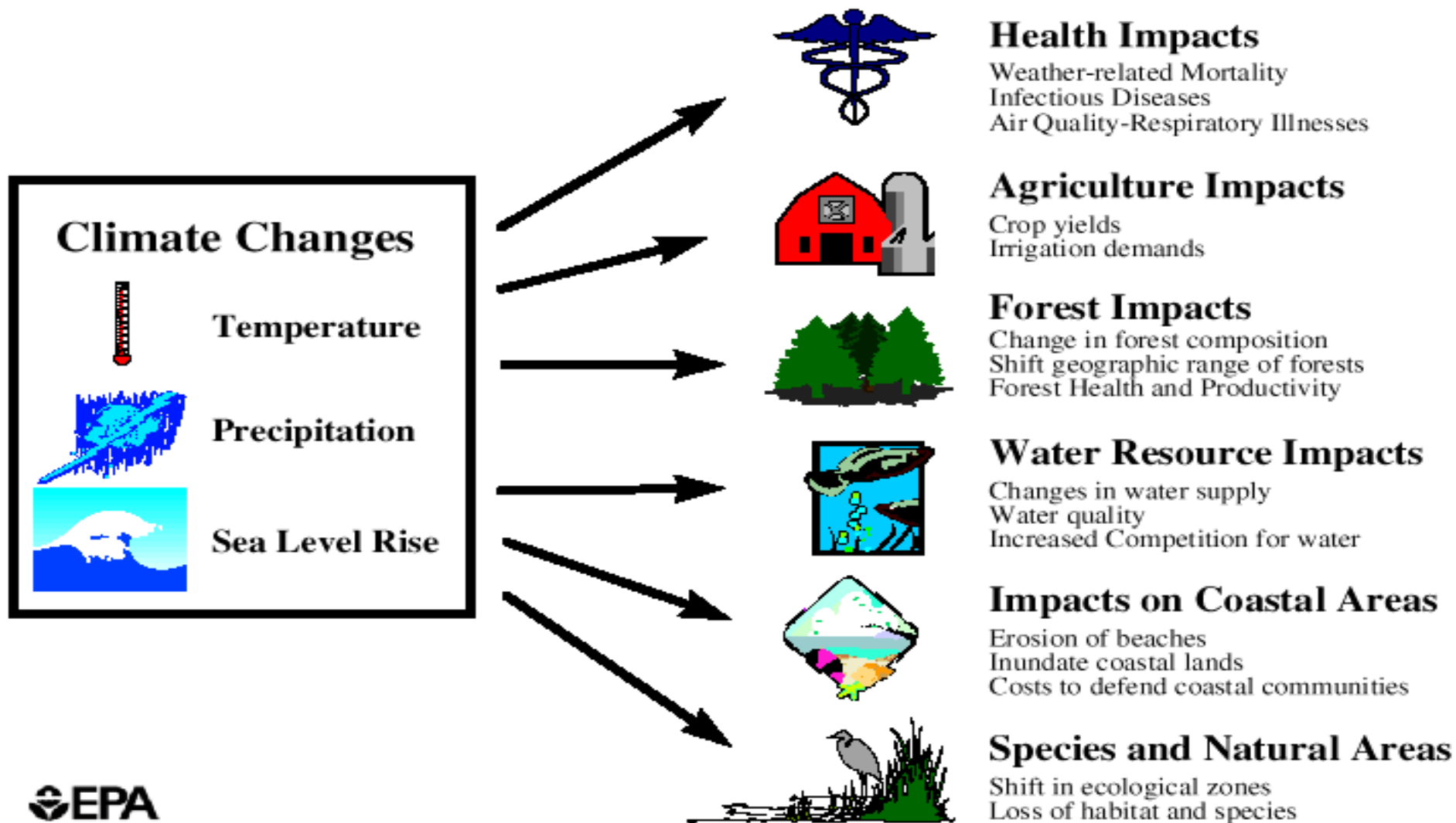


Basic Questions (7)

- What are the implications?



