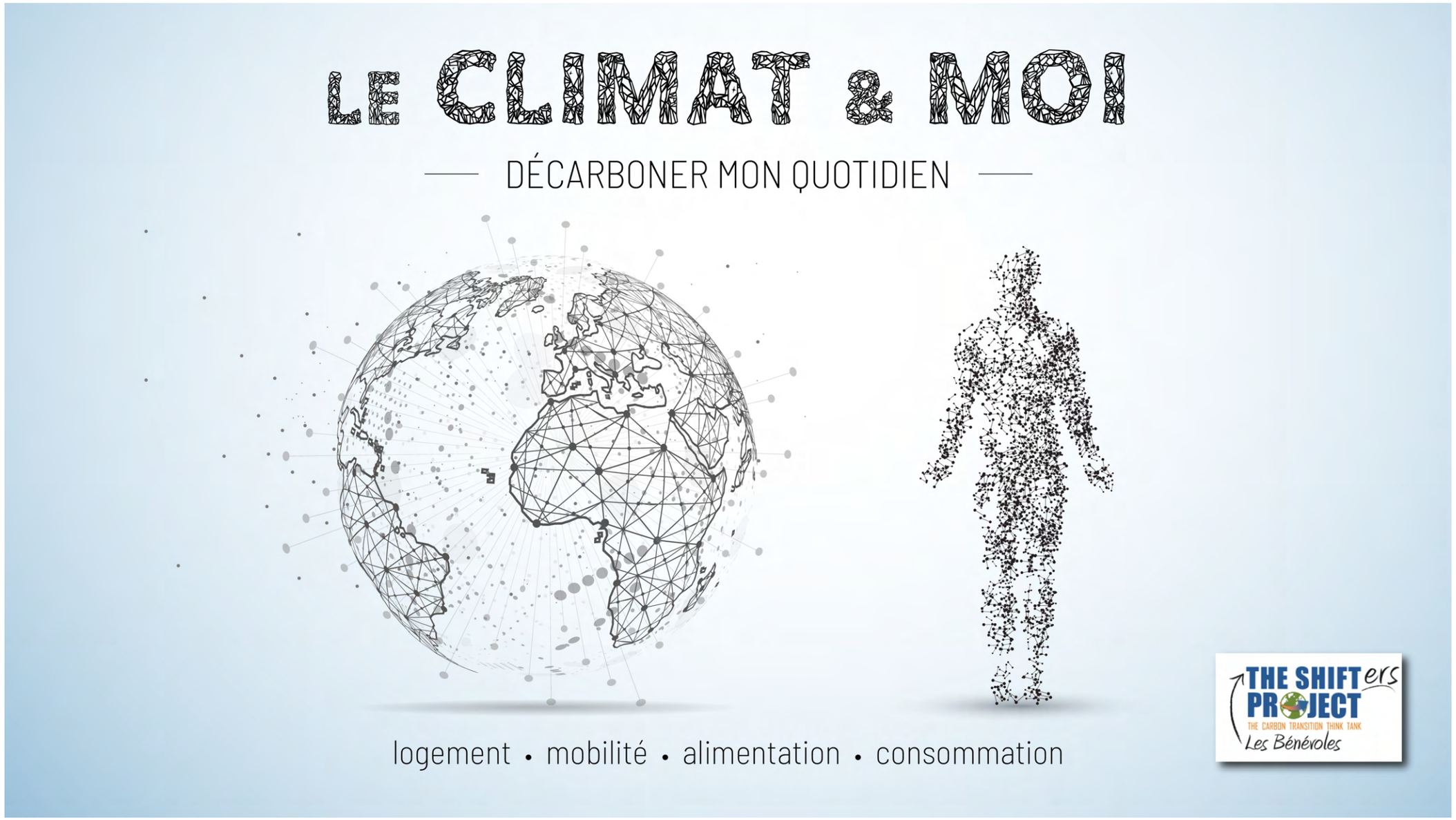
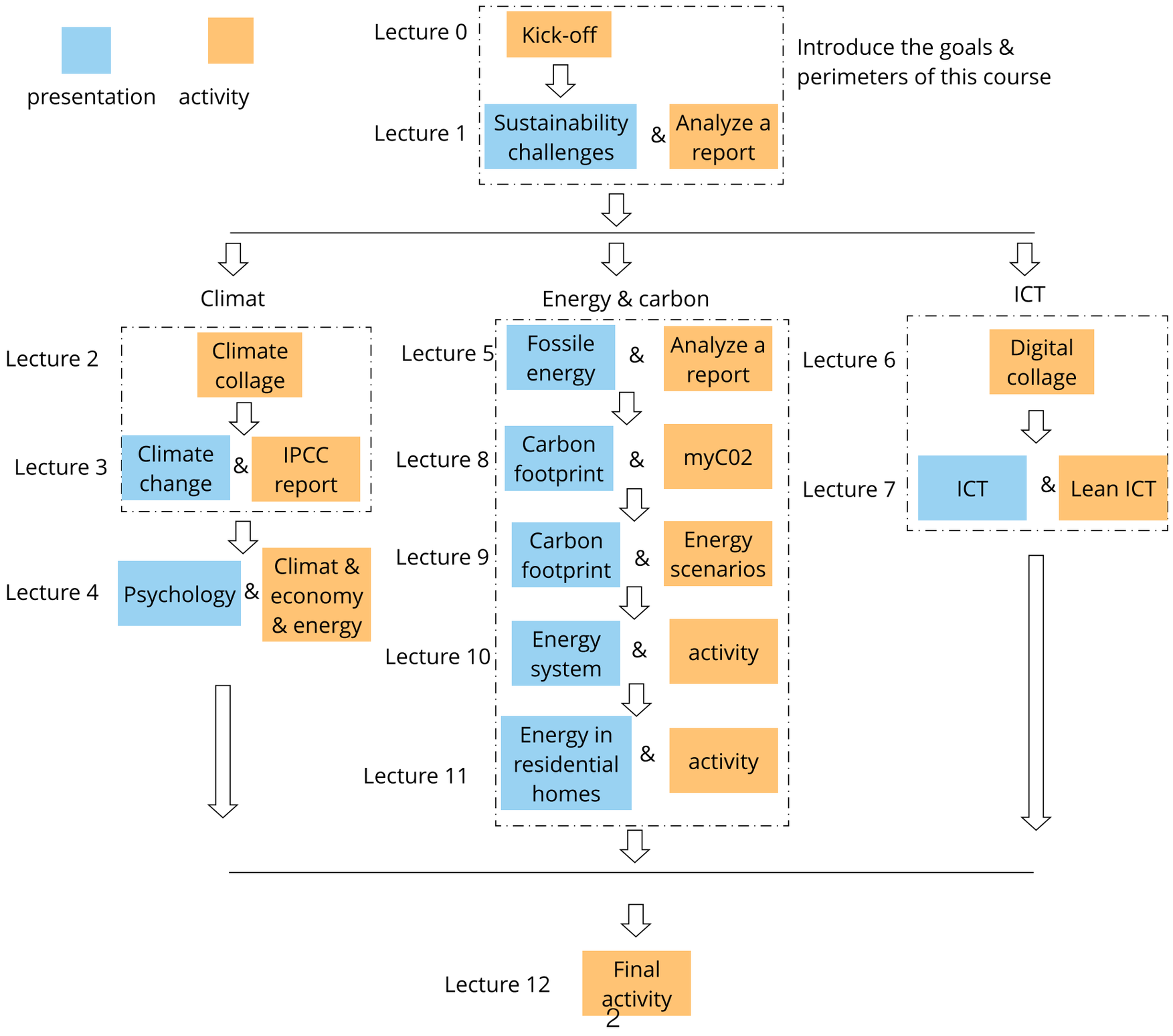
ENVT3065 Sustainability challenges
Lecture 1



Credits: https://theshiftproject.org/equipe/#benevoles

Lecture 1

Course map



Lecture 1

Credits

This lecture is mainly based on:

- Sustainable development & Transition given at the Catholic University of Louvain (UCL LEPL 1804). Professors: Bol David; Jeanmart Hervé; Luis Alconero Patricia; Marichal Xavier; Raskin Jean-Pierre;

- Sustainability development bachelor & lecture of Liège University. Professor: Aurore Degré.

- Jean-Marc Jancovici blog

Lecture 1

Goals

Sustainable development

Sustainable development goals

ENVT 3065 Sustainability Challenges's perimeter

Energy

Rebound effect

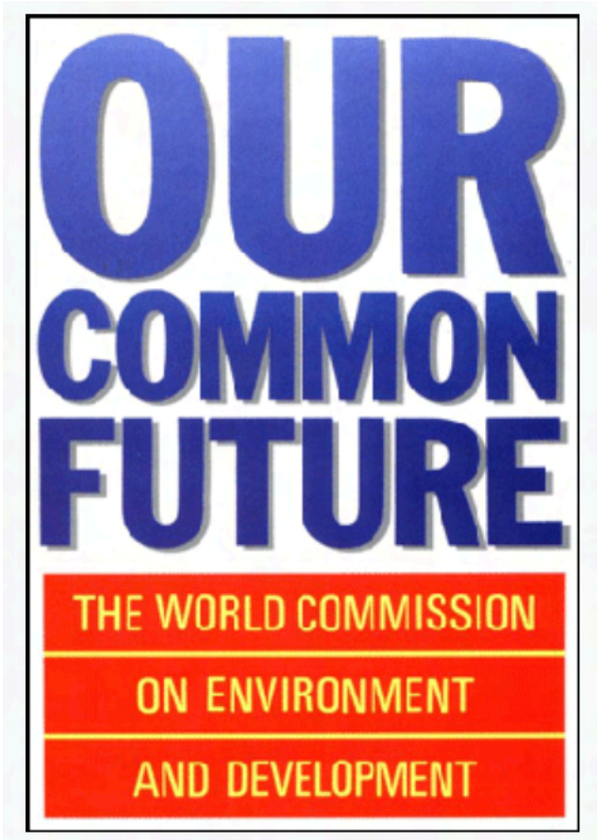
Challenges

Lecture 1

Sustainable development

Our Common Future also known as the Brundtland Report, was published on October 1987 by the United Nations through the Oxford University Press.

The report defined '**sustainable development**' as "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*".

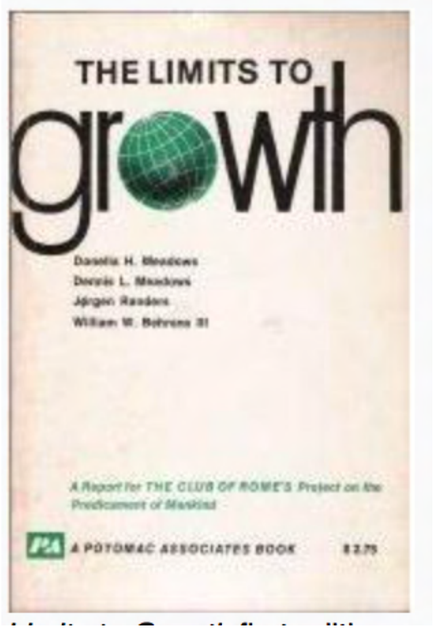


Lecture 1

Sustainable development

The limits to growth is a 1972 report on the exponential economic and population growth with a finite supply of resources, **studied by computer simulation**.

Commissioned by the Club of Rome, the findings of the study were first presented at international gatherings in Moscow and Rio de Janeiro in the summer of 1971. The report's authors are *Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W. Behrens III, representing a team of 17 researchers*.

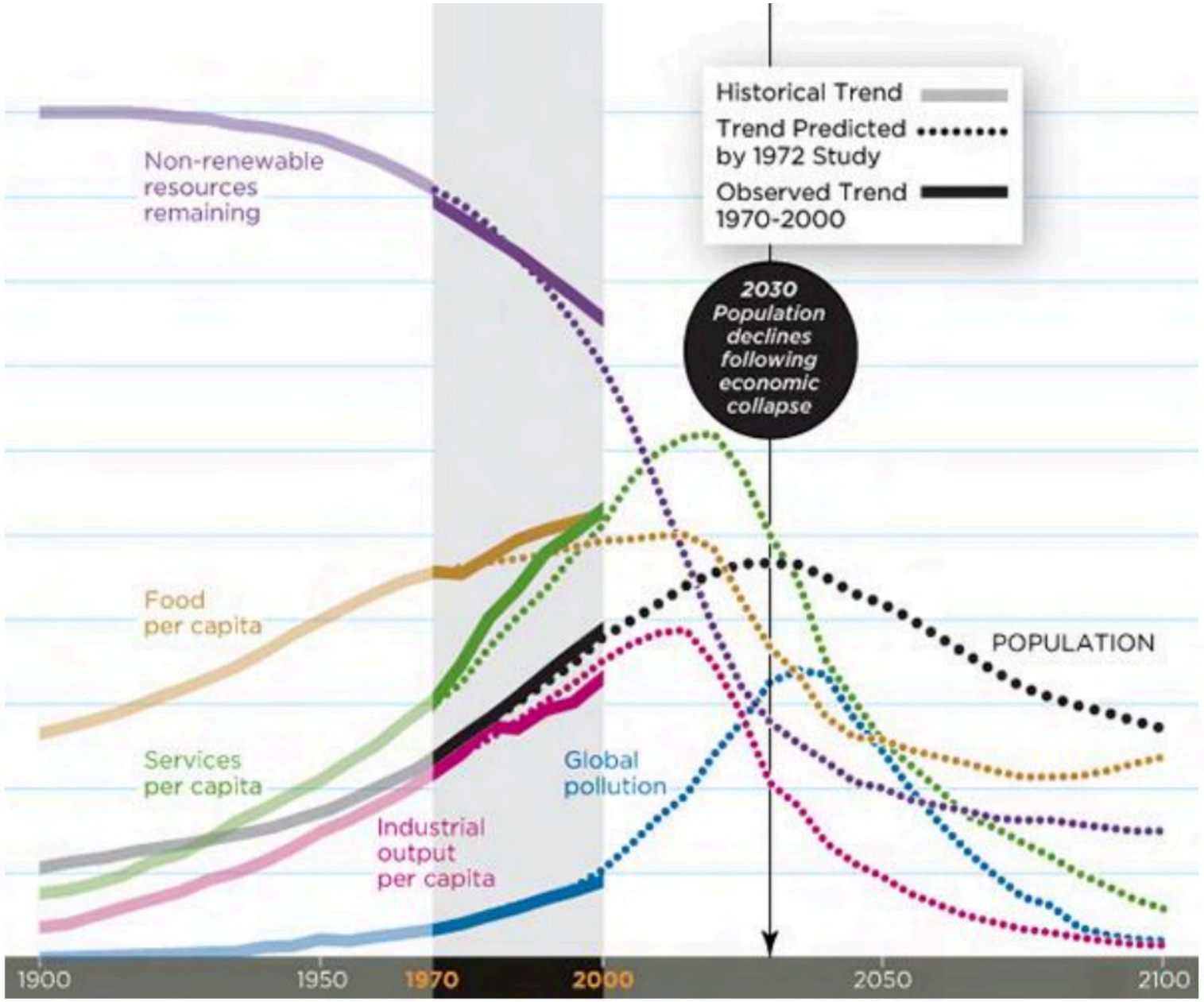


Lecture 1

Sustainable development

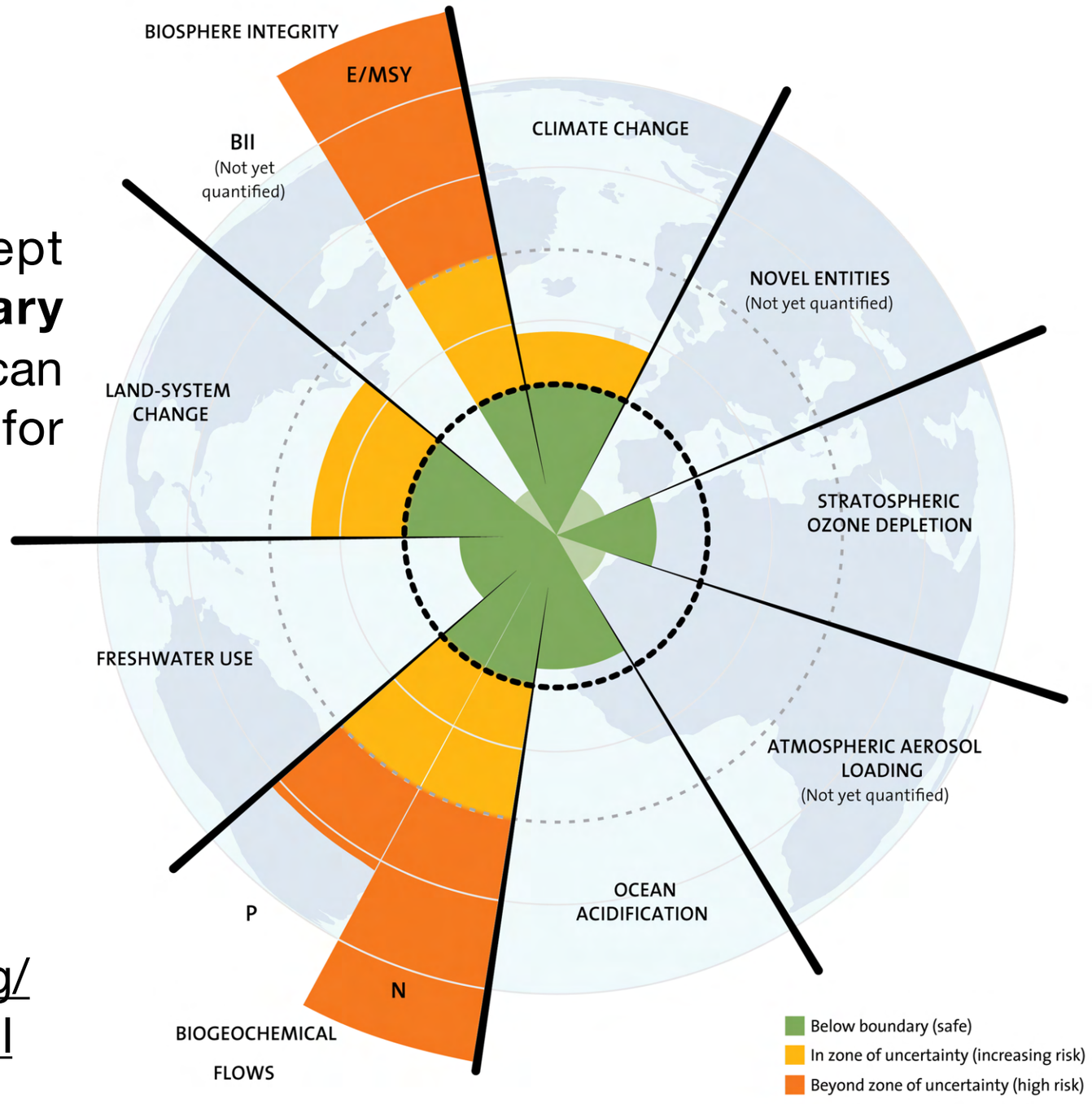
1970 - 2000: the data are in line with the model!

Major trends:
- depletion of non-renewable resources
- malnutrition
- increase in the quality of services
- rapid population growth
- accelerated industrialization
- deteriorated environment



Lecture 1
Sustainable development: planetary boundaries

The planetary boundaries concept presents a set of **nine planetary boundaries** within which humanity can continue to develop and thrive for generations to come.



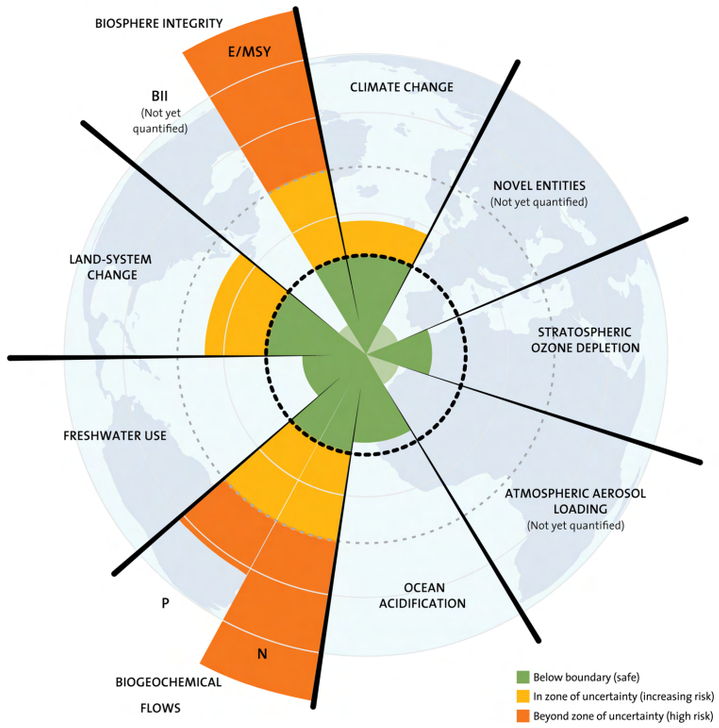
https://www.stockholmresilience.org/research/planetary-boundaries.html

Credits: J. Lokrantz/Azote based on Steffen et al. 2015.

