# About That Other Crisis:
## Climate Change and Academia's Environmental Footprint

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https://www.cs.ucy.ac.cy/~dzeina/
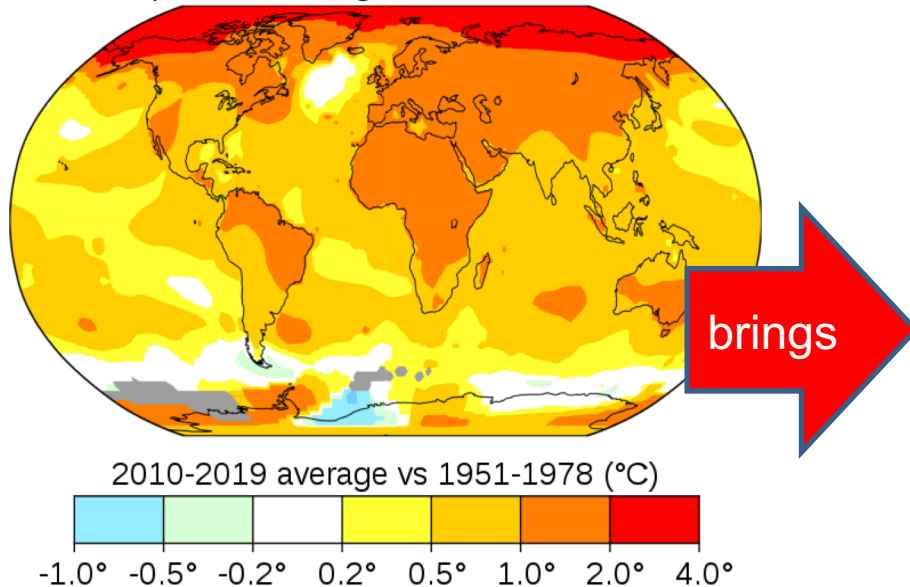


DIG Seminar, April 15, Wherever You Are During Lockdown

1

# Global Warming and Climate Change

Temperature Change in the Last 50 Years



2010-2019 average vs 1951-1978 (°C)

-1.0°  -0.5°  -0.2°  0.2°  0.5°  1.0°  2.0°  4.0°

**brings**

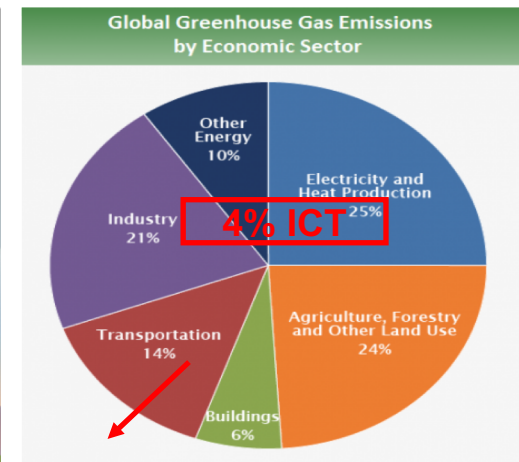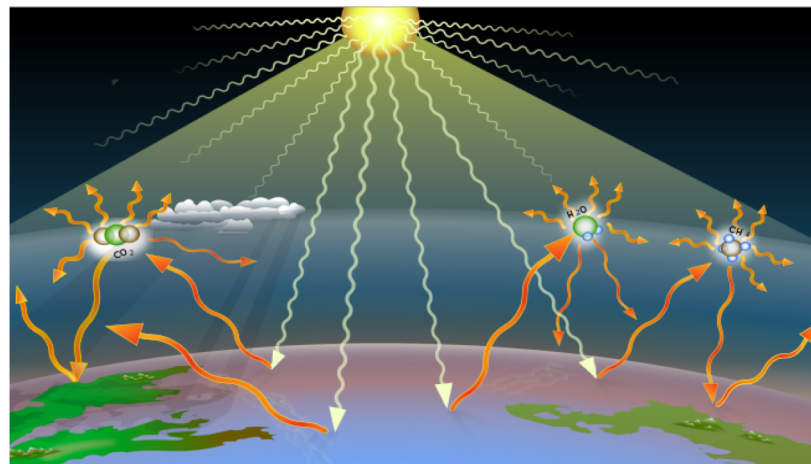**A) Global Warming:** human-caused increase in global surface temperatures.

