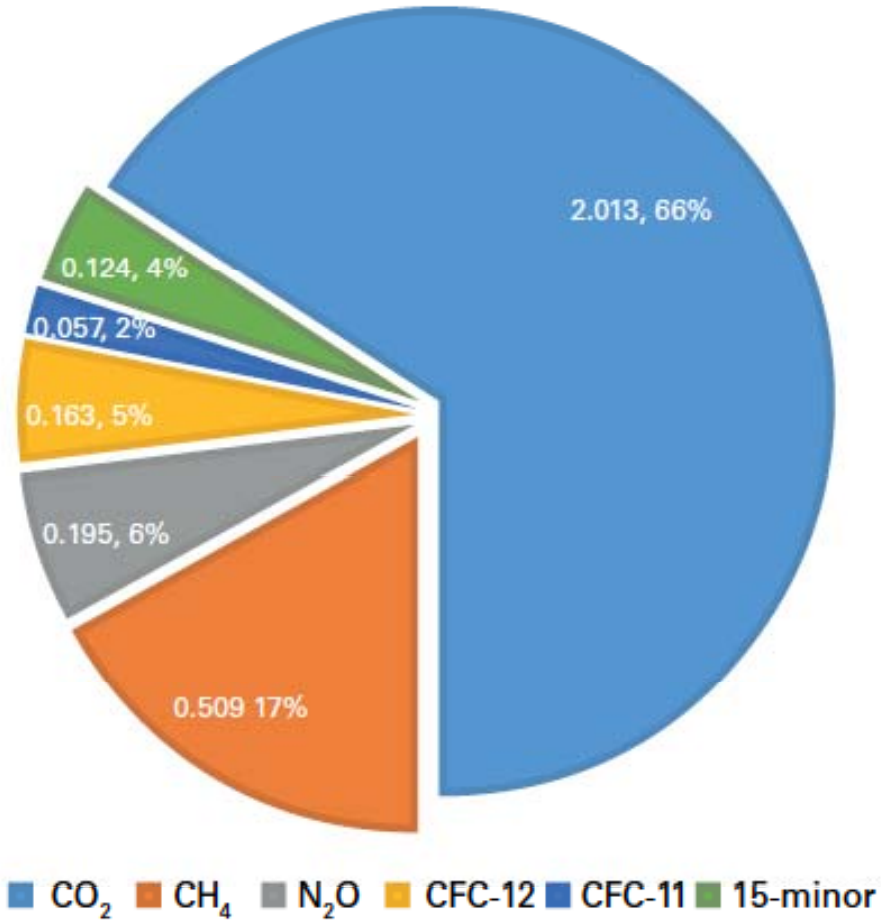
# 1.5°C And The Future Of The Paris Agreement

