Climate Change in the Classroom

Designing impactful climate change lessons for students

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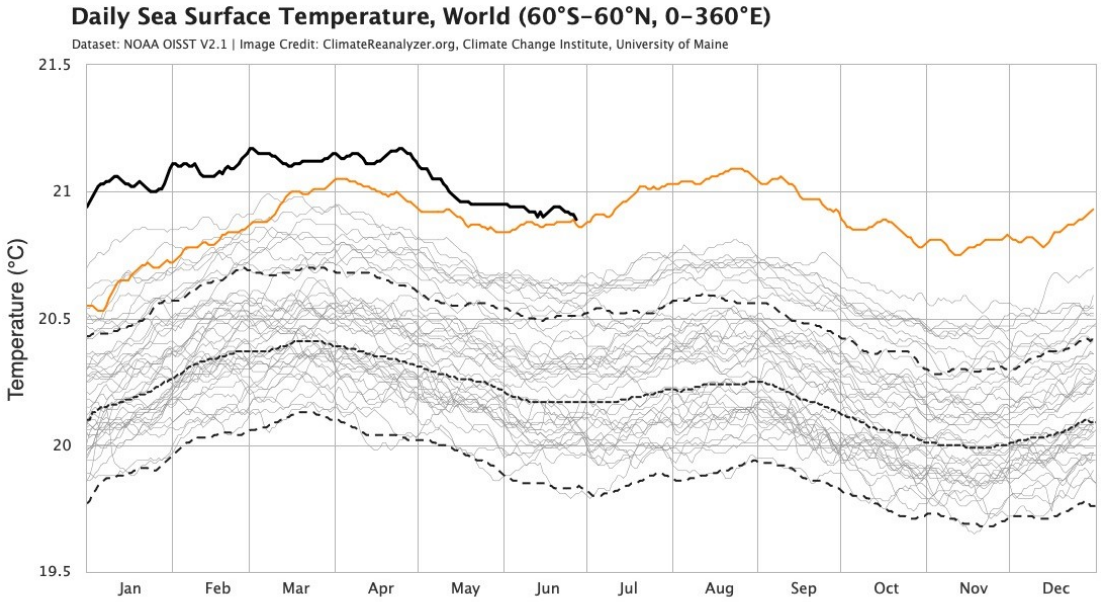
Centre for Science and Environment

