

Technology Assessment and Sustainability

Course description

Lectures:

- Sustainability (tuesdays, have a look on StudIP, (3.101 Room IN PRESENCE!)), Lectures with me: only the next three tuesdays! —> Prof. Heilmann

The block sessions for this course (Technology Assessment, Dr. Henning Döscher) have already been scheduled for the following dates: **October 10, October 17, and November 21** (all Saturdays). In addition, there will be a **joint final session** with Prof. Heilmann and Dr. Henning Döscher during the examination period.

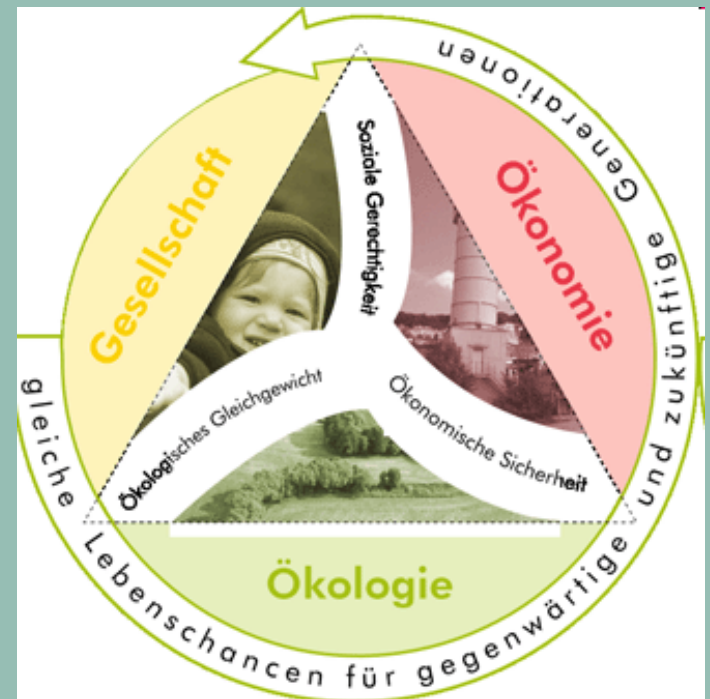
- All sessions will start at **9:00 a.m.**
- The sessions on **October 10 and 17** will be full-day sessions, running until approximately **5:00 p.m.**
- The session on **November 21** will be a half-day session, primarily providing an opportunity for an **interim presentation** of the work developed as part of the course.

Examination/Grades:

joint assessment for the module. The following points provide a preliminary overview:

- The assessment will be based on **project work**.
- Students will be assigned by us to **teams of four**. Each team will work on a range of tasks inspired by the perspective and context of a specific company.
- The main assessed component will most likely be a **final presentation**, consisting of a slide deck, an oral presentation, and a Q&A session.
- In addition, each team will be required to maintain a **research diary** documenting the entire working process in detail, including the approaches taken, unsuccessful attempts or changes in direction, sources used, and other relevant aspects of the project. The research diary may also be taken into account when determining the final grade, particularly in cases where additional evidence of the team's working process is required.

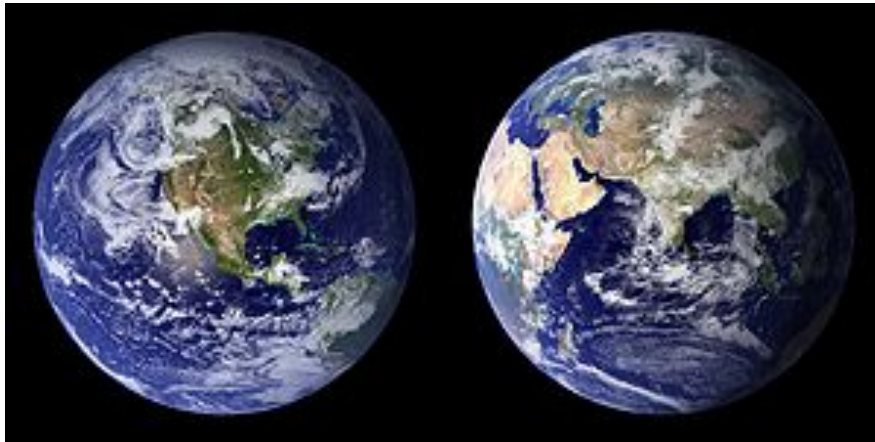
Sustainability as a prerequisite for innovation ?!