Chandra Bhushan
Deputy Director General
Centre for Science and Environment

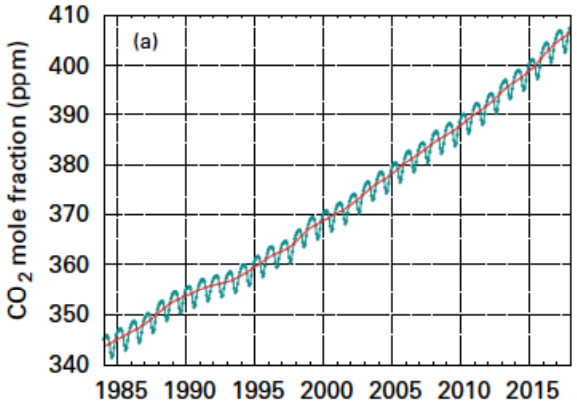
# RADIATIVE FORCING 3.06 $Wm^{-2}$

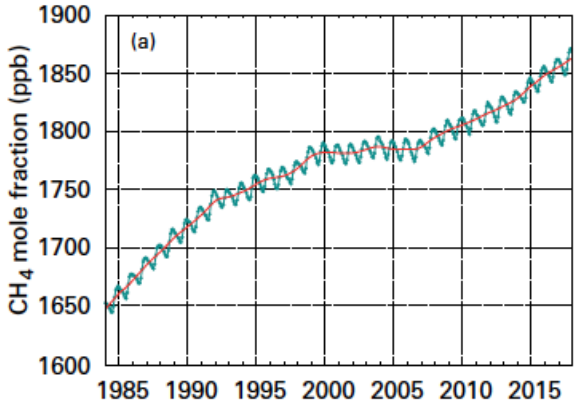


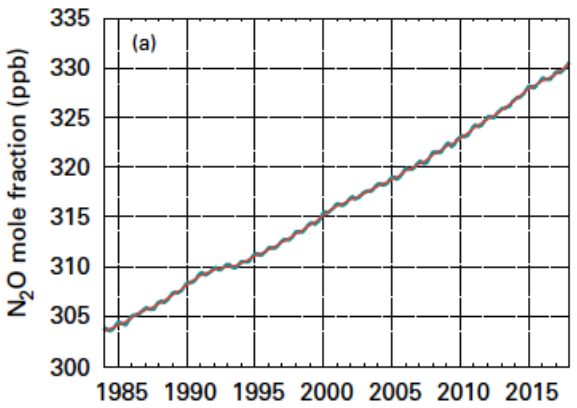
# WMO GHG BULLETIN

| | $CO_2$ | $CH_4$ | $N_2O$ |
|---|---|---|---|
| Global abundance in 2017 | 405.5±0.1 ppm | 1859±2 ppb | 329.9±0.1 ppb |
| 2017 abundance relative to year 1750* | 146% | 257% | 122% |
| 2016–2017 absolute increase | 2.2 ppm | 7 ppb | 0.9 ppb |
| 2016–2017 relative increase | 0.55% | 0.38% | 0.27% |
| Mean annual absolute increase of last 10 years | 2.24 ppm $yr^{-1}$ | 6.9 ppb $yr^{-1}$ | 0.93 ppb $yr^{-1}$ |