Important to establish the science of climate change

Scientific Observations – Temperature Graphs - real-time data

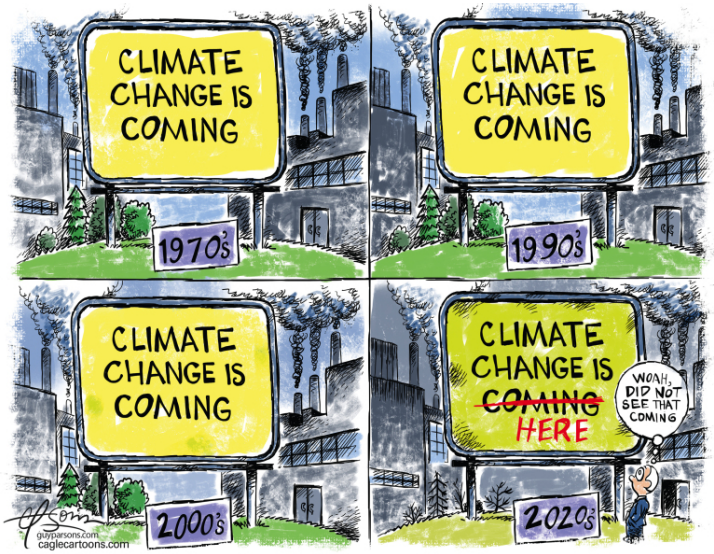


Source: https://climatereanalyzer.org/clim/t2_daily/?dm_id=world#info

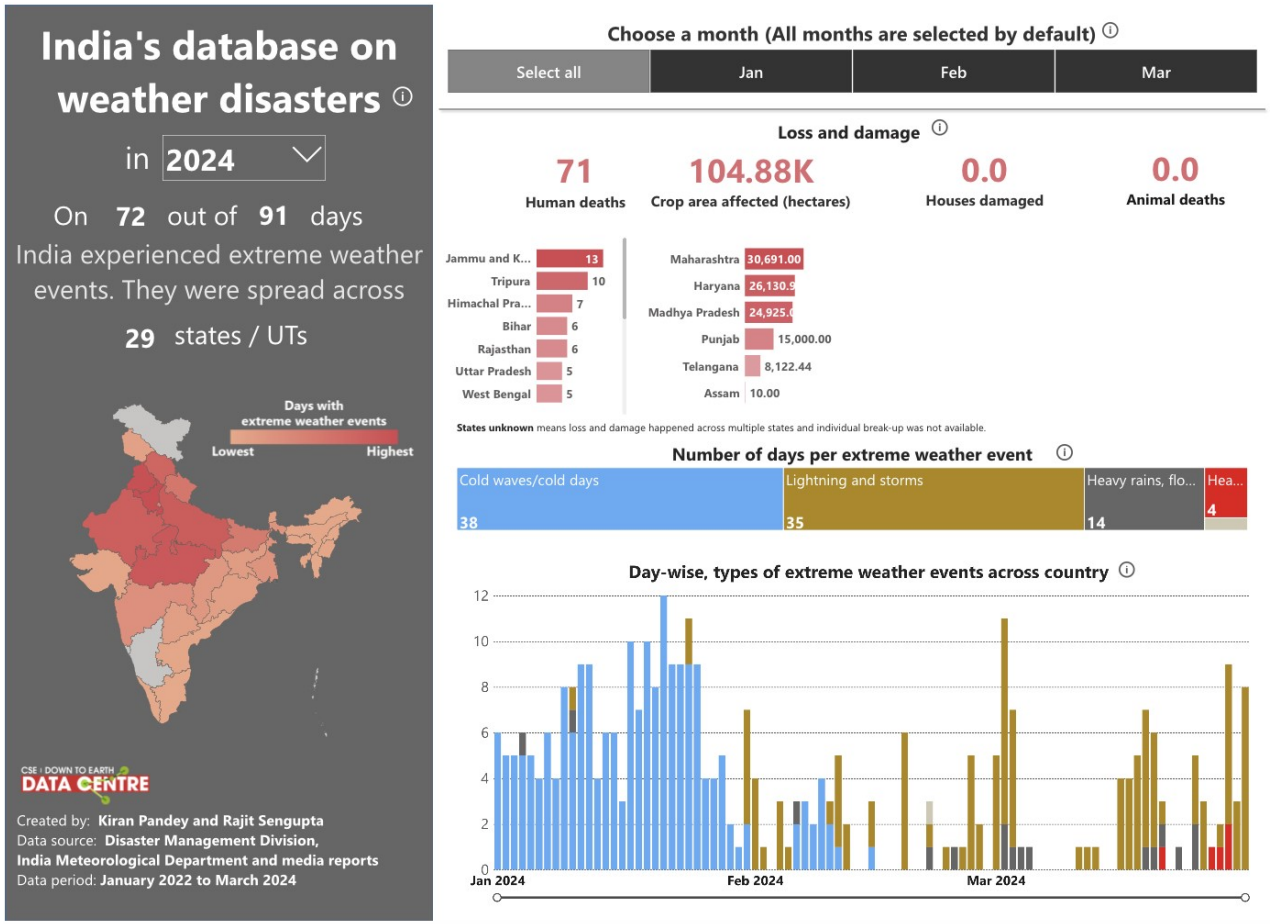
Climate Change is Real!

Without human induced climate change these heat events would however have been extremely rare. In China it would have been about a 1 in 250 year event while maximum heat like in July 2023 would have been virtually impossible to occur in the US/Mexico region and Southern Europe if humans had not warmed the planet by burning fossil fuels.

World Weather Attribution Network



Extreme weather events are the result



https://www.downtoearth.org.in/weather_disasters_india/india.html

Climate crisis impact: Australia's most intense cyclone wiped out 90% of seabirds on an island

Killer heat's shadow: India's labourers on the frontlines, face boiling temperatures

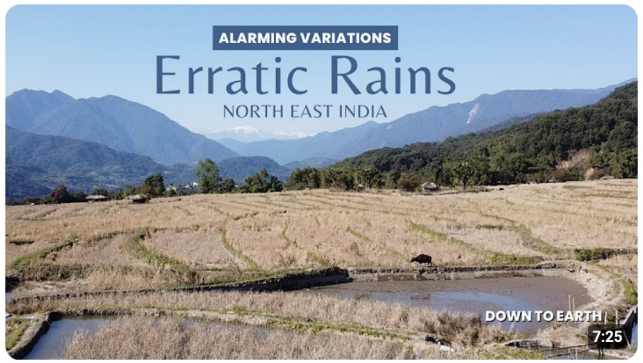
In part one of this series, DTE investigates how the new normal of extreme heat is impacting informal workers and workplaces lacking climate ...

As the rest of Karnataka is bone dry, heavy rains wash away Bengaluru's 133-year-old rainfall record

Karnataka capital latest victim of an unending spate of extreme weather events ...

Is the recent spate of building fires in India due to extreme heat? Yes, says expert

Overloading of air conditioners & transistors due to unprecendented power demand made ...



Erratic Rains impact North East India | Alarming Variations Ep-01

22K views • 3 months ago

Down To Earth

Explore the multifaceted **impacts of climate change** on this ecologically diverse region. Through expert analysis and ...

CC

The Sunita Narain Show | Heatwave In India | How to mitigate the risk?

132K views • 13 days ago

Down To Earth

Life in Delhi with record temperatures close to 50°C has been a grueling experience. This year we saw first-hand what it would ...

See what three degrees of global warming looks like

4M views • 2 years ago

The Economist

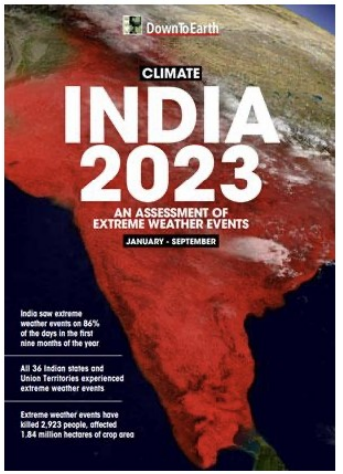
If **global** temperatures rise three degrees Celsius above pre-industrial levels, the results would be catastr