Introduction

- 1. Sustainability as a system of values**
 - for every human being
- 2. Sustainability as a social model**
 - **Sustainable Development Goals**
- 3. Legislative and formative framework**

Definition



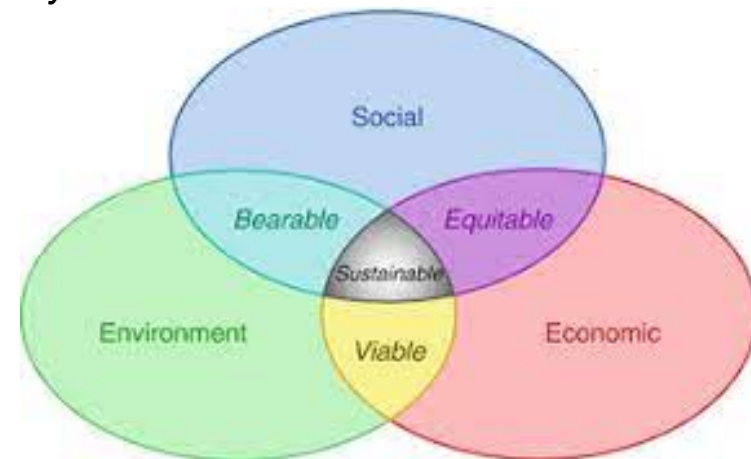
<http://www.nachhaltigkeitsrat.de>

In 1987, the United Nations Brundtland Commission **defined sustainability** as *“meeting the needs of the present without compromising the ability of future generations to meet their own needs.”*

<https://www.un.org/en/academic-impact/sustainability>



„We are searching for a model output that represents a world system that is:
1. sustainable without sudden and uncontrollable collapse; and
2. capable of satisfying the basic material requirements of all of its people.”
Donella Meadows et al. (1972) – The Limits to growth



1. Sustainability as a system of values

1. Sustainability as a system of values – Introduction

What is a suitable (moral) model to minimize undesirable developments? Sustainability?

What are the **ethical responsibilities of the **individual**?**

Which **values have to be taken into account?**

<https://sdgacademy.org/course/ethics-in-action/>

1. Sustainability as a system of values – definition

What are Ethics?

- A person's ethics are the **principles of morality** that inform how a person behaves. They can be described as that person's 'moral code'.

What are Business Ethics?

- There are various branches of ethics, and one branch is 'business ethics'. This type of ethics is focused on how business ought to behave. The type of business ethics that looks at how businesses should act within a society is sometimes referred to as '**corporate social responsibility**'.

<https://imp.center/i/business-ethics-25-reasons-ethics-important-business-5090/>

1. Sustainability as a system of values – definition

Ethics is a branch of philosophy that deals with the prerequisites and evaluation of human behavior. At the centre of ethics is the specifically moral action. (Ethics - teaching of moral behavior)

Morals: system of rules, norms and **values** formed from cultural and religious experience, which is regarded as a standard of behaviour in a society.

Values: are those ideas which are generally recognised as desirable in a society and give people orientation. Different categories are distinguished: moral (honesty, justice,) religious, political, cultural... values.

2. Sustainability as a social model

2. Sustainability as a social model/ framework

AGENDA 2030

- In autumn 2015, the United Nations adopted Sustainable Development Goals (SDGs) for the entire international community.