# GHG CONCENTRATION

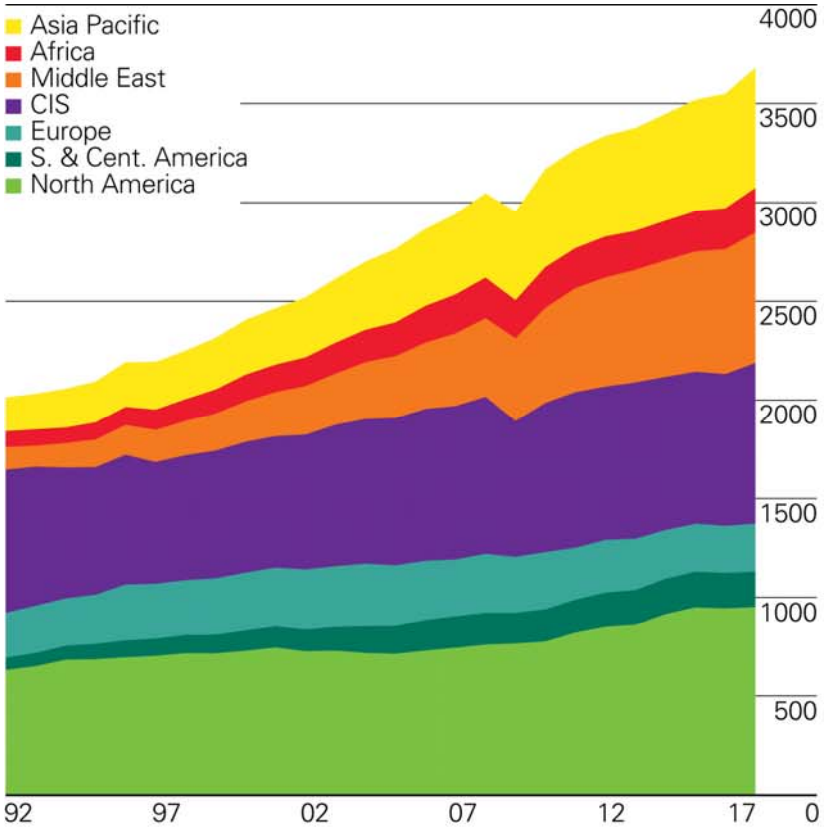


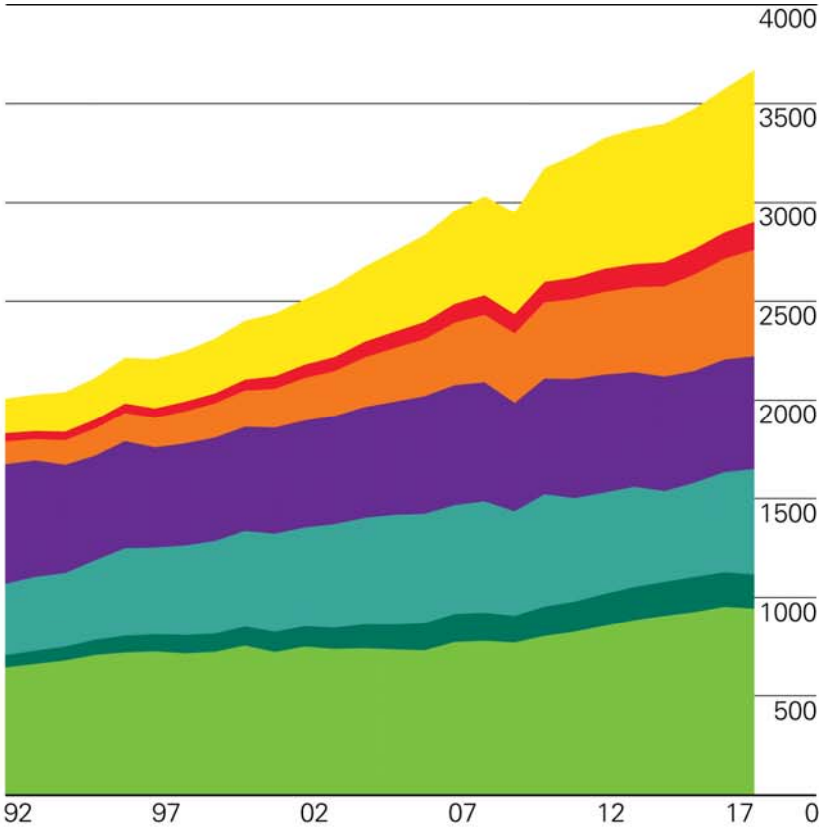



# METHANE & GAS CONSUMPTION

Production by region




Consumption by region



# Political history of 1.5 and 2°C

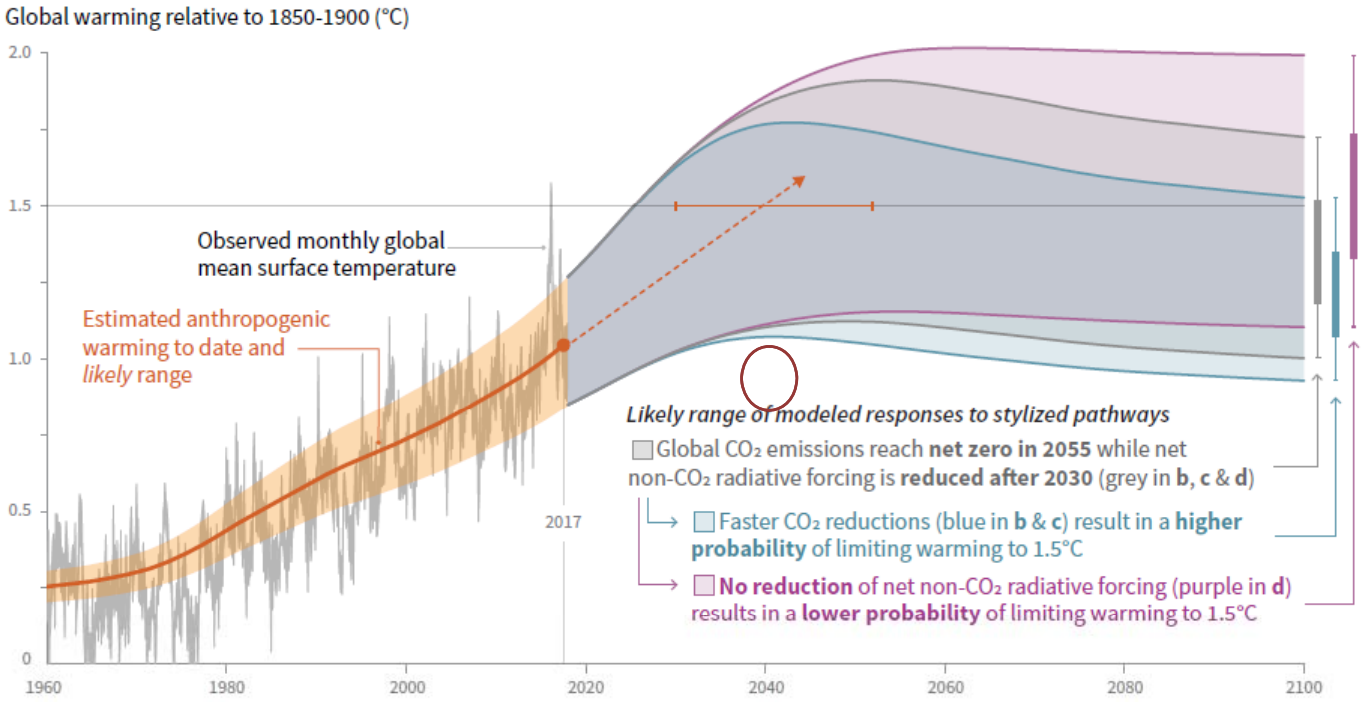
- Compromise language – Paris Agreement (Article 2.1) aims to -