Potential Climate Change Impacts

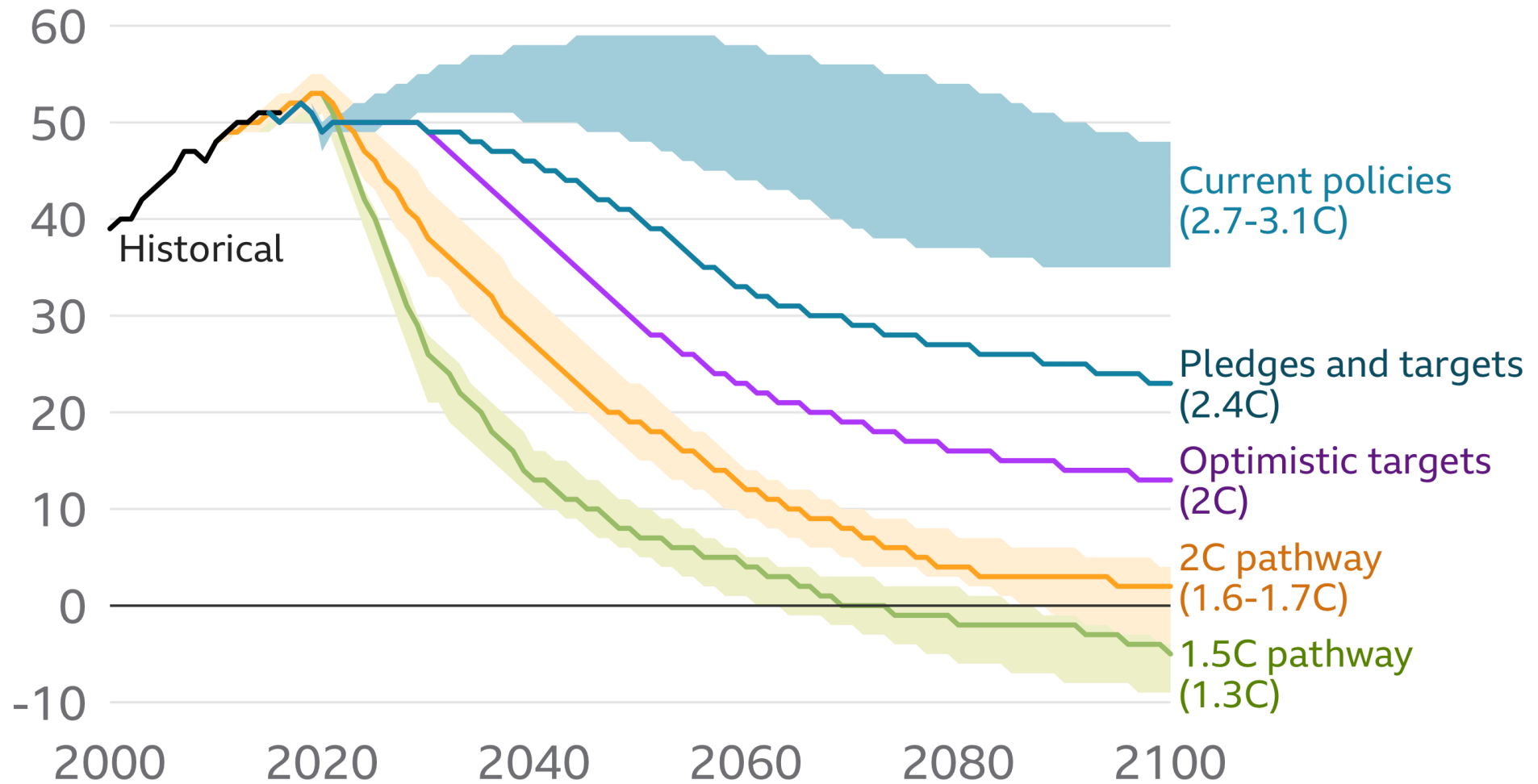


IPCC AR6 Report 2021

- Warning is “**Code Red**” for humanity
- Climate change is already affecting every region across the globe
- Causing droughts and more intense heatwaves
- Target of limiting global warming to 1.5 °C (Paris agreement 2016) will be breached in two decades
- Rise in sea levels of >2m by end of 21st C cannot be ruled out
- “Once-in-a-century” coastal flooding events could happen every year in many coastal areas by 2100
- Arctic could be practically free of summer sea ice by September at least one year before 2050
- Sea level rise caused by climate change is irreversible and will continue for centuries
- It is unequivocal that **humans are warming the atmosphere, land and oceans**