CC

Matching chapter 0:57 Climate change is already having devastating effects

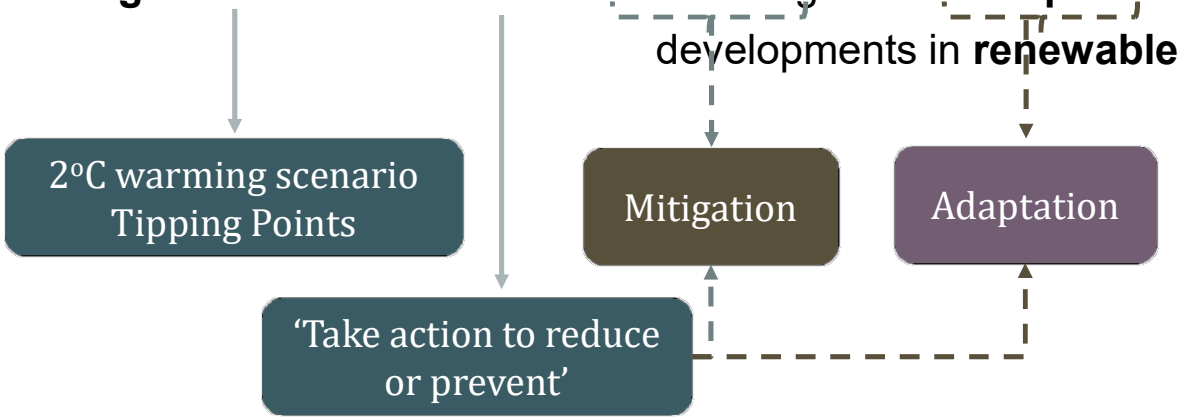
Resources:

- Climate Data: https://climatereanalyzer.org/clim/sst_daily/
- World Weather Attribution: https://www.worldweatherattribution.org/climate-change-made-the-deadly-heatwaves-that-hit-millions-of-highly-vulnerable-people-across-asia-more-frequent-and-extreme/
- Global Climate Dashboard: https://www.climate.gov/climatedashboard
- Disaster a Day: Down to Earth: https://www.downtoearth.org.in/infographics/disaster-a-day-extreme-weather-in-india-in-2023-93545
- https://www.cseindia.org/india-2023-extreme-weather-events-11973



Climate Action

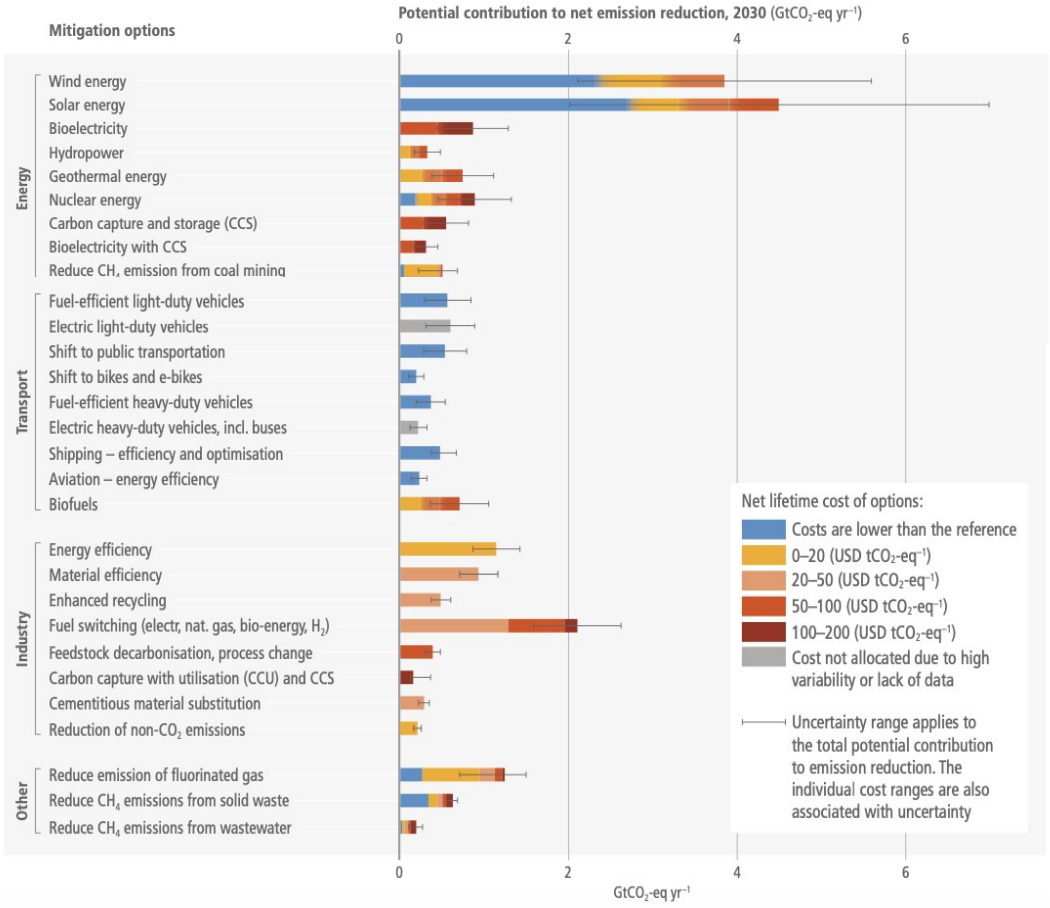
Under the UN-established Sustainable Development Goals, Climate Action (SDG 13) means "Taking **urgent action** to **combat** climate change and **its impacts** by **regulating emissions** and promoting developments in **renewable energy**"



- **Mitigation**: "…achieved by limiting or preventing greenhouse gas emissions and by enhancing activities that remove these gases from the atmosphere."
- **Adaptation:** "The process of adjustment to actual or expected climate and its effects."
  - "In **human systems**, as the process of adjustment to actual or expected climate and its effects to moderate harm or take advantage of beneficial opportunities."
  - "In **natural systems**, adaptation is the process of adjustment to actual climate and its effects; human intervention may facilitate this."

