MHJ 5342
Technology, Society & Environment

Sessions 04/05

Climate change and related issues

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Content

Introduction

- Why do we need to talk about climate change & Technology?
- We experience consequences of the disturbed environment due to technology
- Air pollution, water pollution, noise pollution, breakdown of biological and material cycles, degradation of soils, climate change.
- Catastrophic impacts of climate change due to global warming caused by industrial developments.
- Fast reaction is necessary for the survival of human beings, animals etc.
- Introduction to climate change & possible consequences
- Predictions made by different international forums, groups & individuals (expertise)

Reasons to study the Interaction/conflict of technology with the balance of ecosystems

Forest Ecosystem

Mangrove Ecosystem

Pond Ecosystem

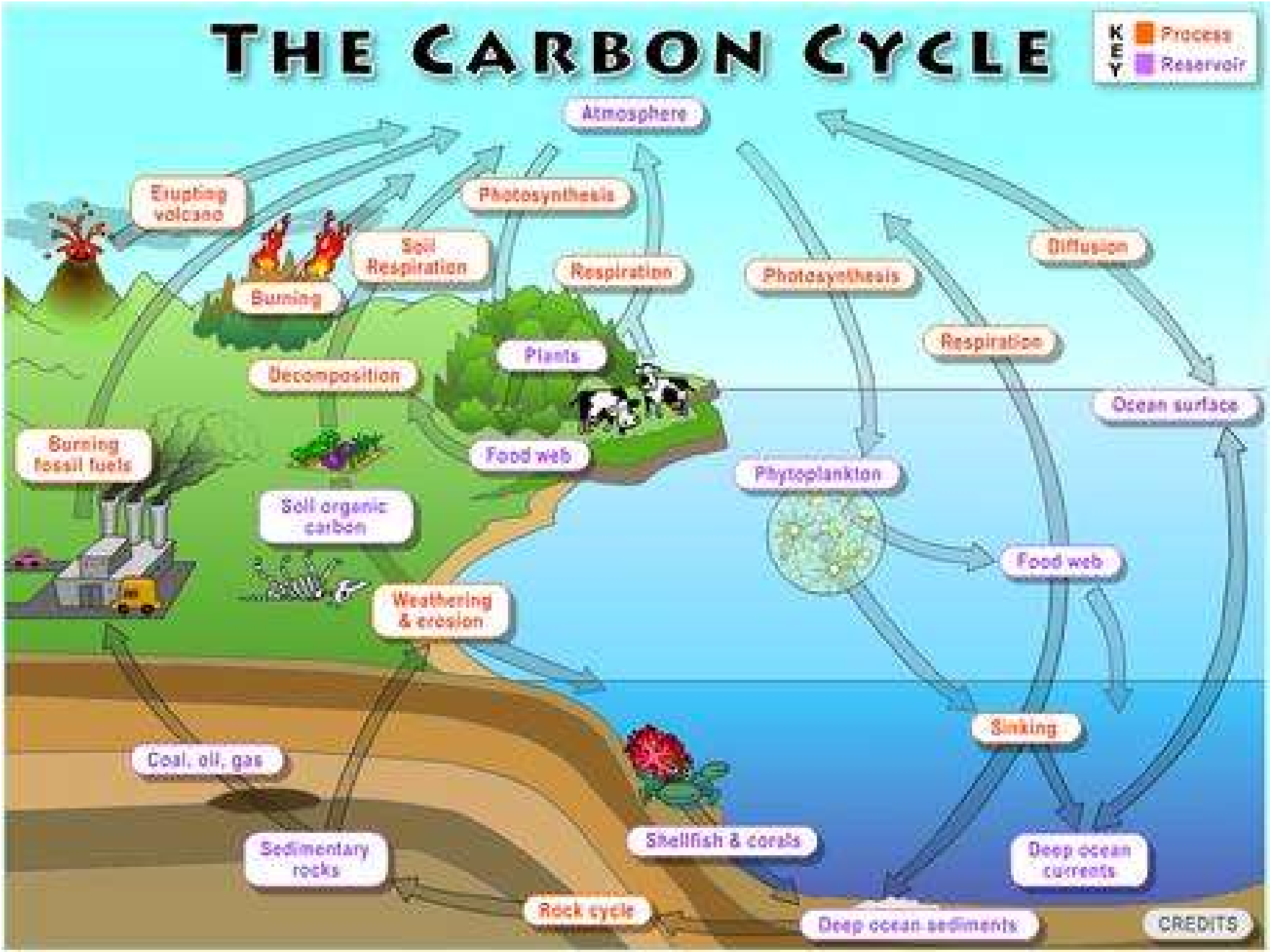
Marine Ecosystem

Technology- tools & machines use to solve real world problems

Climate Change

Ecosystem-unit of interdependent organisms which share the same habitat-biotic & abiotic factors in the environment

Climate Change



(Source: Earth labs)