How the world is projected to warm by 2100

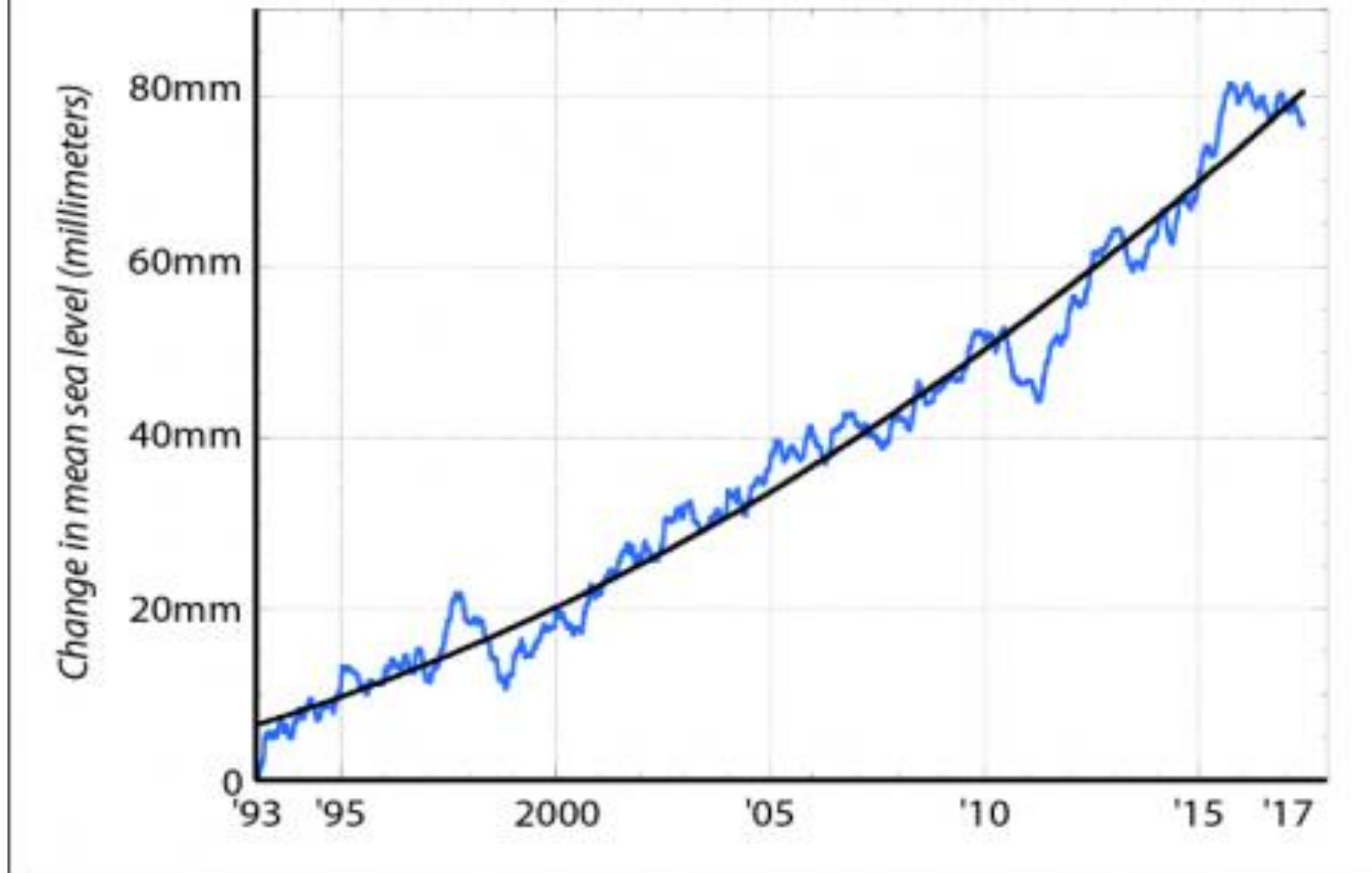
Past and projected emissions in gigatonnes of carbon dioxide



Source: Climate Action Tracker

AVERAGE GLOBAL SEA LEVEL RISE

In millimeters as measured by satellite, 1993-2017



SOURCE: Steve Nerem/University of Colorado, Boulder

InsideClimate News

What will happen To UK if sea levels rise 7m:

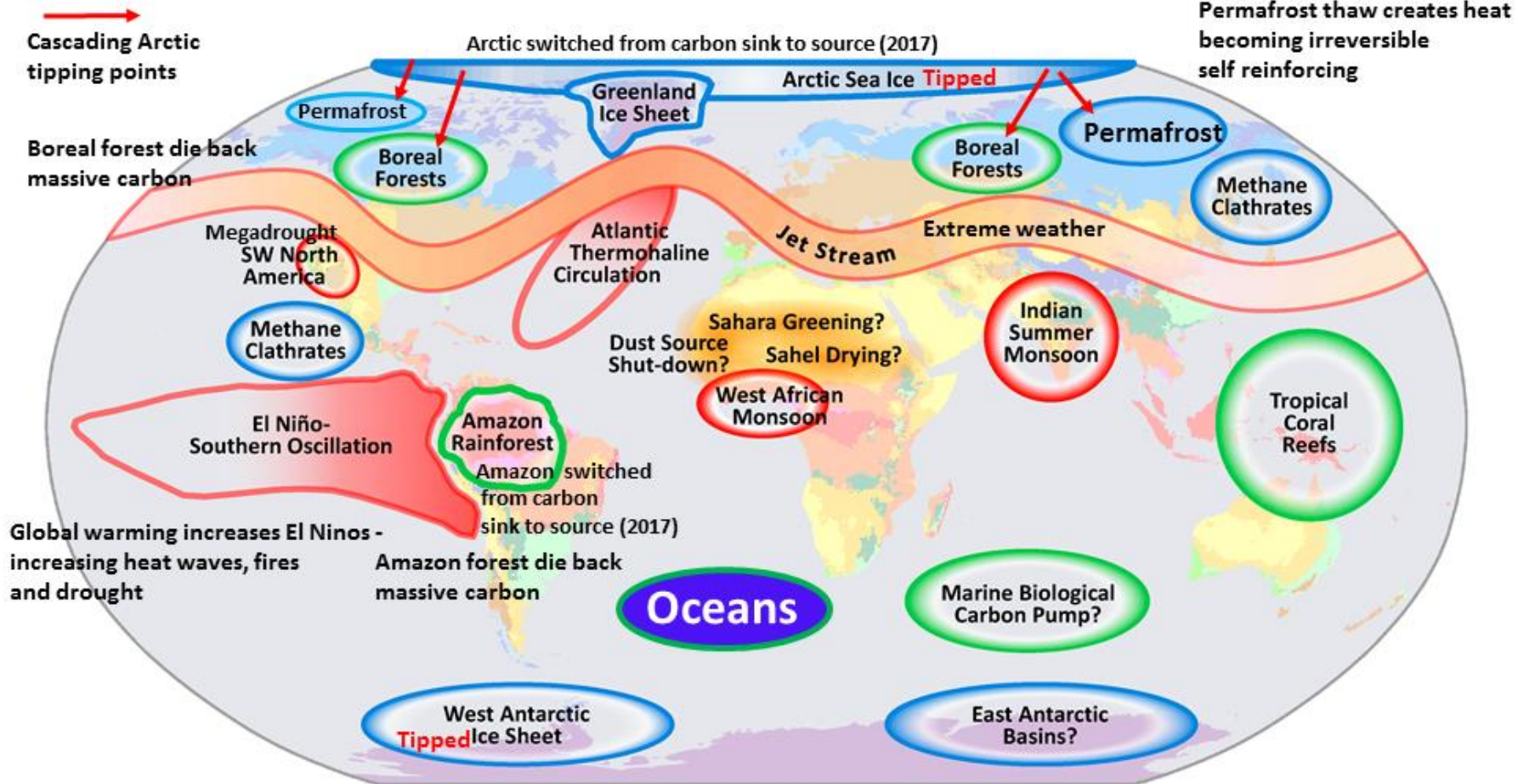




Global Warming Vulnerable Tipping Points

Committed global warming (>2°C) commits most, most likely past tipping
Thawing permafrost is emitting CO₂, methane & nitrous oxide