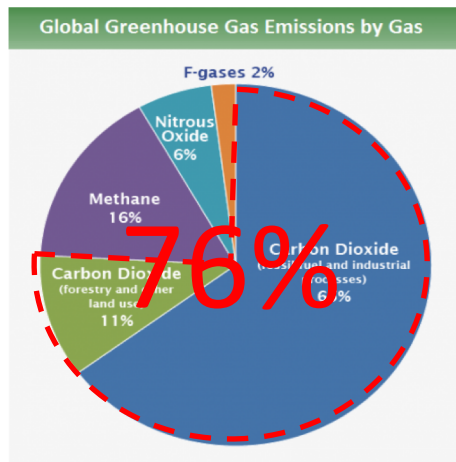**B) Climate Change:** new weather patterns that remain for an extended time having an impact on **human health** and the **environment**.



***Rising Temperatures: a)** dryness, wildfires; **b)** tornadoes, hurricanes, earthquakes, tsunamis; **c)** ice-melting, sea-level risings, floodings, …*

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3

# CO2 - Global Warming Culprit

- **Why do we have Global Warming?**

  – Current Human activity (coal, oil, gas) generates **Carbon Dioxide ($CO_2$),** the predominant **Greenhouse Gas** (76%)!

  – **$CO_2$** traps **Solar Radiation** inside the **atmosphere** that eventually leads to Global Warming.

    – Oceans clean only ¼ of CO2 pollution while trees another ¼.



US EPA: https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data

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4

# CO2 - Global Warming Culprit

- $CO_2$ emerging in all sectors and rising economies

- We are witnessing a steady increase in $CO_2$ since the Industrial Revolution (1760 – 1840 AD)

- **Global warming will continue if we don't act promptly!**



2014 Global $CO_2$ Emissions from Fossil Fuel Combustion and Some Industrial Processes

Other 30% | China 30% | United States 15% | EU-28 9% | India 7% | Russian Federation 5% | Japan 4%



Global Surface Temperature

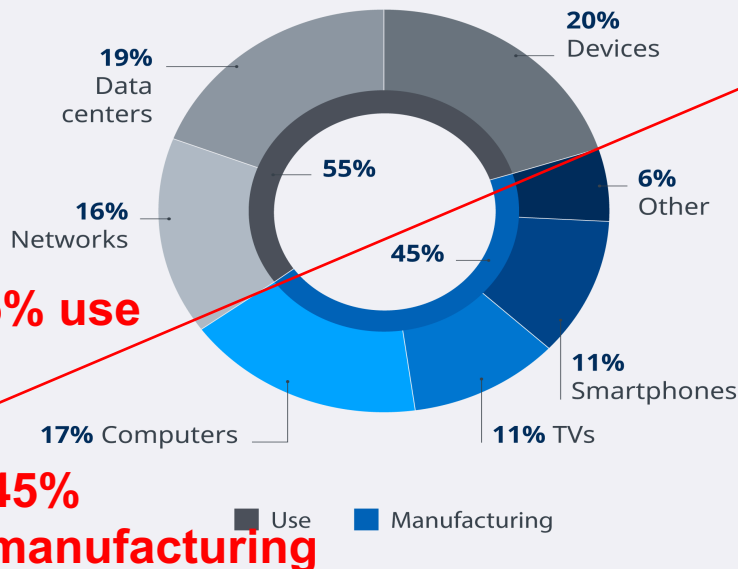- Observed temperature (°C)
- Human drivers only
- Natural drivers only
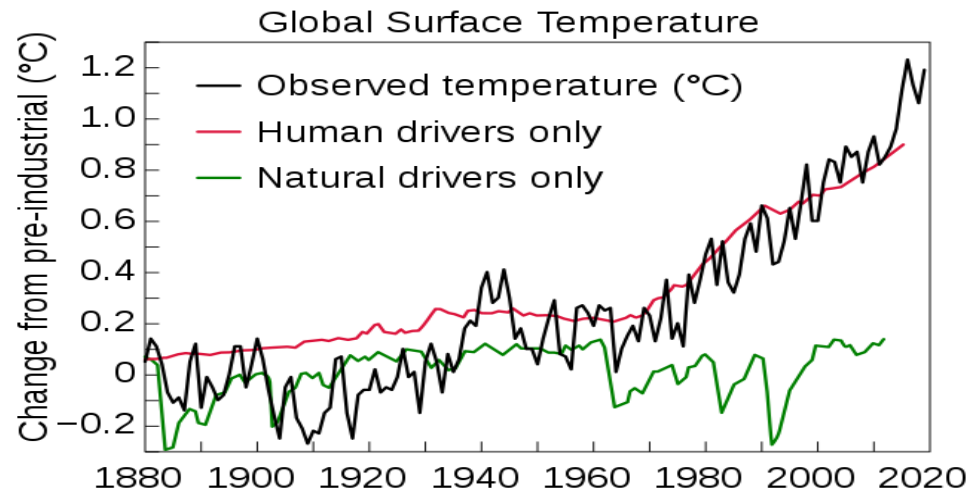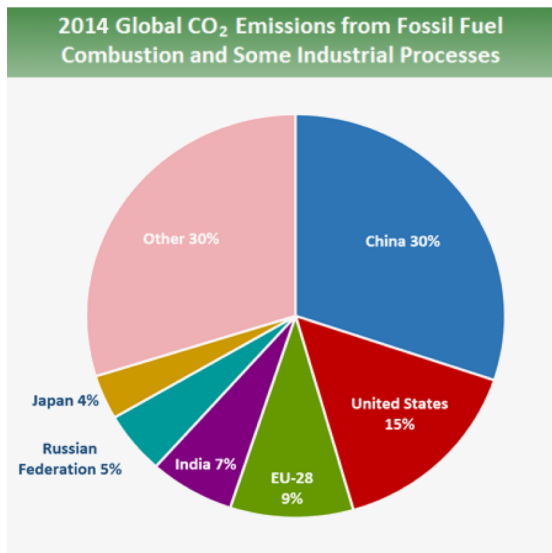
The **Intergovernmental Panel on Climate Change** (**IPCC**) is an intergovernmental body of the United Nations: World Meteorological Organization (WMO) United Nations Environment Programme (UNEP)