Effects of Global warming

https://www.nationalgeographic.com/environment/article/global-warming-effects

Recent examples of the climate change effects

Europe faces worst drought in 500 years

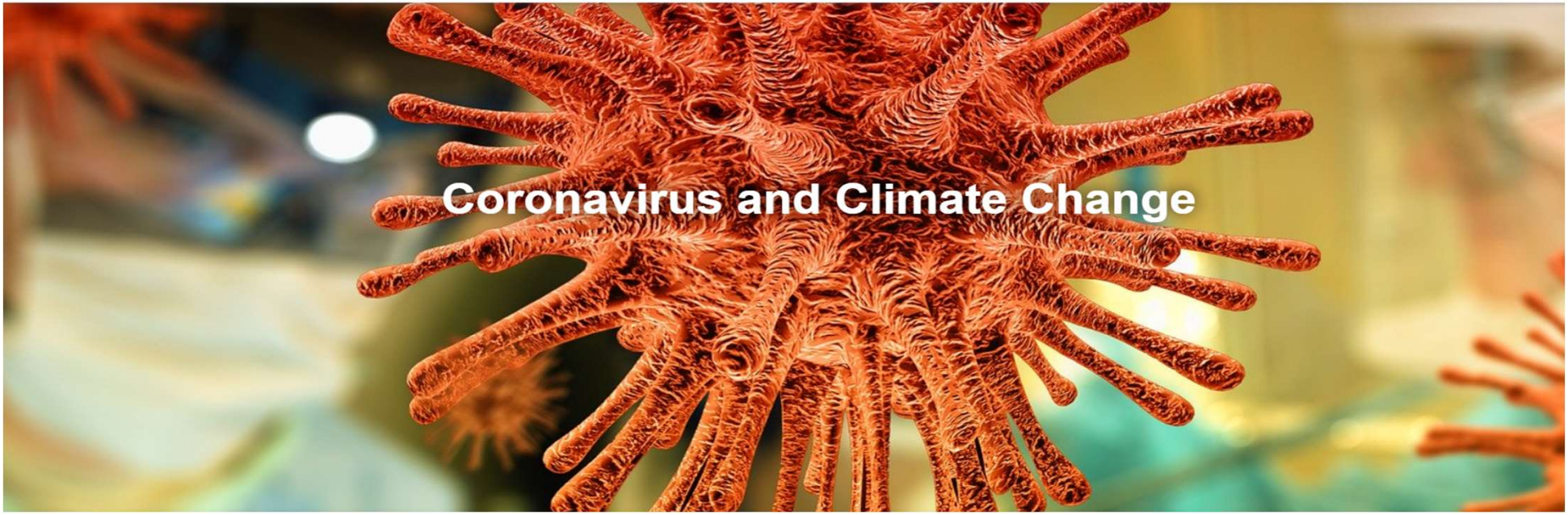
https://www.youtube.com/watch?v=BFwXVu0-Yss

Recent examples of the climate change effects

IPCC climate change 2022 impact report

https://www.youtube.com/watch?v=xqAibhJzsh8&t=168s

Pandemic situations



Does climate change affect the transmission of coronavirus?

How likely are we to see infectious disease spread as a result of climate change?

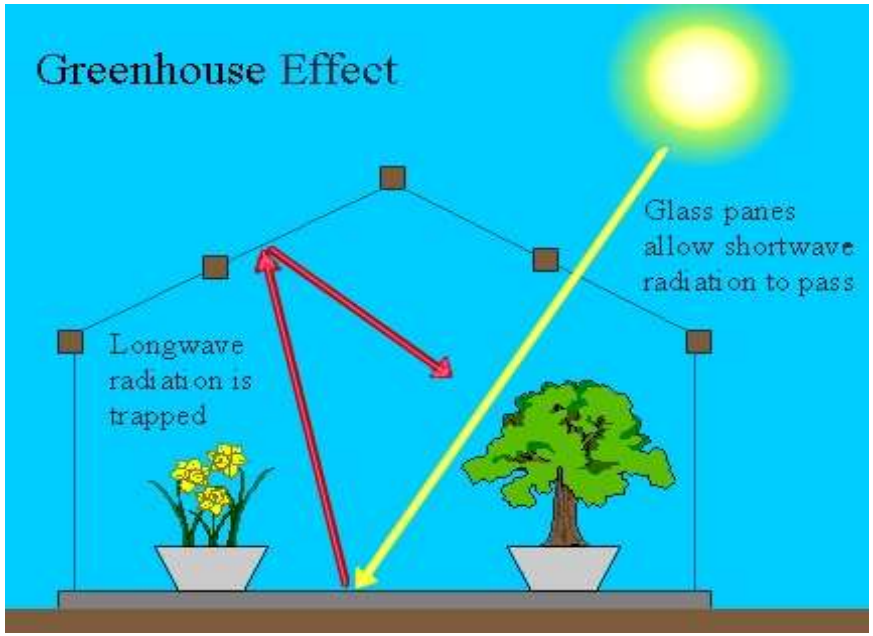
- Climate change has already made conditions more favorable to the spread of some infectious diseases