- Cryosphere Entities
- Circulation Patterns
- Biosphere Components



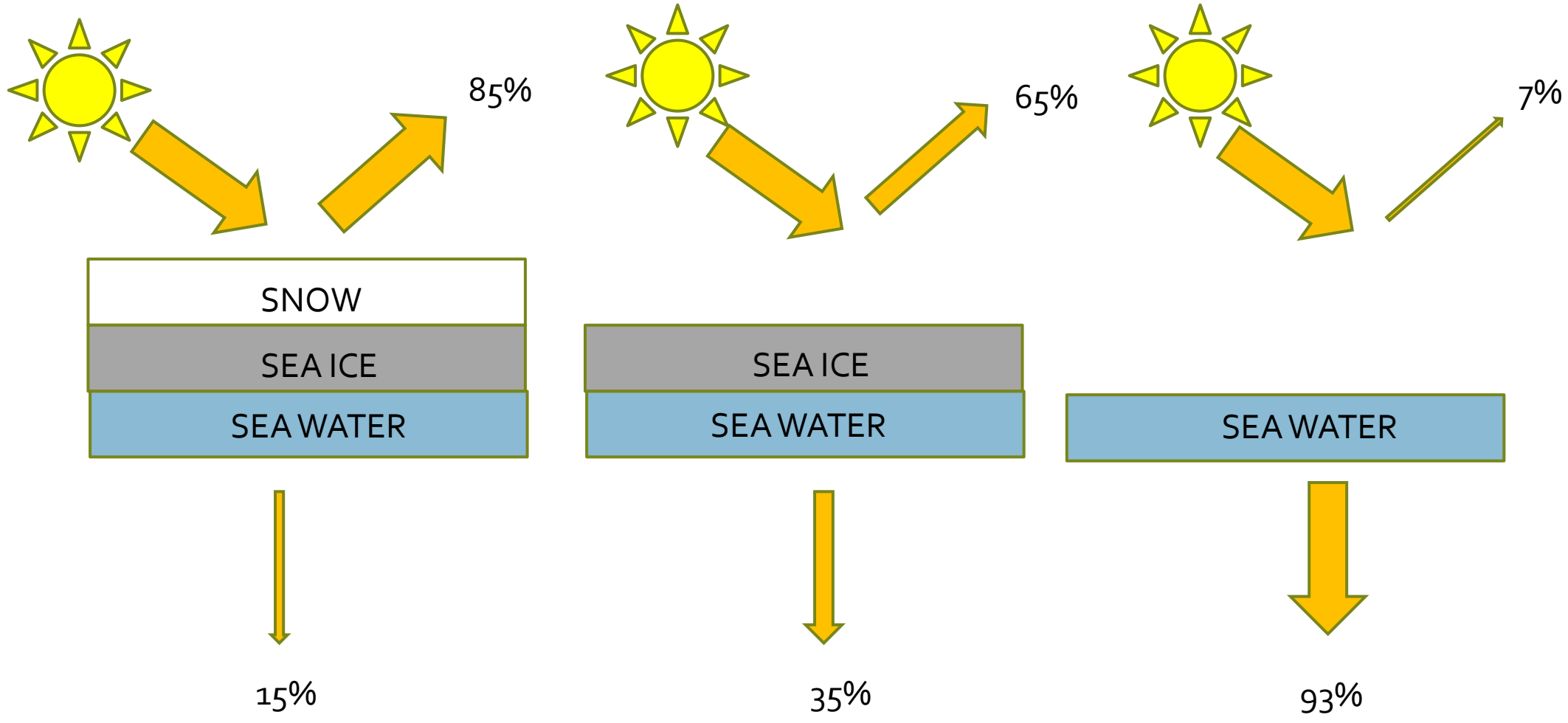
Tundra/permafrost



**Methane flame
on Tundra**



Frozen methane bubbles



Mar 07, 2017



Sep 15 2020



ARCTIC SEA ICE LOSS SINCE 1981

BLUE OUTLINE IS WHERE
THE ICE WOULD HAVE BEEN
IN 1981



RED OUTLINE IS THE
SEA ICE AS OF AUGUST 9,
2020



Over the past few decades, the increasing meltwater yield from glaciers has led to the formation of thousands of new lakes high in the Himalaya

(University of St Andrews)

Basic Questions (8)

- What actions can we take?



Opportunities to reduce net emissions

POWER GENERATION:

- Biofuels (interim)
- Fracked gas (interim)
- Wind
- Solar (incl. from space stations)
- Hydro
- Nuclear (national, local SMRs)
- Nuclear fusion (eg ITER, Tokamak)
- Waves
- Tidal
- Geothermal
- Earth's hot rocks
- Earth's magnetic field
- Earth's radioactivity

HOMES:

- Improved Insulation
- Solar/Battery
- Heat pumps (air, ground)
- Mine water – district heating
- Hydrogen

ROAD TRANSPORT:

- Hybrid (interim)
- Electric/Battery
- Hydrogen
- Biofuels (interim), eFuels

SHIPPING:

- Wind
- Solar/Battery
- Nuclear
- Hydrogen

AIR TRANSPORT:

- Solar/Battery
- eFuels
- Hydrogen

AGRICULTURE:

- More mixed, less intensive
Vertical arable "fields"
- Hydroponics
- Aeroponics
- Reforestation

OTHER:

- Carbon Offset (interim)
- Carbon Capture & Storage
- Improved storage (battery, salt silos etc)
- More plant-based diets
- City forests
- Seeding clouds
- Robotic mirror drones

How can we live with Climate Change?