  "[Hold] the increase in the global average temperature to **well below 2°C** above pre-industrial levels and **pursuing efforts to limit the temperature increase to 1.5°C** above pre-industrial levels […]"

- Equally important - Paris **Decision** requested IPCC to provide special report on "impacts of global warming of 1.5°C" in 2018.

# The IPCC 1.5°C Report

a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways




**At current rate, we are set to cross 1.5°C between 2030-2052.**

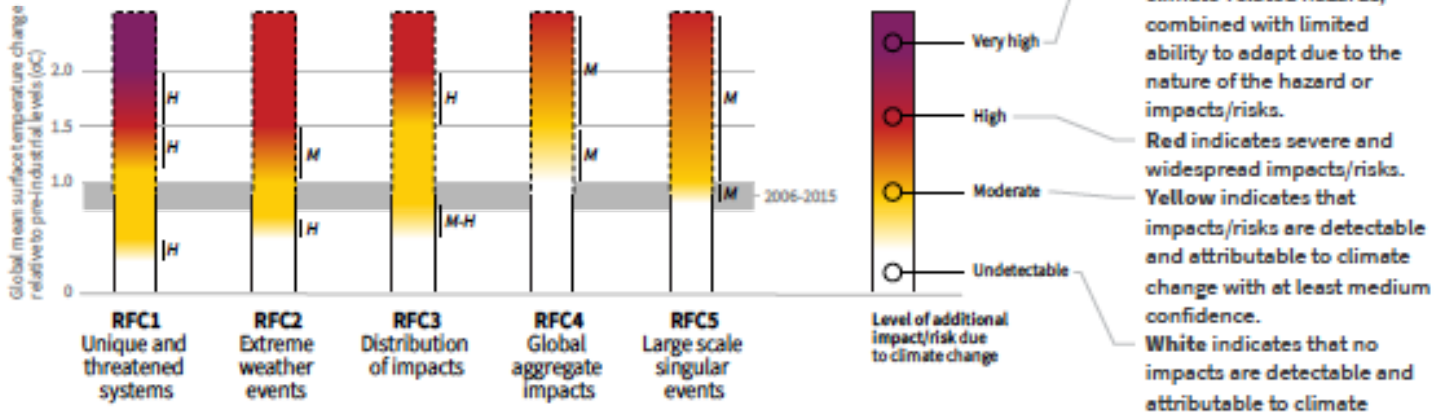
# IPCC 1.5°C Report – Key Takeaways

- The impacts at 1.5°C of warming on economy and ecosystems is much higher than anticipated in the previous scientific reports.
- The impacts at 2°C will be far higher than 1.5°C and will be catastrophic for the poor and the vulnerable communities. Makes clear that 2°C is an anti-poor target
- Staying on the right side of 1.5°C will require unprecedented transformation in every sector
- Demands drastically scaled-up action starting now. Next 10-15 years critical.