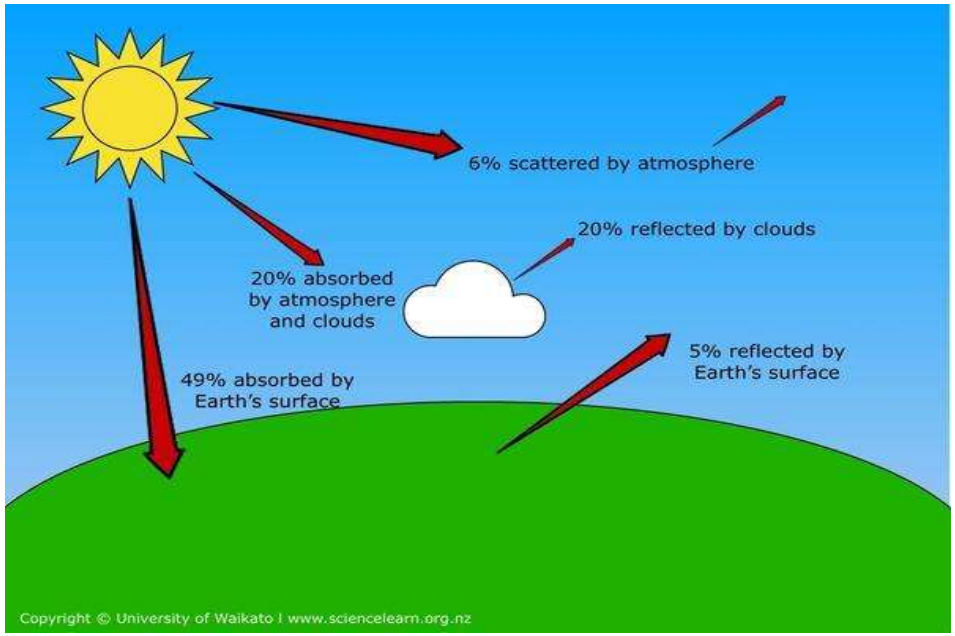
- To help limit the risk of infectious diseases, we should do all we can to vastly reduce greenhouse gas emissions and limit global warming to 1.5 degrees

The Problem: Climate Catastrophe

- Reason for climate catastrophe is global warming

- Global warming due to - Greenhouse Gas Emissions (CO_2, CH_4 etc.)
- GHG - gases in atm. that absorb and emit radiation within the thermal infrared range - affect the temperature of the earth.
- Without GHG, earth surface would be 33°C cooler than at present.





Green House effect

Global warming

- Global warming increases in average 0.74±0.18 °C during last century.
- By end of this century, it will continue to increase to catastrophic proportions.

Contribution of greenhouse gases to green house effect:

- Affected by -characteristics of the gas and its abundance.
- Ex: on molecular basis CH_4 is eight times stronger than CO_2, but the concentration present in atmosphere is smaller. Therefore the contribution to greenhouse gas effect is less.

- When these gases are ranked by their contribution:

H_2O vapour > CO_2 > CH_4 > O_3

(36-72%) (9-26%) (4-9%) (3-7%)

Global warming –alarms

Global warming by 2-4 °C lead to :

- Mass starvation will be the challenge
- If global temperature increase by 3 °C- Chinas agricultural production crashes
- Choice/option would be to starve or migration

Global warming by 3-4 °C lead to :

- Global food production becomes under threat as main food baskets in Europe, Asia, & US suffer drought & heat waves outstripping the tolerance of crops
- Irreversible decline in food production and farming occurs
- Salt-water creeping up in rivers & in groundwater
- Loss of reservoirs due to high evaporations
- Climate induced migration to northern part of the earth – Scandinavia, Baltic, British isles etc.