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5

# CO2 by Information and Communications Technology (ICT)

- ICT contributes **~2-4%** of world CO2 emissions and will increase to **8%** by 2025!

## Energy consumption in the IT sector



20% Devices
19% Data centers
16% Networks
17% Computers
11% TVs
11% Smartphones
6% Other
55%
45%

**55% use**

**45% manufacturing**

Use   Manufacturing

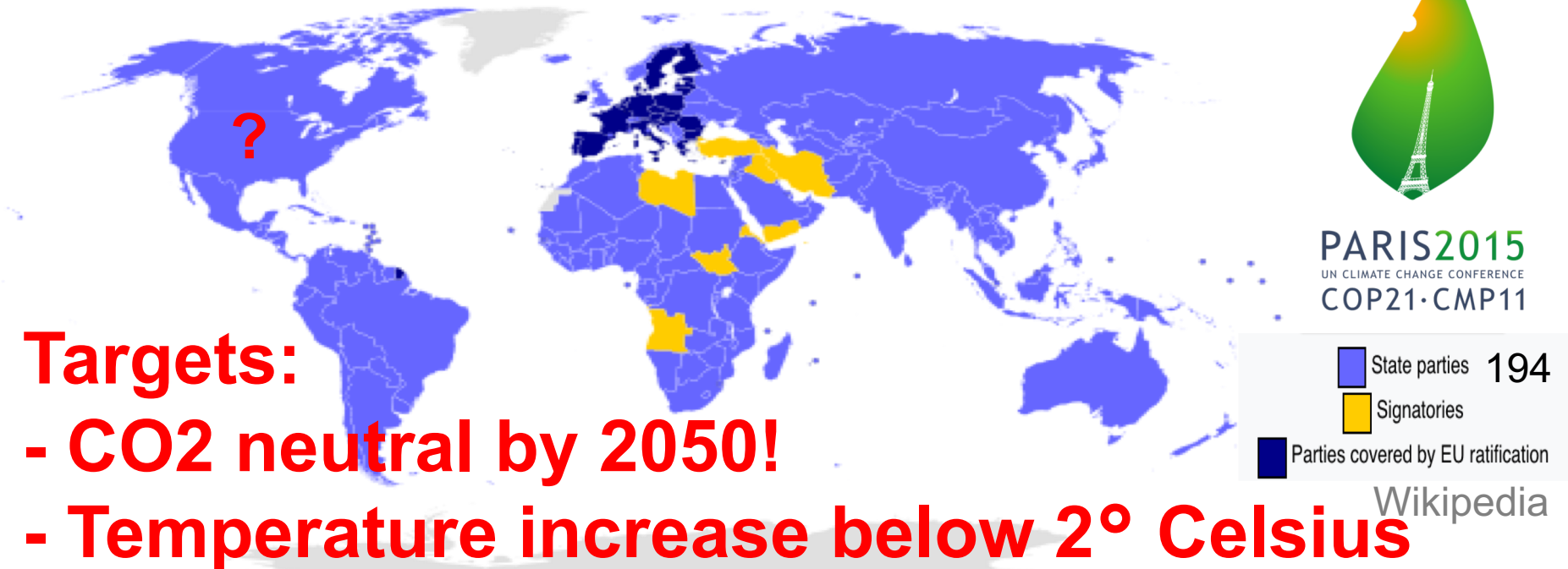Source: Lean ICT - Towards Digital Sobriety / The Shift Project 2019   ©DW

