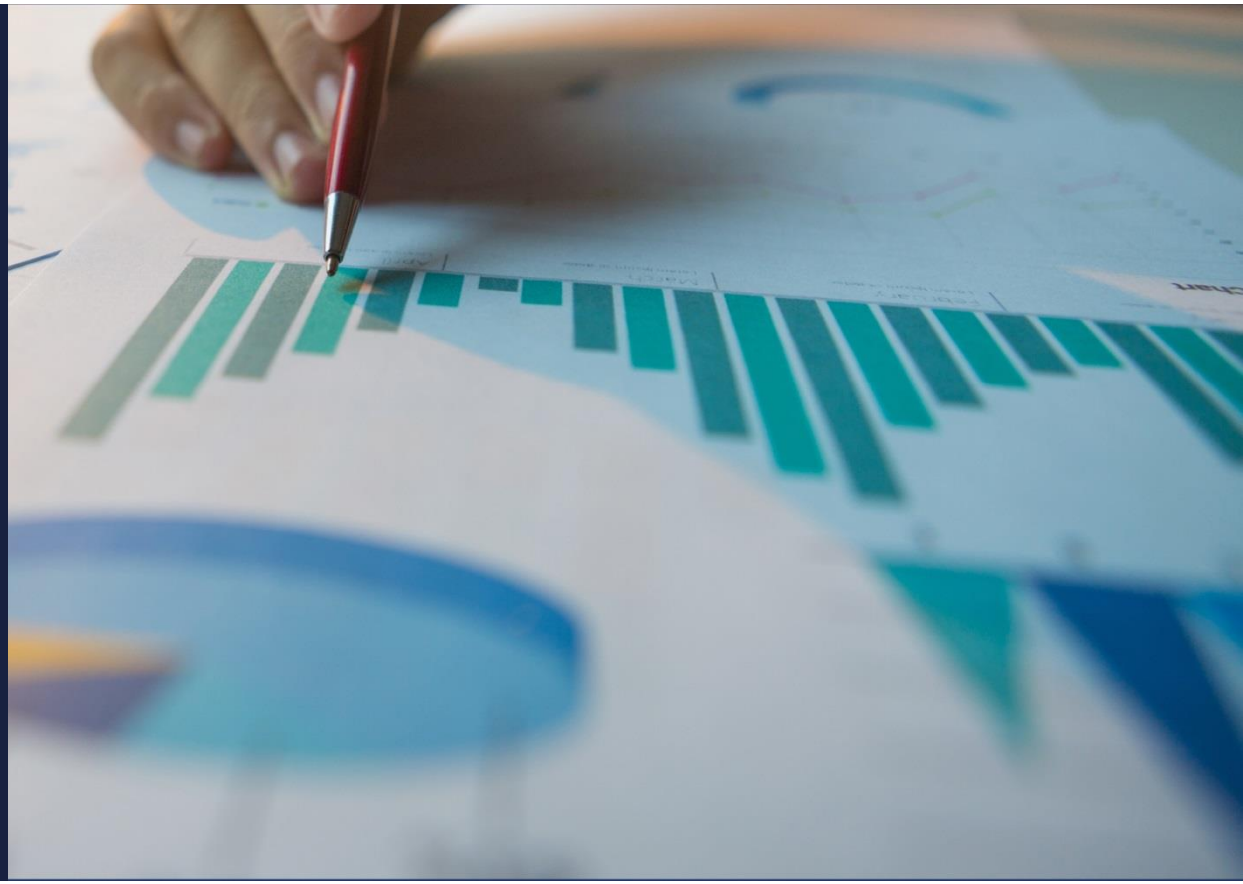


Climate Change

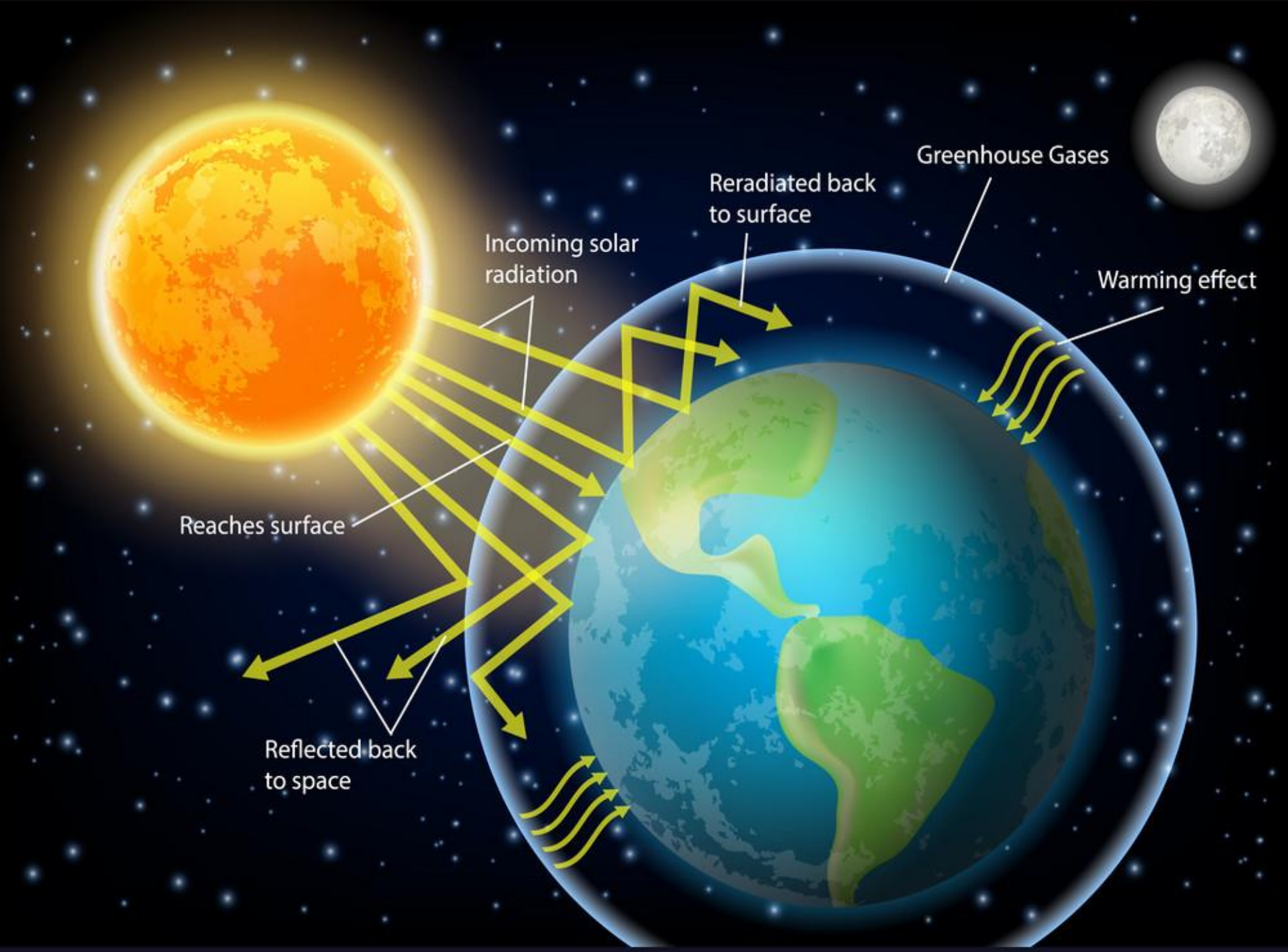
- Considered to be the greatest environmental threat we face
- **Climate change**
- **Climate change impacts**
- **Economics of climate change**
- **Policies**
- **Applied economic work**

Climate Change

Climate Change

The earths climate is determined by:

1. changes in incoming **solar radiation**
2. changes in **albedo** (reflected radiation by clouds and vegetation)
3. changes in the transmission of **long wave radiation** from Earth back to space


Greenhouse Gases
Reradiated back to surface
Incoming solar radiation
Warming effect
Reaches surface
Reflected back to space

Enhanced GHG effect

- Greenhouse gas (GHG) emissions increase back radiation, increasing global temperatures and climate patterns
- This creates an **enhanced** Greenhouse gas effect vs. the natural GHG effect
- Climate Change
- Global warming

GHGs

The GHG are:

CO_2 : carbon dioxide

CH_4 : Methane

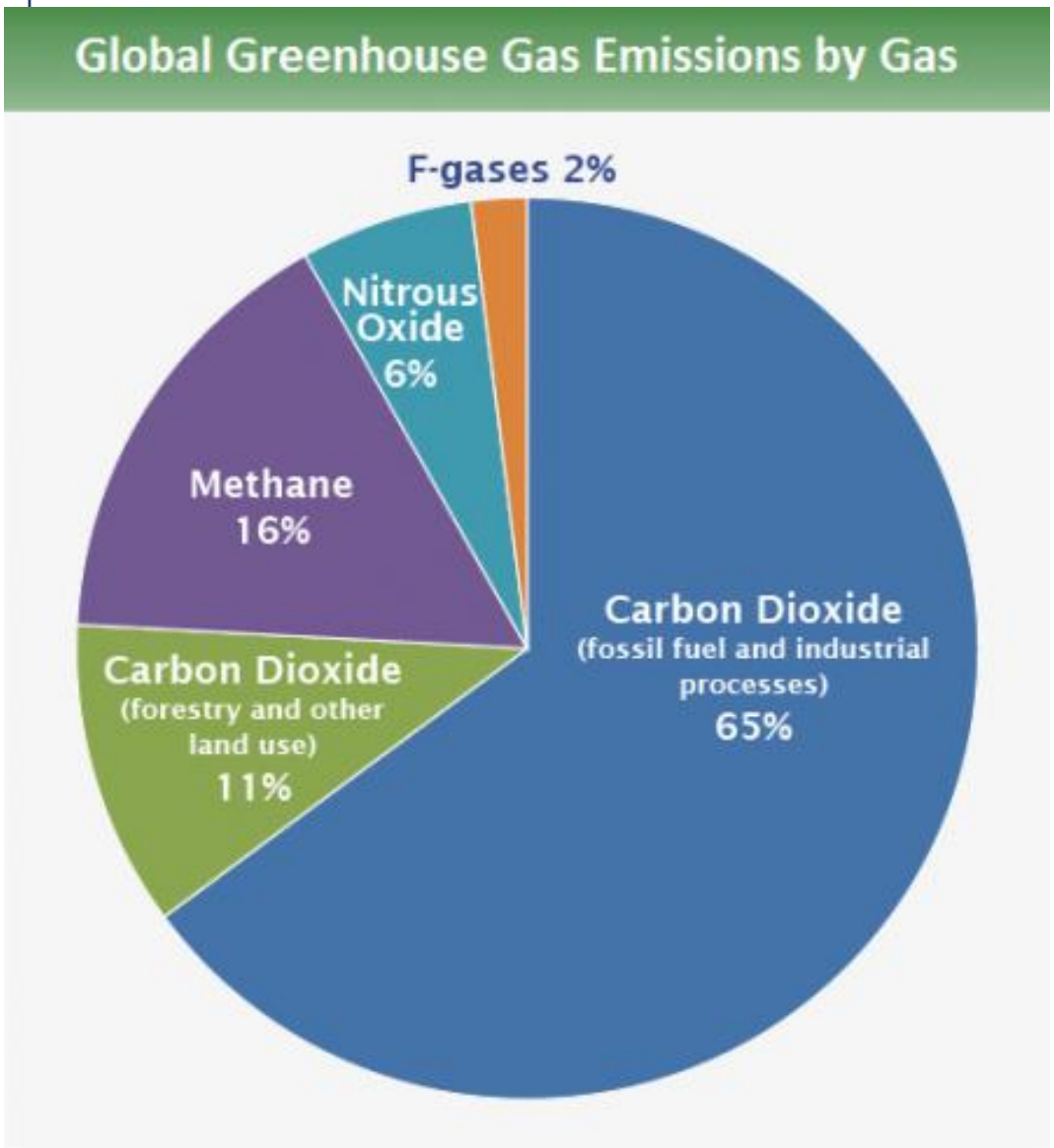
N_2O : Nitrous oxide

O_3 : Ozone

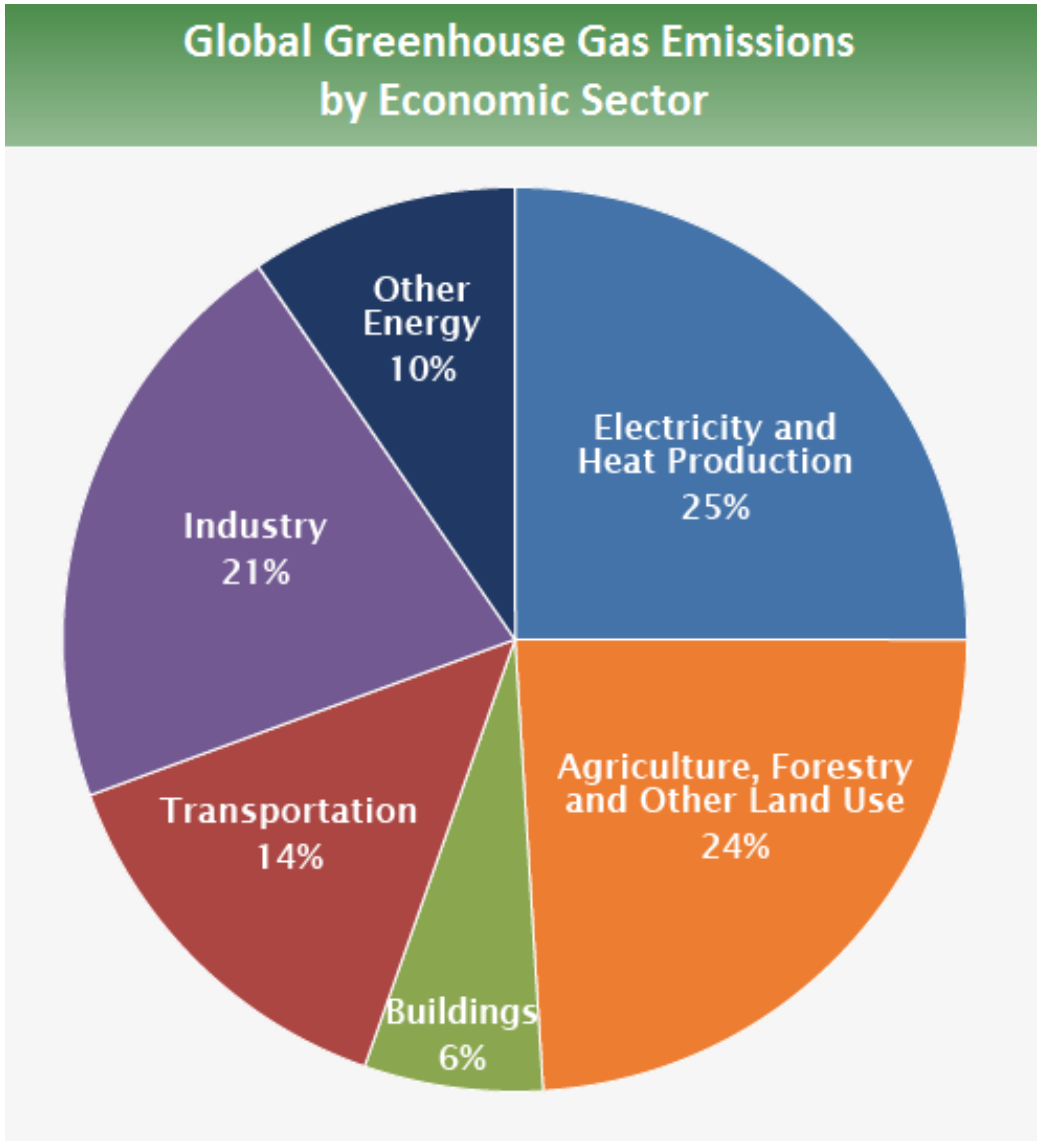
H_2O : water vapor

CFCs

Source: IPCC


Global Greenhouse Gas Emissions by Gas
F-gases 2%
Nitrous Oxide 6%
Methane 16%
Carbon Dioxide (forestry and other land use) 11%
Carbon Dioxide (fossil fuel and industrial processes) 65%

Source: IPCC


Global Greenhouse Gas Emissions
by Economic Sector
Other Energy 10%
Electricity and Heat Production 25%
Industry 21%
Agriculture, Forestry and Other Land Use 24%
Transportation 14%
Buildings 6%