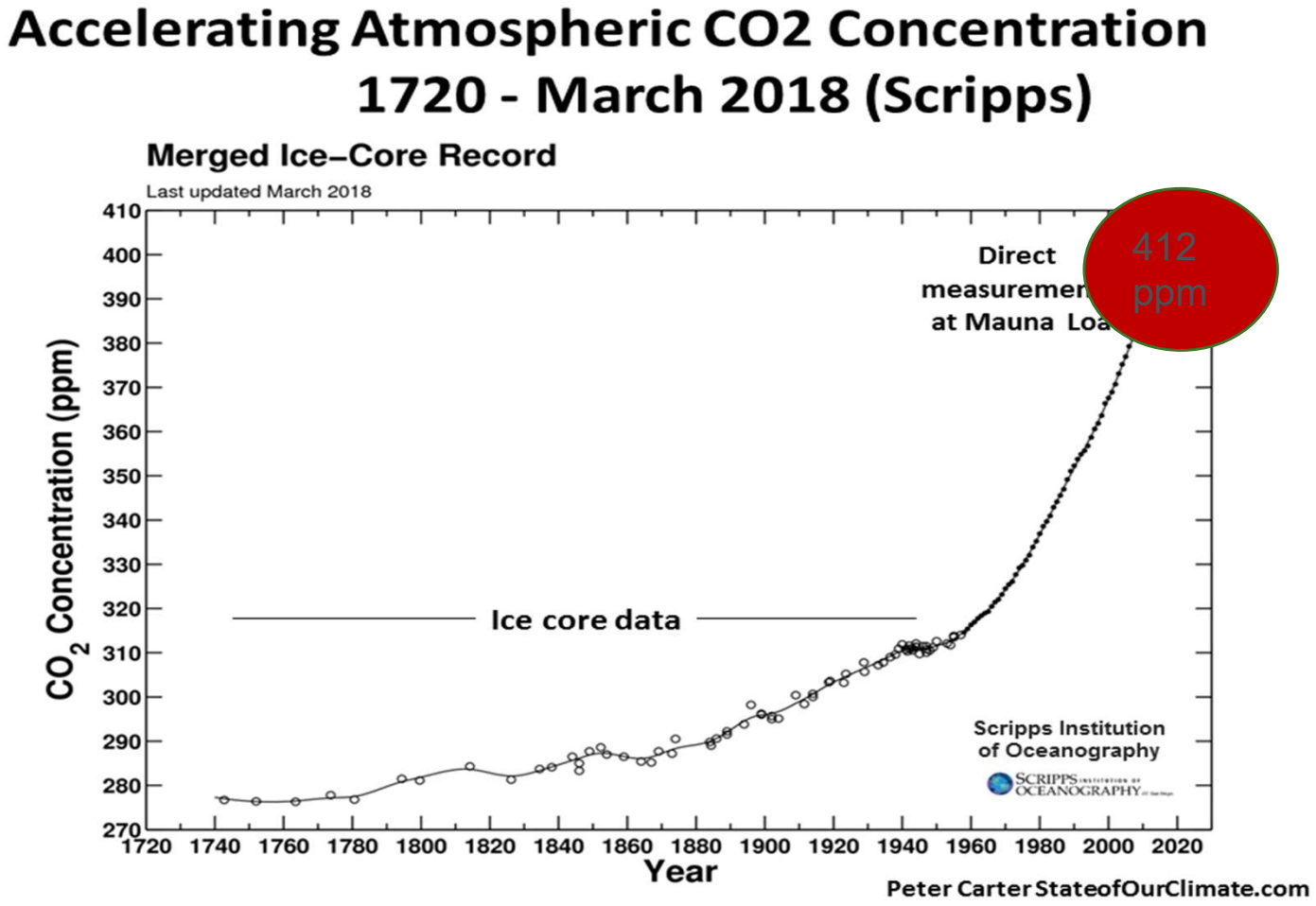
What if global temperature increases 4-5 °C

- Ice sheets will vanish from both poles
- Rainforest will burn up and gradually turn to desserts
- Migration of people from dry areas towards the newly thawed regions- North to Canada, Siberia or even to poles
- Tapped Methane in sea-bed releases and accelerates the global warming

What if global temperature increases 5-6 °C

- Ice in both poles melt down completely –arctic sea ice cover melts faster than that is predicted to diminished.
- Human will migrate in search of food
- **NO hope for survival**

Change in atmospheric CO_2 concentrations



- Atm. Co_2 increase upto 600 ppm.

The Cause: Fossil Fuels

- Carbon balance has greatly modified by post industrial human activities
- An increment of **new carbon** into the atmosphere.

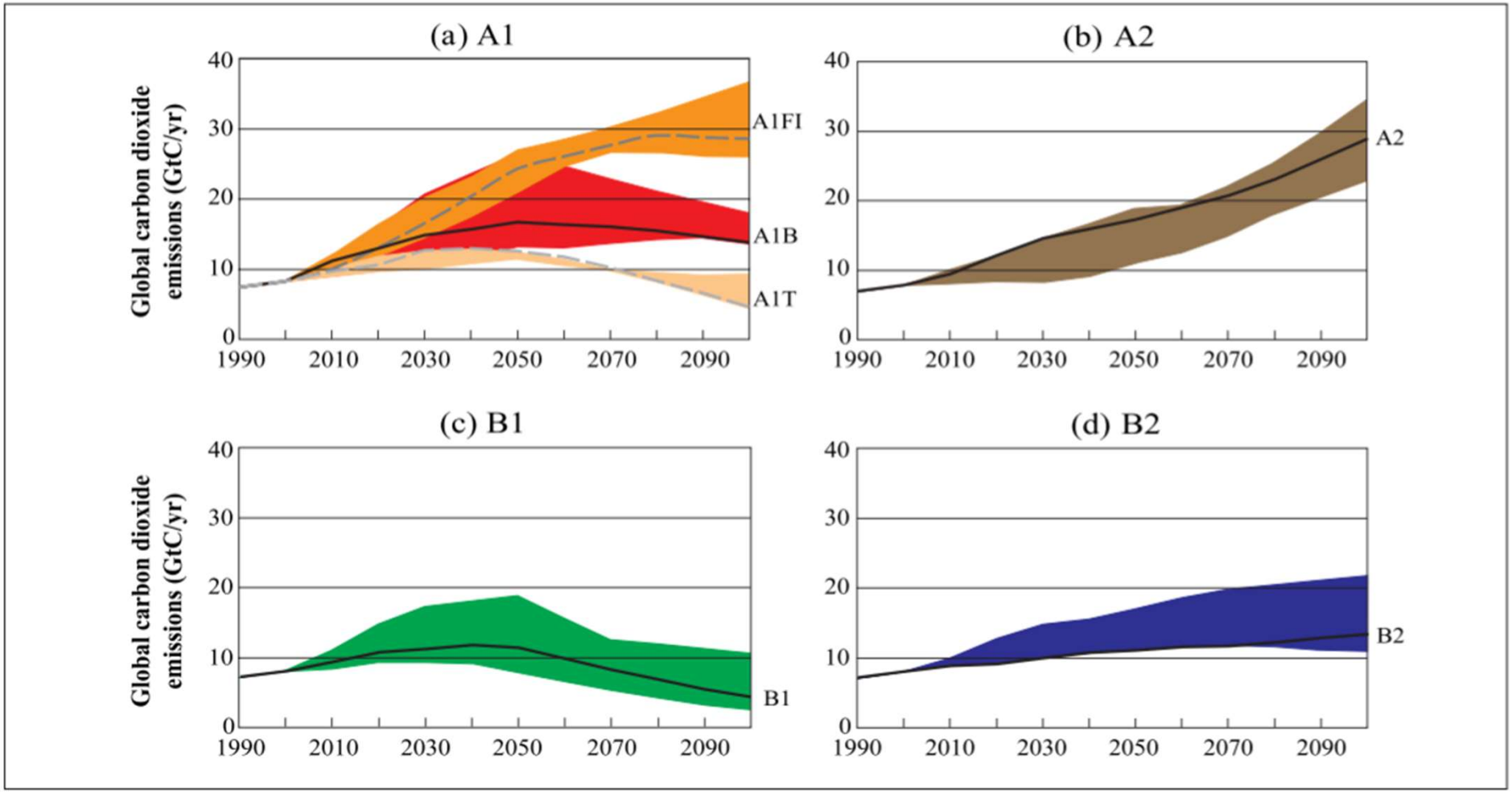
- The estimated fossil carbon stock on earth - 1.38 million GtC, out of which 2193 GtC is biotic carbon.
- Due to industrial activities, carbon stock in the atmosphere & ocean surface has increased by another 1720 GtC leading to climate catastrophe.