Lecture 1
Sustainable development: planetary boundaries

To go further:

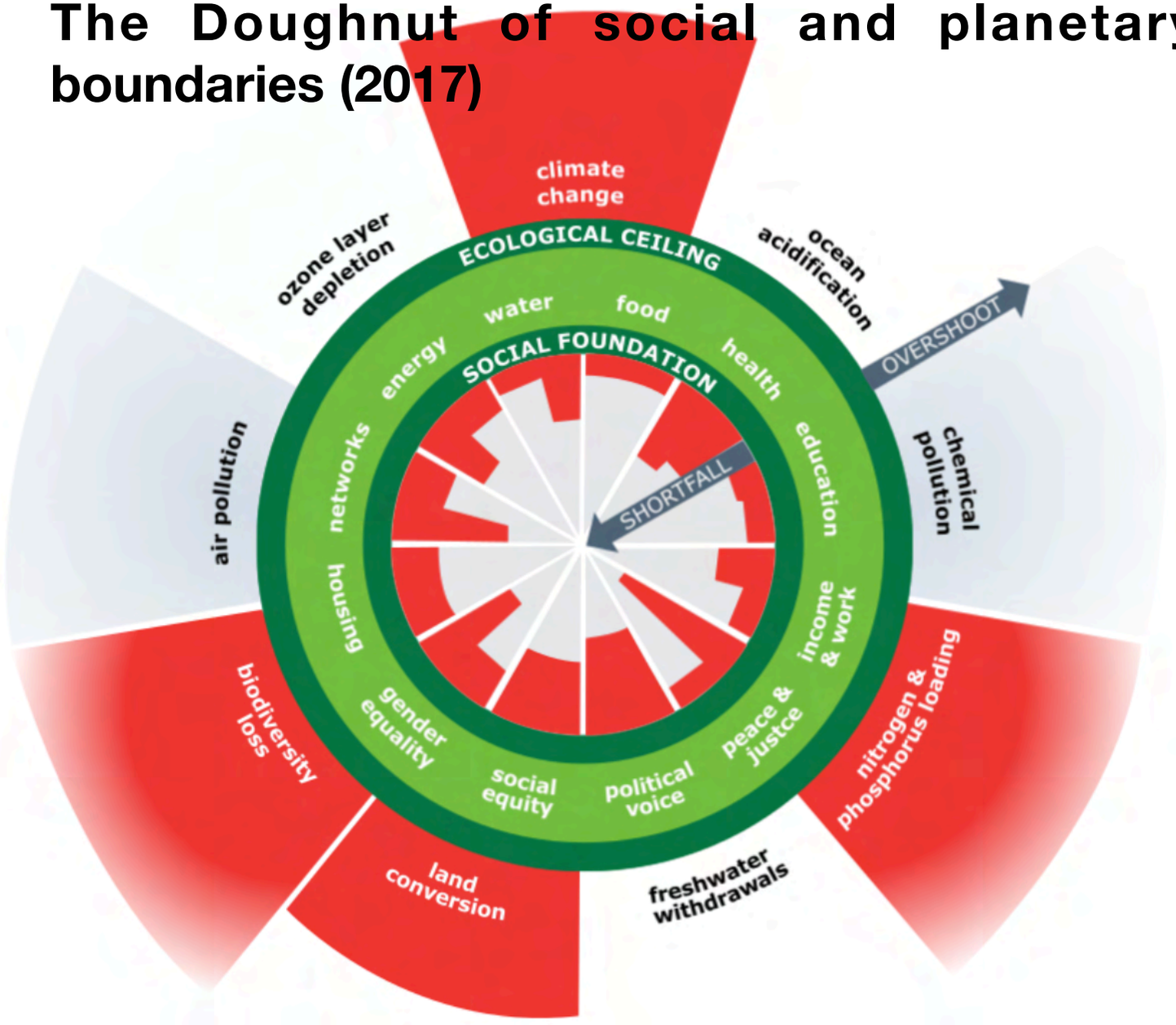
Johan Rockström introduces the Planetary Boundaries framework at TED Global 2010. https://youtu.be/RgqtrlixYR4



Steffen, Will, et al. "Planetary boundaries: Guiding human development on a changing planet." Science 347.6223 (2015). https://science.sciencemag.org/content/347/6223/1259855

Lecture 1
Sustainable development: DONUT !

The Doughnut of social and planetary boundaries (2017)

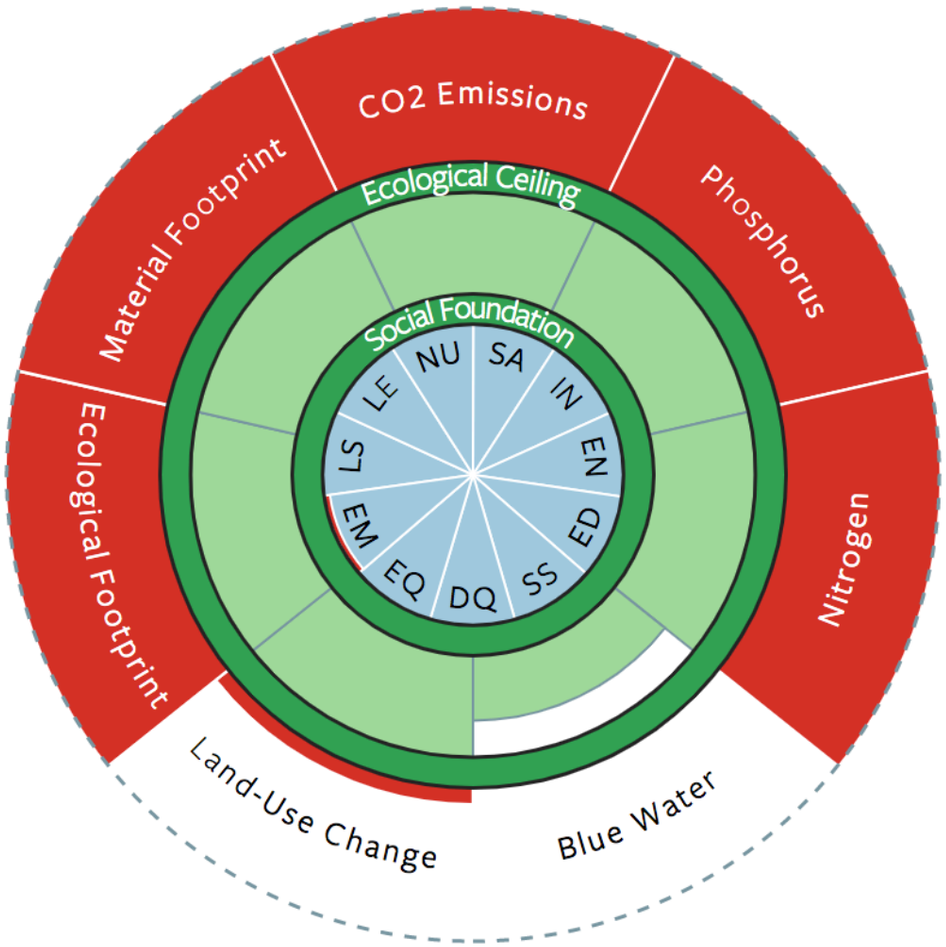


TED: A healthy economy should be designed to thrive, not grow

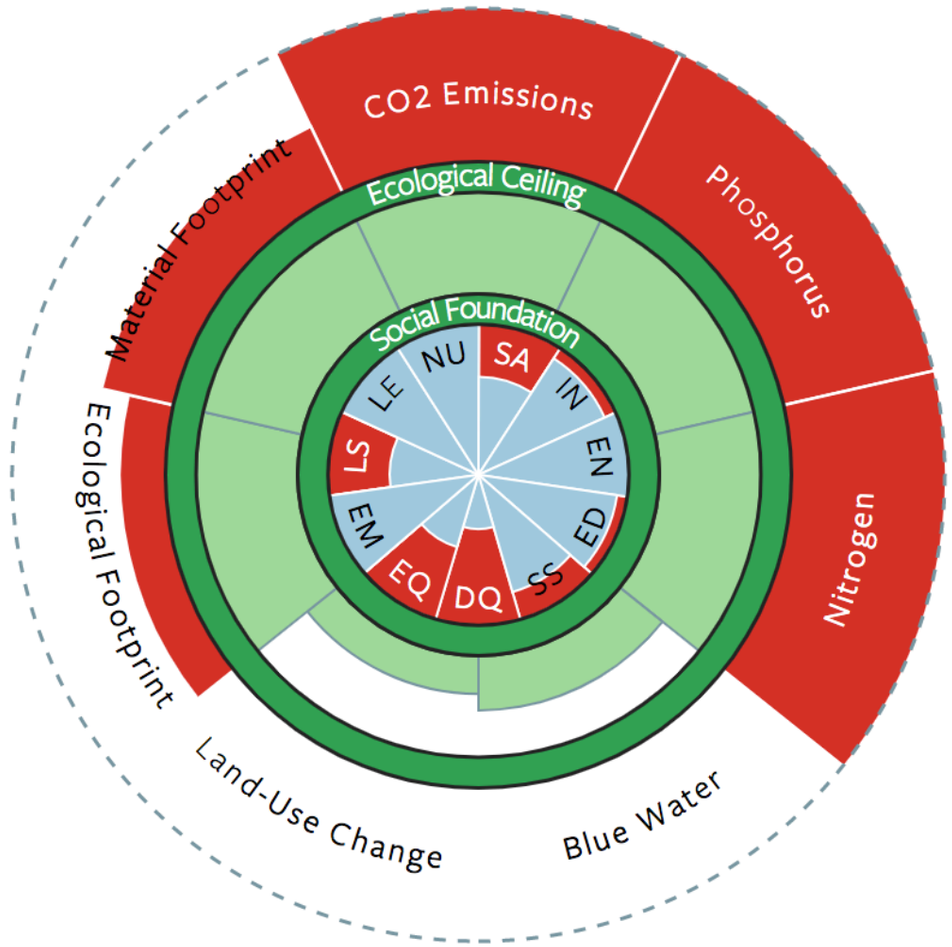
https://www.kateraworth.com/doughnut/

Lecture 1
Sustainable development: DONUT !

Belgium



China

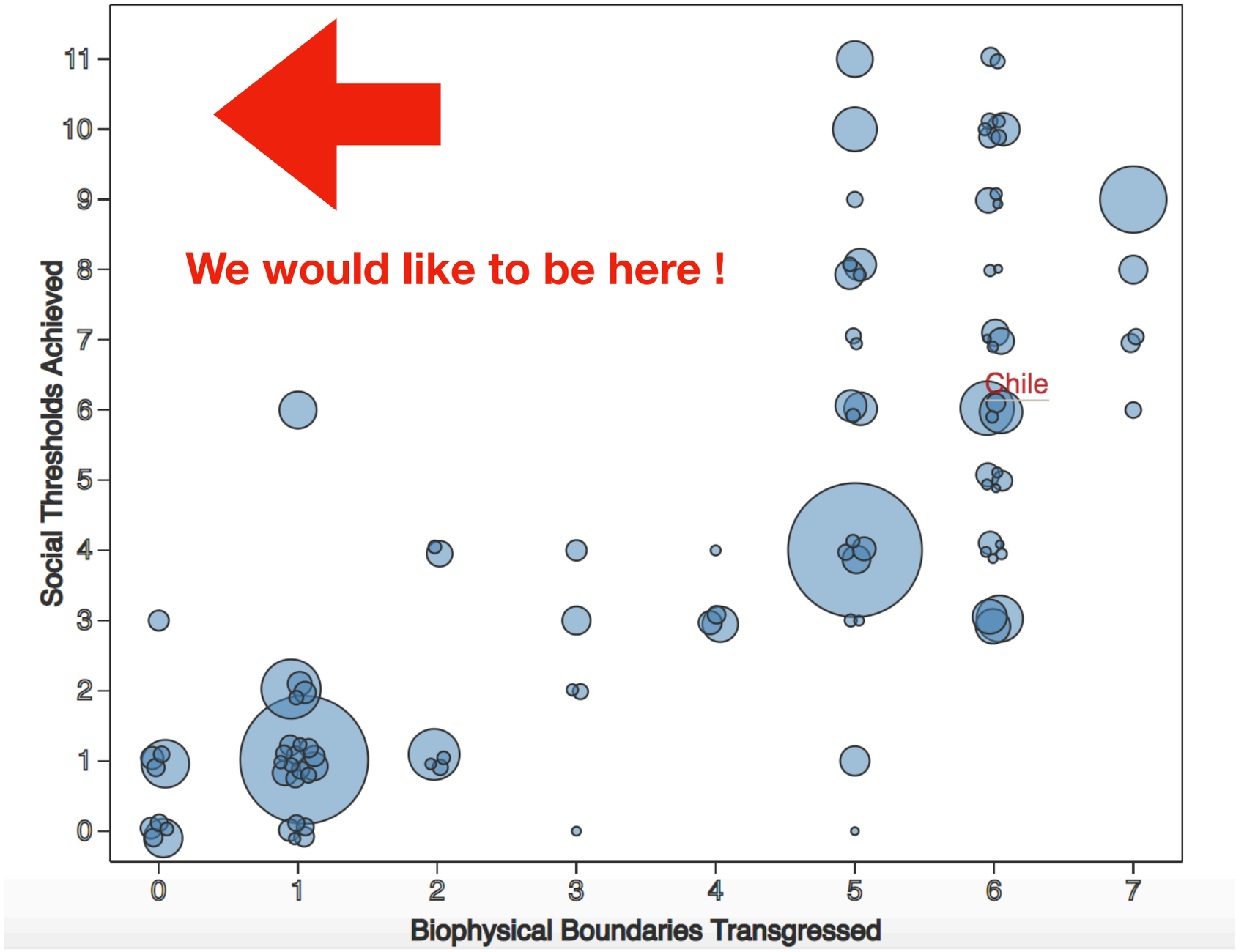


LS - Life Satisfaction	ED - Education
LE - Healthy Life Expect.	SS - Social Support
NU - Nutrition	DQ - Democratic Quality
SA - Sanitation	EQ - Equality
IN - Income	EM - Employment
EN - Access to Energy	

A Good Life For All Within Planetary Boundaries

https://goodlife.leeds.ac.uk/

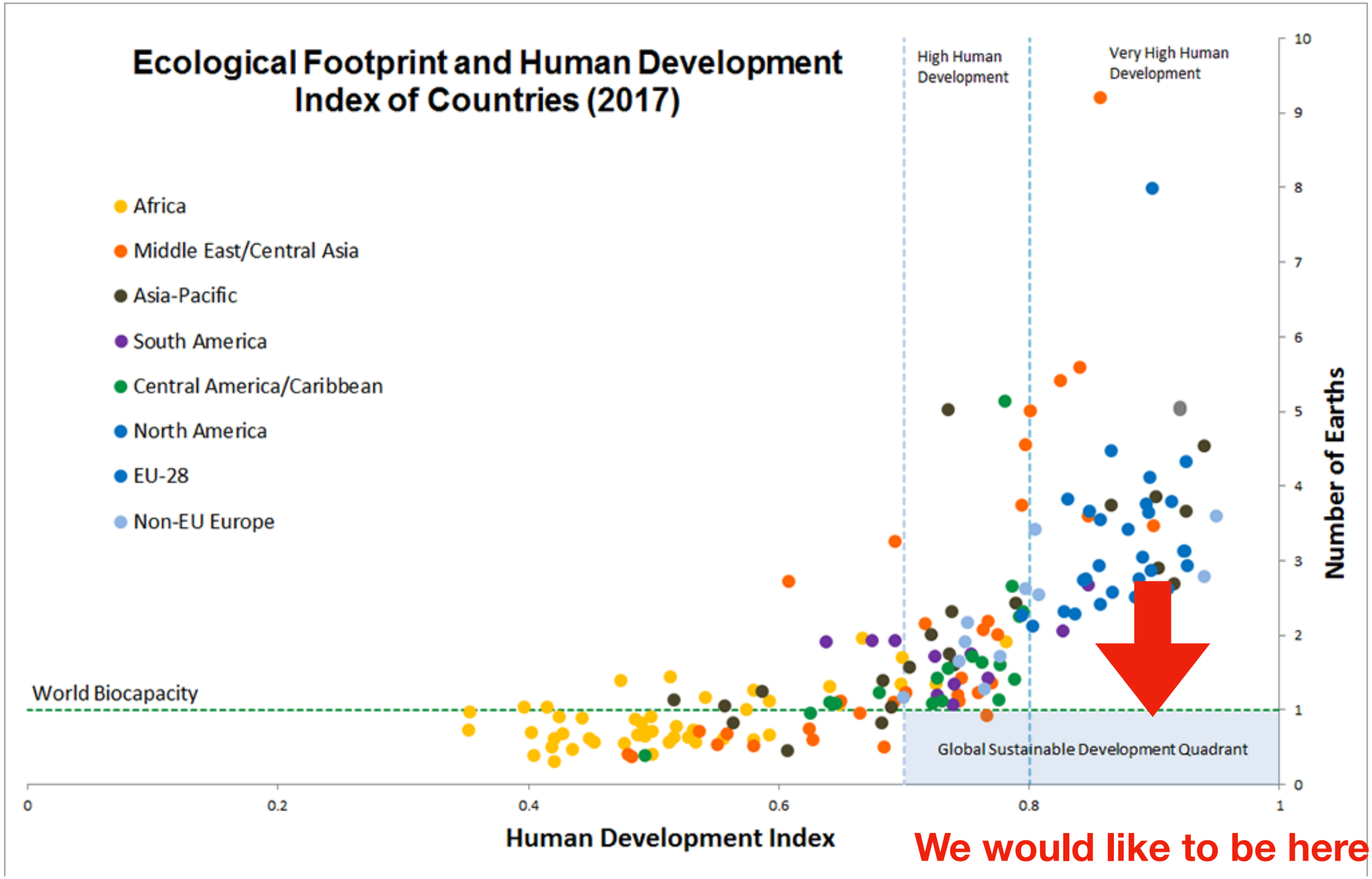
Lecture 1
Sustainable development: boundaries vs social thresholds



Biophysical Boundaries Transgressed versus Social Thresholds Achieved by Nation

https://goodlife.leeds.ac.uk/

Lecture 1
Sustainable development: ecological footprint vs HDI



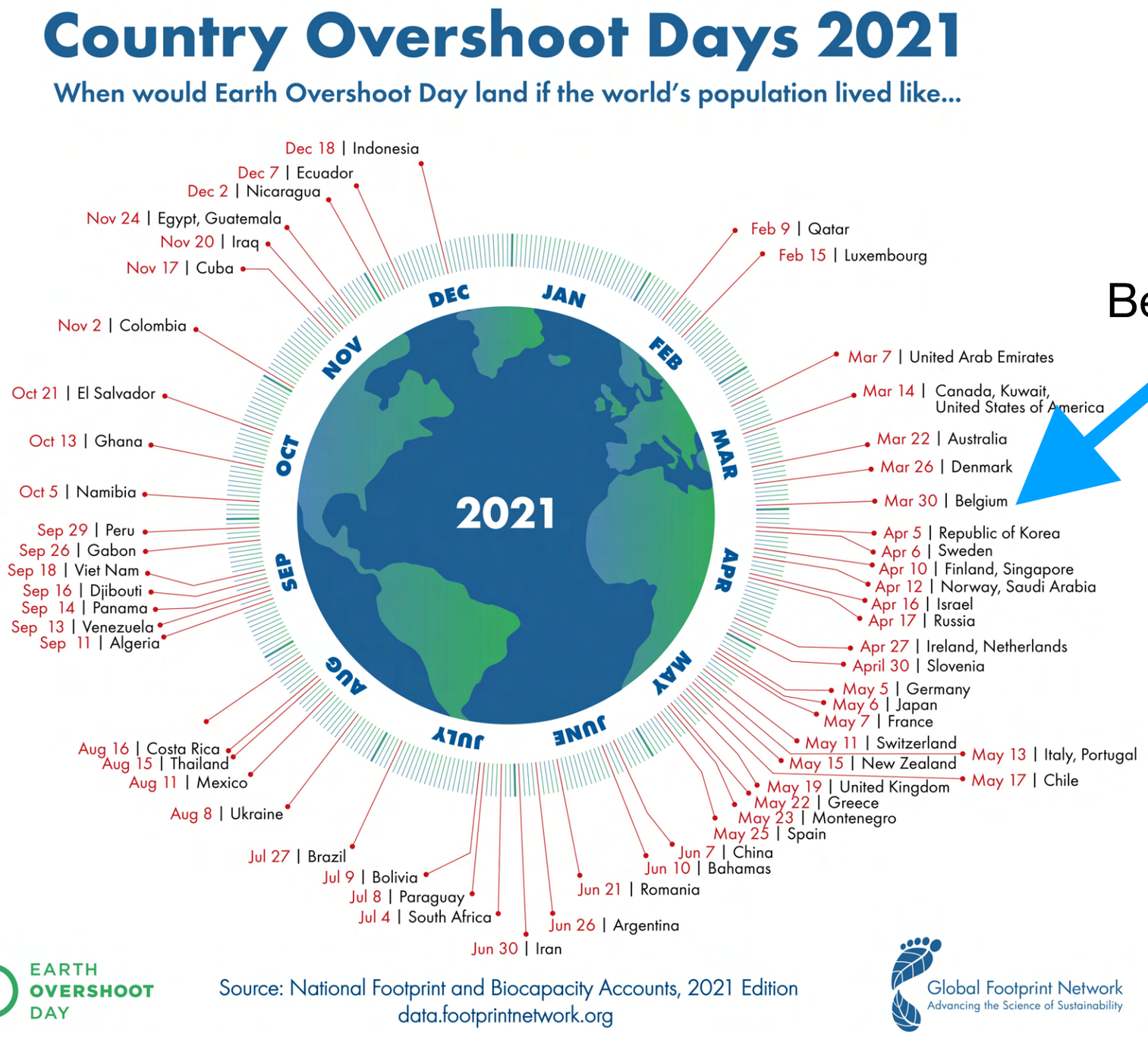
https://www.footprintnetwork.org/our-work/sustainable-development/

Lecture 1
Sustainable development: country overshoot day

A **country's overshoot day** is the date on which Earth Overshoot Day would fall if all of humanity consumed like the people in this country.
https://www.overshootday.org/newsroom/country-overshoot-days/

Lecture 1
Sustainable development: country overshoot day

In 2021, Earth Overshoot Day lands on July 29.