→ Are we **comfortable doing research** that (allegedly) contributes to CO2 increase?

→ How much CO2 **is technology saving anyway**? (Teleconferencing vs. Physical Meetings?)

→ How to make **impactful research** to reduce this increase from **4% to 8%?** (edge computing?, energy efficiency?, reusable systems?, transparency? )

# The Paris Agreement

- The **Paris Agreement** within the **United Nations Framework Convention on Climate Change (UNFCCC),** dealing with **greenhouse-gas-emissions mitigation**, **adaptation**, and **finance**, signed in New York City, on April 22, 2016.

**? **

**Targets:**
**- CO2 neutral by 2050!**
**- Temperature increase below 2° Celsius**

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

State parties 194
Signatories
Parties covered by EU ratification

Wikipedia

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7

# How are we part of the problem?

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# CO2 Emissions from Air Travel
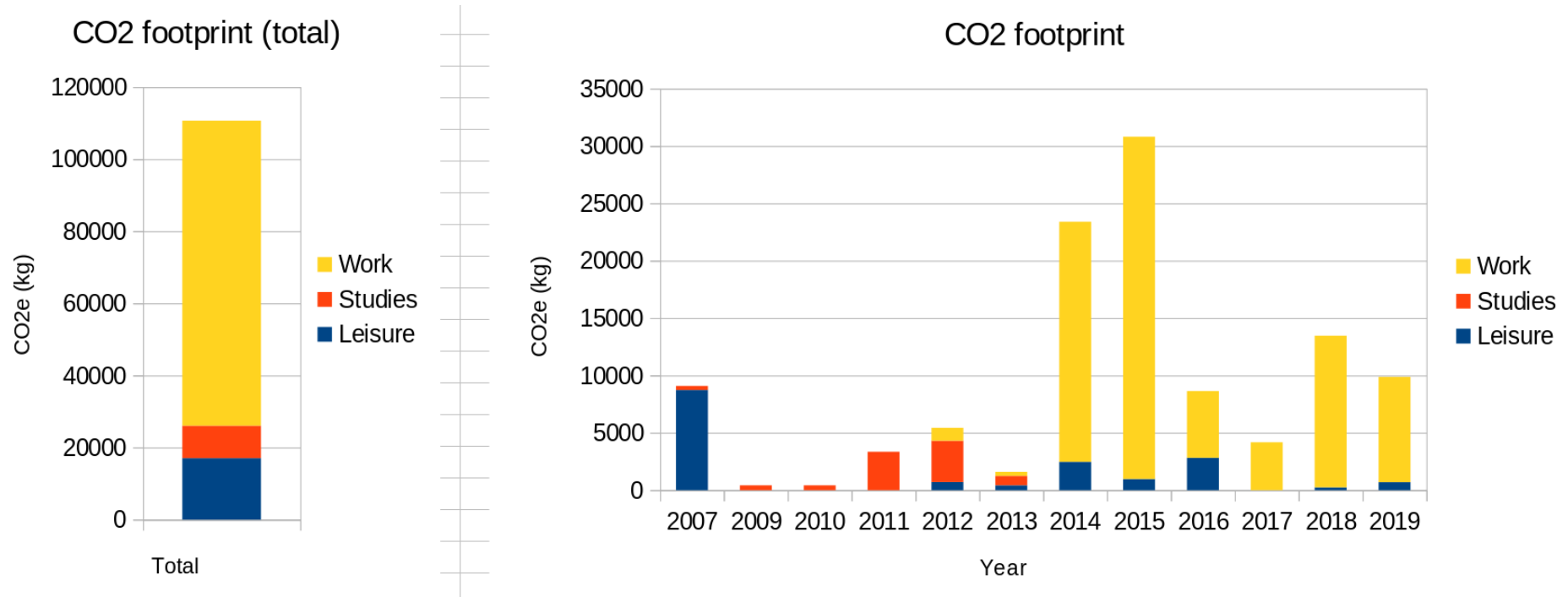
- Air travel: currently **~2-3%** of emissions, but on the rise, because people tend to travel more:

- i.e., **~100 gCO2/passenger-km**

  → But in fact **~250 gCO2eq**

  because of other pollutants

- Road and rail are **~60g CO2eq**

- Fly Lisbon ↔ Copenhagen:
  **1 ton CO2eq!**

- Your lifetime carbon budget
  (for everything, not just travel):
  **200 tons CO2eq**
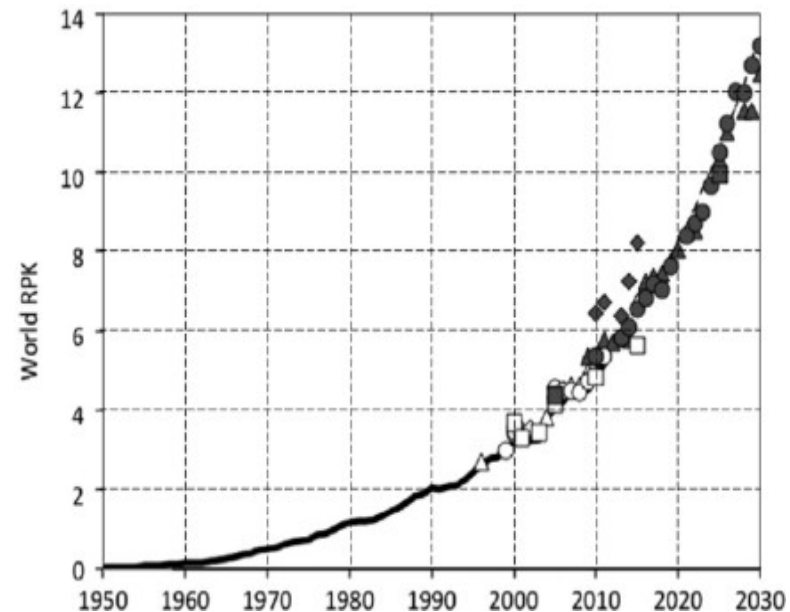


Trillions of revenue passenger kilometres per year, from Wild, Baxter, Sabatini, Sustainable Technologies for Aircraft Energy Generation, Storage, and Distribution, PRCC 2014

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11

# Example: Footprint of my flights



CO2 footprint (total)

CO2 footprint

- 125 flights including 70 work flights
- Total footprint: 110 tons of CO2e
- Total lifetime budget: 200 tons (for everything)...

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12

# Reducing the Need to Travel

- To reduce emissions, avoid plane travel, and **travel more wisely and be more selective? Publish less?**

- First: **measure** the total travel footprint of attendees

  - Analyze the data, **choose places** minimizing travel?

  - Unfair advantage for only a few cities?

- **Colocation** with other conferences to reduce travel

- Improving **remote participation**:

  - **Live streaming** of talks?

  - Allow **remote talks** and questions?

# Carbon Offsets

- **Idea:** support projects that reduce $CO_2$ emissions

  - **Measure** your $CO_2$ footprint, say 1 ton $CO_2$

  - **Finance** projects whose expected outcome is to reduce $CO_2$ emissions by 1 ton

- Nowadays: around **25 EUR / ton CO2**

- Could be included in **registration fees**

- Could be payed by **the employer**

- Not a perfect solution (still better: don't travel)

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14

# Other Ideas to Reduce Impact

- Producing **food**, especially **meat**, emits lots of CO2
  - **All-vegetarian** menus?
  - **Local producers**?