COP25

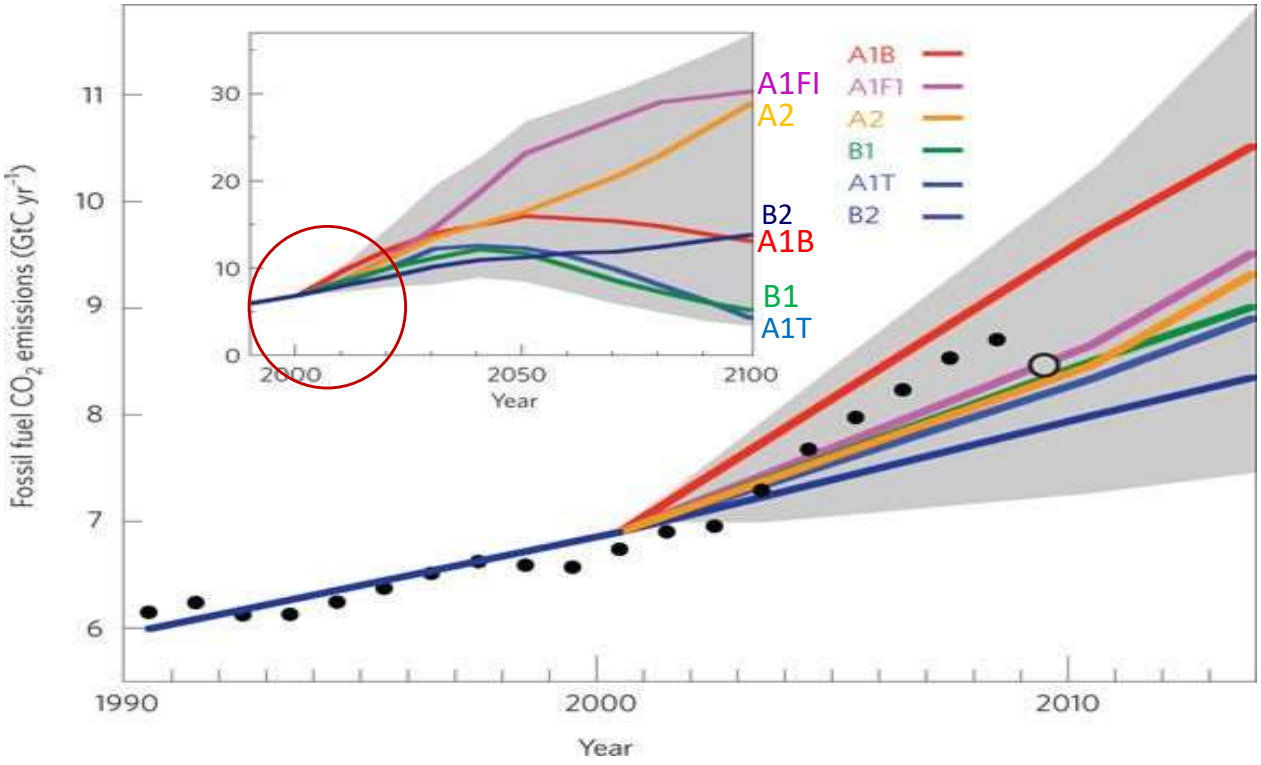
2019 United Nations Framework Convention on Climate Change
Dates: **Dec 2, 2019 –Dec 13, 2019**
Location: Madrid, Spain

Climate change is happening—the world is already **1.1°C warmer** than it was at the onset of the industrial revolution, and it is already having a significant impact on the world, and on people's lives. And if current trends persist, then global temperatures can be expected to rise by **3.4 to 3.9°C this century**, which would bring wide-ranging and destructive climate impacts.