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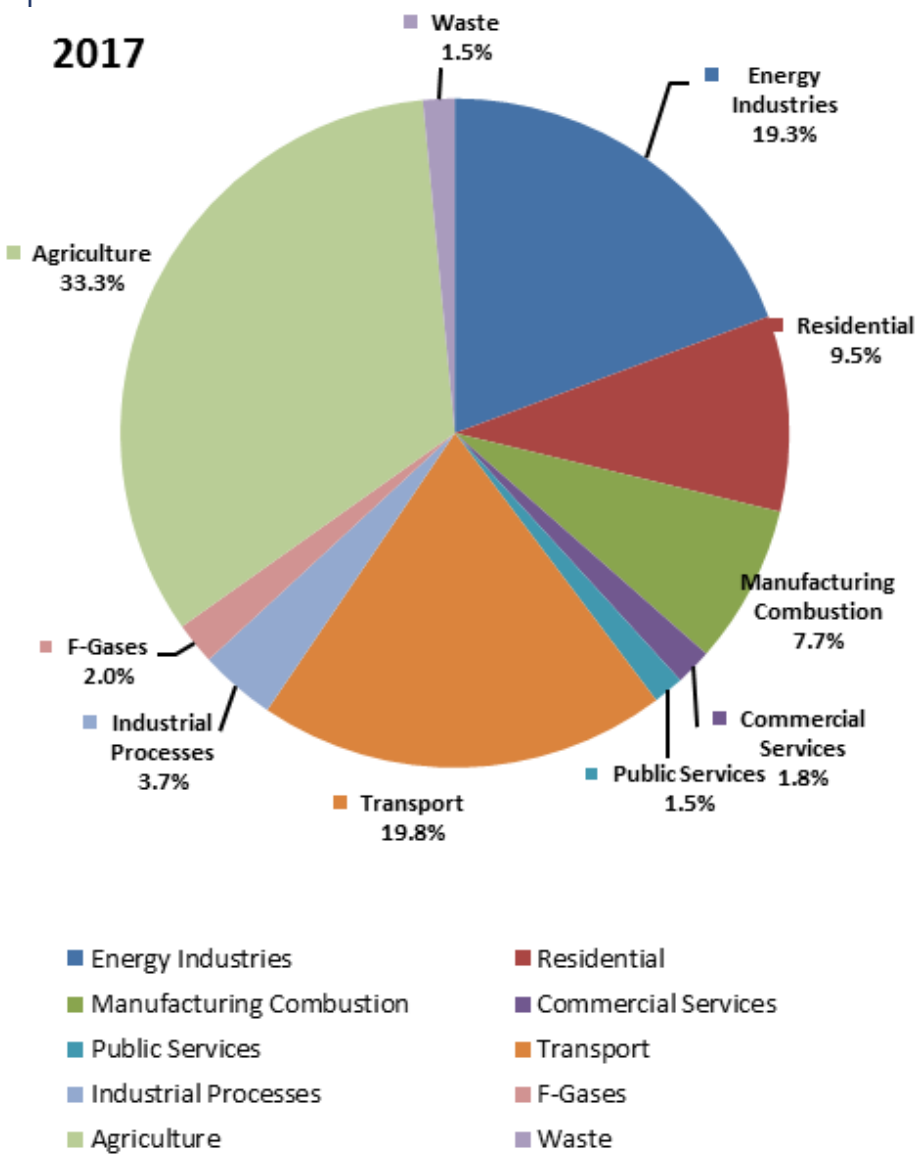
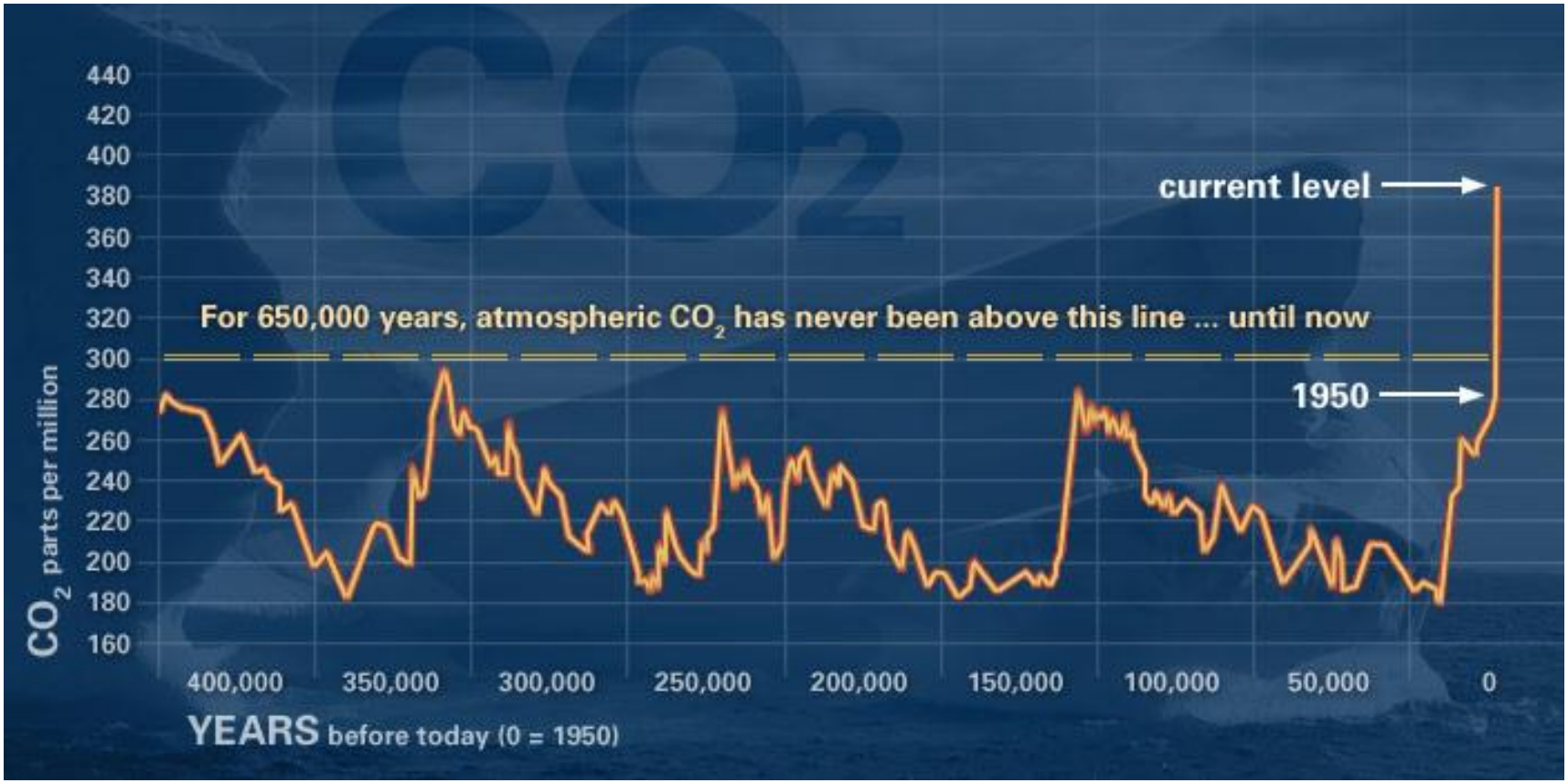
Irelands sources of GHGs



The rise of GHG concentrations



Climate Change Impacts

Climate Impacts

- Increased **average temperatures**
- Increased **climate variability**
- Increased **extreme weather events**

Climate Change Impacts

- Freshwater resources
- Ecosystems
- Agriculture
- Coastal and low lying areas: sea level rise
- Floods
- Droughts
- Settlements
- Health
- Leisure
- Tourism
- Catastrophic events
- Extreme weather events (hurricanes, storms etc)
- Conflict