Mitigation

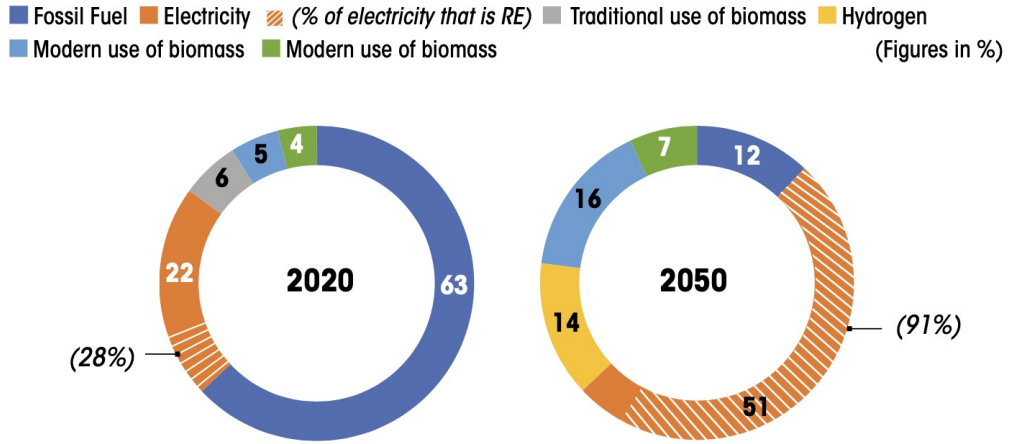
Overview of emission mitigation options and their cost and potential for the year 2030 (IPCC)



Sectorial Responses: Energy Sector

Reduced fossil fuel consumption, increased production from low- and zero-carbon energy sources, and increased use of electricity and alternative energy carriers

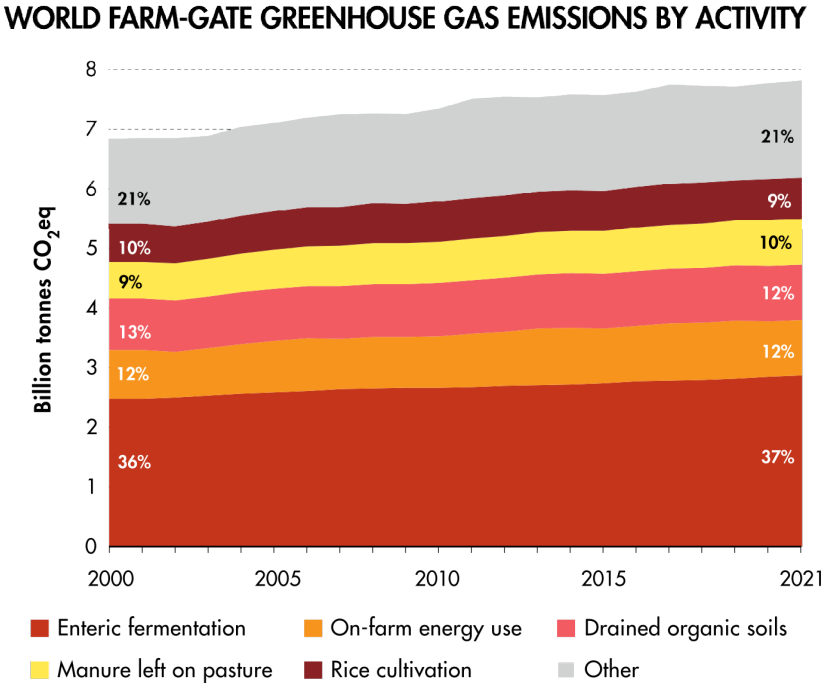
Total final Energy Consumption under a 1.5C Scenario