IPCC Scenarios on emissions



IPCC Scenarios on emissions



CO_2 emmission rates of Scenarios B2-middle path, A1T-green socialism and B1-Green capitalism are much better and less damaging.

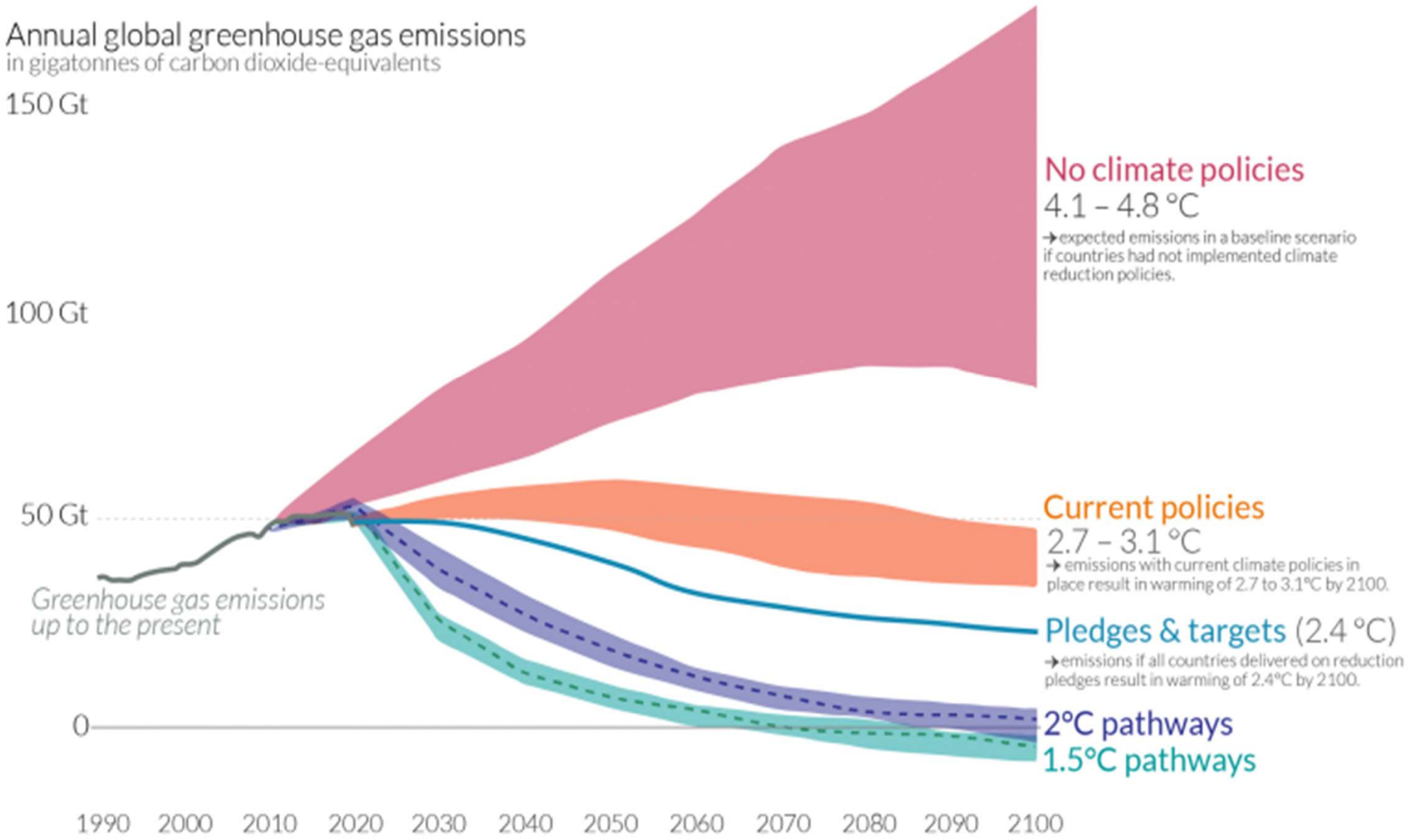
However, in all above cases emissions increase above 50% by 2050.

Impacts of climate change even under better scenarios are not very encouraging as global average temperature increase above pre industrial levels.

Global greenhouse gas emissions and warming scenarios

Our World in Data

– Each pathway comes with uncertainty, marked by the shading from low to high emissions under each scenario.
– Warming refers to the expected global temperature rise by 2100, relative to pre-industrial temperatures.



Data source: Climate Action Tracker (based on national policies and pledges as of May 2021).
OurWorldinData.org – Research and data to make progress against the world's largest problems.

Last updated: July 2021.