Belgium

Lecture 1

Goals

Sustainable development

Sustainable development goals

ENVT 3065 Sustainability Challenges's perimeter

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Lecture 1
Sustainable Development Goals

UN Sustainable Development Goals SDGs

Do you know the **15 SDGs** ?
https://youtu.be/0XTBYMfZyrM

Lecture 1
Sustainable Development Goals

https://www.un.org/sustainabledevelopment/news/communications-material/

Lecture 1

Goals

Sustainable development

Sustainable development goals

ENVT 3065 Sustainability Challenges's perimeter

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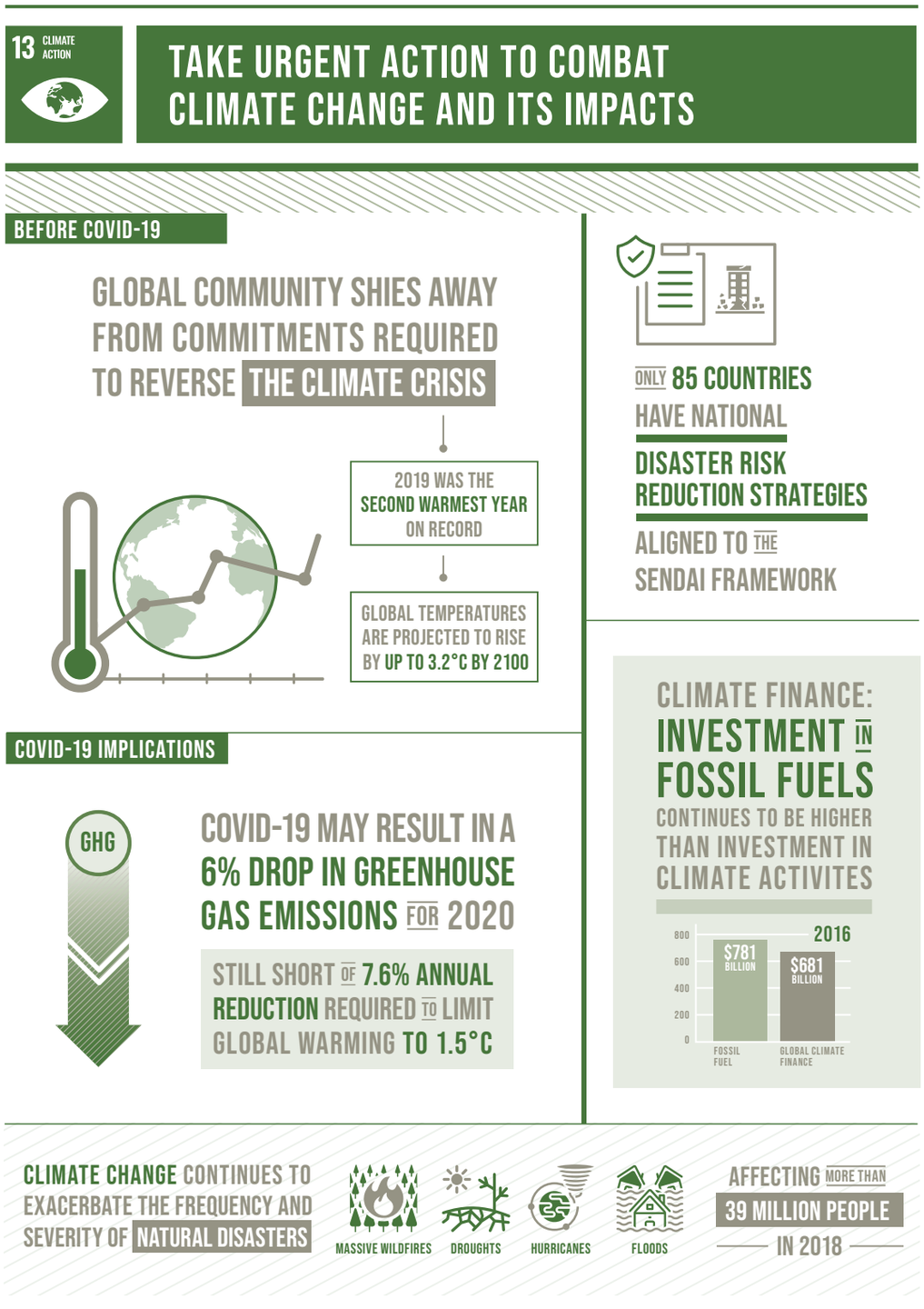
Lecture 1

Course perimeter

https://www.un.org/sustainabledevelopment/news/communications-material/

Lecture 1

Climat Change



13 CLIMATE ACTION

To limit global warming to 1.5C, as called for in the Paris Agreement, greenhouse gas emissions must begin falling by **7.6 % each year** starting in 2020

CLIMATE ACTION: WHY IT MATTERS

What's the goal here?

Taking urgent action to tackle climate change and its impacts.

Why?

The climate crisis continues unabated as the global community shies away from the full commitment required for its reversal. 2010-2019 was warmest decade ever recorded, bringing with it massive wildfires, hurricanes, droughts, floods and other climate disasters across continents.

How are people being affected by climate change?

Climate change is affecting every country in the world. It is disrupting national economies and affecting lives and livelihoods, especially for the most vulnerable.

Weather patterns are changing, sea levels are rising, and weather events are becoming more extreme,

The Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.

SPECIAL REPORT: GLOBAL WARMING OF 1.5 ºC
https://www.ipcc.ch/sr15/

Lecture 1

Climat Change

A.2. Warming from anthropogenic emissions from the pre-industrial period to the present will persist for centuries to millennia and will continue to cause further long-term changes in the climate system, such as sea level rise, with associated impacts (*high confidence*), but these emissions alone are *unlikely* to cause global warming of 1.5°C (*medium confidence*). (Figure SPM.1) {1.2, 3.3, Figure 1.5}

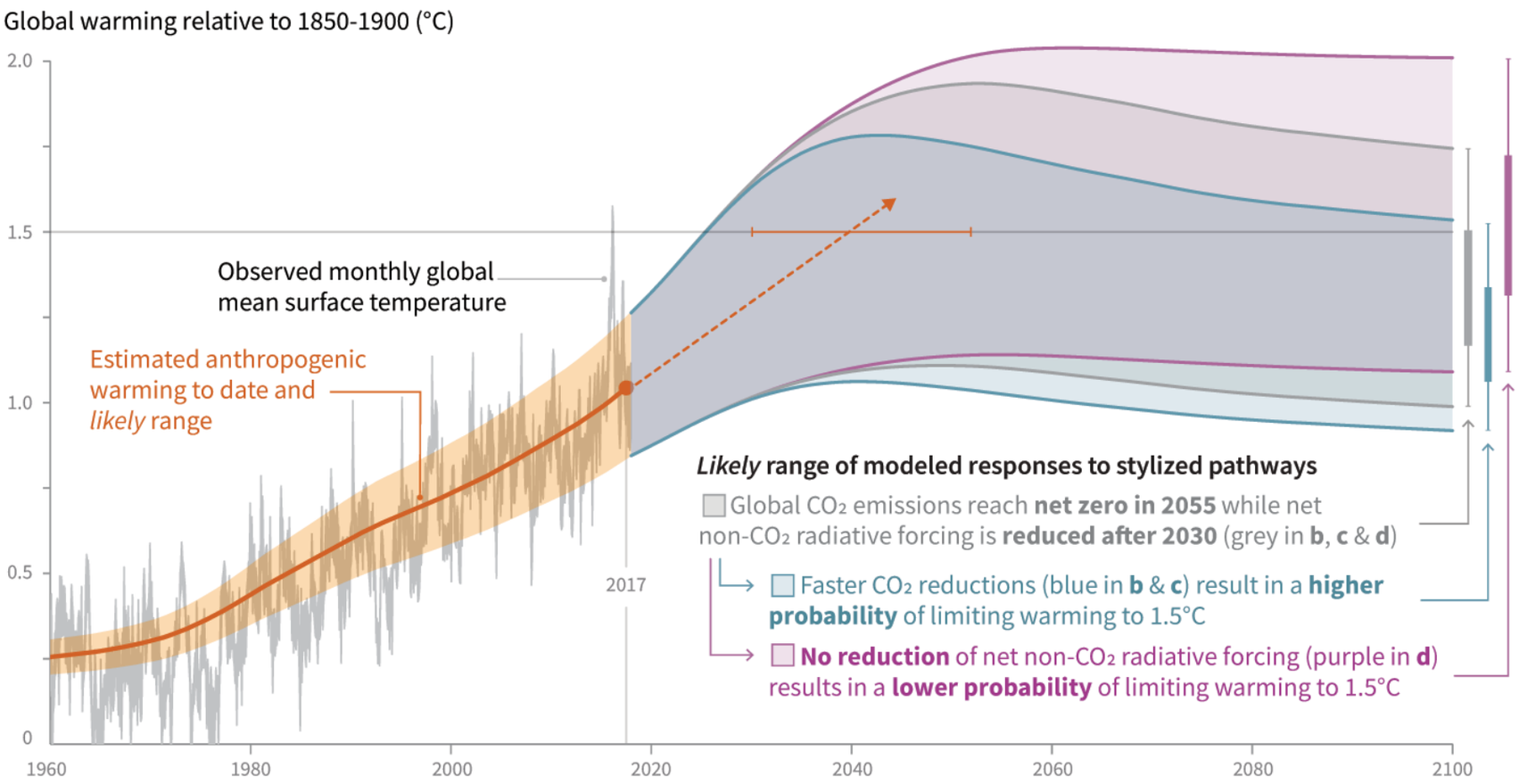
Summary for Policymakers
https://www.ipcc.ch/sr15/chapter/spm/

Lecture 1

Climat Change

Cumulative emissions of CO_2 and future non-CO_2 radiative forcing determine the probability of limiting warming to 1.5°C

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

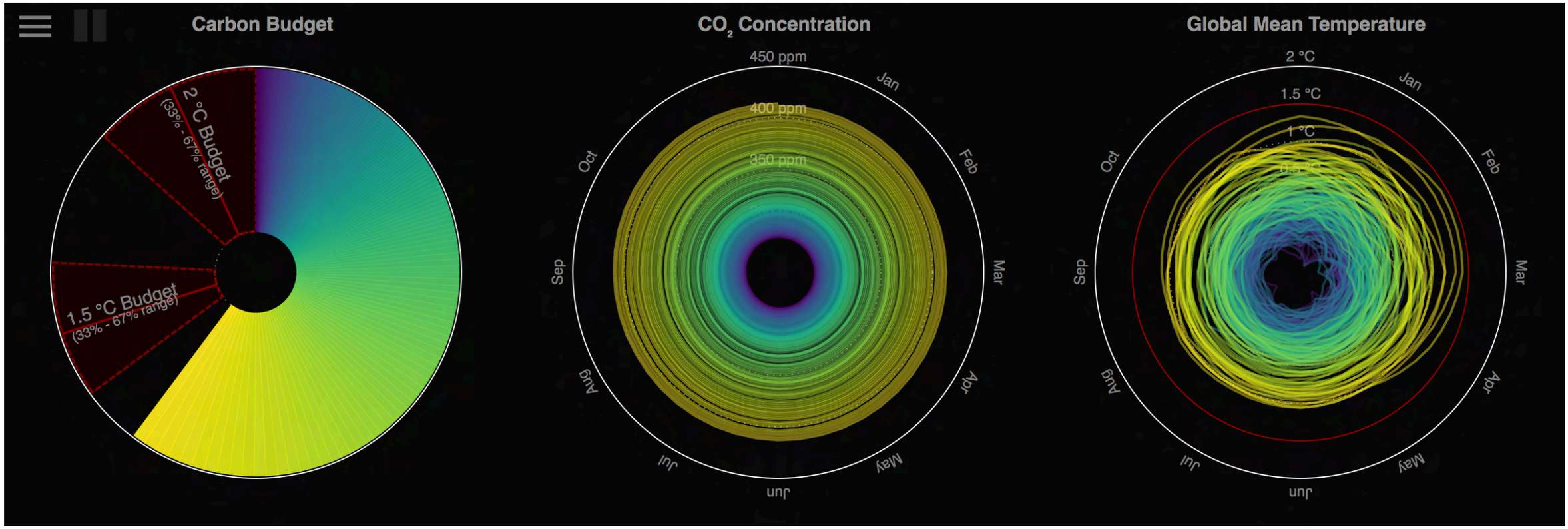


Summary for Policymakers
https://www.ipcc.ch/sr15/chapter/spm/

Lecture 1

Climat Change

Combined animations for temperature, CO2 and carbon budgets



openclimatedata.net

Lecture 1

Climat Change

C.1. In model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO_2 emissions decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range). For limiting global warming to below 2°C FN 12 **CO_2 emissions are projected to decline by about 25% by 2030 in most pathways (10–30% interquartile range) and reach net zero around 2070 (2065–2080 interquartile range). Non-CO_2 emissions in pathways that limit global warming to 1.5°C show deep reductions that are similar to those in pathways limiting warming to 2°C. *(high confidence)* (Figure SPM.3a) {2.1, 2.3, Table 2.4}**

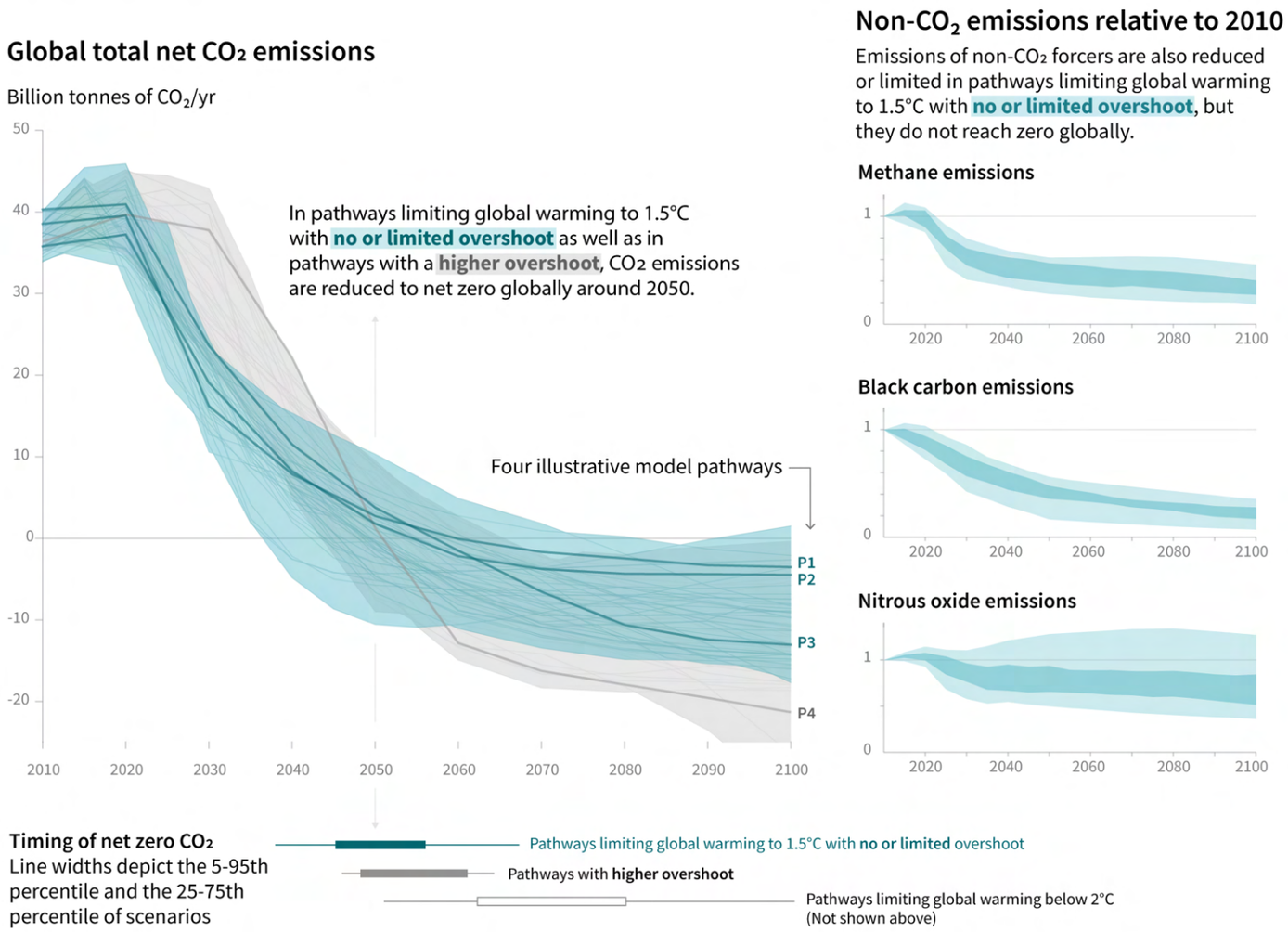
Summary for Policymakers
https://www.ipcc.ch/sr15/chapter/spm/

Lecture 1

Climat Change

Global emissions pathway characteristics

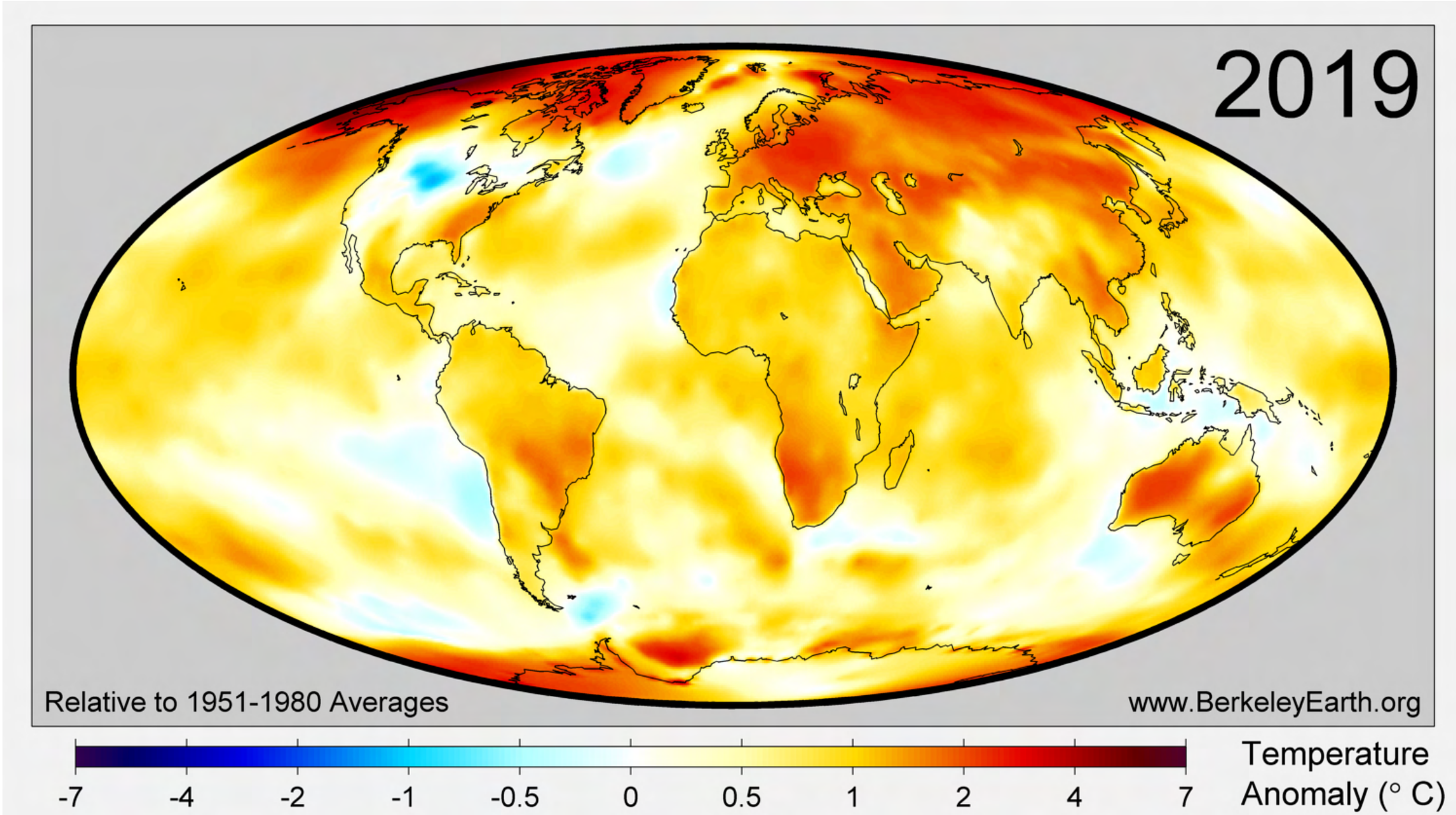
General characteristics of the evolution of anthropogenic net emissions of CO_2, and total emissions of methane, black carbon, and nitrous oxide in model pathways that limit global warming to 1.5°C with no or limited overshoot. Net emissions are defined as anthropogenic emissions reduced by anthropogenic removals. Reductions in net emissions can be achieved through different portfolios of mitigation measures illustrated in Figure SPM.3b.