- Avoid **disposable dishware**

- Avoid **conference bags** and other gadgets?
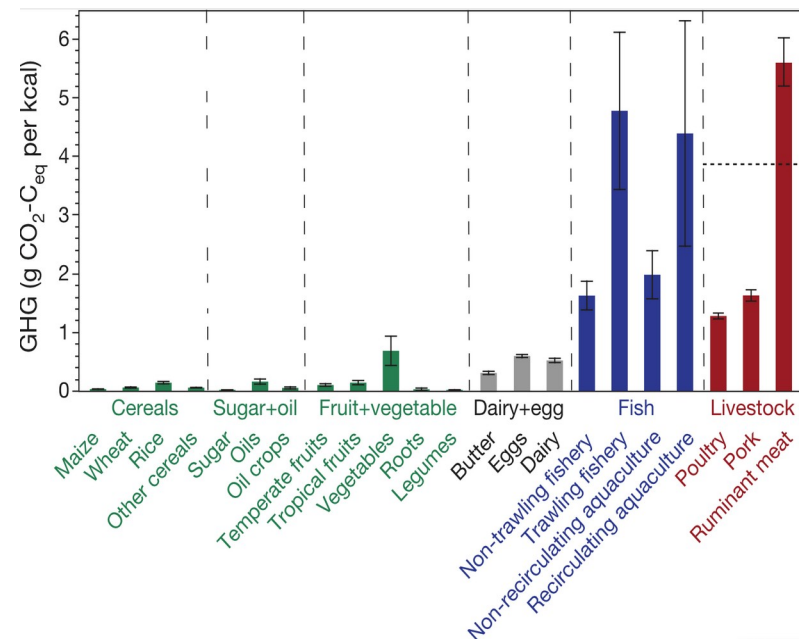


Source: Tilman and Clark, Global diets link environmental sustainability and human health, Nature, 2014

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15

# Other initiatives and call to discussion

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# Other initiatives in CS

- **SIGPLAN Climate Committee**

  - https://www.sigplan.org/Resources/Climate/

  - Asks ACM to **charge conferences** for their footprint

- **Moshe Vardi's piece in CACM**

  - Asks ACM to **allow video talks** in its conferences

- **acm-climate mailing-list**

- **TCS4F.org** (theoretical computer science group)

  - **Manifesto** to commit to CO2 reductions

  - Can be signed by individuals, conferences, groups

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17

# Manifesto

## Pledge for sustainable research in theoretical computer science

Human activity over the last decades has been changing our planet's climate by releasing greenhouse gases into the atmosphere. The Earth's atmosphere now contains about 410 ppm carbon dioxide (compared to 280 ppm in the 18th century)[1,2]. The resulting global warming is anticipated to cause considerable harm to human civilization throughout the 21st century and beyond, particularly if the concentration rises above 450 ppm[3]. To mitigate this, we must urgently reduce our carbon emissions. There are initiatives on many levels of international politics setting goals for this reduction[4,5]. For instance, the IPCC panel of the United Nations advocates a 45% reduction of carbon dioxide emissions by 2030 relative to 2010 levels, to limit global warming to 1.5°C[6].

We, as researchers in Theoretical Computer Science, acknowledge that our activities also contribute to the problem, in particular by the greenhouse gas emissions caused by our travel.

We believe that our research community should aim for a significant reduction of carbon emissions and evolve towards more sustainable practices. We believe that this can be achieved while preserving the quality of our research.

**As an objective, we commit ourselves to reducing our emissions by at least 50% before 2030 relative to pre-2020 levels.**

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18

| | |
|---|---|
| Kostia Chardonnet | LRI |
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| Jean-Louis Dessalles | Telecom Paris |
| Thomas Schwentick | TU Dortmund University |
| Prof Manuel Bodirsky | TU Dresden |
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| Antoine Amarilli | Télécom Paris |
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| Olivier Gauwin | U. Bordeaux |
| Arnaud Casteigts | U. Bordeaux |
| Anca Muscholl | U. of Bordeaux |

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19

# Discussion

- **Should we care** about contributing to the climate crisis?
- **How can we** travel less?
- **Can we help** with our research?
- Should we still do **in-person conferences**? How?
- Can DIG sign the **TCS4F manifesto**?
- What can be done at the level of **Télécom**?



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20