The Solution

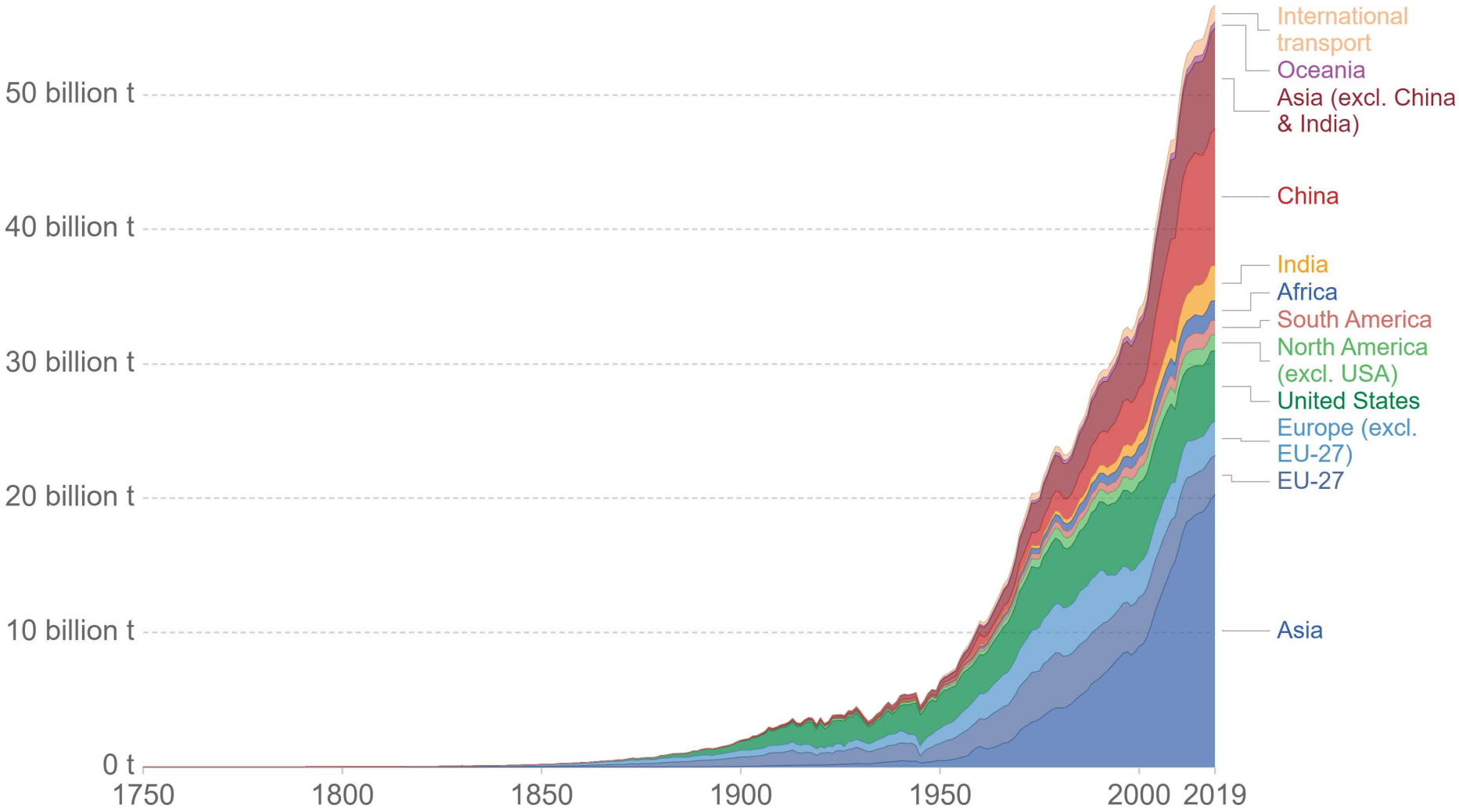
1. Low carbon life styles

- Both at macro and individual level
- Not a new concept-introduced in early 1970s
- Seems to be ignored by people

At macro level:

- Low carbon economy – do not burn fossil fuels
- Renewable energy is the target

Annual total CO_2 emissions, by world region



Source: Our World in Data based on the Global Carbon Project OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY
Note: This measures CO_2 emissions from fossil fuels and cement production only – land use change is not included. 'Statistical differences' (included in the GCP dataset) are not included here.

2. Low carbon transport

- Transportation in Sri Lanka -100% on burning fossil fuels
- People travel long distances
- Eliminate the unequal development
- Development in Information and communication technology – work from home office basis
- Self sufficiency in basic needs in locality
- public transport
- Shift from fossil fuel-based vehicles to renewable energy-based vehicles

Develop low-cost low-carbon energy and battery technologies.

- To do this quickly, and allow lower-income countries to avoid high-carbon development pathways, low-carbon energy needs to be cost-effective and the default choice.

3. Low carbon electricity supply

- At present power sector depends 60% on burning fossil fuels
- Both at domestic level, industrial level & hotel sector
- Introduce a tariff system to reduce the wastage & demand

4. Low carbon industries

- Energy use in industrial sector in 2009 –
  - biomass thermal (68%)
  - fossil oil thermal (14%) and
  - electrical (18%)

It is necessary to stop fossil fuel use in industrial thermal applications t reach the carbon neutral status

5. Low carbon agriculture

The energy consumption in agriculture sector:

Fertilizer - 43%

Field operations - 20%

Overhead – 17%

Harvest – 8.5%

Irrigation – 7.5%

Pesticides – 4%

- Solution : to combine production consumption and disposal of waster into smaller units based on multiple crops so that large scale processing and transport is avoided.
- Postharvest losses is minimized
- This create opportunity to fertilize the soil by incorporating waste to the farm itself.