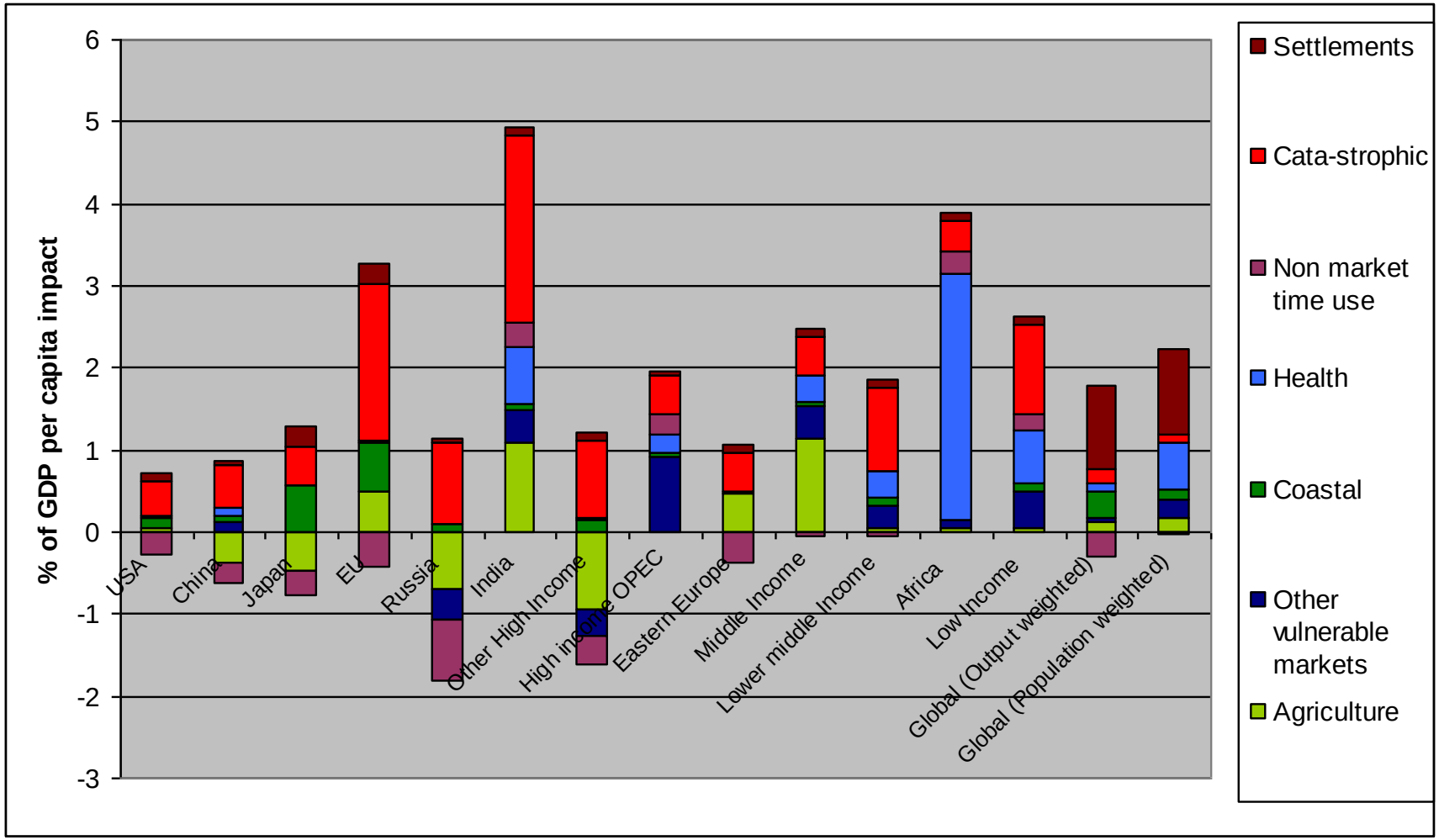
Level of Impacts

- **2% annual loss** of GDP by 2070
- Likely underestimate
- Compare to crisis one time shock of 2-3% great
- Extreme differences across countries and groups within countries
- Generally the already vulnerable will be hit hardest

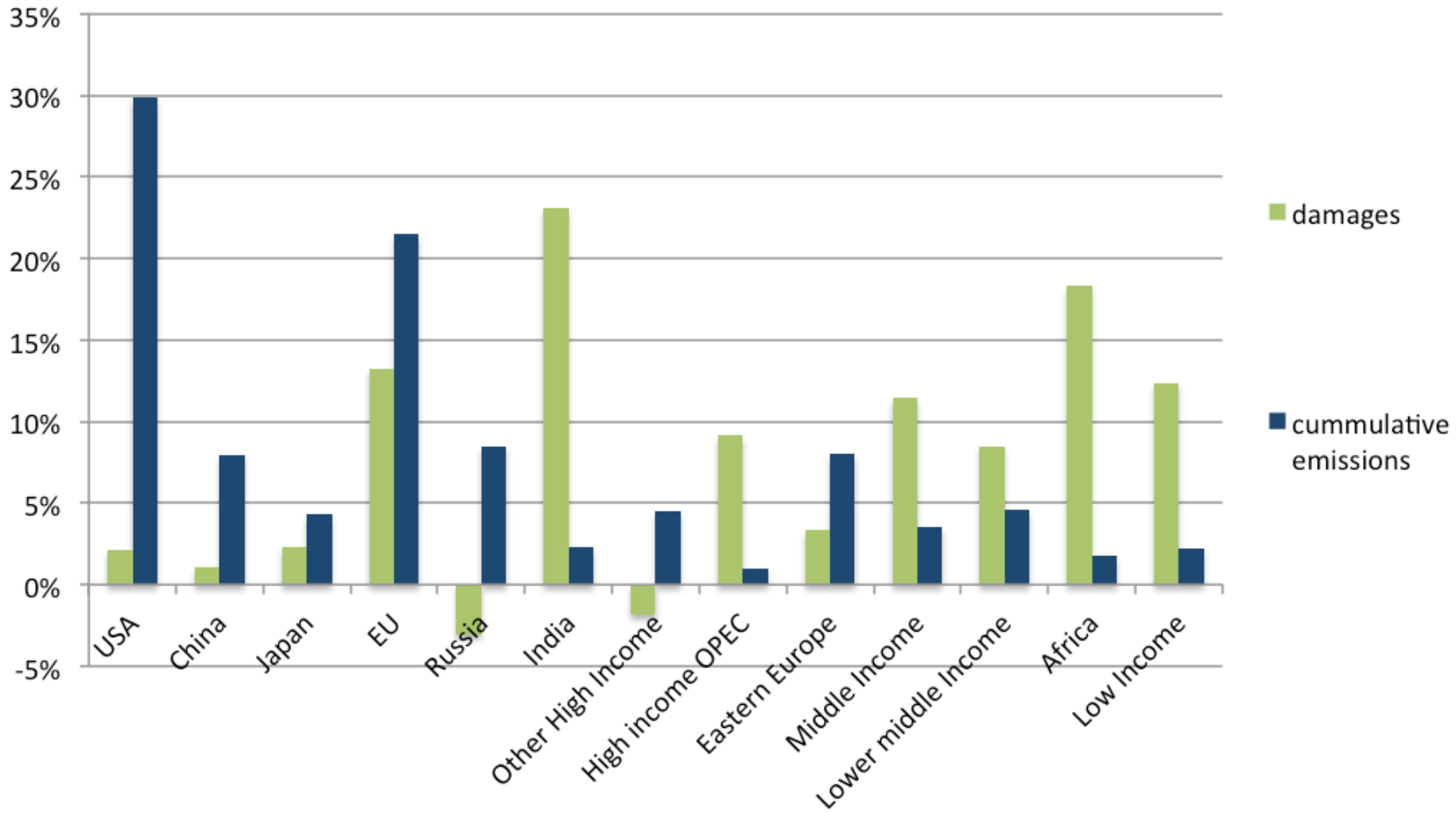
Thresholds and irreversibilities

- Discontinuous changes in **ocean circulation**
- Release of carbon from **permafrost**
- **Ice albedo** effect
- climate sensitivity coefficients rise **endogenously**

Distribution of Impacts



Regional impacts and emissions



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Climate Change Economics

Climate Change economics

- Climate change economics may seem like an oxymoron
- But economics is defined as optimising utility given scarce resources
- Hence climate change and environmental economics are quite natural concepts

Economics

- In an economy a market creates an **optimal** price and quantity of a good
- What is optimal?
- Costs are weighed against benefits
- Environmental costs are not considered
- This is called market failure

Why market failure?

- **Externalities**: what you do effects others, your pollution hurts other people, not (just) you.
- You don't consider all costs when weighing costs and benefits
- **Public goods:** you cant exclude someone from using an environmental good (clean air)
- Climate change is considered to be the greatest market failure ever
- Immense externalities and purest public good (over space and time)

Public Bad

Why is climate change a public bad?

- Transboundary (and transtemporal) nature
- Universally mixing pollutant
- Limited ways to protect against it (exclude yourself)

This makes policy setting extremely difficult and calls for global cooperation

Climate Change Economics

- Addresses this market failure, focusing on:
- Assessing (economic) **impacts** of climate change
- Finding the **optimal balance** between costs and benefits of climate change
- Assessing policy **instruments** to implement this optimal level of climate change (permits, taxes, etc.)