Summary for Policymakers
https://www.ipcc.ch/sr15/chapter/spm/

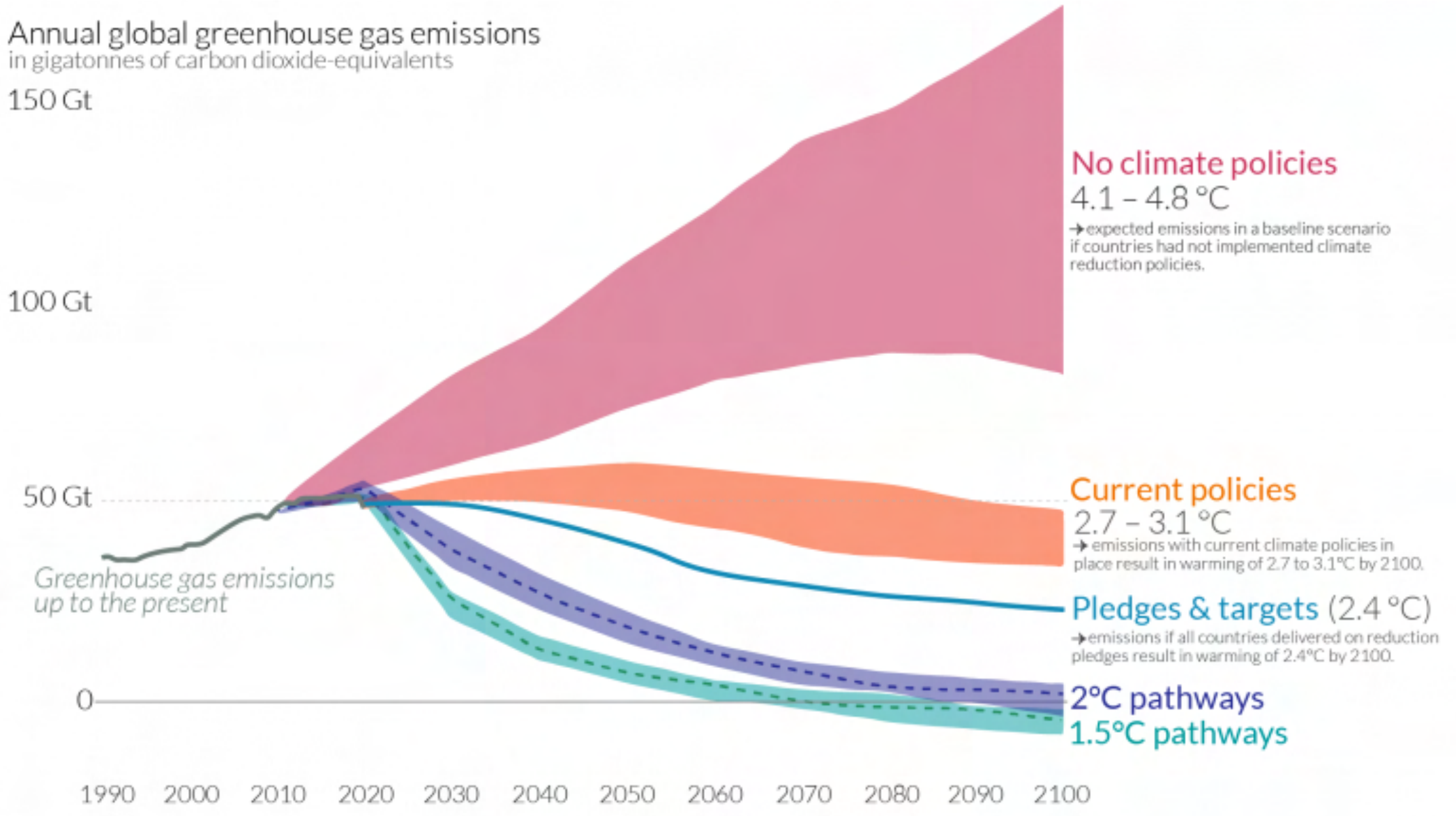
Lecture 1

Climat Change



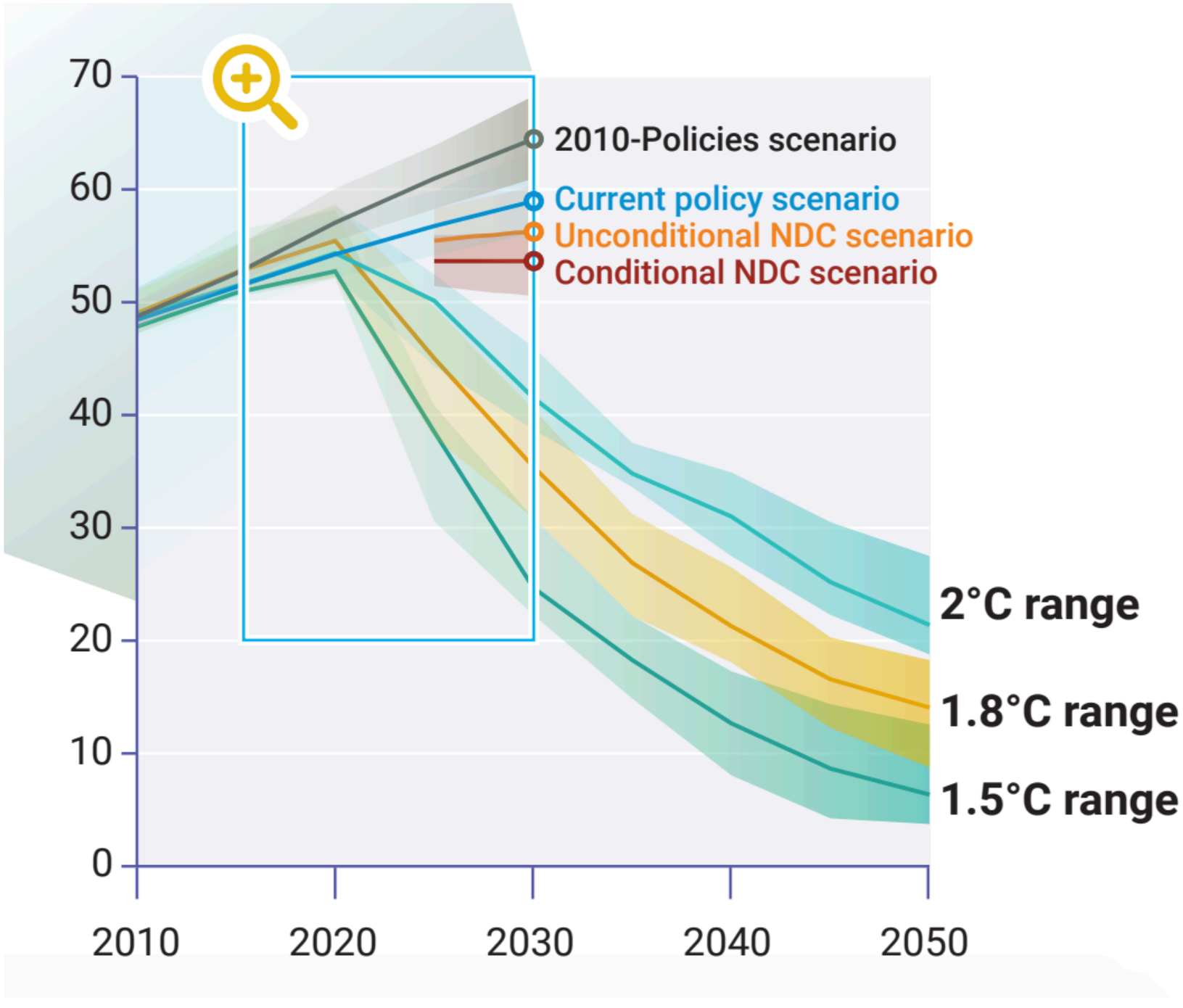
from the Berkeley Earth global temperature reports

Lecture 1
Climat Change & C02 & gaps



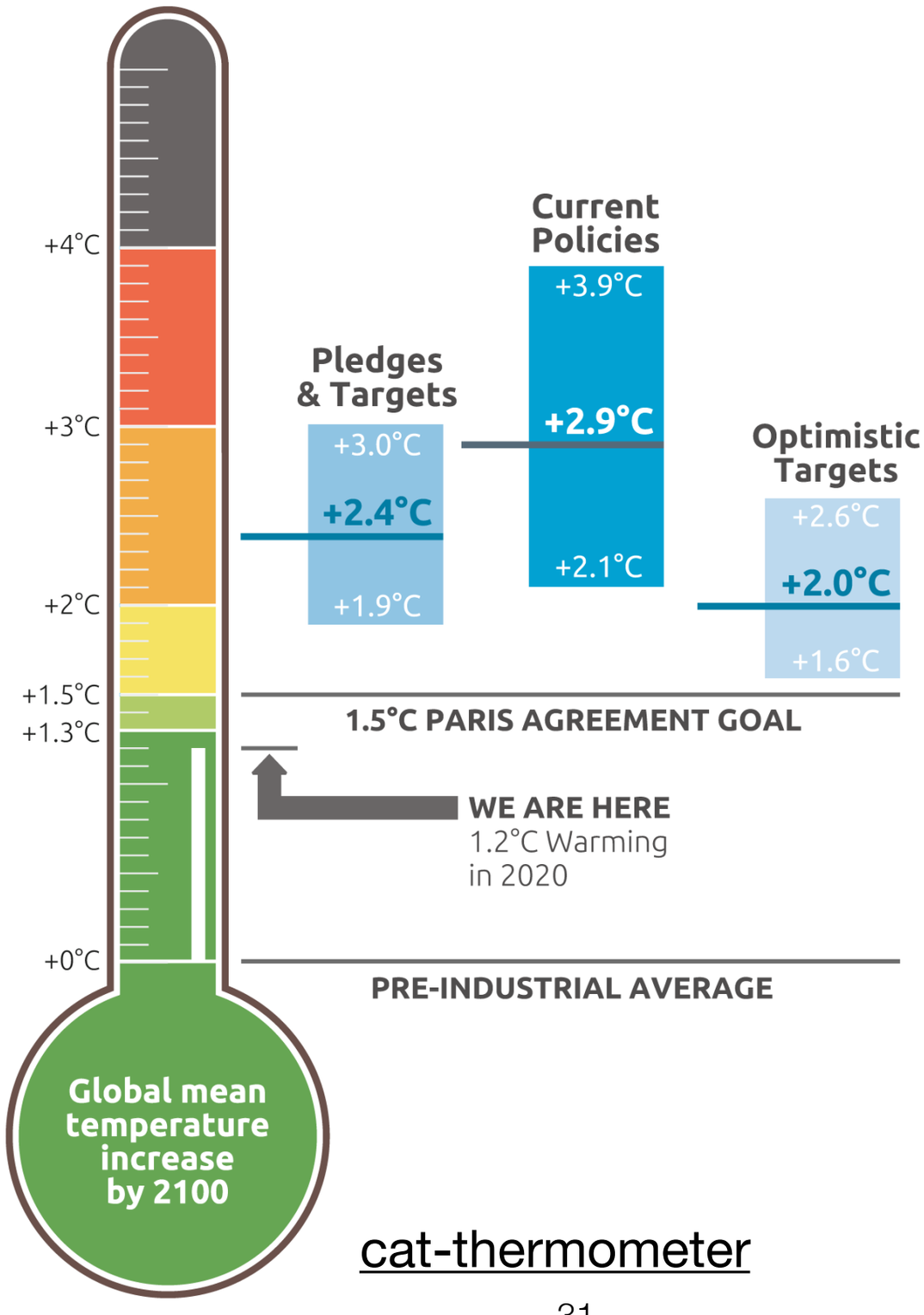
our world in data

Lecture 1
Climat Change & C02 & gaps



UN C02 gap

Lecture 1
Climat Change & C02 & gaps



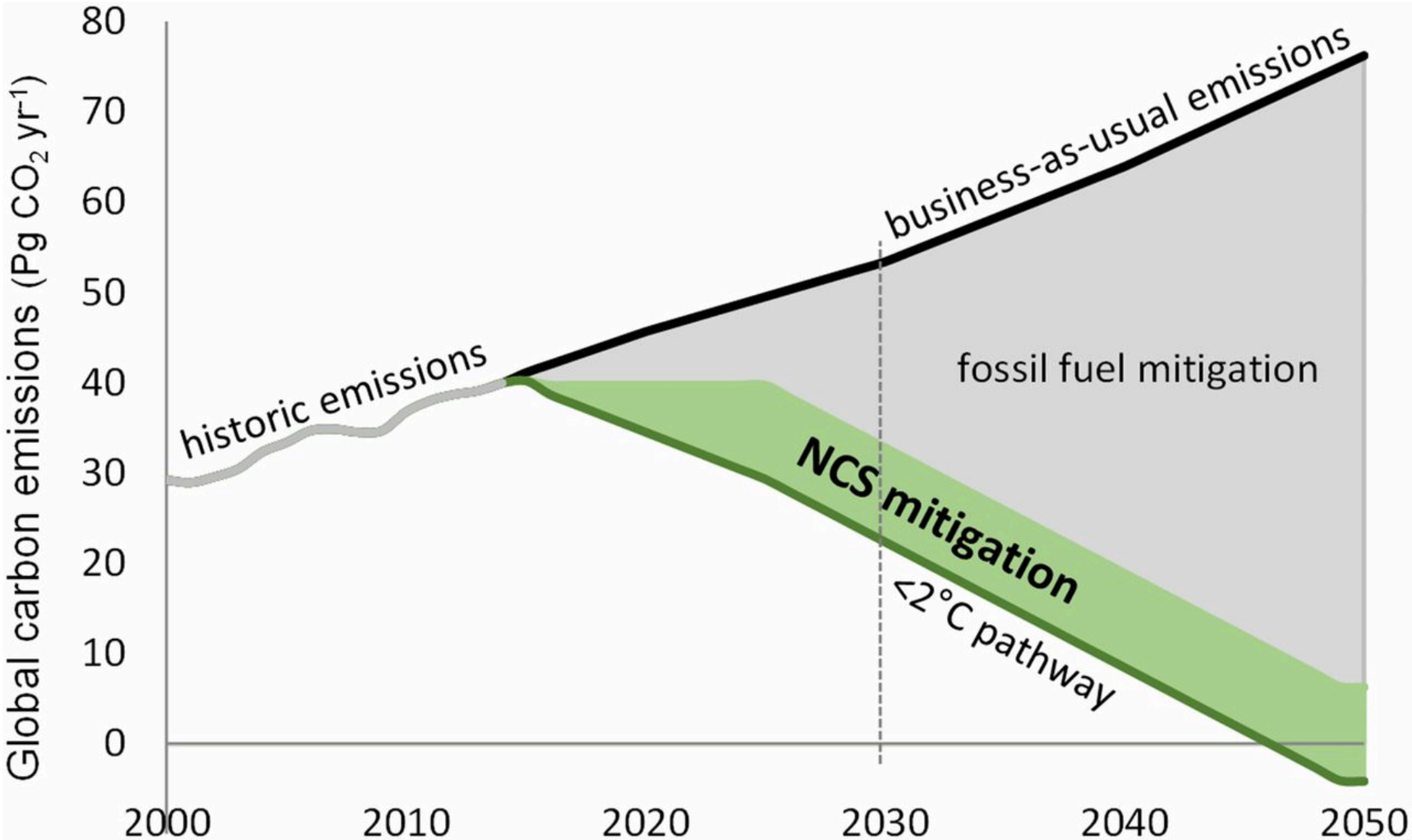
Climate Action Tracker

CAT warming projections
Global temperature increase by 2100

May 2021 Update

cat-thermometer

Lecture 1
Climat Change & C02 & Natural Climate Solutions (NCS)



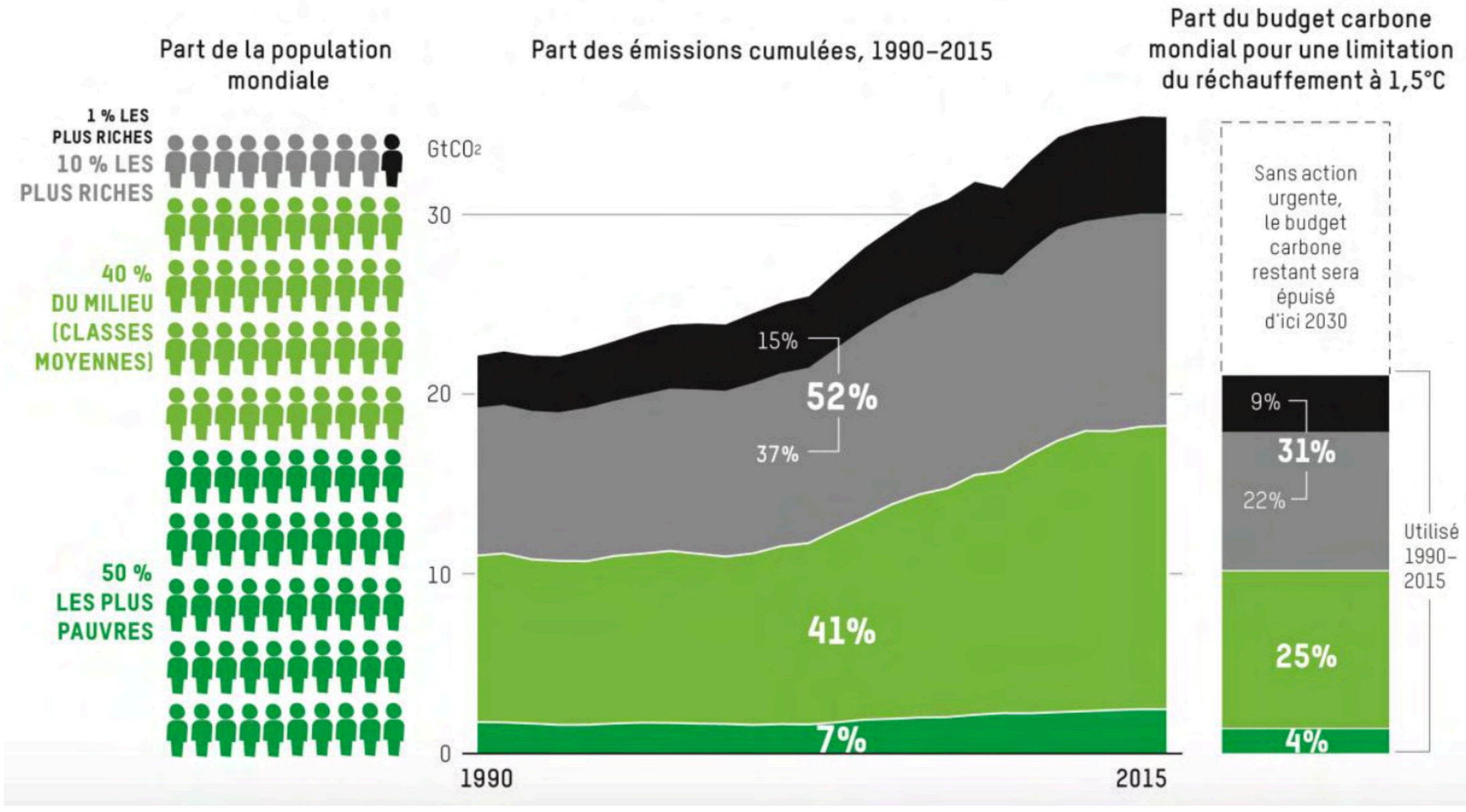
NCS cannot do job alone !

NCS cannot do job alone ! Reforestation is the main NCS.

Griscom, Bronson W., et al. "Natural climate solutions." Proceedings of the National Academy of Sciences 114.44 (2017): 11645-11650.