How can we reduce emissions from food production and agriculture?

1. Reduce meat and dairy consumption, especially in higher-income countries
2. Promote lower-carbon meat and dairy production
3. Improve crop yields
4. Reduce food waste

Solutions to climate change

- How to reduce CO_2 concentration in the atmosphere?

  Examples ?

  Can we ask bacteria to eat the CO_2?

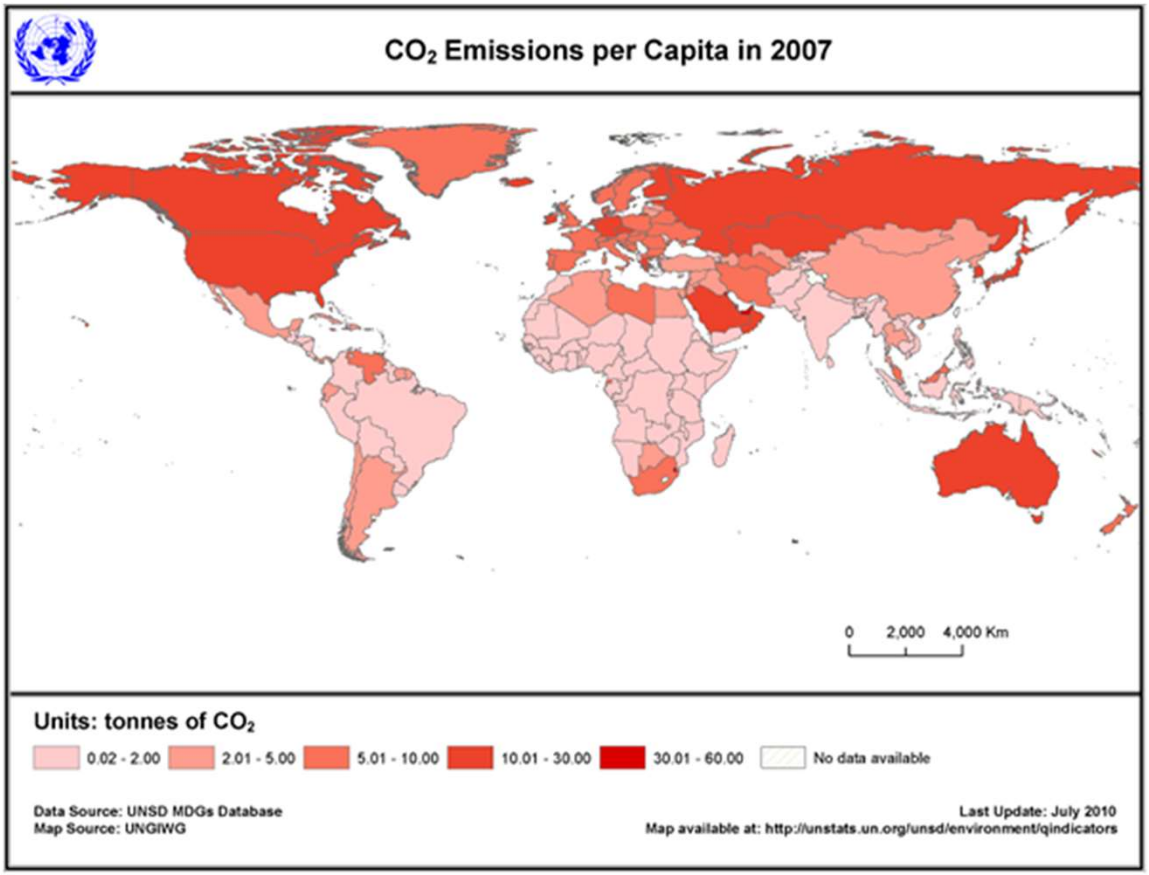
Source: The independent,
29 November 2019

Solutions to climate change

Can we grow trees ?

The Path: Lead from the front

- Per capita emission level of the North is 15-20 times more than the South



- North is emitting more and do not listen to the south.
- Target seal is 2 °C temperature rise and COP24 plans to maintain it at 1.5 °C.

Solutions to climate change

What can we do at University/Individual level?

- At OUSL-University Green Committee
- A University green policy is formulated and will be implemented (by CESSD)
- Address 6 aspects
    1. Natural environment (green landscaping)
    2. Built environment (green buildings)
    3. Teaching
    4. Research
    5. Advocacy &
    6. Life styles (cycling, energy consumption etc.)

Summary

- Why we need to learn the interaction between the ecosystem balance & Technology
- Climate catastrophe
- Causes for climate catastrophe-fossil fuel triggered
- Global warming
- Greenhouse gases
- IPCC scenarios on emissions
- Solution & the path

Questions

1. Can we reach carbon neutral status by 2050 in Sri Lanka?
2. What major challenges Sri Lanka may have to face while formulating a plan for a low carbon economy?
3. What is the most likely IPCC scenario that may happen by 2050? Justify your statement.
4. Is it true climate change will cause the end of civilization by 2050 ?

Thank you for your attention !