Policies

Mitigation and carbon sinks

Mitigation:

- **Decrease** in emissions (from production/consumption)
- Alternative energy sources
- Energy efficiency
- Changes in consumption patterns
- Less consumption

Carbon sinks:

- **Absorbs** emissions
- Increased planting, changes in species
- Limited potential : 10-20% of emissions
- Not permanent solution, flow
- Opportunity cost of land

Adaptation

- Adaptation refers to all strategies which alter economic and social infrastructure to better fit the new climate, in this way reducing the gross damages caused by climate change

- Can include many different options: use of air-conditioning, seawalls, agricultural adjustments, leisure adjustments, mosquito nets etc.

The Start of the Climate Discussion

- In the 1970s discussions on climate change started and the **IPCC** was formed
- Intergovernmental panel on Climate Change
- Meets annually to report scientific findings and discuss cooperation
- IPCC does not conduct research but summarises it
- Policy relevant yet policy neutral and not policy prescriptive
- Scientific body

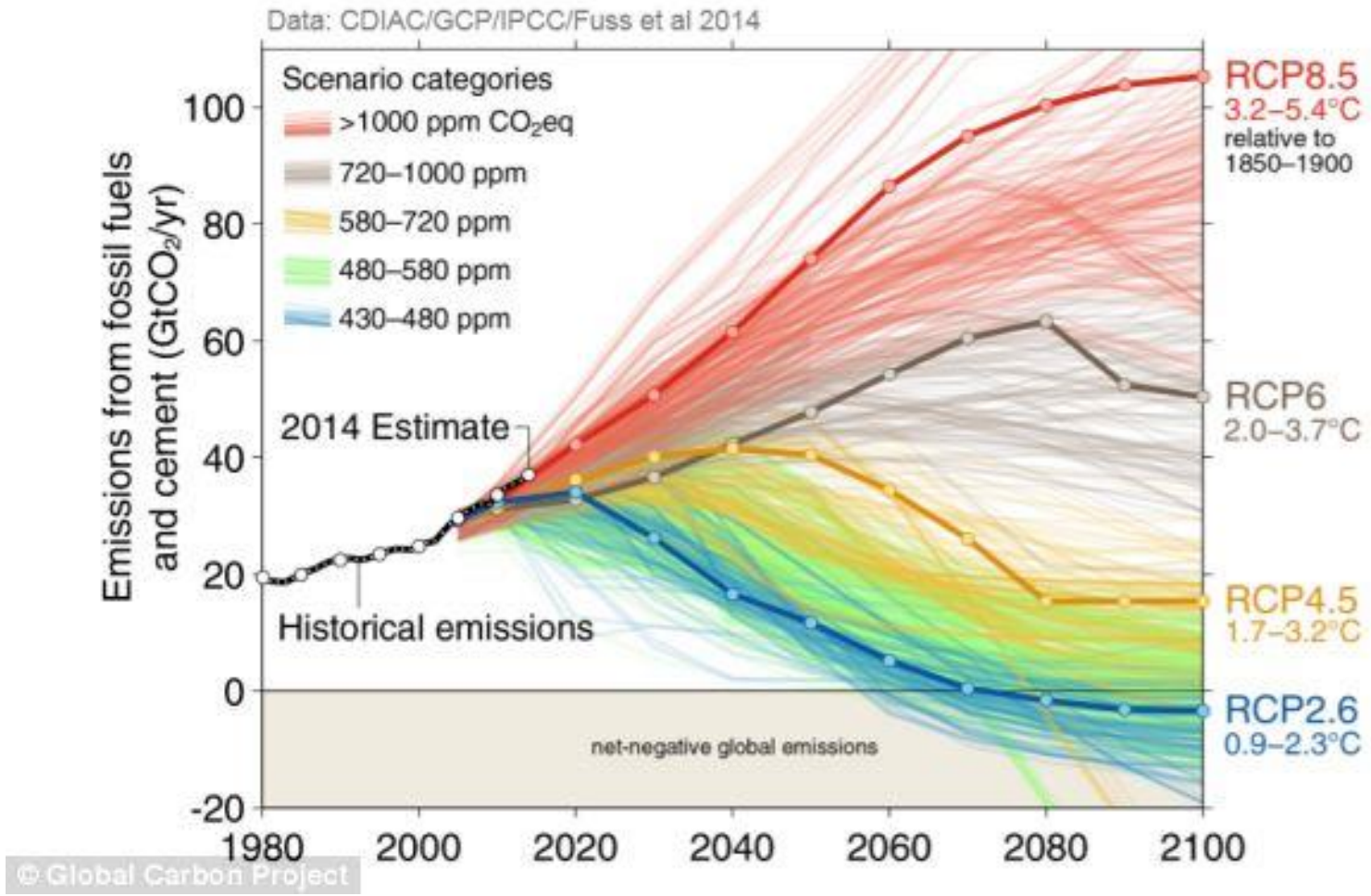
IPCC reports

- Every 5-7 years an Assessment report is published
- The assessment report consist of 3 groups:
- **Physical science basis**
- **Impacts, adaptation and vulnerability**
- **Mitigation of climate change**

IPCC Scenarios

- The IPCC also develops scenarios which describe possible future climate change
- These are based on storylines that assume different developments in terms :
- Population growth
- Development
- Carbons sinks
- Technology progress
- Land use changes (particularly rainforests)

Scenarios (SSPs)



UNFCCC

- **UNFCCC** (UN framework convention on climate change) is a policy orientated body that tries to facilitate global cooperation on mitigation
- It works in close proximity with the IPCC
- Conference of Parties (COP) involves negotiations on global mitigation
- **Kyoto Protocol (1997)**: the first substantial agreement to set country-specific GHG emissions limits and a timetable for their attainment.

Paris Agreement

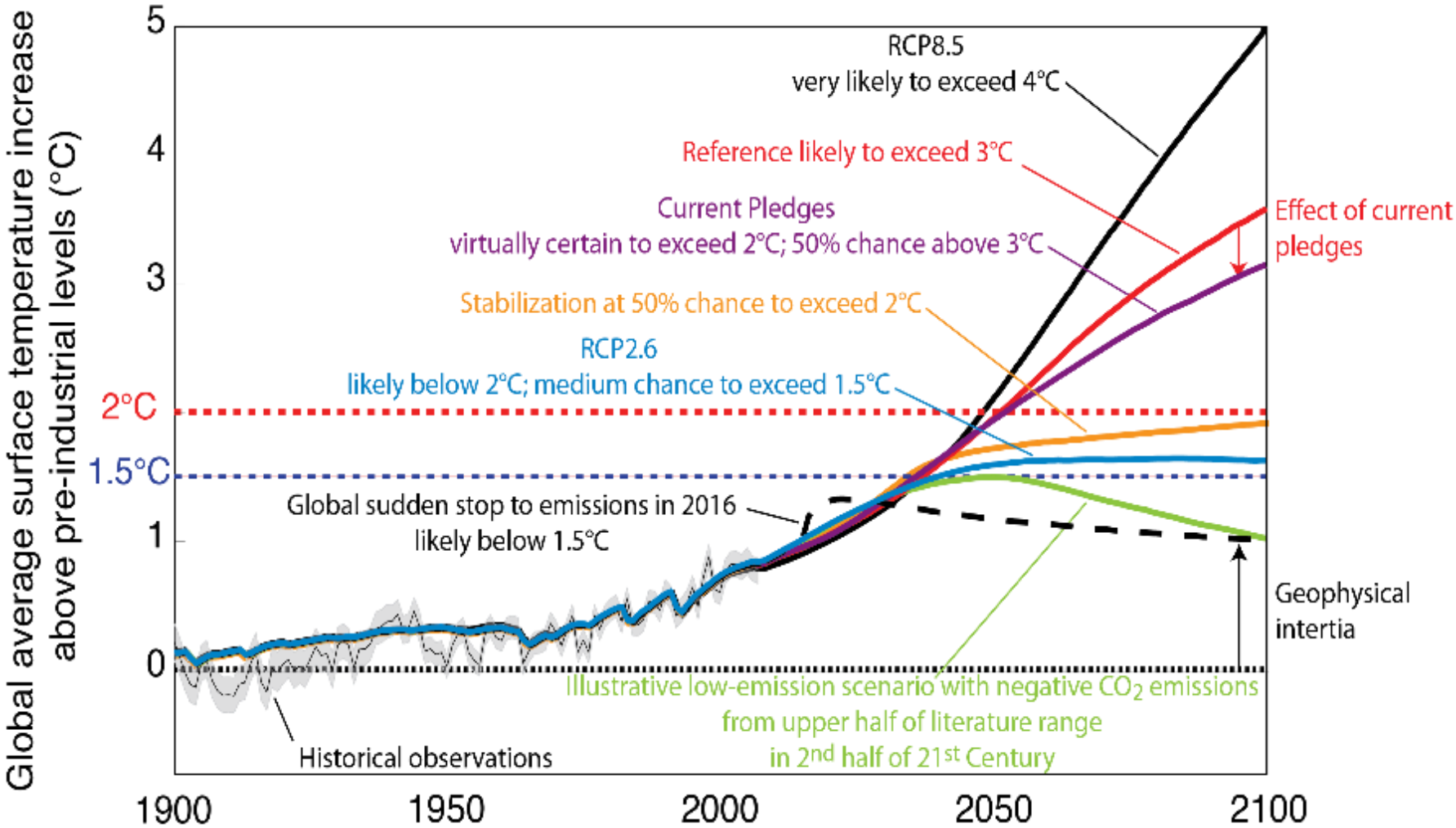
- AT **COP 21** in Paris 195 countries signed a universal legally binding global climate deal