# How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems

Five Reasons For Concern (RFCs) illustrate the impacts and risks of different levels of global warming for people, economies and ecosystems across sectors and regions.

## Impacts and risks associated with the Reasons for Concern (RFCs)



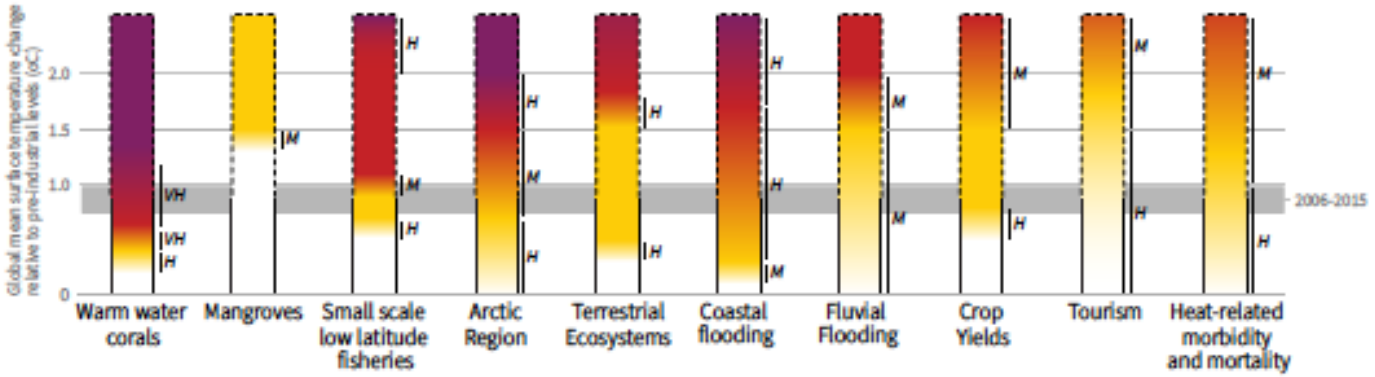

**Purple** indicates very high risks of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks.

**Red** indicates severe and widespread impacts/risks.

**Yellow** indicates that impacts/risks are detectable and attributable to climate change with at least medium confidence.

**White** indicates that no impacts are detectable and attributable to climate change.

## Impacts and risks for selected natural, managed and human systems




Confidence level for transition: *L*=Low, *M*=Medium, *H*=High and *VH*=Very high

# 1.5°C vs. 2°C

| Indicator | Impact increase (1.5 vs. 2°C) | Regions most affected |
|---|---|---|
| **Water scarcity** – Increase in % of global population exposed and vulnerable | **2x** | Europe, Australia and Southern Africa (geographically exposed); North Africa, Middle/Near East (socio-economically vulnerable) |
| **Food scarcity** – population exposed to lower crop yields | **10x** | Africa (particularly West Africa/Sahel), Central and South America, South East Asia, China. |
| **Agricultural productivity** – reduction in maize yield in the tropics | **2.3x** | |