- Walking, cycling & public transport
- Coastal forests, floating villages
- Flood defences, selective abandonment
- Reinforcing/diverting infrastructure (roads, railways, bridges, networks)
- Fire-adapted forests & communities
- Selective insurance to incentivise change in land & building use
- Reflective roofs, roof gardens, vertical gardens
- Sandwiched flooring
- Shading, shutters & blinds; reflective, triple glazed windows
- Heat-absorbent, non-melting surfaces for roads & pathways
- Retain lawns in favour of concrete or tarmac
- Heat & drought-tolerant plants, irrigation, composting, garden ponds
- Breeding heat-tolerant farm animals
- Man-made meat
- Sustainable communities



**“reducing waste
is the no.1 thing
We can all do”**





Sustainable Settlements



Rugeley power station site

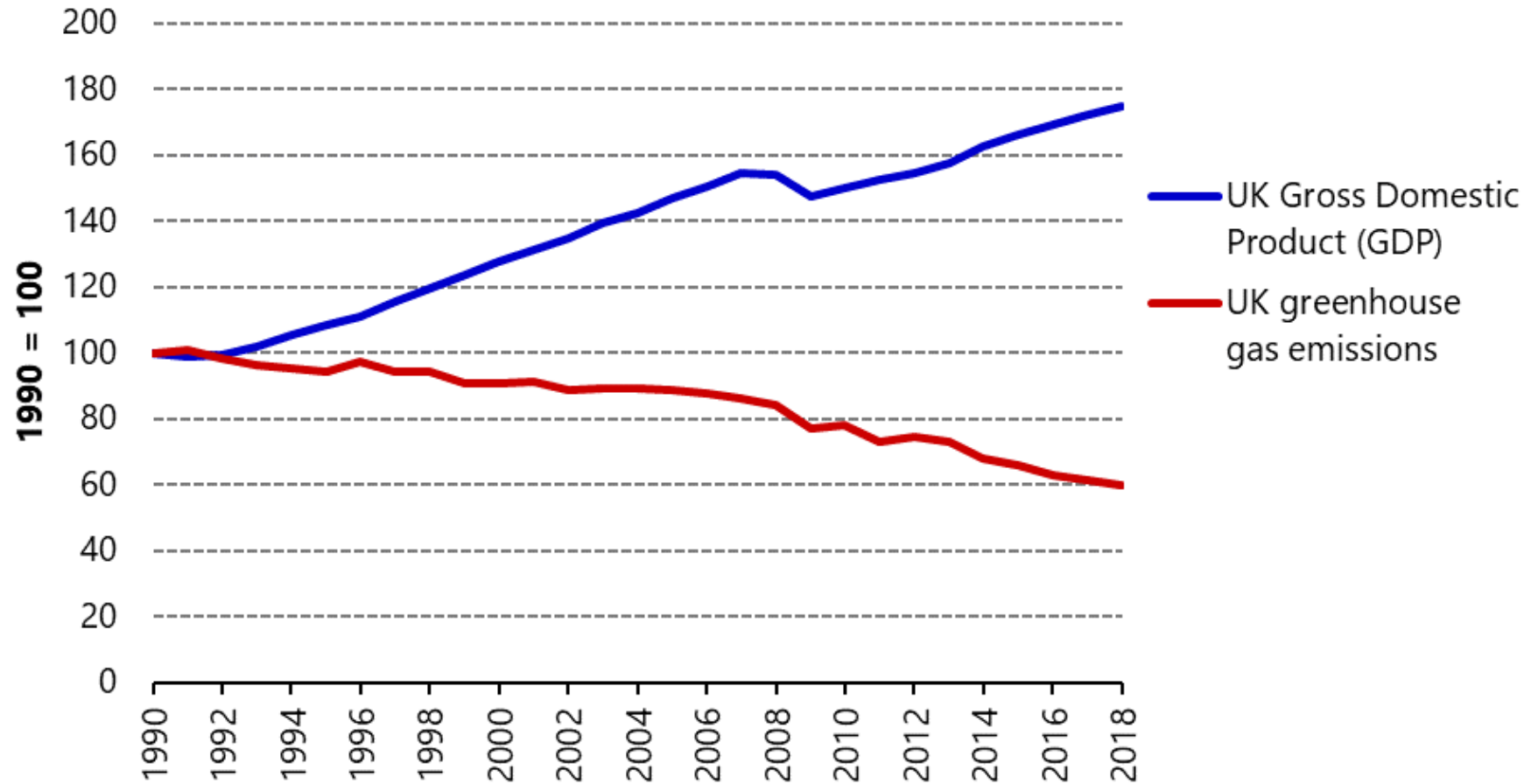
- Smart city framework
- Learning & innovation
- Smart mobility