  3 point goal:
- 1. Holding the increase in the global average temperature to well **below 2 °C** above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C
- 2. Increasing the ability to **adapt**
- 3. Making **finance** available for developing countries to adapt and mitigate

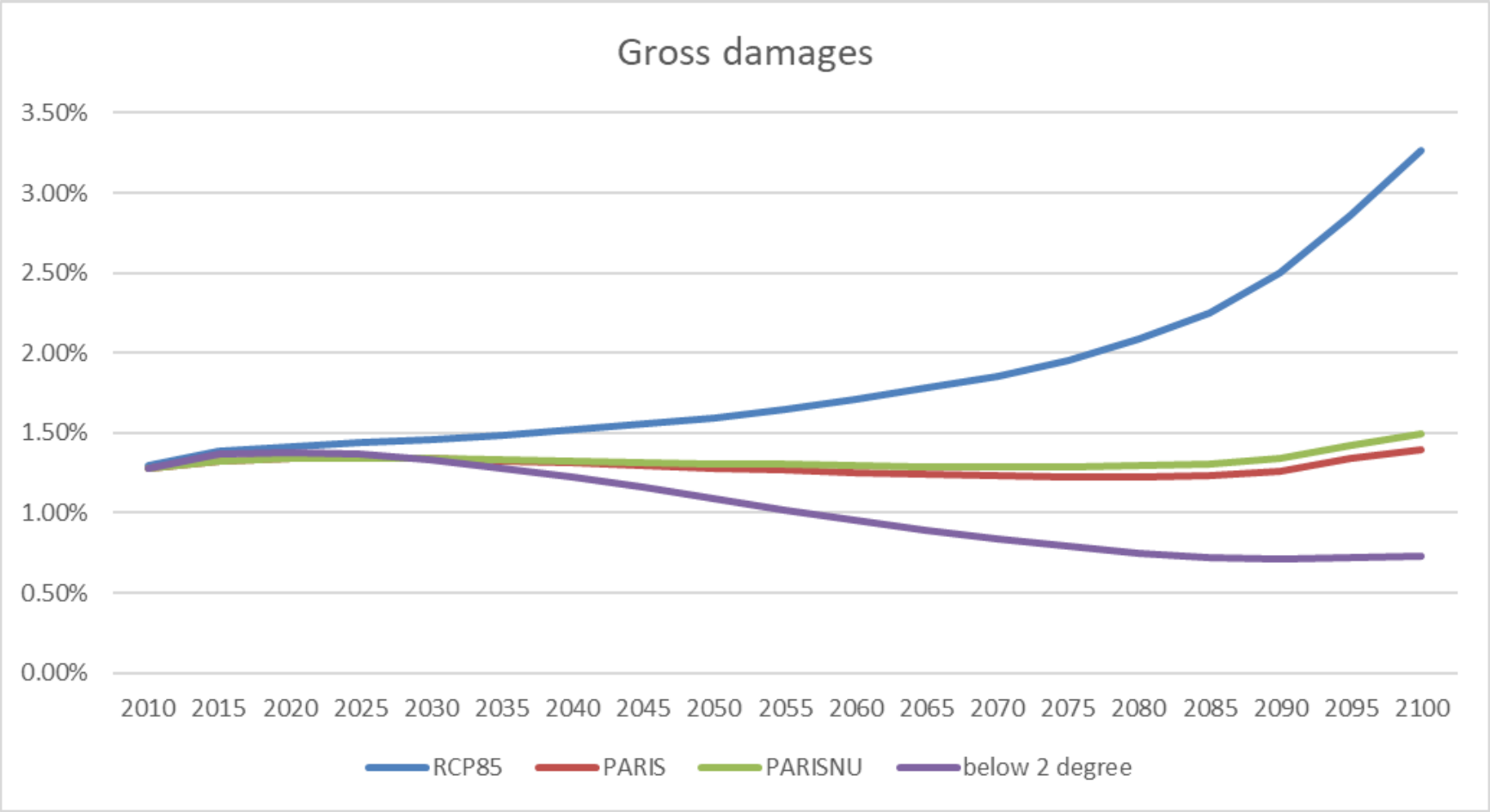
INDCs

- Each country sets a Individual Nationally Determined Contribution
- Voluntary
- “Name and shame" system

Emissions Gap



Climate change economics in action
Impacts in Africa



EU INDC

- The main elements of the EU INDCs are summarised in the EU 2030 climate and energy framework
- At least 40% reduction of GHG emissions compared to 1990 levels
- At least 27% share of renewable energy
- At least 27% improvement in energy efficiency
- 80% -95% reduction of GHG emissions compared to 1990 levels by 2050

EU ETS

- The EU has implemented a cap and trade system, namely the EU Emissions Trading System (ETS) to achieve these targets
- A certain amount of permits are made available for auction
- Heavy energy-using installations (power stations and industrial plants) and airlines in the EU have to buy emission allowances
- Each year companies need to surrender allowances to cover their emissions or face heavy fines.
- Companies can trade emission permits throughout the EU, ensuring reductions at the least cost
- The EU ETS operates in all 28 EU countries as well as in Liechtenstein and Norway, covering 45% of EU GHG emissions
- The cap is set to decrease emissions from the ETS sectors by 21% in 2020 (compared to 2005) and by 43% in 2030.