“Transforming our world: the 2030 Agenda for Sustainable Development”

http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

- Goals apply universally and for the first time take all states into account as addressees
- Need to be taken into account in all areas of society

Video <https://sdgs.un.org/goals>

Sustainable Development Goals



SDGs - in a different representation

People

Planet

Prosperity

Peace

Partnership



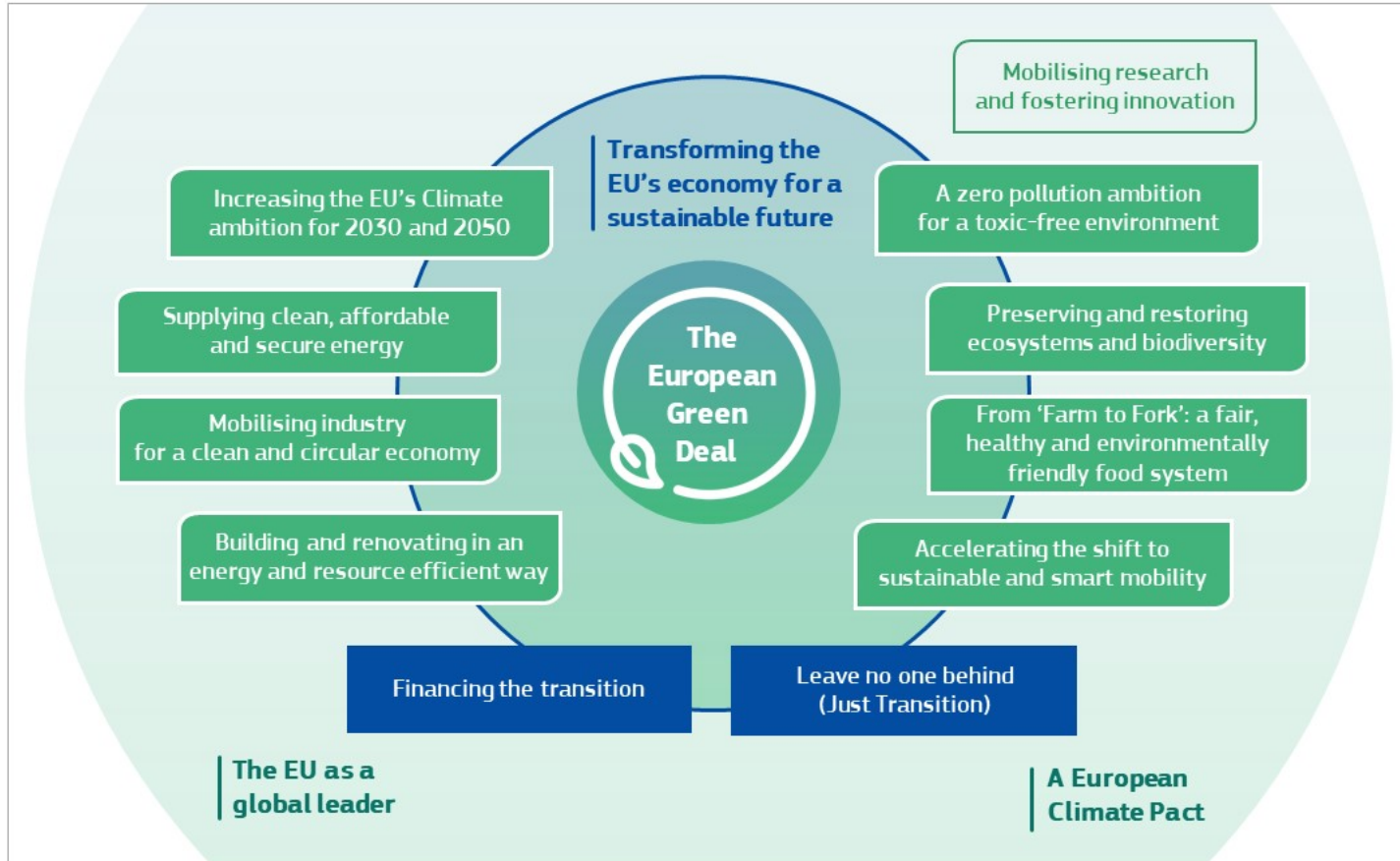
Tripple Bottom Line (TBL)

5P

2. Sustainability as a social model/ framework

The European Green Deal

<https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52019DC0640&from=ET>



One third of the 1.8 trillion euro investments from the NextGenerationEU Recovery Plan, and the EU's seven-year budget will finance the European Green Deal.