Source: SR15 Chapters 3 and 5; Tables 3.4, 3.5 and 5.1

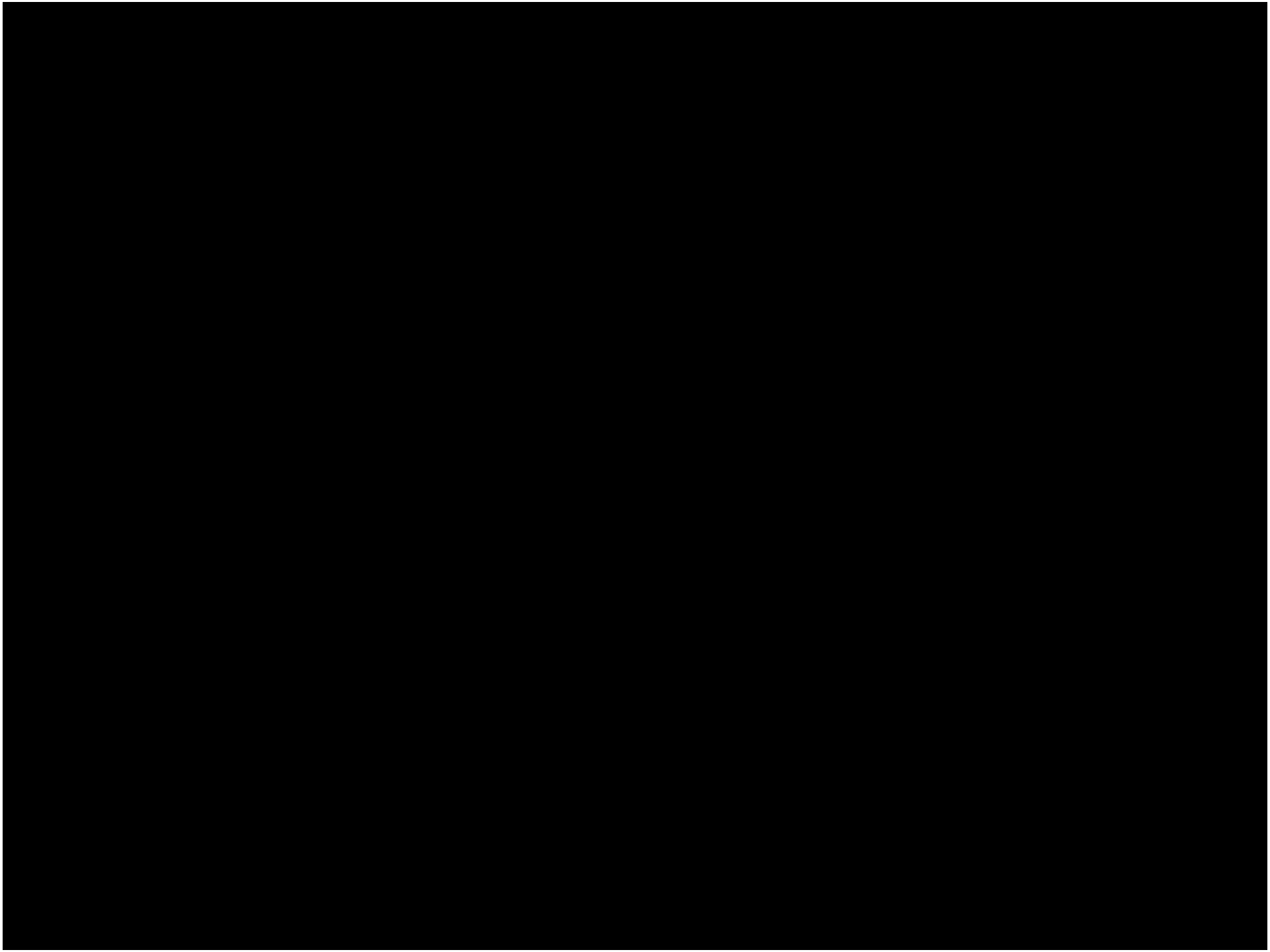
# 1.5°C vs. 2°C

| Indicator | Impact increase (1.5 vs. 2°C) | Regions most affected |
|---|---|---|
| **Flooding** – Increase in % of global population affected by fluvial flooding | **1.7x** | Asia, US, Europe |
| **Sea level rise** – population at risk/year | **2x - 6x** | Asia, small islands, potentially African nations. |
| **Heatwaves** – Population exposed and vulnerable | **1.5x** | Tropical regions (for occupational heat stress); all regions (for heat-related morbidity and mortality). |

# 1.5°C vs. 2°C

| Indicator | Impact increase (1.5 vs. 2°C) |
|---|---|
| **Arctic sea-ice**– sea-ice-free summers | **10x**<br>One per century vs. once per decade |
| **Coral reefs** – population decline | **0.3x**<br>70-90% vs. near complete extinction |
| **Permafrost** – Area loss | **0.4x**<br>4.8 million sq. km vs. 6.6 million sq. km. |
| **Species loss** – Percentage of species which lose at least half of range | |
| Vertebrates | **2x** (4% vs. 8%) |
| Plants | **2x** (8% vs. 16%) |
| Insects | **3x** (6% vs. 18%) |