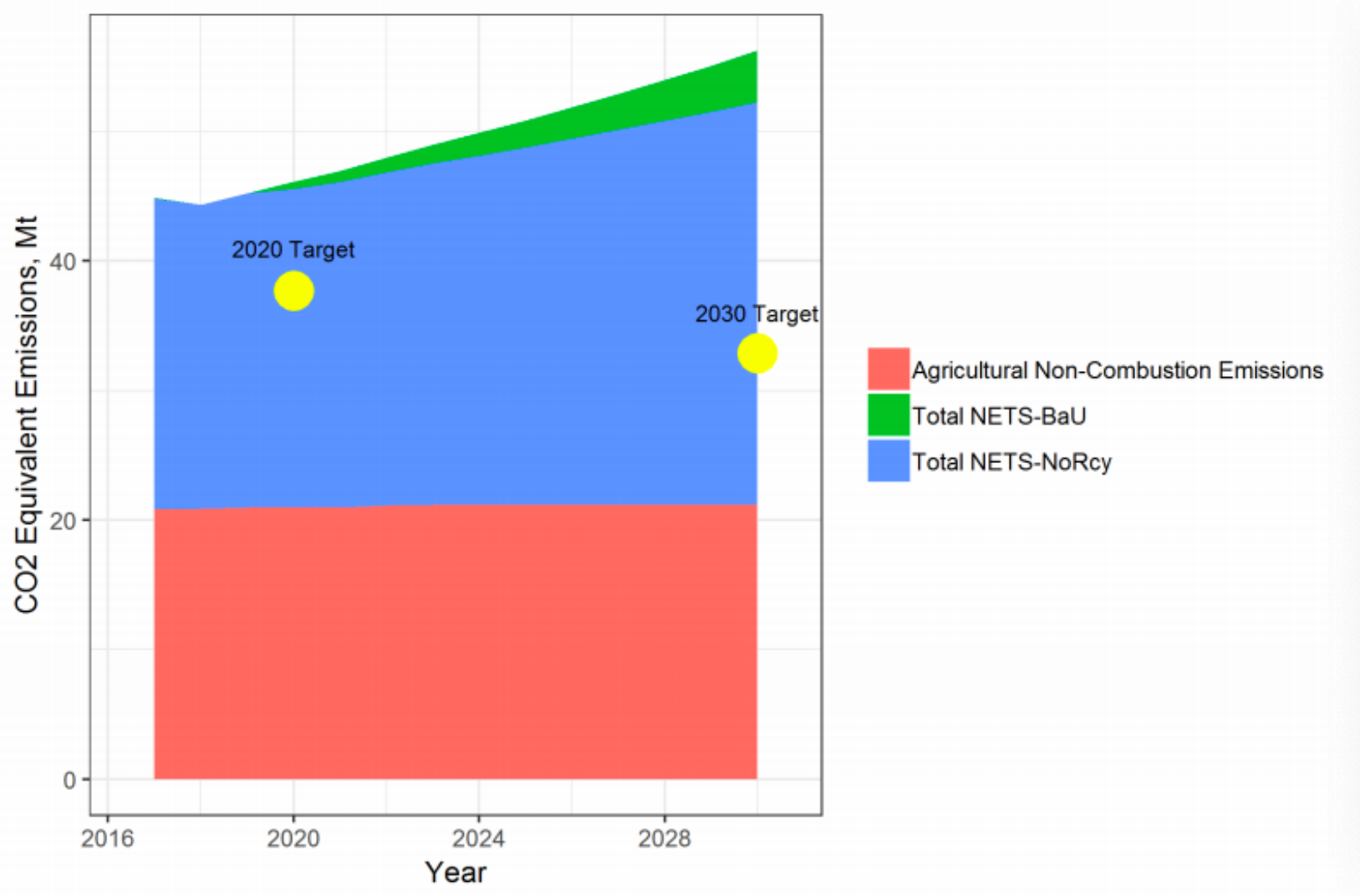
Non-ETS

- Emissions not covered by the ETS will also need to be reduced
- The overall EU goal is to reduce non-ETS emissions by 30% by 2030 (compared to 2005).
- This overall EU goal is translated into an individual binding target for each Member State based on the Effort Sharing Decision
- Ireland needs to reduce non ETS emissions by 20% by 2020 and 30% by 2030

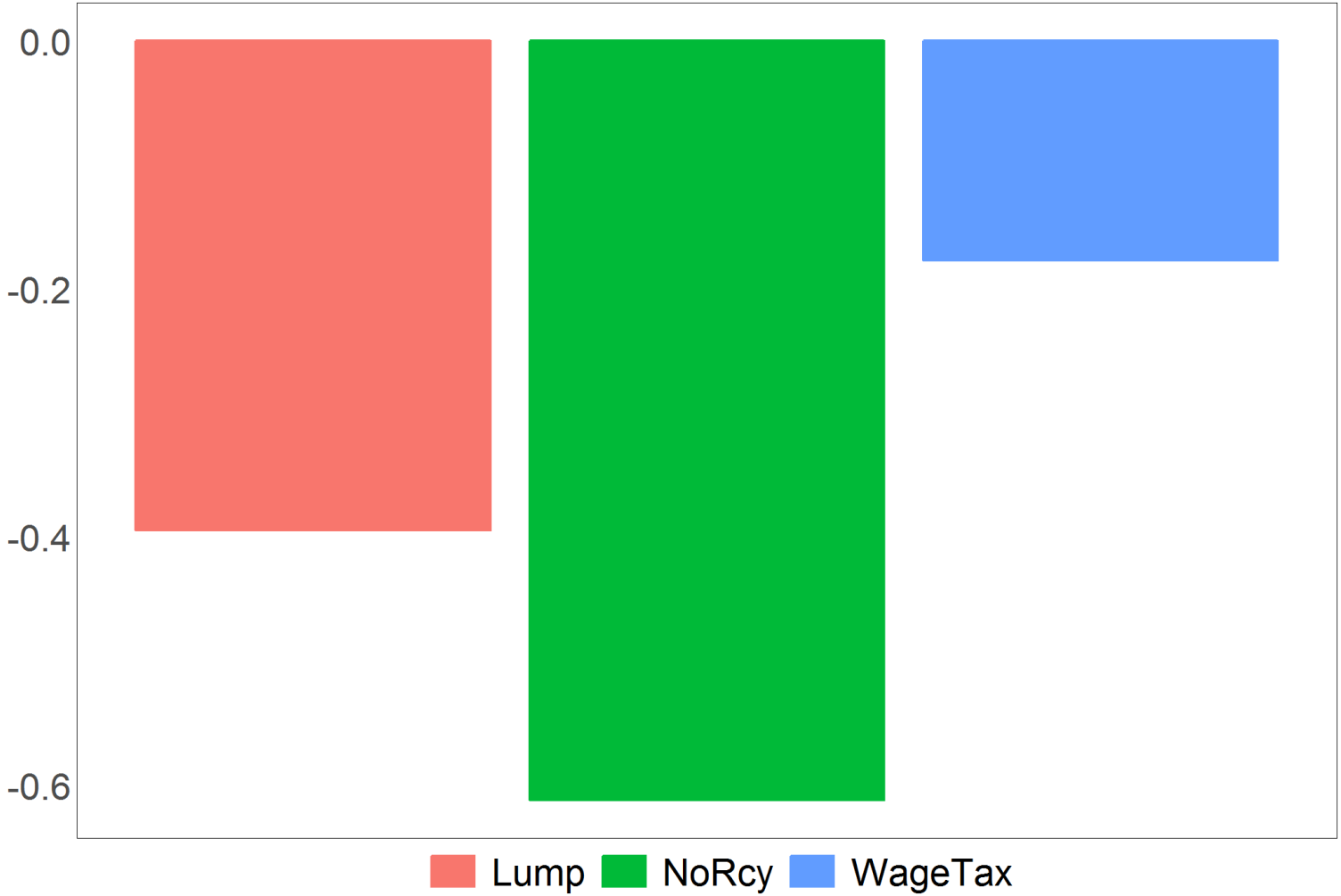
Ireland and its targets

- Ireland will almost certainly miss its 2020 targets and likely its 2030 targets
- Carbon tax increase suggested from 20 Euro now to 80 in 2030
- What are the economic impacts of that?