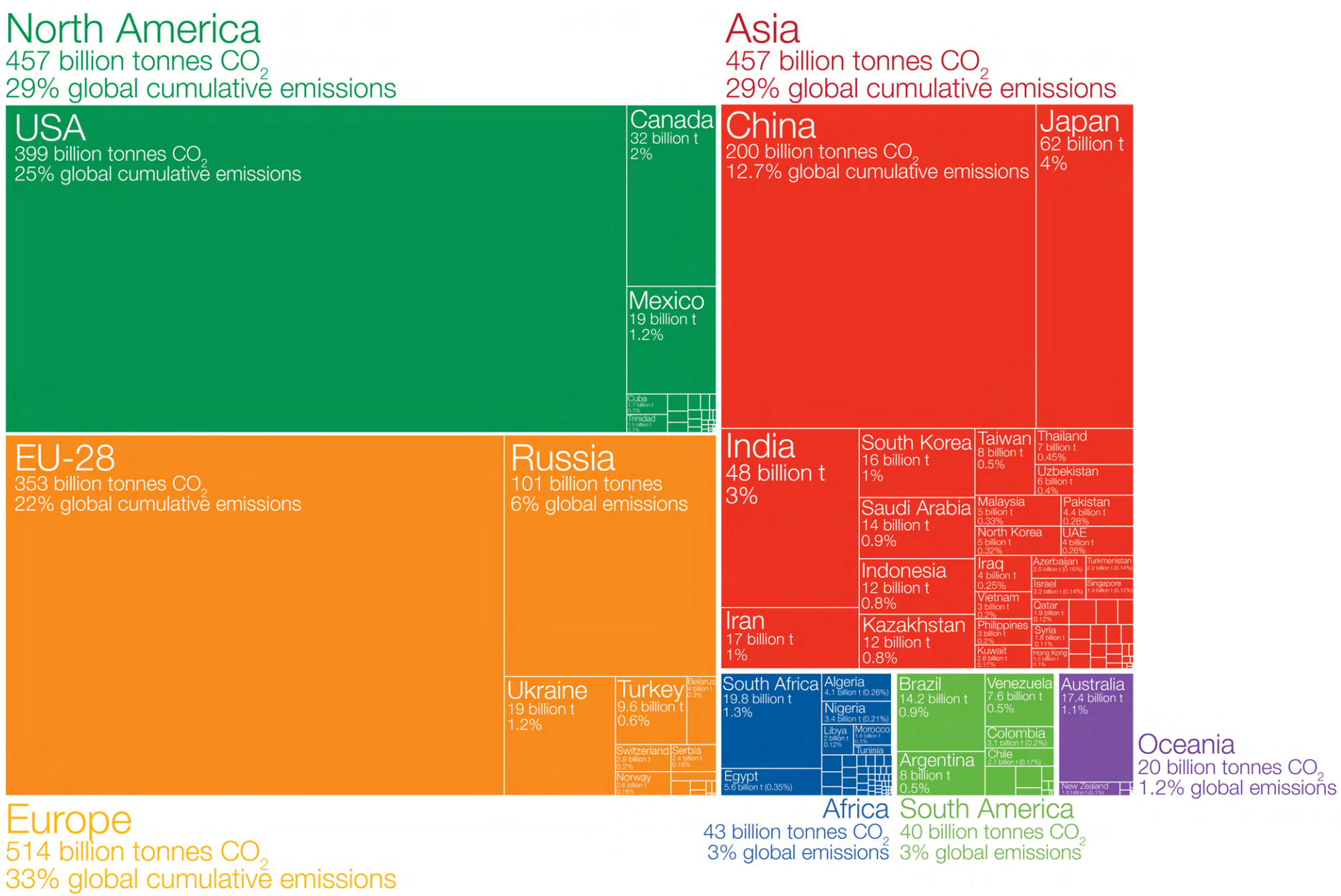
article

Lecture 1
Climat Change & C02 & inequalities



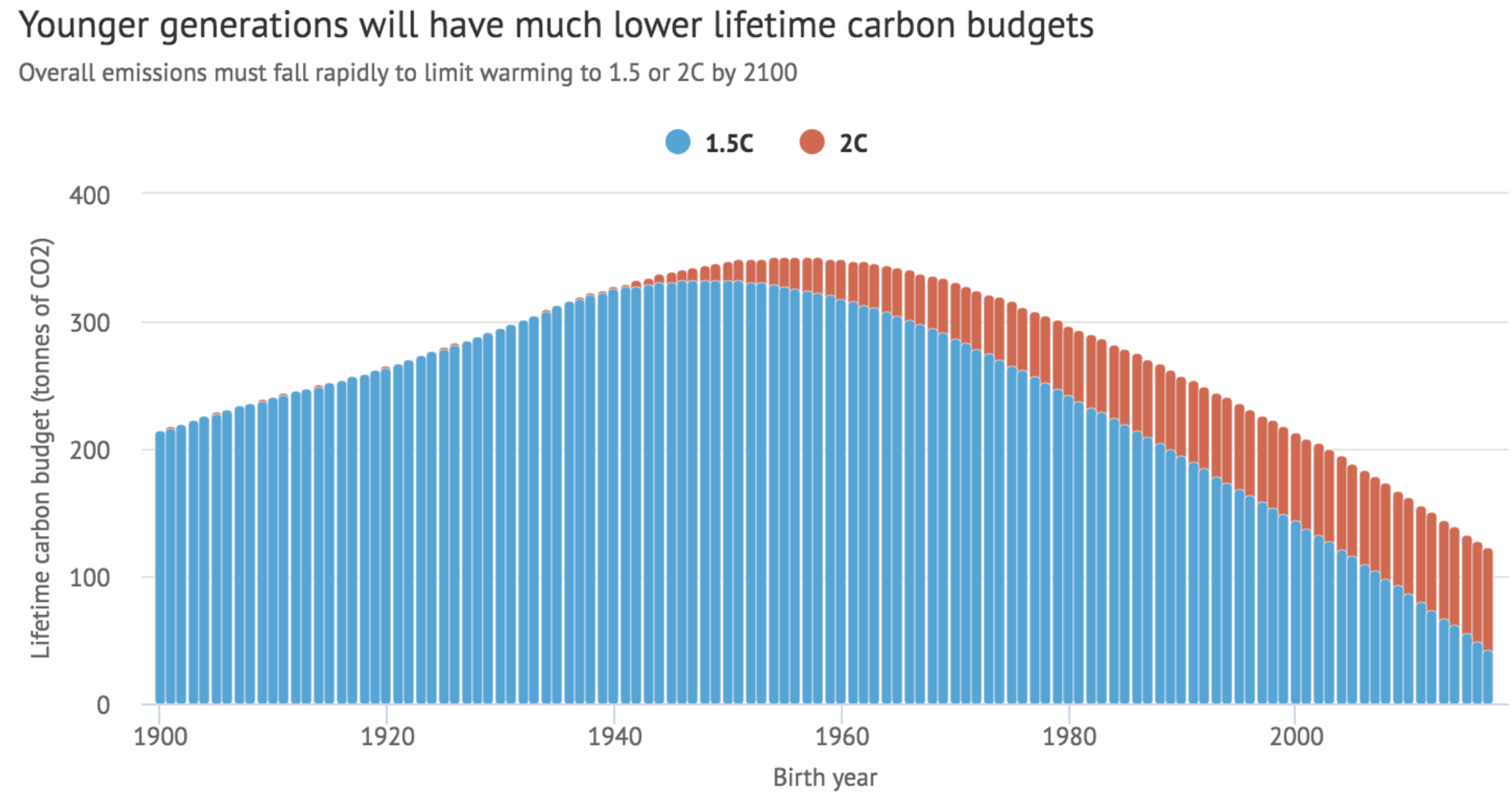
Oxfam

Lecture 1
Climat Change & C02 & inequalities



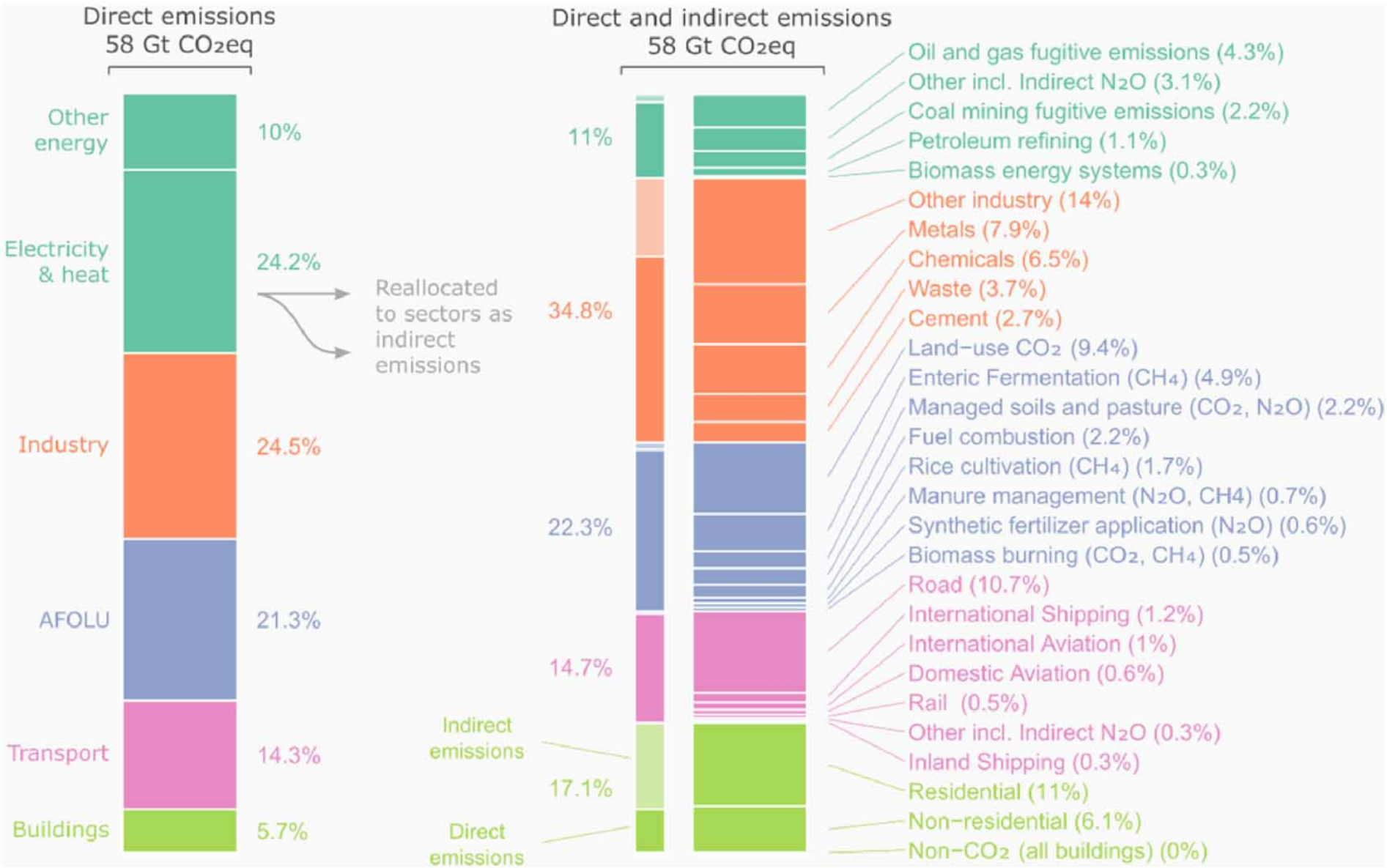
our world in data

Lecture 1
Climat Change & C02 & inequalities



carbonbrief

Lecture 1
Climat Change & C02 & sectors



Lamb, William F., et al. "A review of trends and drivers of greenhouse gas emissions by sector from 1990 to 2018." *Environmental Research Letters* (2021).

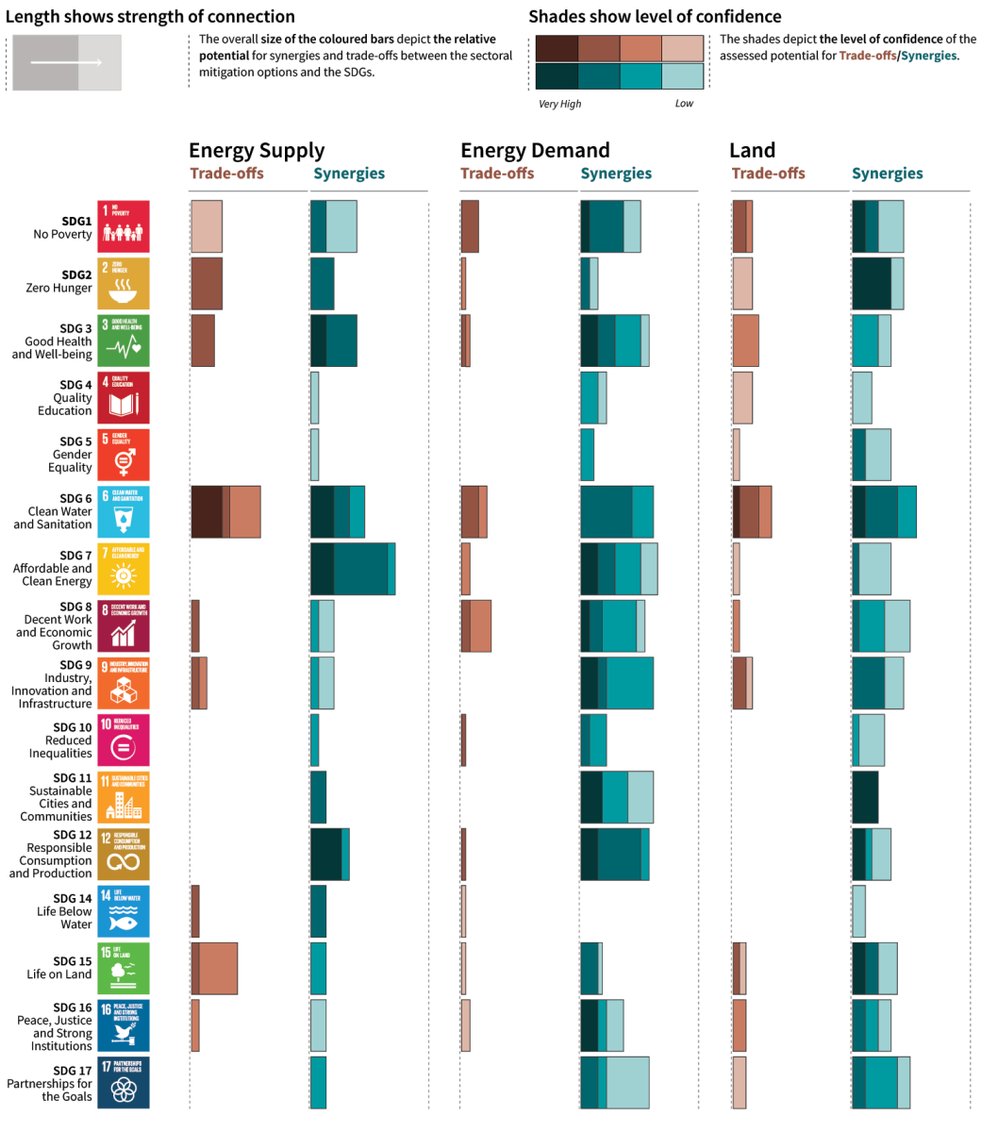
D.4. Mitigation options consistent with 1.5°C pathways are associated with multiple synergies and trade-offs across the Sustainable Development Goals (SDGs). While the total number of possible synergies exceeds the number of trade-offs, their net effect will depend on the pace and magnitude of changes, the composition of the mitigation portfolio and the management of the transition. ***(high confidence)*** **(Figure SPM.4) {2.5, 4.5, 5.4}**

Summary for Policymakers
https://www.ipcc.ch/sr15/chapter/spm/

Lecture 1
Climat Change & others SDGs

Indicative linkages between mitigation options and sustainable development using SDGs (The linkages do not show costs and benefits)

Mitigation options deployed in each sector can be associated with potential positive effects (synergies) or negative effects (trade-offs) with the Sustainable Development Goals (SDGs). The degree to which this potential is realized will depend on the selected portfolio of mitigation options, mitigation policy design, and local circumstances and context. Particularly in the energy-demand sector, the potential for synergies is larger than for trade-offs. The bars group individually assessed options by level of confidence and take into account the relative strength of the assessed mitigation-SDG connections.



Lecture 1

Course perimeter

WARNING!

We focus on climate change & energy but is does not solve the other issues (cf SDGs):

- Bio-diversity;
- Clean water
- Pollution;
- Inequalities;
- Etc

Everything must be address!

Lecture 1

Goals

Sustainable development

Sustainable development goals

ENVT 3065 Sustainability Challenges’s perimeter

Energy

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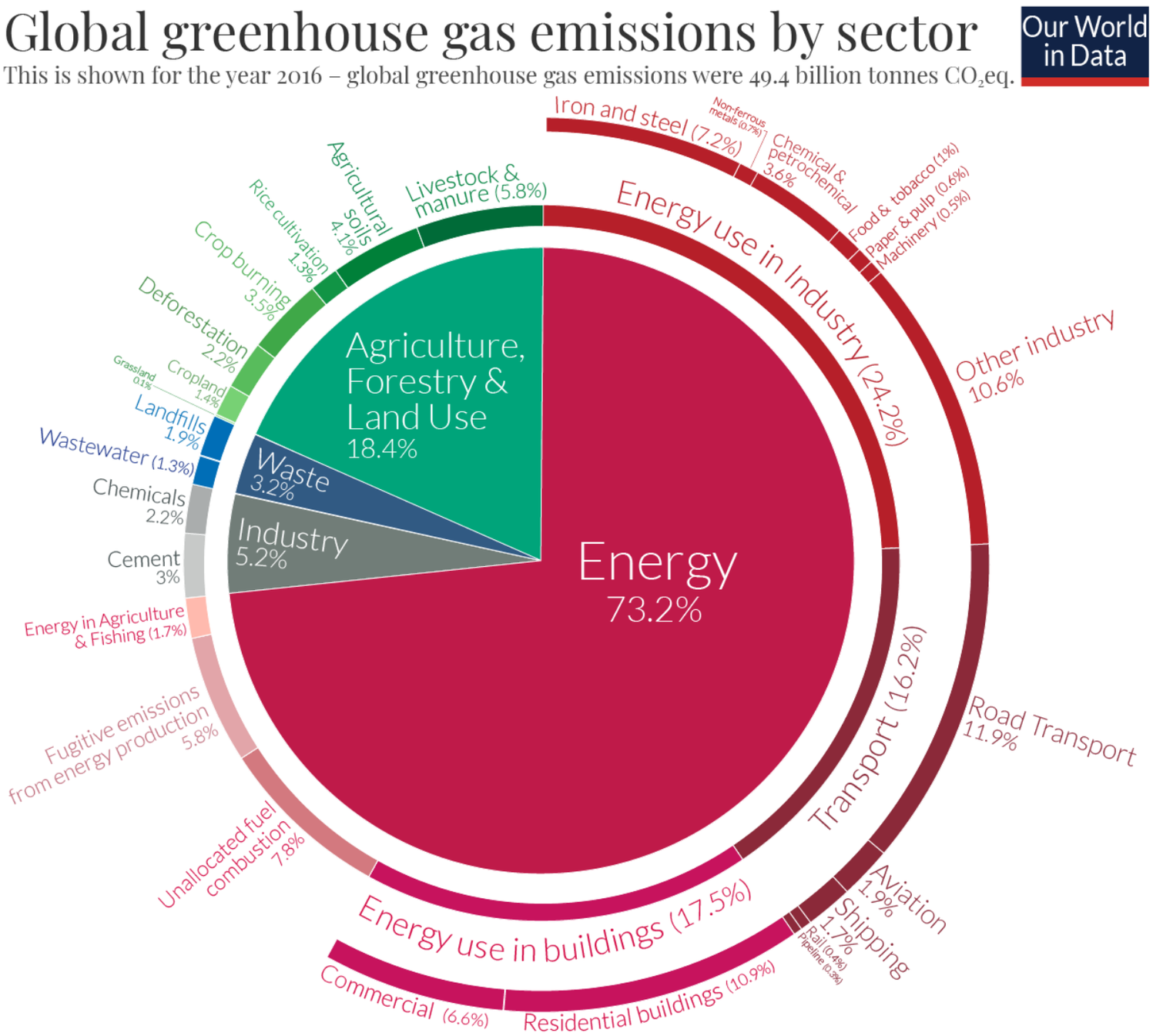
Lecture 1