# What does this mean for India?



# Climate Change Impacts in India

- **India is already one of the most vulnerable countries to climate change. Research done by CSE estimates that between 1901 and 2017, India has warmed by almost 1.2°C - 0.2°C more than the global average temperature.**
- **Consequently, India is losing about 1.5 per cent of its GDP.**
- **The risk of exacerbation of extreme poverty in India is significant under a 1.5°C warming scenario and is worse under current trends, as it is expected to drive 42 million Indians into poverty by 2030-40.**
- **The future of India will be incredibly grim in the face of increased temperatures and extreme events such as floods, water scarcity and drought.**

**Source: CRIDA, World Bank 2018, Government of India 2018**

# Impacts in India at 1.5°C

- Coastal flooding – annual global cost estimated in trillions of USD
  - India among countries where at least 50 million people will be exposed (along with China, Bangladesh, Egypt, Indonesia, Japan, Philippines, United States and Vietnam)

- Increased river salinity/saline intrusion, impacting food security
  - Minimum of 44% of the land area in Ganges-Brahmaputra, Indian Bengal and Indian Mahanadi deltas will be exposed

Source: SR15 Chapter 3

# Impacts in India at 1.5°C

- "Statistically significant reductions in Gross Domestic Product (GDP) per capita growth are projected across much of the African continent, southeast Asia, India, Brazil and Mexico"

- "At +2°C warming, Karachi (Pakistan) and Kolkata (India) could expect annual conditions equivalent to their deadly 2015 heatwaves"

Source: SR15 Chapter 3

# 1.5°C Carbon Budget Near Exhausted

- The remaining carbon budget of 580 $GtCO_2$ for a 50% probability of limiting warming to1.5°C, and 420 $GtCO_2$ for a 66% probability.

- The is marginally more than what was anticipated under AR5.

- But even this marginally higher **carbon budget is likely to get exhausted in 2030s.**