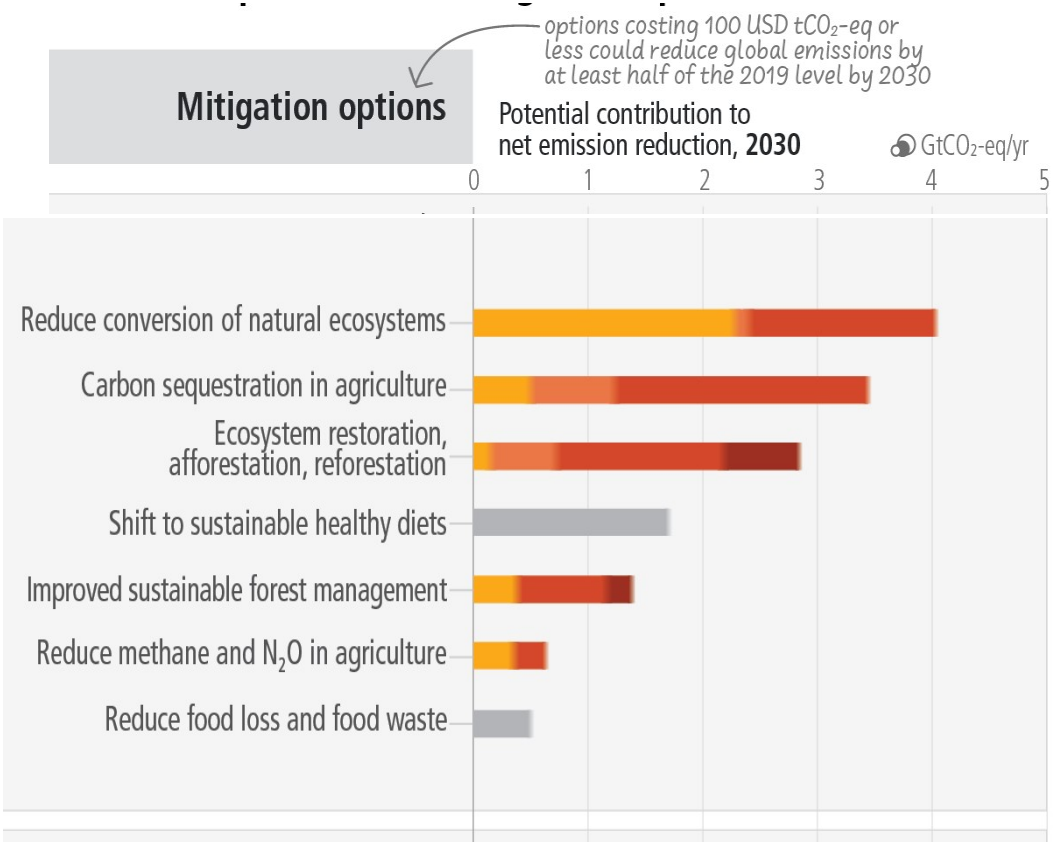
Source: World Energy Transition Outlook 2023, IRENA.

Sectoral Responses: Agriculture, Forests and Land Use

Mitigation



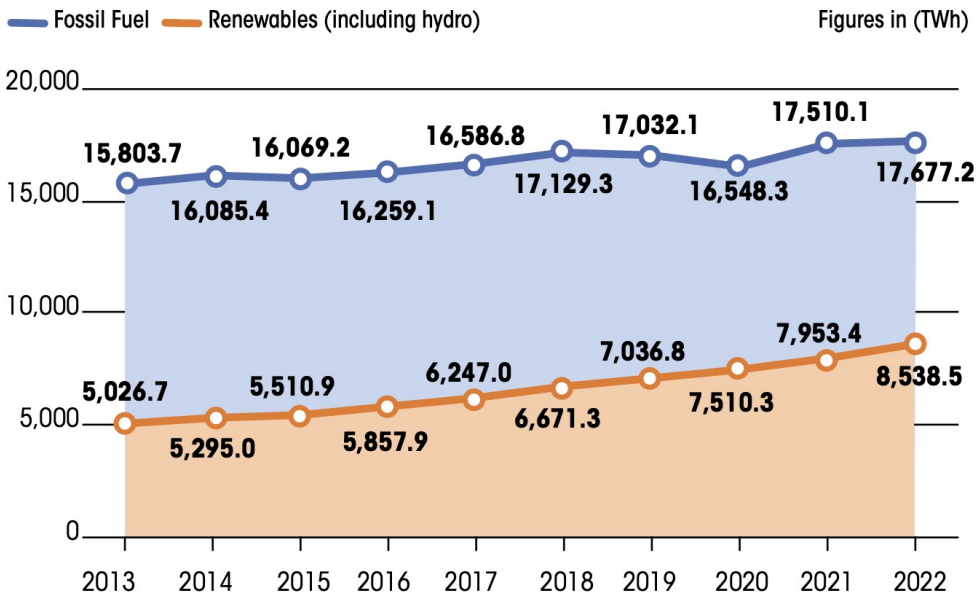
Source: FAO. 2023. Emissions totals. In: *FAOSTAT*. Rome. [Cited October 2023]. https://www.fao.org/faostat/en/#data/GT
Download: https://doi.org/10.4060/cc8166en-fig67