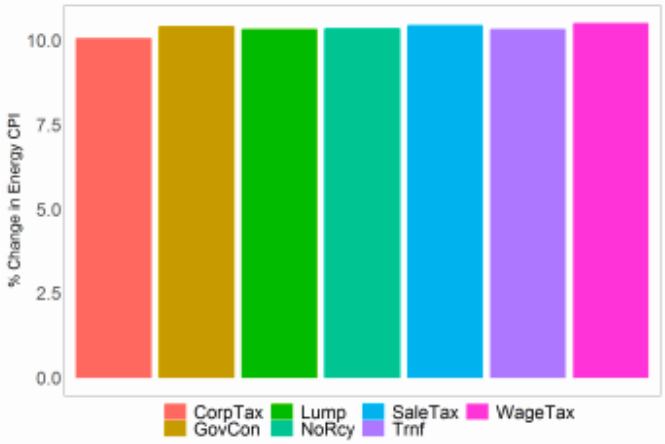
Irish Carbon tax increase: emissions



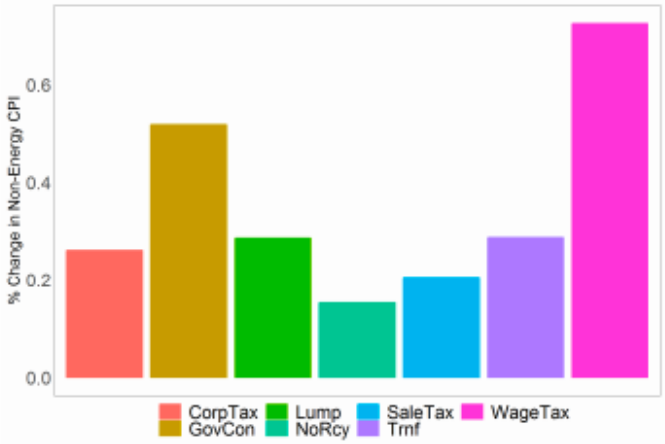
Irish Carbon tax increase: GDP



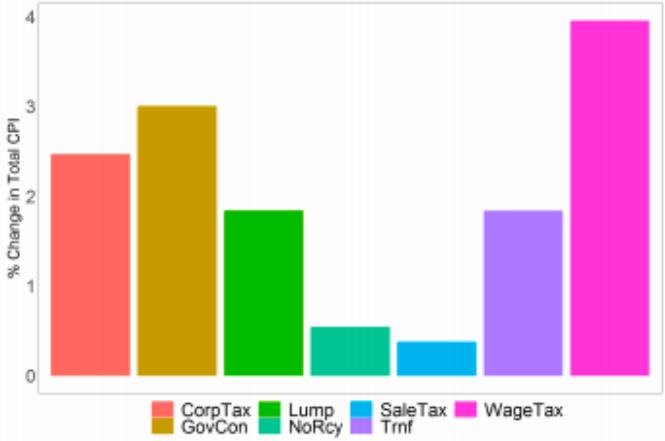
Irish Carbon tax increase: Prices



(a) Energy CPI

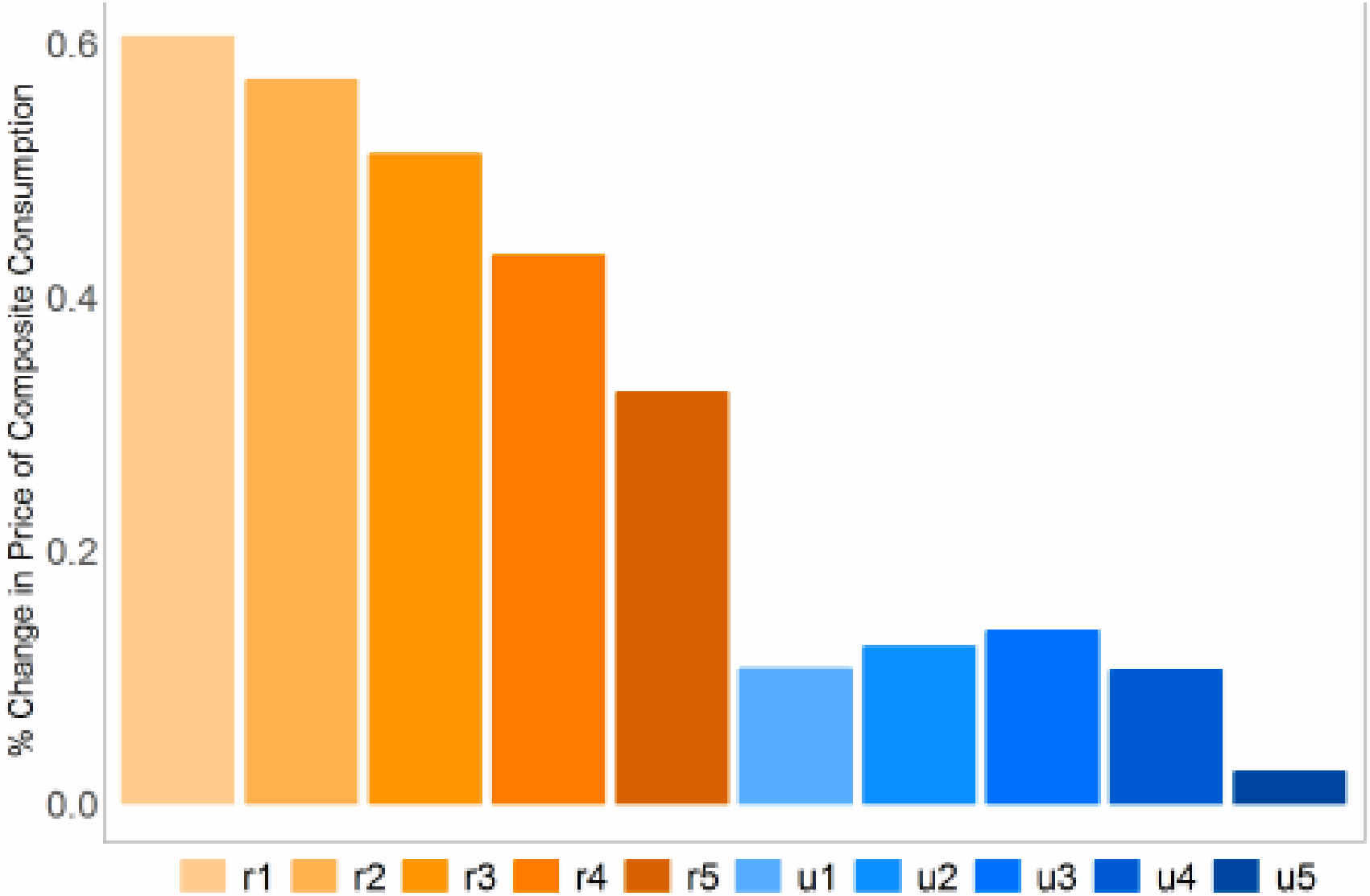


(b) Non-energy CPI

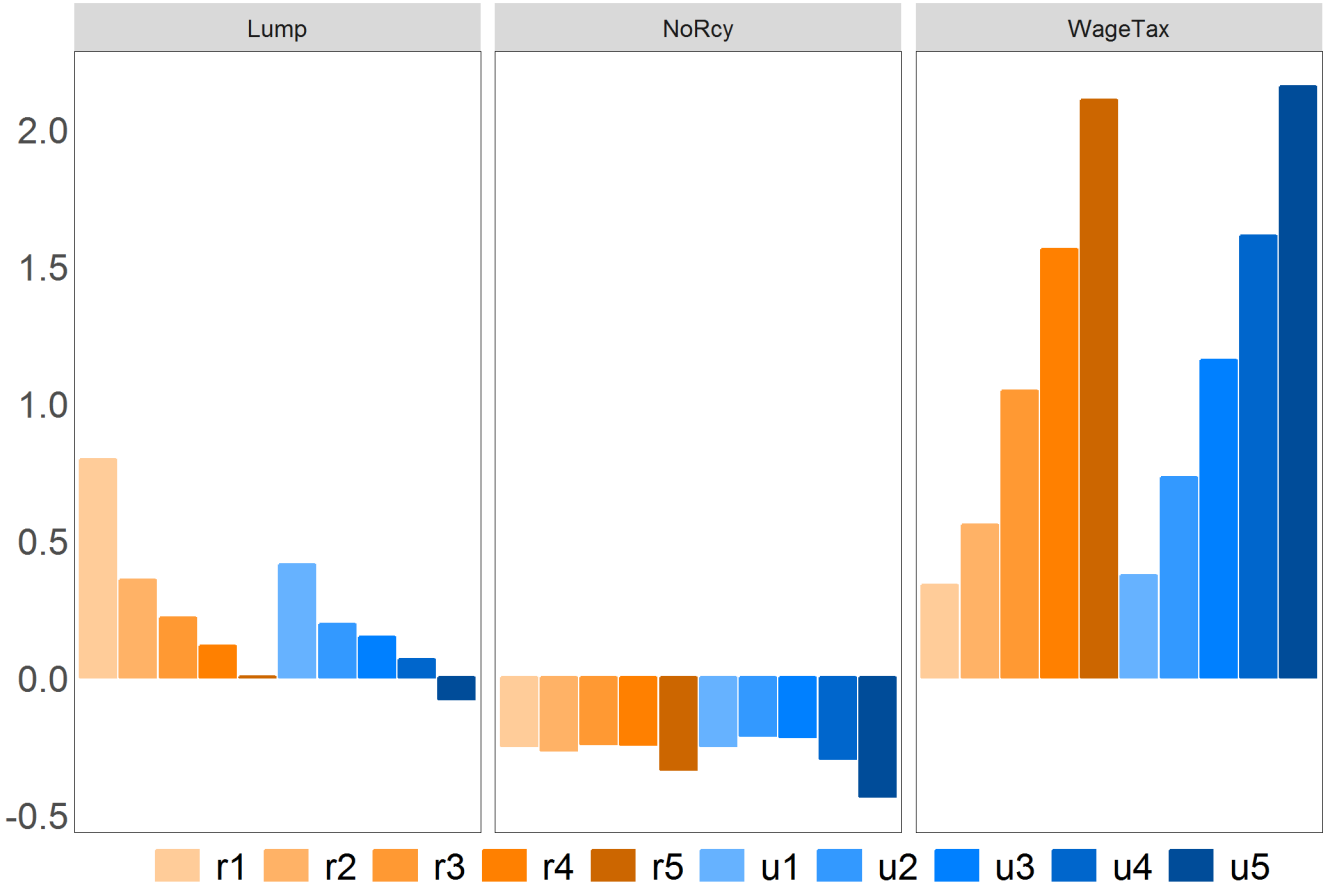


(c) Total CPI

Households prices



Real income



Good sources

https://www.jpl.nasa.gov/edu/learn/video/nasas-earth-minute-gas-problem/

https://climate.nasa.gov/climate_resources/188/graphic-the-greenhouse-effect/

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https://www.epa.ie/climate/communicatingclimatescience/whatisclimatechange/

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