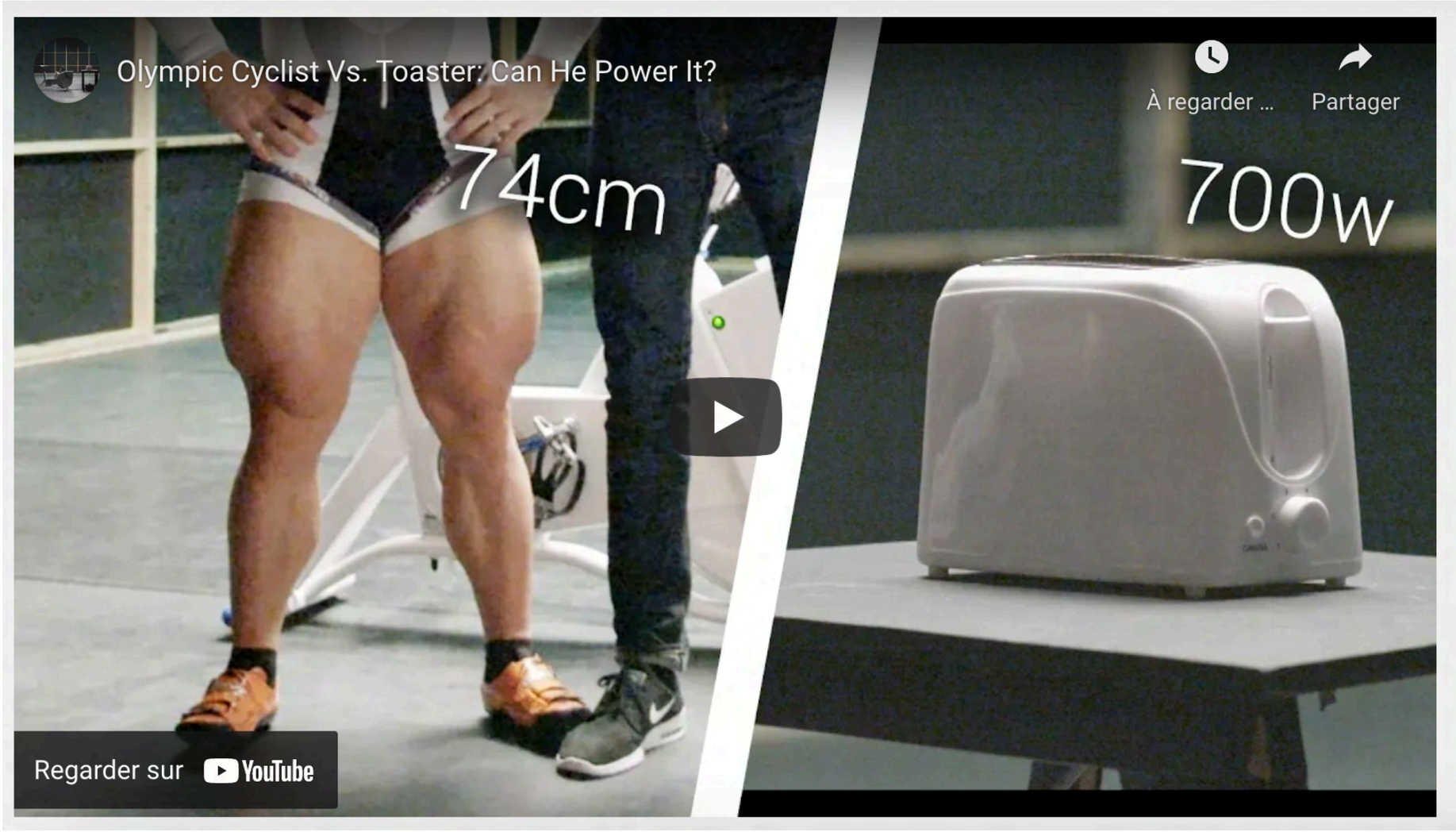
Energy & C02



https://ourworldindata.org/emissions-by-sector

Lecture 1

What is 1kWh?



https://youtu.be/S4O5voOCqAQ

https://jancovici.com/en/energy-transition/energy-and-us/how-much-of-a-slave-master-am-i/

Lecture 1

Energetic slaves

1 human being = 2 000 calories / day = **2,3 kWh / day**
-> 800 kWh / year

1 liter of oil = **10 kWh** of thermal energy

30 MWh / year = 400 energetic slaves
(by taking into account the efficiencies
see the assumptions in the article)

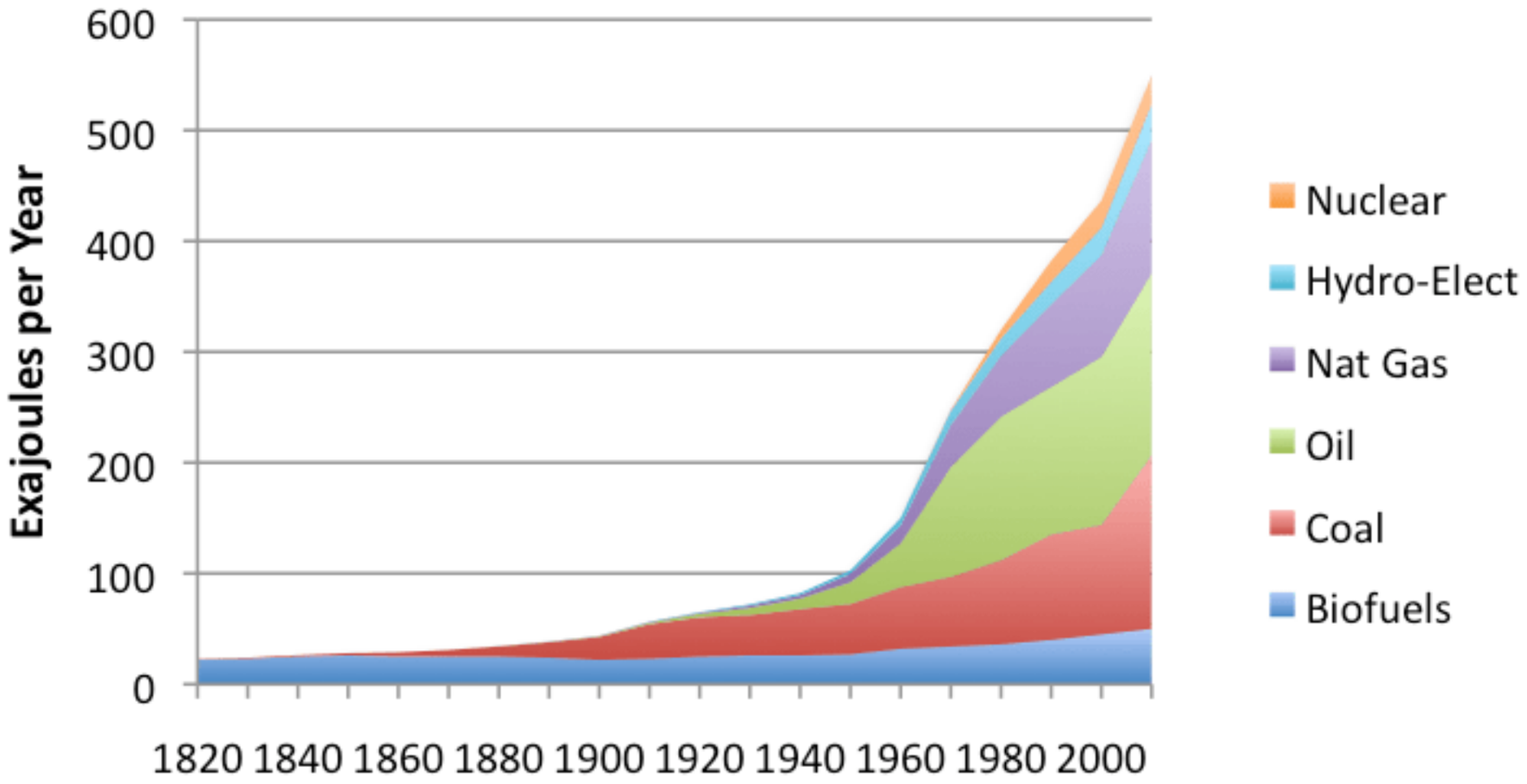
https://jancovici.com/en/energy-transition/energy-and-us/how-much-of-a-slave-master-am-i/

Lecture 1

Energy

What do you think ?

Is there an energy transition ?

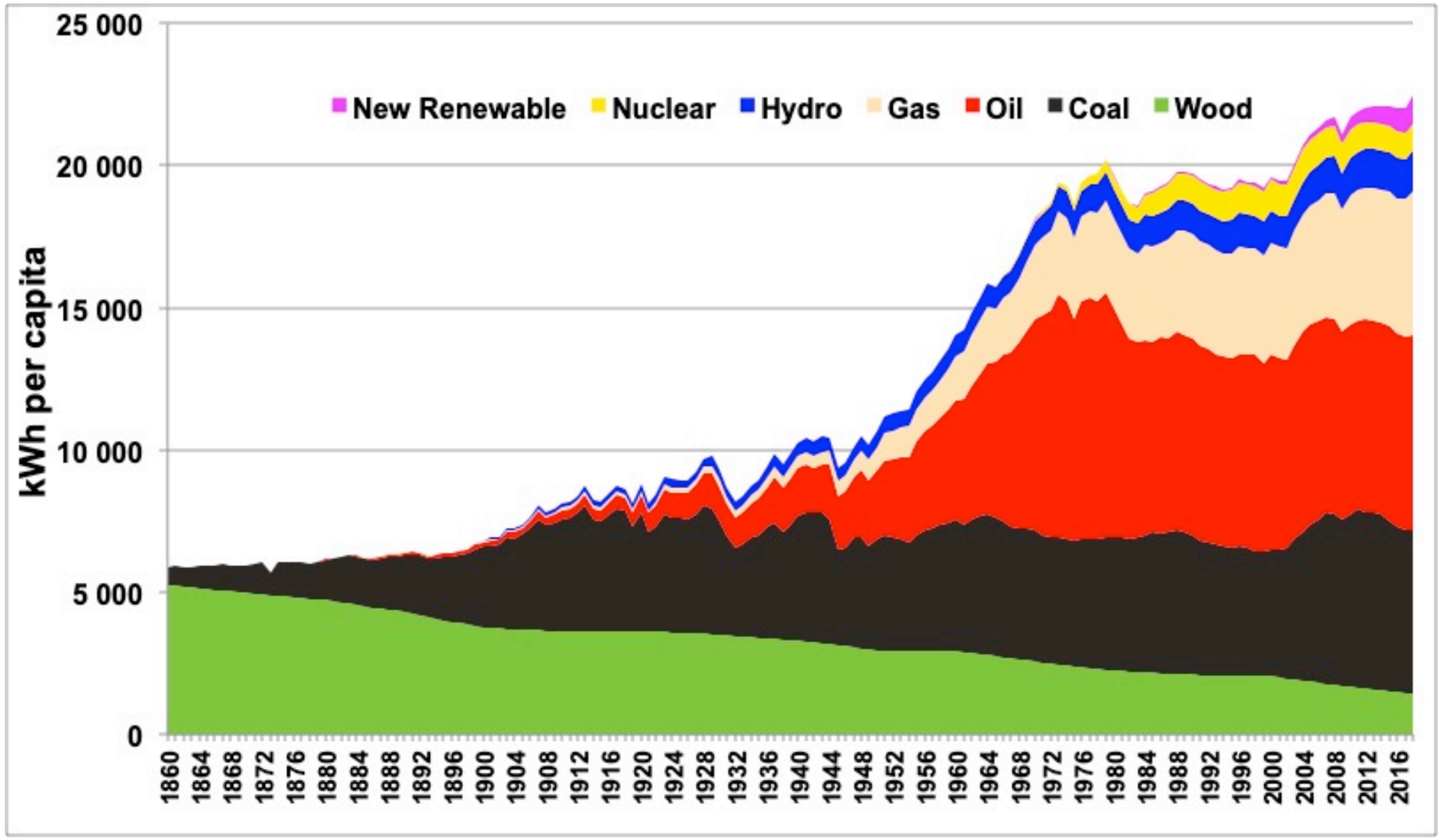


World Energy Consumption by Source, Based on Vaclav Smil estimates from Energy Transitions: History, Requirements and Prospects together with BP Statistical Data for 1965 and subsequent

Lecture 1

Energy

World per capita energy consumption

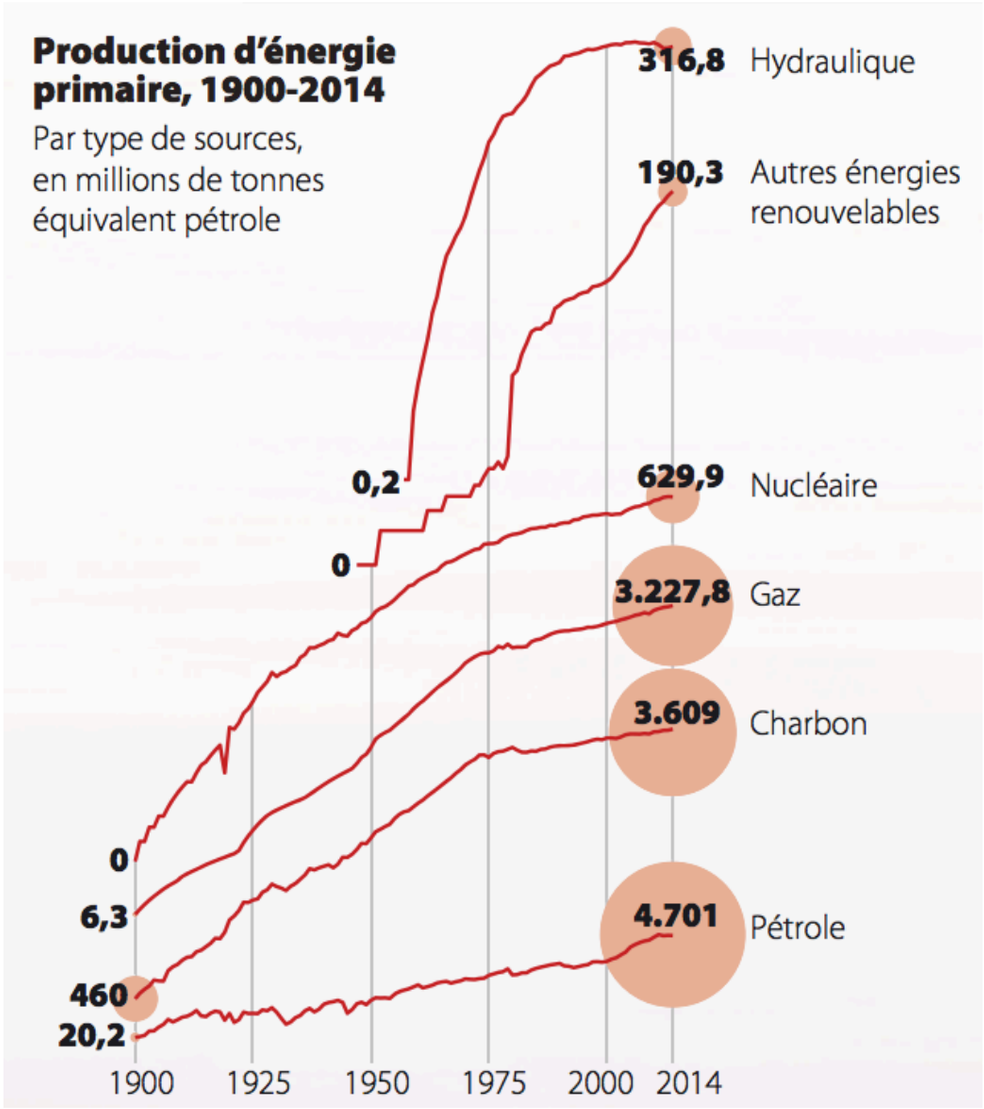


Author's compilation of the following primary sources: Shilling et al., BP statistical review, Energy Information Agency, United Nations.

https://jancovici.com/en/energy-transition/energy-and-us/what-is-energy-actually/

Lecture 1

Energy

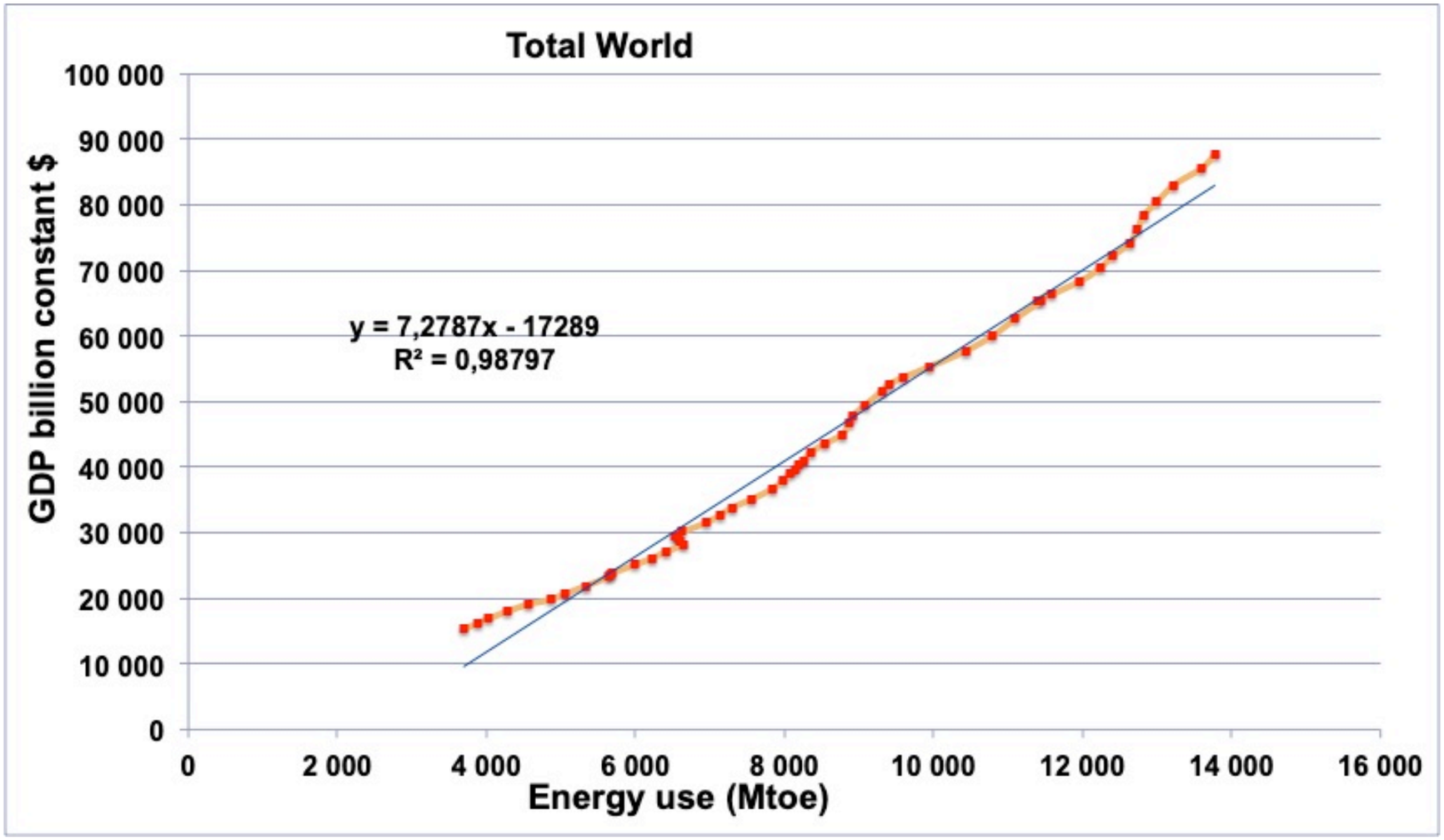


Credits: Source : The Shift Project Data Portal, d'après B. Etemad, J. Luciani (1900 - 1980) et US EIA Historical Statistics (1981-2014), www.tsp-data-portal.org

Lecture 1

Energy & GDP

World Gross Domestic Product GDP in constant dollars plotted against the world energy consumption in million tonnes oil equivalent, from 1965 to 2014.