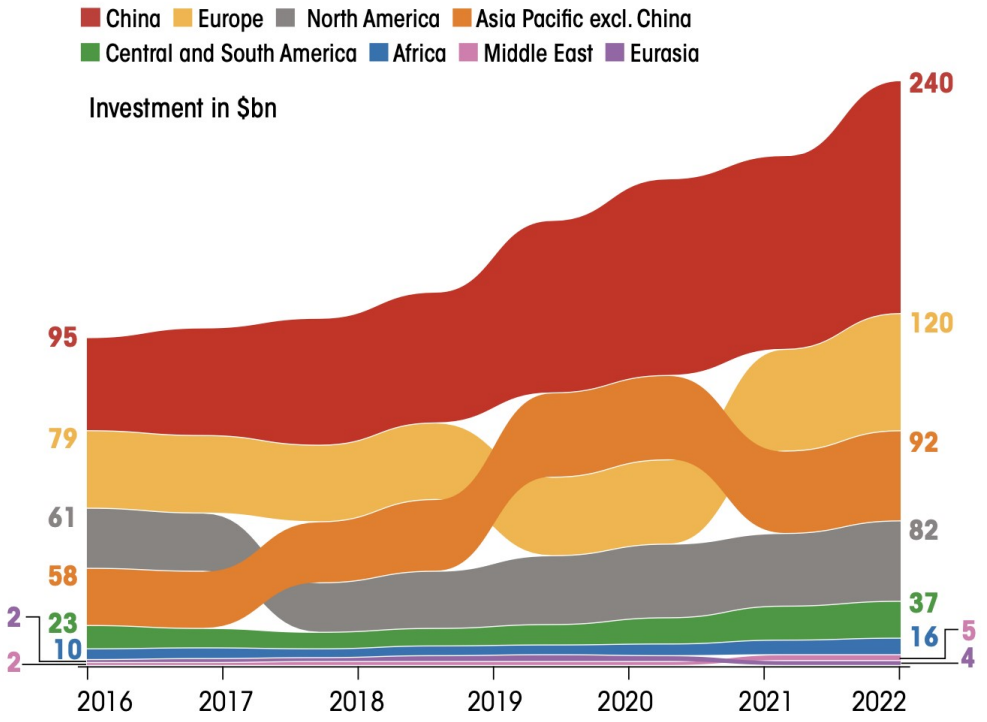
Challenges in Energy Transition

"If investments in coal and other fossil infrastructure continue, energy systems will be locked-in to higher emissions, making it harder to limit warming to 2°C or 1.5°C "

Data on Energy Generation. While RE capacity has been steadily increasing, so has been fossil-based power capacity



The regional difference in clean energy investment and generation has only grown over the year with the combined investment in Asia, Africa, Central and South America being less than China



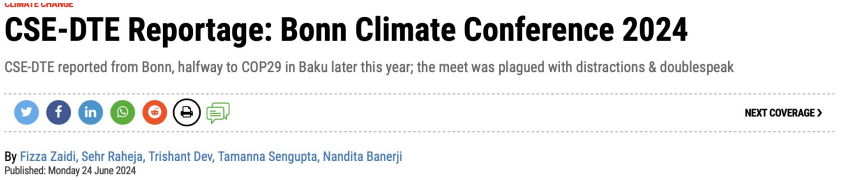
Mitigation Action: Challenges

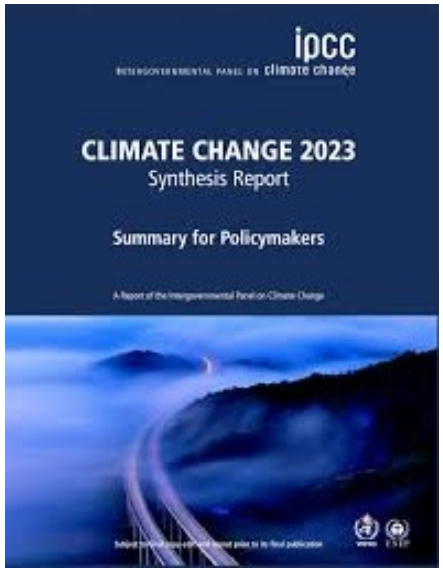
Mitigation

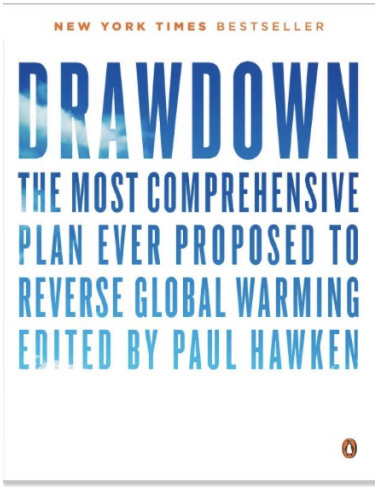
Climate Finance	• $5.8-$5.9 trillion needed by developing countries for NDC implementation • $100 B Climate Finance Goal
Impact on Economy	• Crude oil & NG contribute 38.7% of Saudi Arabia's GDP (Lock-in Effect) • Coal remains the top source of energy for India at 46% (2022)
Political Support	• Britain's backsliding on banning petrol and diesel cars • Yellow Vest protest to oppose fossil Taxes; Farmer protest across Europe
Data Availability	• Incomplete emission inventory, inadequate monitoring of deforestation and land-use change • Uncertainty in climate models
Technological Innovation	• Energy Storage • CCS (Carbon Capture and Storage)

Resources

- UNFCCC Process (Media Reporting, UNFCCC Website)
- IPCC Reports
- Project Drawdown