Basic Questions (9)

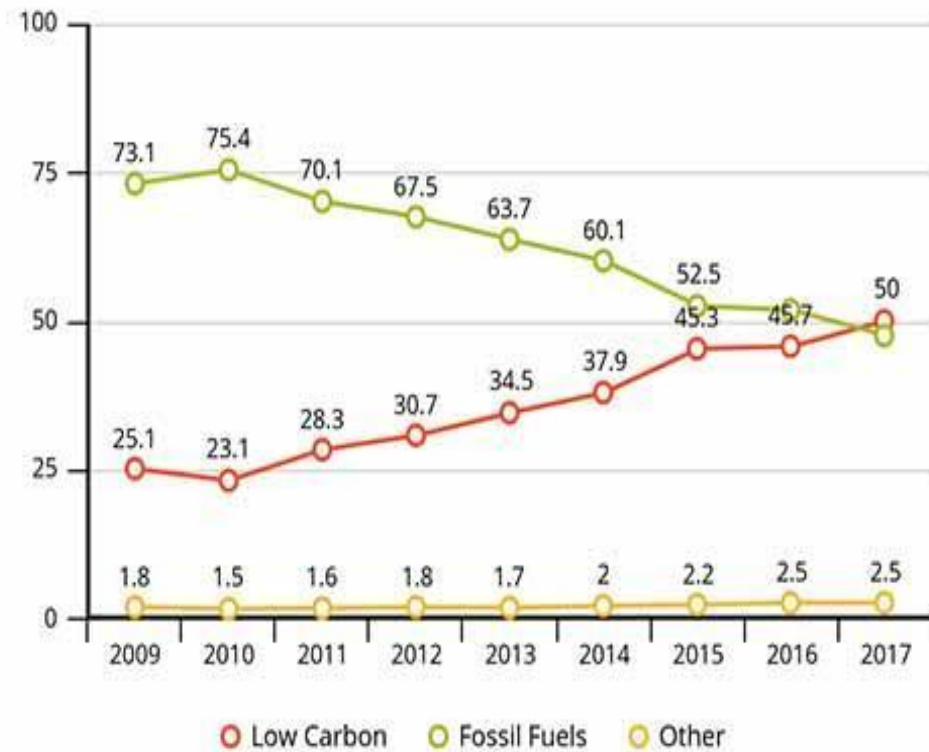
- How is UK doing?
- What are the consequential risks?