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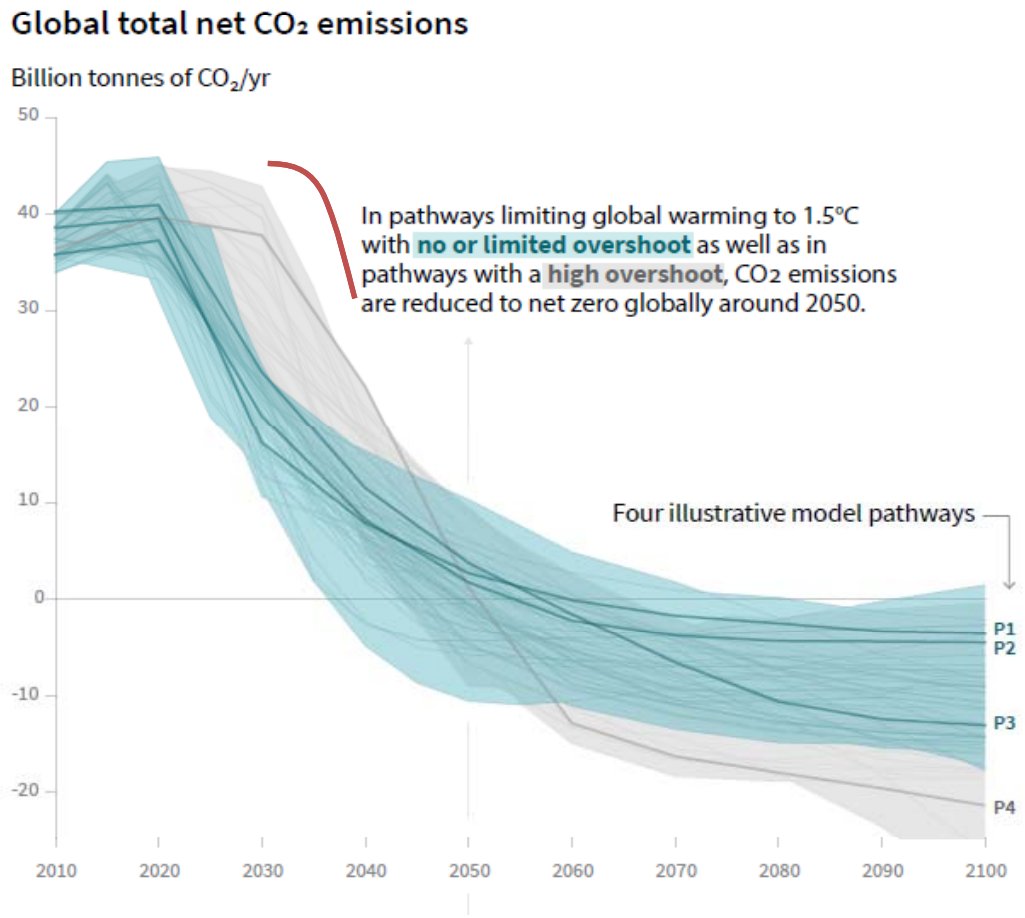
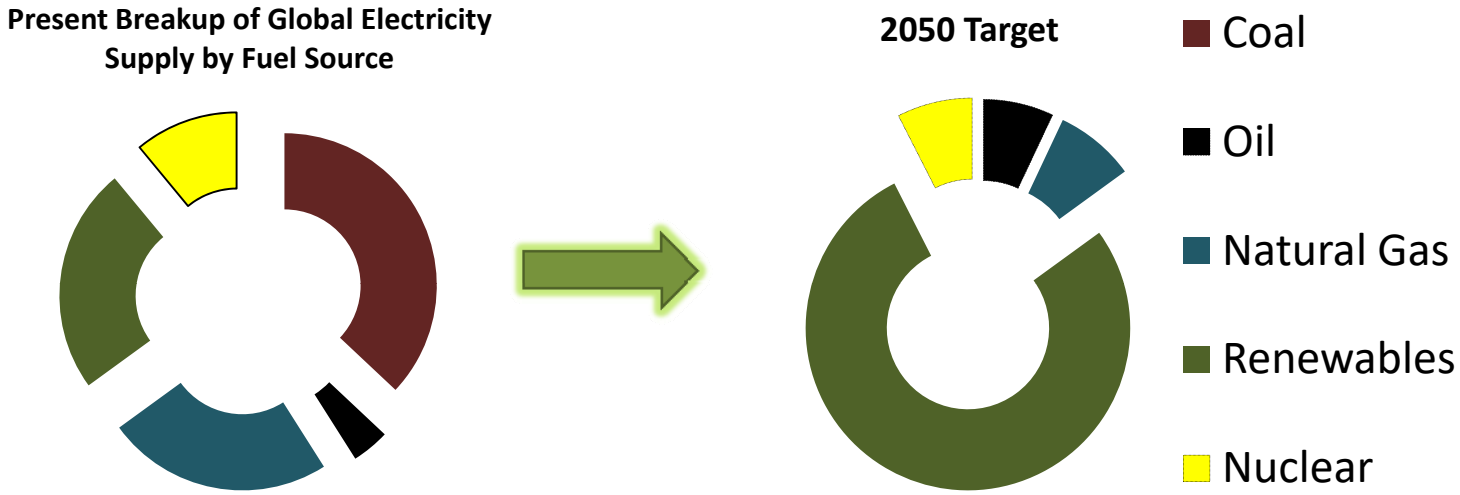



- Gray zone – overshoot 1.5°C, then aim to "return". **Later peak, steeper cliff**.
- Requires large scale deployment of "carbon dioxide removal" – natural (sinks) + expensive technology (BECCS)
- Capacity to "return" **deeply uncertain**

# What does 1.5°C Require?




**Renewables** – from 24% today to 47-65% in 2030, to 70-85% in 2050

900 billion USD/year (2015-2050) required.

**Coal** – from 37% today to 0% in 2050

Solar, wind, electricity storage, energy efficiency, electrification of energy end-use. No silver bullet.

Source: SR15 SPM; Chapter 4, Table 4.1; World Coal Association; BP Statistical Review of World Energy 2018

# What does 1.5°C Require?

| Indicator | Change (year) |
|---|---|
| Energy demand for buildings (2010 baseline) | ↓ 19-37% (by 2050) |
| CO2 emissions from industry (2010 baseline) | ↓ 75–90% (by 2050) |
| Share of low carbon fuels - electricity, hydrogen and biofuel - in transport (2020 baseline) | ↑ 30-60% (by 2050) |

Source: SR15 SPM; Chapter 4, Table 4.1