Adaptation

Adaptation in Human Systems

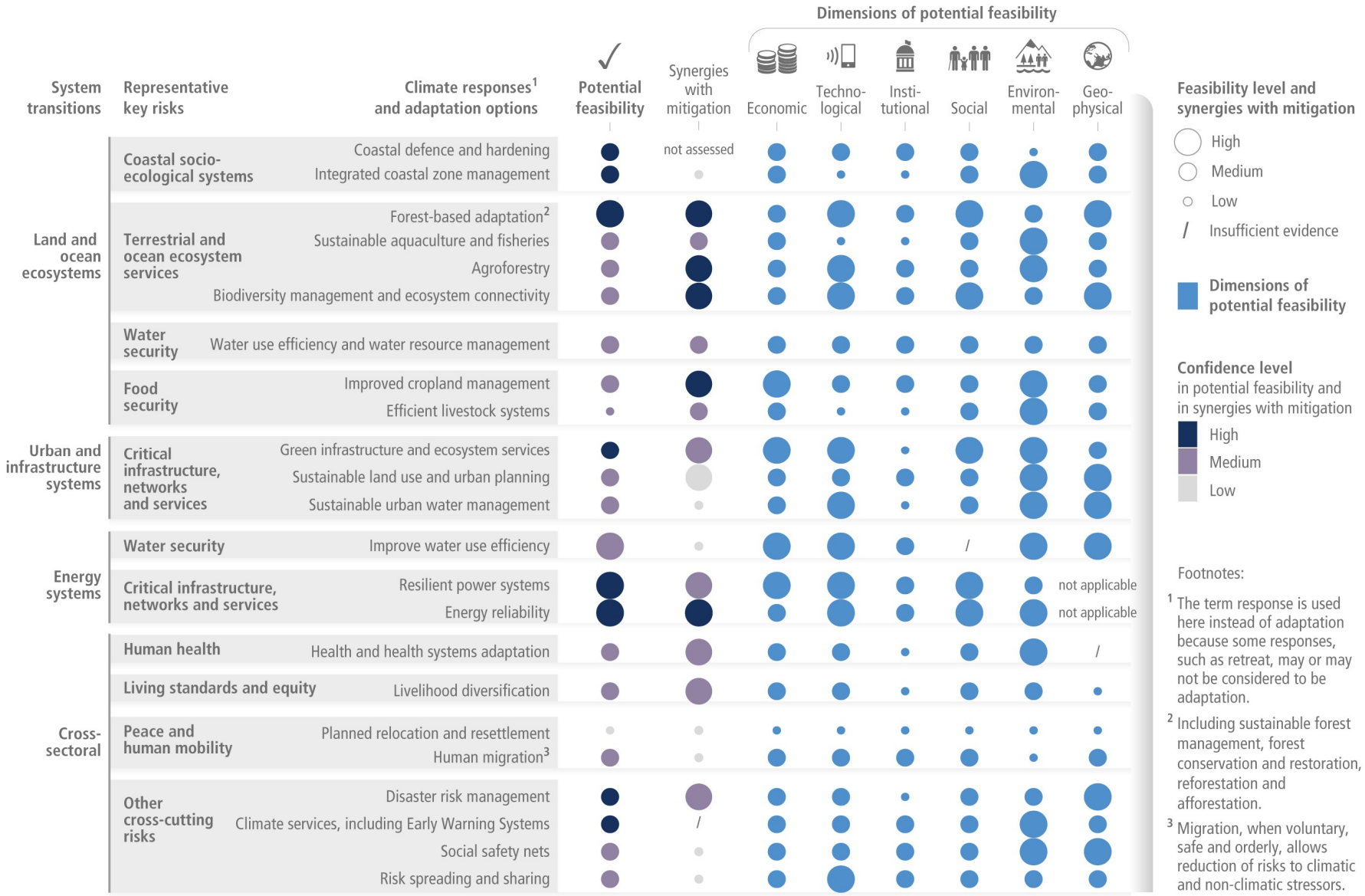
- Infrastructure Resilience
- Crop Diversification
- Water Management
- Healthcare Planning
- Coastal Retreat and Defence