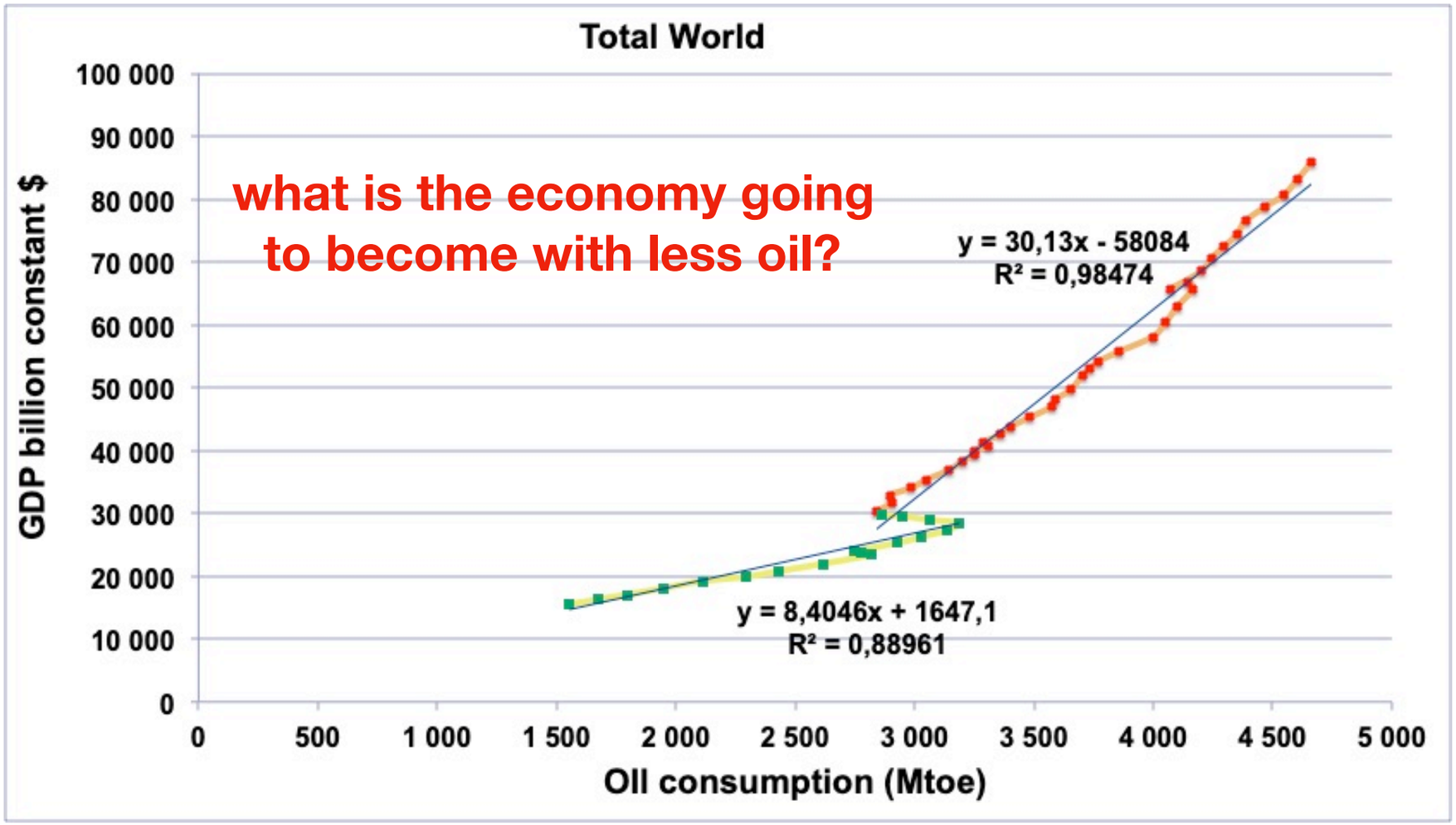
Author's calculation on primary information coming from BP Statistical Review, 2015, and World Bank 2015 (GDP).

https://jancovici.com/en/energy-transition/energy-and-us/what-is-energy-actually/

Lecture 1

Energy & oil & GDP

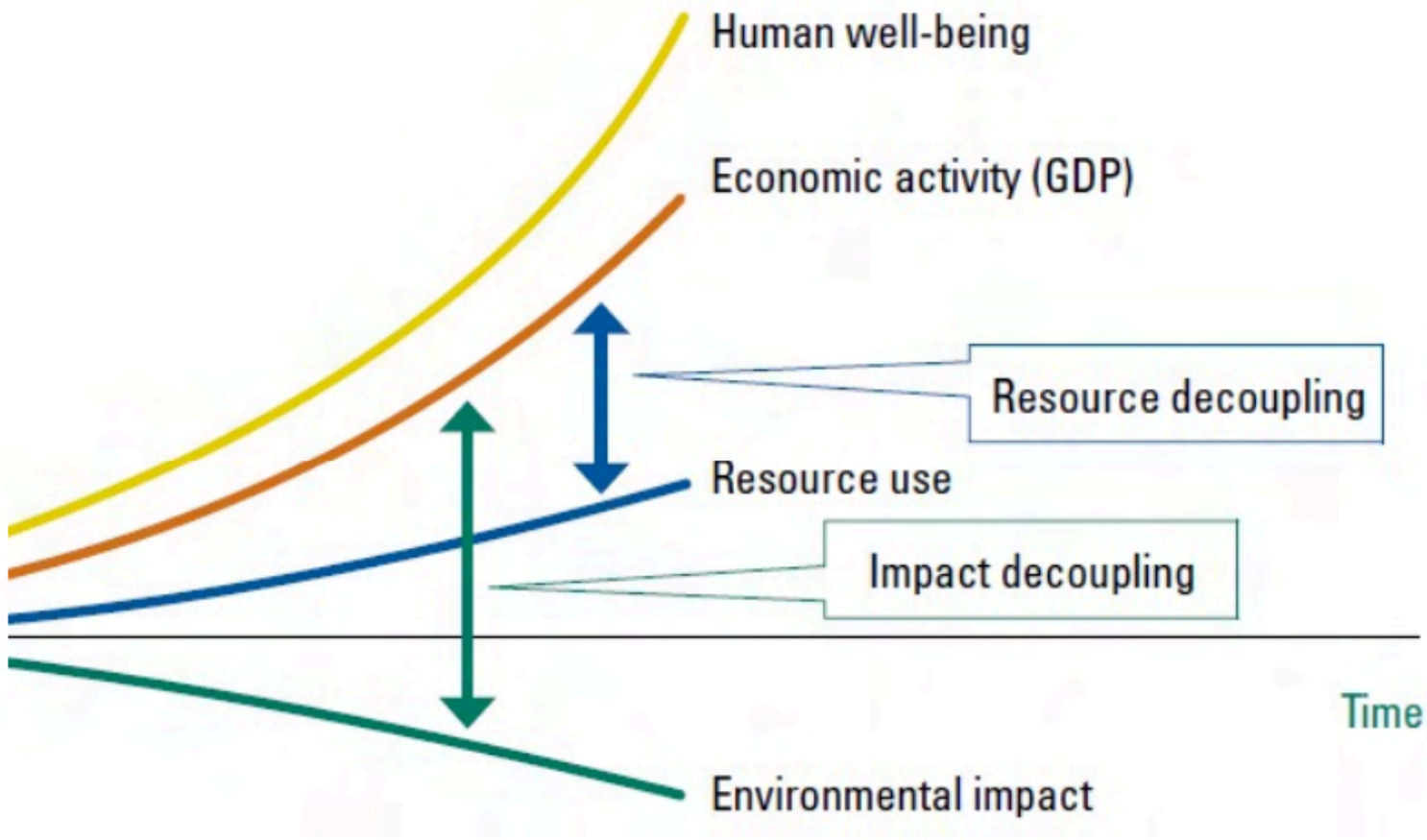
GDP per capita – world average – in constant 2012 dollars plotted against the world oil consumption in million tonnes oil equivalent, from 1965 to 2014.



Author's calculation on primary information coming from BP statistical review & Shilling et al. (energy) and World Bank (GDP).

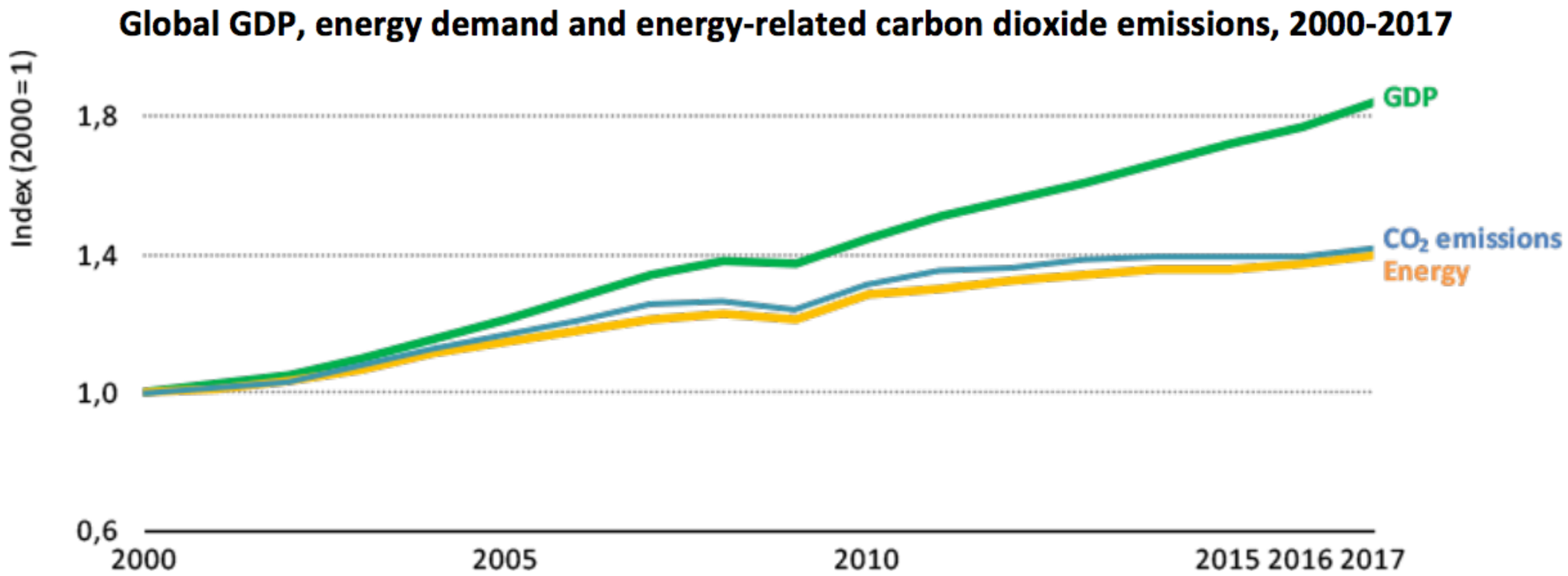
https://jancovici.com/en/energy-transition/energy-and-us/what-is-energy-actually/

Lecture 1
Energy & GDP & decoupling



We would like to decouple GDP - energy & resource use !

Lecture 1
Energy & GDP & decoupling



But the decoupling is still relative and not significant …

International Energy Agency, Global Energy & CO 2 Status Report 2017, March 2018 .

https://www.iea.org/reports/global-energy-co2-status-report-2017

Lecture 1

Goals

Sustainable development

Sustainable development goals

ENVT 3065 Sustainability Challenges’s perimeter

Energy

Rebound effect

Challenges

Lecture 1

Rebound effect

Do you know what it is ?

Lecture 1

Rebound effect

Jevons paradox

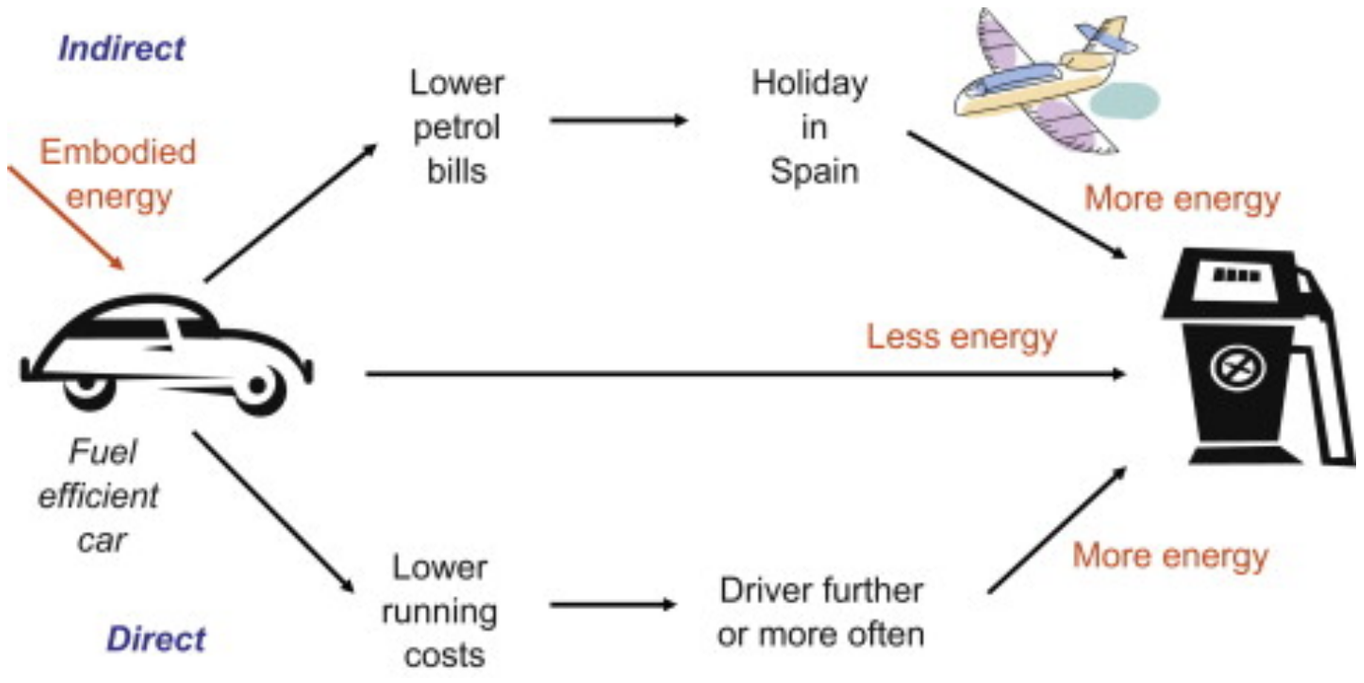
In economics, the Jevons paradox occurs when technological progress or government policy increases the efficiency with which a resource is used (reducing the amount necessary for any one use), but the rate of consumption of that resource rises due to increasing demand. The Jevons paradox is perhaps the most widely known paradox in environmental economics.

However, governments and environmentalists generally assume that efficiency gains will lower resource consumption, ignoring the possibility of the paradox arising.

Lecture 1

Rebound effect

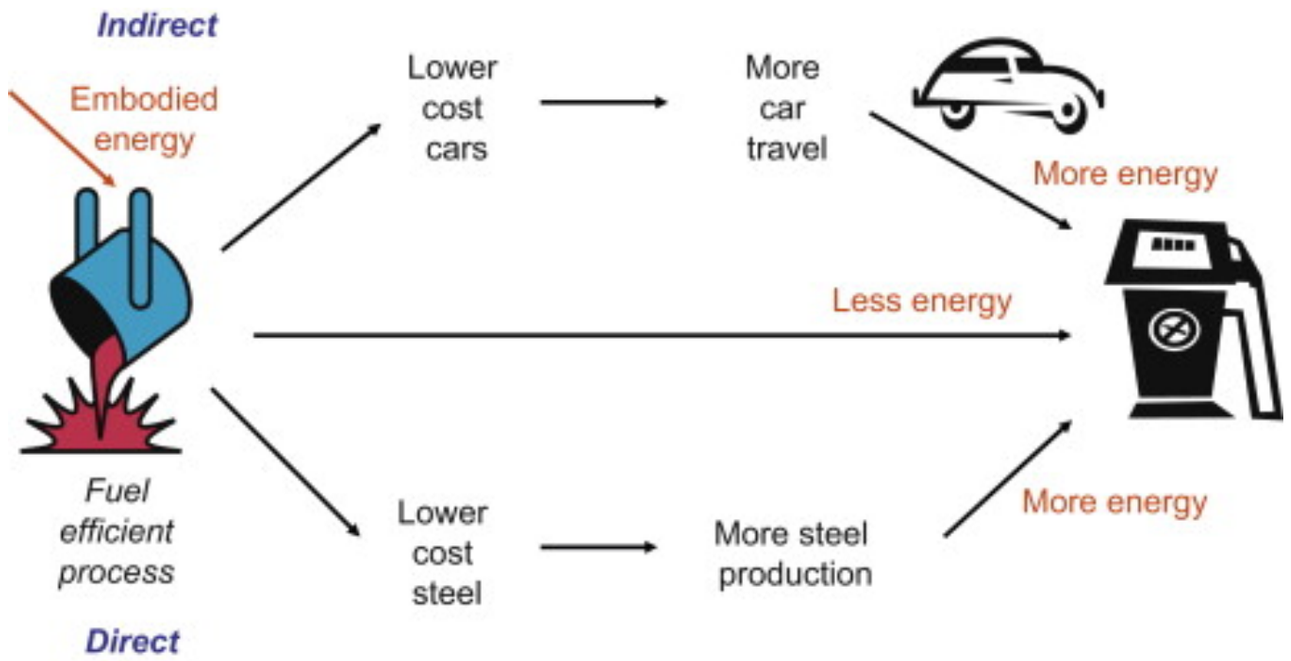
« While the evidence in favour of 'Jevons Paradox' is far from conclusive, it does suggest that ***economy-wide rebound effects are larger than is conventionally assumed*** *and that energy plays a more important role in driving productivity improvements and economic growth than is conventionally assumed. »*



Sorrell, Steve. "Jevons' Paradox revisited: The evidence for backfire from improved energy efficiency." Energy policy 37.4 (2009): 1456-1469.

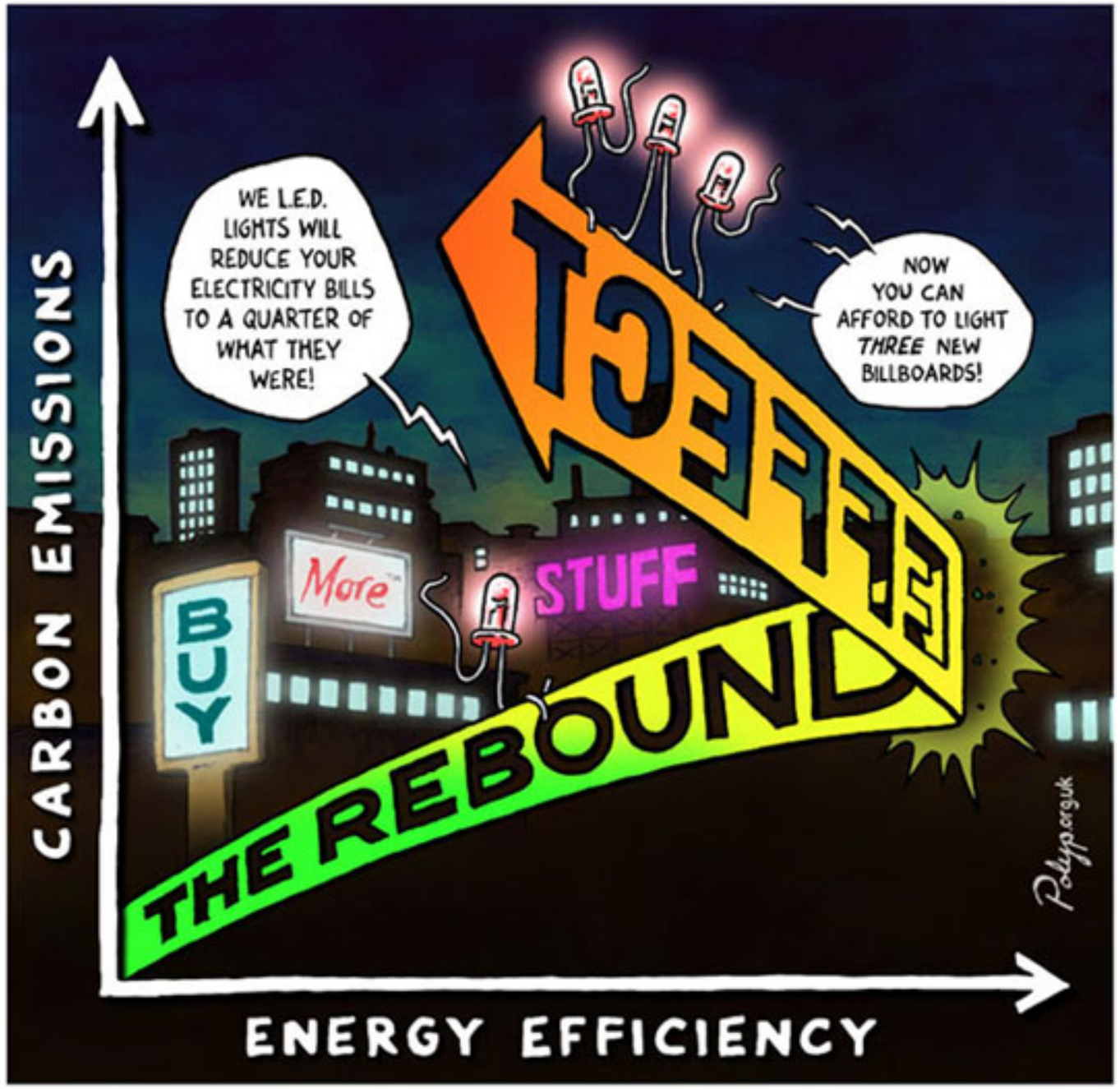
Lecture 1

Rebound effect



Lecture 1

Rebound effect

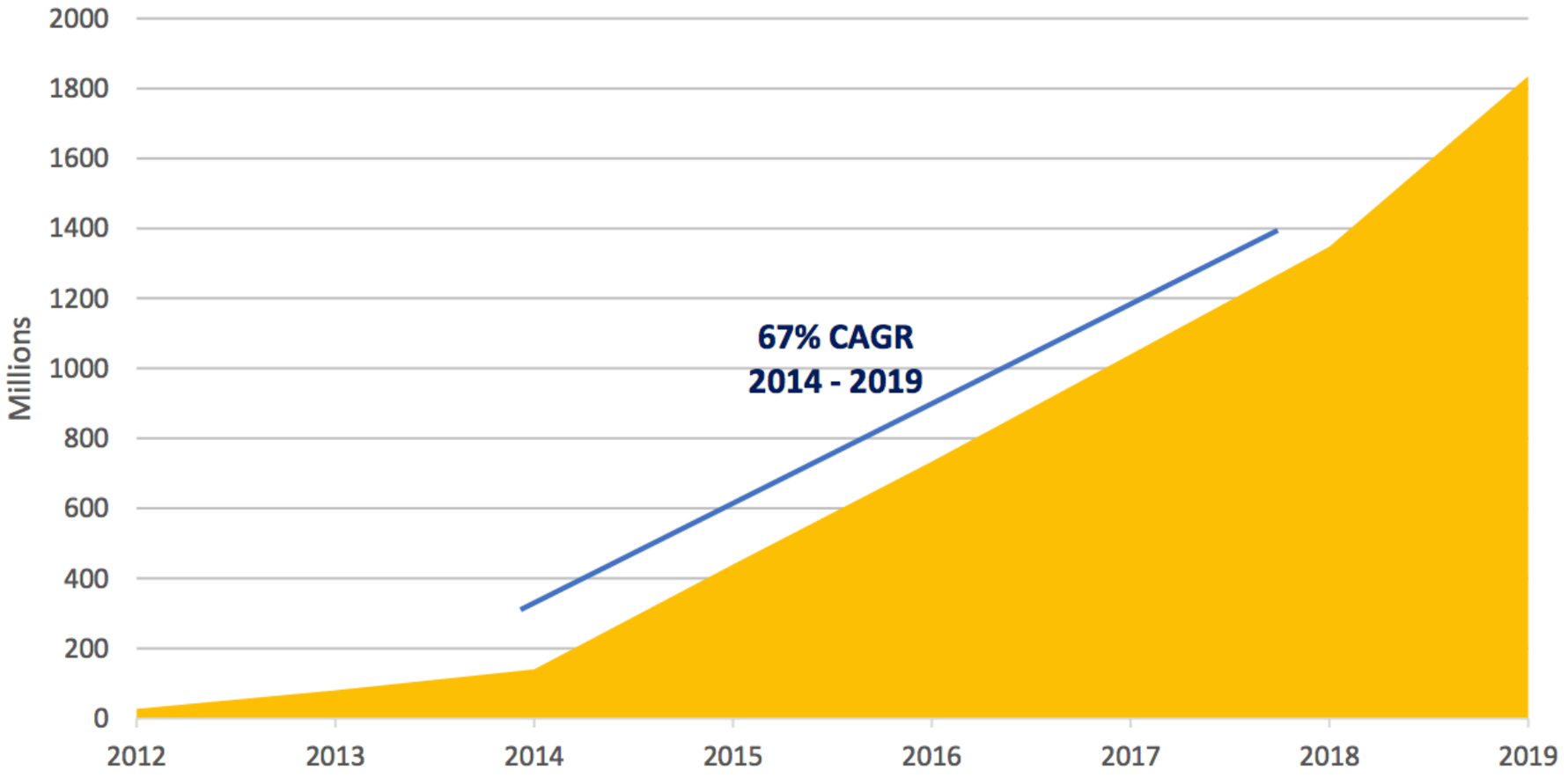


https://www.thegwpf.com/green-madness-energy-efficient-led-lighting-increases-energy-consumption-light-pollution/

Lecture 1

Rebound effect

The multiplication of peripherals of daily life (or "**connected living**")



« New peripherals are appearing (bracelets measuring physical activity, portable Bluetooth speakers, etc.) and existing equipment in all households is becoming capable of communicating (televisions, refrigerators, coffee machines, alarm and monitoring systems, thermostats, lighting, etc.). »

https://theshiftproject.org/en/article/lean-ict-our-new-report/

Lecture 1

Rebound effect

Digital devices in a household of 4 persons in an OECD country.