UK Greenhouse Gas Emissions vs GDP

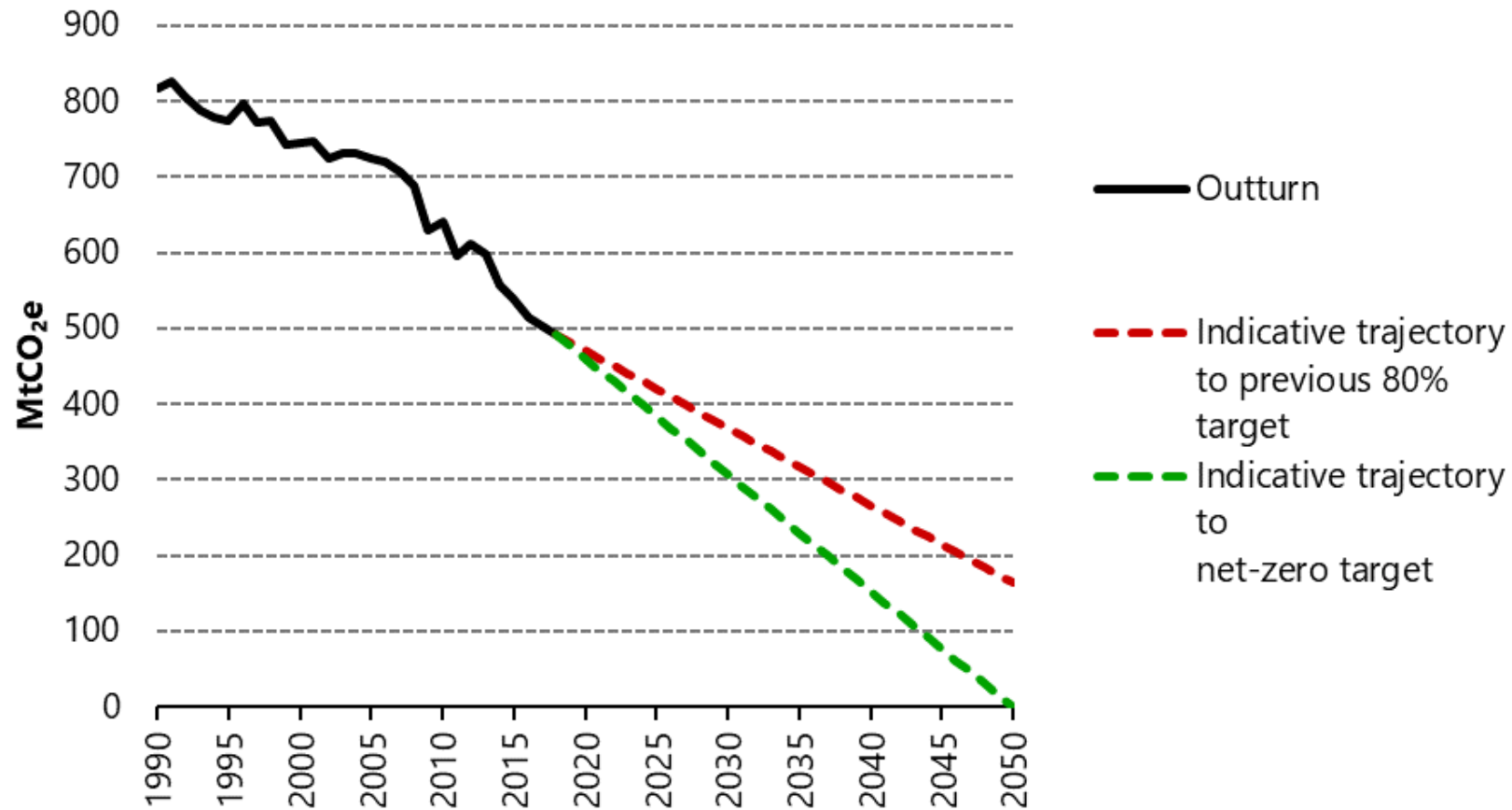


UK Electricity Generation: Low-carbon vs Fossil Fuels (% of total)



Source: Carbon Brief analysis of data from Electric Insights and the Department for Business Energy and Industrial Strategy (BEIS).

Progress required to UK achieve net-zero target by 2050



Will UK continue to achieve its targets?

According to BBC Fact-check Oct 01 2021:

- **Power Generation** – decision outstanding to close gas-fired power stations by 2035 if not capturing carbon
- **Cars, buses, trains & bikes** – scrappage scheme for non-electric cars awaited, behind schedule on charging infrastructure
- **Flights & shipping** – strategy awaited to freeze demand for flights and cut emissions from other modes of transport
- **Heating & buildings** – strategy awaited on improving insulation and installing heat pumps
- **Food** - strategy awaited on diet and reducing agricultural emissions
- **Trees** - behind schedule on tree-planting, especially in England
- **Hydrogen** - production currently in infancy, rapid & significant scale-up planned
- **Carbon capture & storage** - technology still emerging and expensive, projects being planned
- **Industry** - ambitious plans to cut emissions but unclear how this will avoid shifting more production outside UK

What can we do? (IPCC ARS Report 2021)

- Eat less beef, lamb & pork
- Set room thermostats no higher than 19°C & water no higher than 55° C
- Minimise flying, esp. long-haul
- Make your next car an electric one
- Improve homes with draught-proofing & extra insulation
- Choose LED light bulbs & high-efficiency appliances
- Consider switching to a low-carbon heating system such as a heat pump
- Install smart energy meters to manage their use
- Use peat-free compost
- Share rather than buy items such as power tools that you use infrequently

CONSEQUENTIAL RISKS



- Undermining UK productivity, competitiveness, prosperity
- Overdependency on electricity
- Failure of “delinquent” nations (eg China, India, Brazil, Australia) to act quickly enough to make a difference
- Potential for Conflict – uncontrolled emissions (above), polar shipping lanes, fishing grounds, mineral resources
- Migration

Summary

- **Climate Change *is* happening, driven by **Global Warming****
- Caused by:
 1. **Milancovitch effect**
 2. **Post-industrial human activity**
 3. **Population growth.**
- Causing current & future damage to:
 1. **The natural environment**
 2. **Human activities.**
- Only Governments and major organisations can really influence this
- We can play our part, every little helps
- We won't burn, we won't drown, but **we will have to adapt.**



KEEP
CALM
AND
CARRY
ON