Adaptation in Natural System

- Altered reproductive timing
- Animal Adaptation

Human facilitated Natural System Adaptation

- Forest Management
- Wetland Restoration
- Coral Reef Restoration

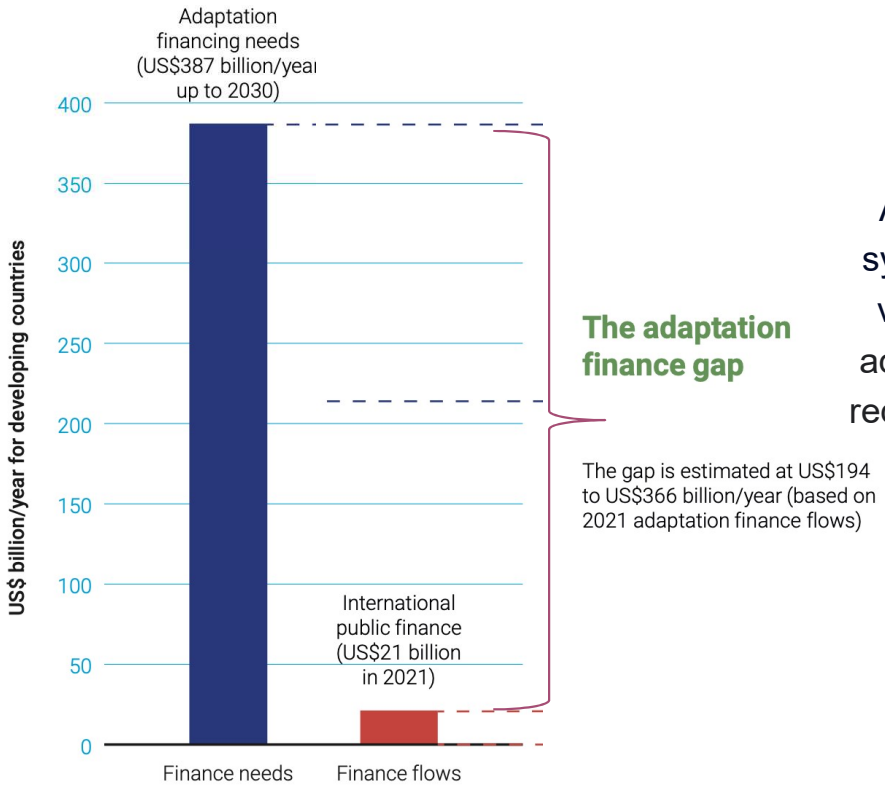

Dimensions of potential feasibility
System transitions
Representative key risks
Climate responses[1] and adaptation options
Potential feasibility
Synergies with mitigation
Economic
Techno-logical
Insti-tutional
Social
Environ-mental
Geo-physical
Land and ocean ecosystems
Coastal socio-ecological systems
Coastal defence and hardening
Integrated coastal zone management
not assessed
Terrestrial and ocean ecosystem services
Forest-based adaptation[2]
Sustainable aquaculture and fisheries
Agroforestry
Biodiversity management and ecosystem connectivity
Water security
Water use efficiency and water resource management
Food security
Improved cropland management
Efficient livestock systems
Urban and infrastructure systems
Critical infrastructure, networks and services
Green infrastructure and ecosystem services
Sustainable land use and urban planning
Sustainable urban water management
Energy systems
Water security
Improve water use efficiency
Critical infrastructure, networks and services
Resilient power systems
Energy reliability
not applicable
not applicable
Cross-sectoral
Human health
Health and health systems adaptation
Living standards and equity
Livelihood diversification
Peace and human mobility
Planned relocation and resettlement
Human migration[3]
Other cross-cutting risks
Disaster risk management
Climate services, including Early Warning Systems
Social safety nets
Risk spreading and sharing
Feasibility level and synergies with mitigation
High
Medium
Low
Insufficient evidence
Dimensions of potential feasibility
Confidence level
in potential feasibility and
in synergies with mitigation
High
Medium
Low
Footnotes:
[1] The term response is used here instead of adaptation because some responses, such as retreat, may or may not be considered to be adaptation.
[2] Including sustainable forest management, forest conservation and restoration, reforestation and afforestation.
[3] Migration, when voluntary, safe and orderly, allows reduction of risks to climatic and non-climatic stressors.

Source: IPCC

Adaptation Challenges

Adaptation

- Inadequate Finance
- Institutional Constraints
- Knowledge Gap



Source: Adaptation Gap Report, UNEP 2023

Maladaptation

Any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; an adaptation that does not succeed in reducing vulnerability but increases it instead.

Resources:

- Media Stories/documentaries:
  - UNFCCC - https://unfccc.int/topics/resilience/resources/adaptation-committee-adaptation-forum-video-documentary-adapting-to-a-changing-climate
- The Adaptation Gap Report – UNEP
- National Adaptation Plans of Countries, accessible here (UNFCCC): https://napcentral.org/submitted-NAPs

Climate Policy and Politics

Climate Justice

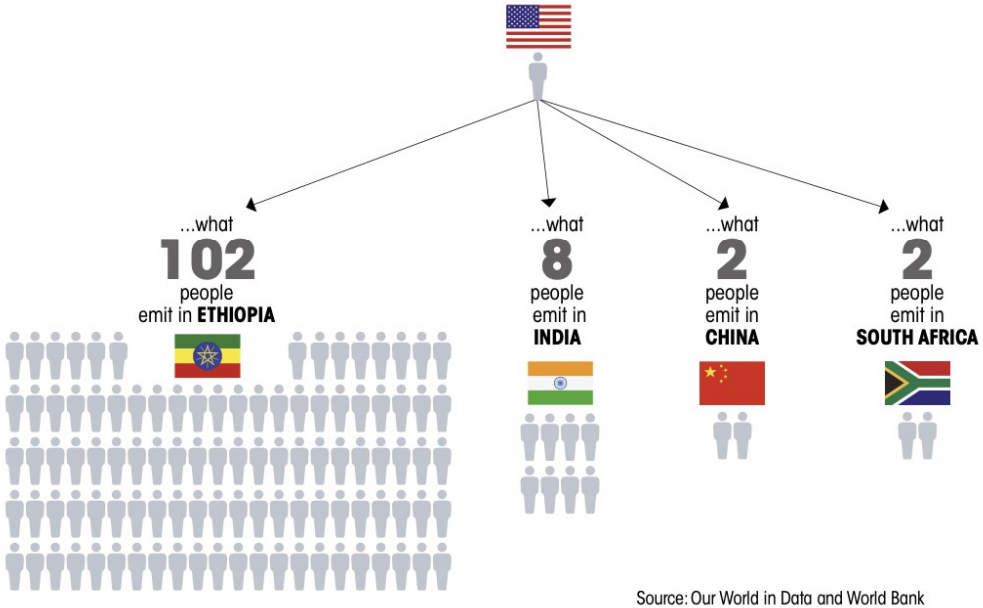
Remaining carbon budget will be exhausted in this decade

All figures in $GtCO_2$

World CO_2 emissions (Fossil fuel and cement)	**1870-2020**	1676.50
	2021	37.12
	1870–2021	1713.63
	BAU 2022–2030	345.94
	NDC 2022–2030	328.46
Remaining IPCC AR6 Budget to stay below 1.5°C as of 2021*		**386.8**
Remaining carbon budget 2022 onwards		**314.87**

*We assume that land-use, land-use change and forestry (LULUCF) emissions account for 3.3% of CO_2 emissions and reduce the 400Gt budget accordingly for this analysis; BAU: business and usual; NDC: Nationally Determined Contributions

Source: Our World in Data, IPCC and CSE Analysis



Source: Our World in Data and World Bank

India's Climate Policy

India's NDCs

- An emissions-intensity target of **45%** below **2005** levels by **2030**
- A target of achieving **50%** cumulative electric power installed capacity from non-fossil fuel-based energy resources by **2030**
- Creation of a carbon sink of **2.5 to 3 GtCO2e** through additional forest and tree cover by **2030**.

Aspects of International Cooperation

- Rio Earth Summit
- Kyoto Protocol
- Paris Agreement

Thank you!