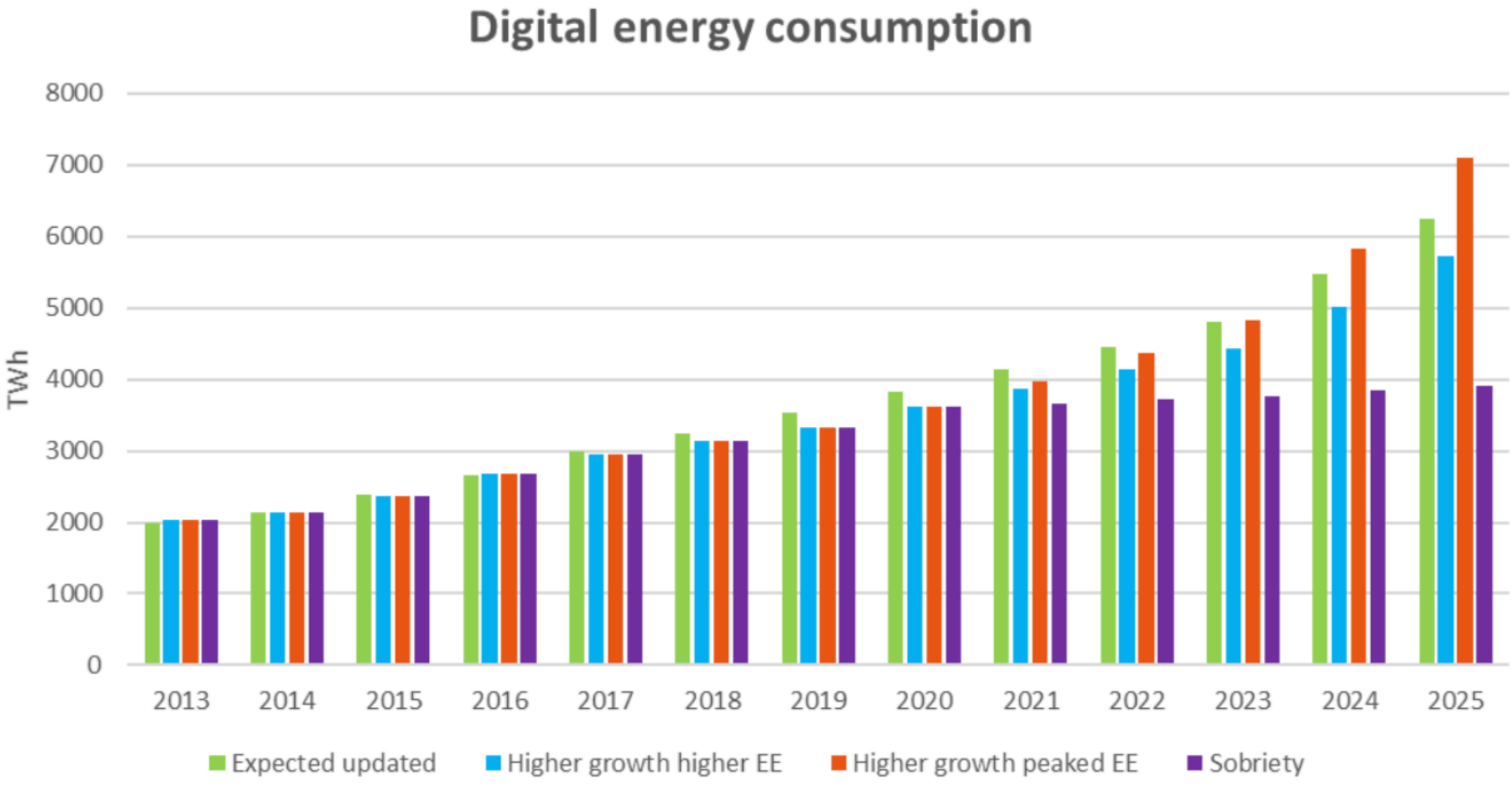
2012	2017	2022
2 smartphones	4 smartphones	4 smartphones
2 laptops/computers	2 laptops	2 laptops
1 tablet	2 tablets	2 tablets
1 DSL/Cable/Fibre/Wifi Modem	1 connected television	3 connected television
1 printer/scanner	2 connected set-top boxes	3 connected set-top boxes
1 game console	1 network attached storage	2 eReaders
	2 eReaders	1 printer/scanner
	1 printer/scanner	1 smart metre
	1 game console	3 connected stereo systems
	1 smart metre	1 digital camera
	2 connected stereo systems	1 energy consumption display
	1 energy consumption display	2 connected cars
	1 Internet connected car	7 smart light bulbs
	1 pair of connected sport shoes	3 connected sport devices
	1 pay as you drive device	5 internet connected power sock
	1 network attached storage	1 weight scale
		1 eHealth device
		2 pay as you drive devices
		1 intelligent thermostat
		1 network attached storage
		4 home automation sensors

https://theshiftproject.org/en/article/lean-ict-our-new-report/

Lecture 1

Rebound effect

The share of digital technology in final energy consumption (growing by 1.5% per year) will have increased by **almost 70%** between 2013 and 2020.



https://theshiftproject.org/en/article/lean-ict-our-new-report/

Lecture 1

Rebound effect

The gain of energy efficiency is not capable of compensating the exponential increase of numbers of digital devices.

https://theshiftproject.org/en/article/lean-ict-our-new-report/

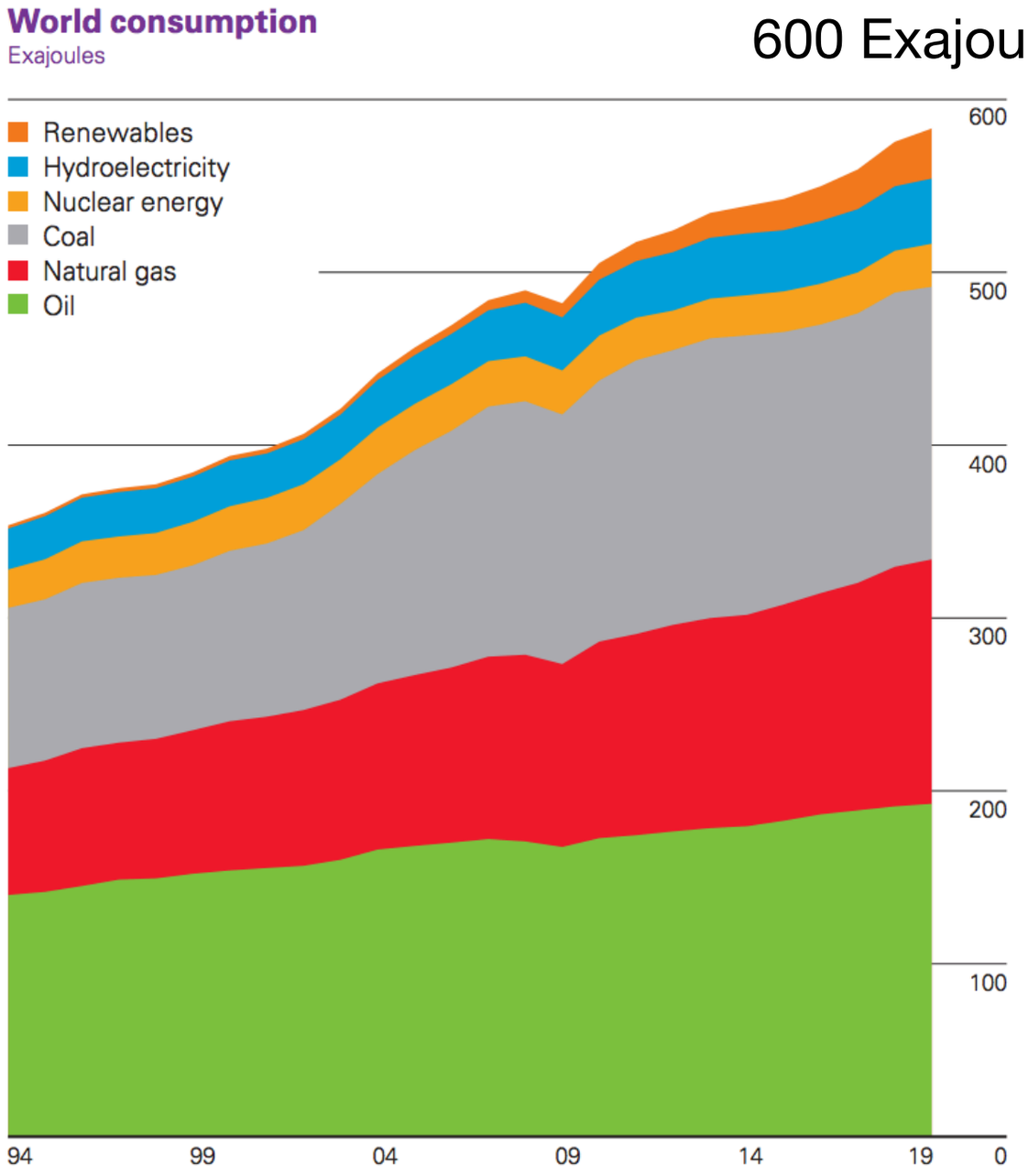
Same phenomenon for cars, etc.

Lecture 1
Rebound effect & energy

600 Exajoules = 166 667 TWh

The energy consumption at the world scale keeps on increasing.

And **fossil fuels are not decreasing** …



Credits: bp Statistical Review of World Energy 2020

Lecture 1

Rebound effect & 5G

What do you think of 5G ?

TSP 5G report

Lecture 1

Goals

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Lecture 1
Sustainability challenges

How to live x times better by using x times lesser resources?

How to get x times more meaning with x times less things?

Credits: Sustainable development & Transition UCL LEPL 1804

Lecture 1
Sustainability challenges

Will **technology** save us ?

Can **technology** save us ?

What do you think ?

Lecture 1
Sustainability challenges

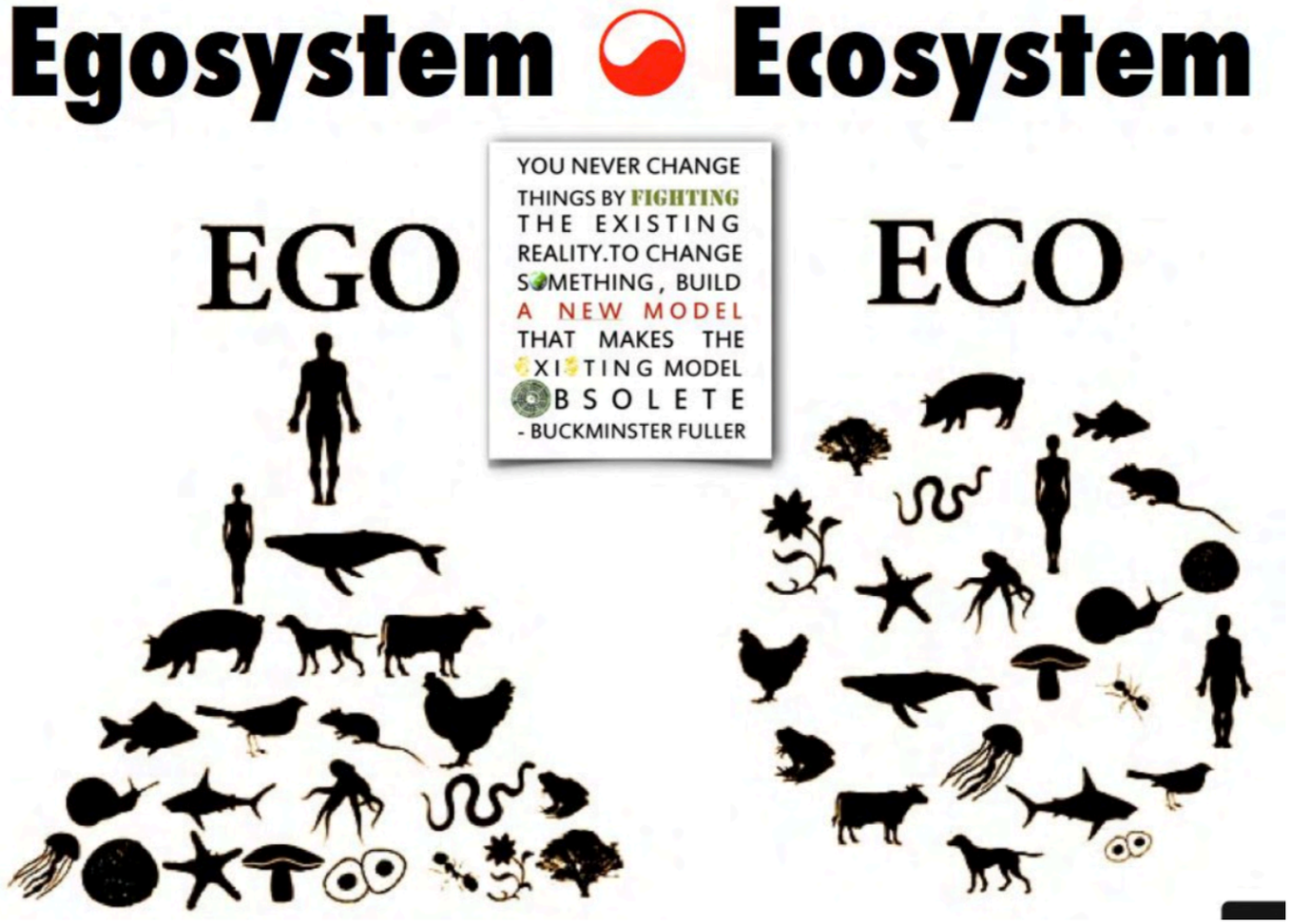
Let's question our imagination, our relationship to the world?

Anthropocentrism

Biocentrism

Credits: Sustainable development & Transition UCL LEPL 1804

Lecture 1
Sustainability challenges



Credits: Sustainable development & Transition UCL LEPL 1804

Lecture 1
Sustainability challenges

The need to re-invent ourselves

- Global, holistic, systemic approach
- Thinking at the same time: technical, economic, responsibility, consequences (environmental, social),... Think with limits!
- Evaluate all the costs of innovation!
- Where are the winners, where are the losers?
- Importance of the collective, working together
- Collaboration vs Competition
- New instruments, new units, new criteria of success, of excellence, of well-being
- Transition to appropriate technologies - responding to needs, responding to a common vision of society - Human-centered innovations

Credits: Sustainable development & Transition UCL LEPL 1804

Lecture 1
Sustainability challenges

Transition to appropriate technologies

- Need for decision support tools - Life Cycle Assessment (LCA) Granta, GaBI, SimaPro, Umberto, OpenLCA,...
- Circular economy with recycling as a last resort
- Eco-design, modular design,... with a view to repair, re-use,... (the 11 Rs)
- Fight against programmed obsolescence
- Anticipate the rebound effects (3-level environment impacts concept framework)
- The economy of functionality
- Legislation as a lever for change

Credits: Sustainable development & Transition UCL LEPL 1804

Lecture 1

Conclusions

Sustainable development

Sustainable development goals

ENVT 3065 Sustainability Challenges’s perimeter

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Lecture 1

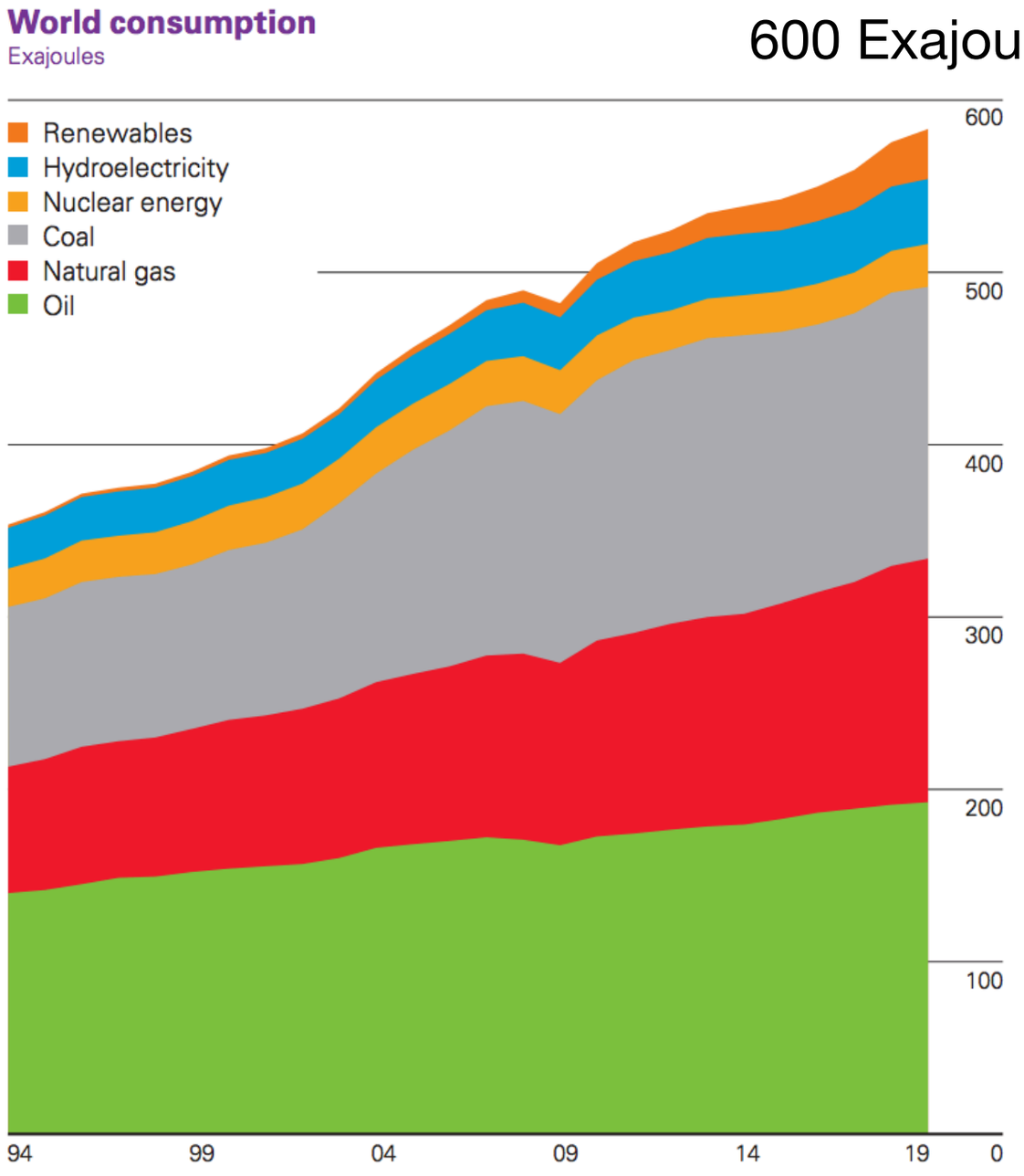
Course perimeter

https://www.un.org/sustainabledevelopment/news/communications-material/

Lecture 1
Rebound effect & energy

The energy consumption at the world scale keeps on increasing.

And **fossil fuels are not decreasing** …



600 Exajoules = 166 667 TWh

Credits: bp Statistical Review of World Energy 2020

Lecture 1

Course map