2. Sustainability as a social model/ framework

The European Green Deal – Benefits

https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en



**fresh air, clean water,
healthy soil and
biodiversity**



**renovated, energy
efficient buildings**



**healthy and affordable
food**



more public transport



**cleaner energy and
cutting-edge clean
technological
innovation**



**longer lasting
products that can be
repaired, recycled and
re-used**



**future-proof jobs and
skills training for the
transition**



**globally competitive
and resilient industry**

3. Legislative and formative framework for sustainability

ISO Standards (Examples)

- DIN EN ISO 14001 – Environmental Management System Standard
- DIN EN ISO 50001 - Energy management systems - requirements with guidance on application
- ISO 45001 - ISO 45001 - Management systems of occupational health and safety
- **Integrated Management Systems**

ISO Standards – main structure

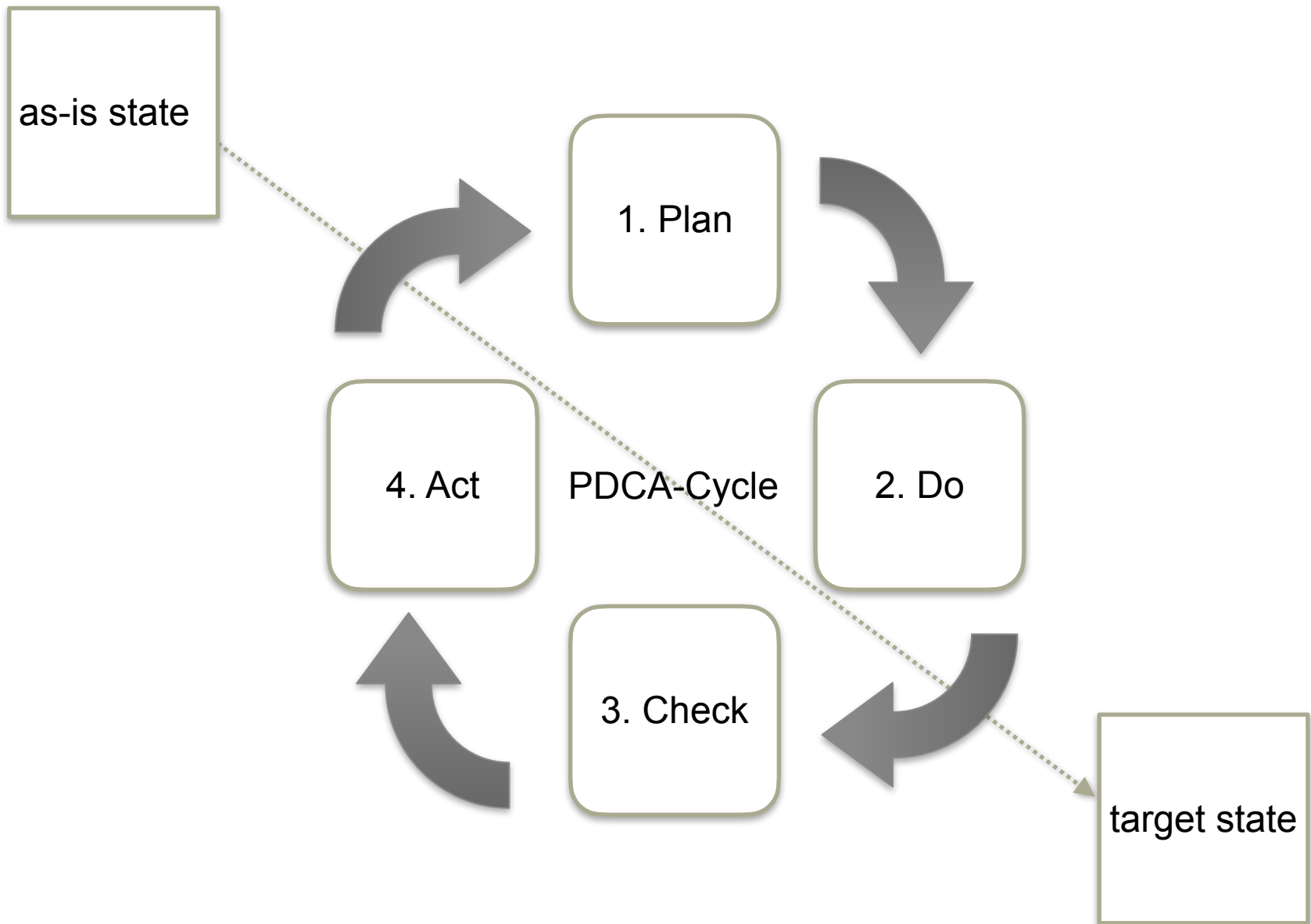
P = planning and structuring the MS

D = doing, and realizing your program

C = controlling and evaluating environmental performance, verification

A = acting on continual improvement and equally important, communication





SUSTAIN 2023 (Online-Simulation in presence!)

27.03. 11:30-15:00

5.302 Active Learning Space
(innovativer Lernraum)

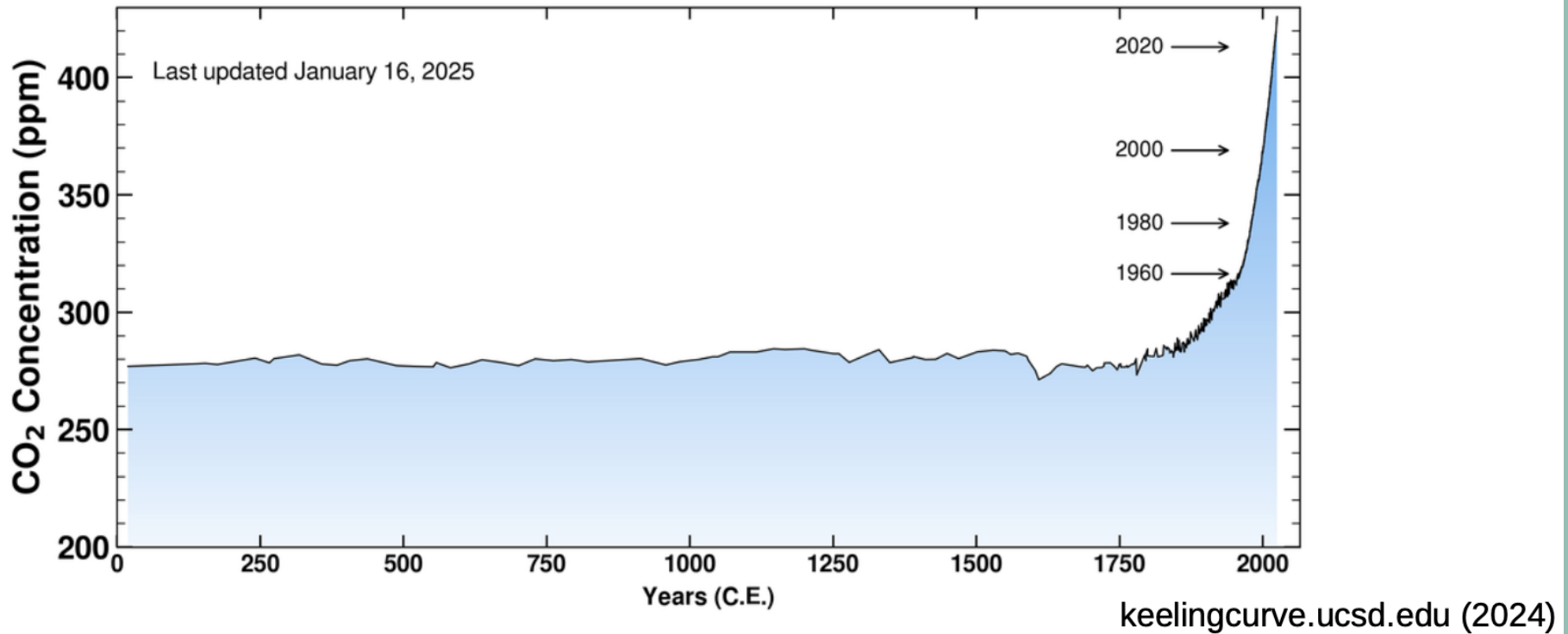
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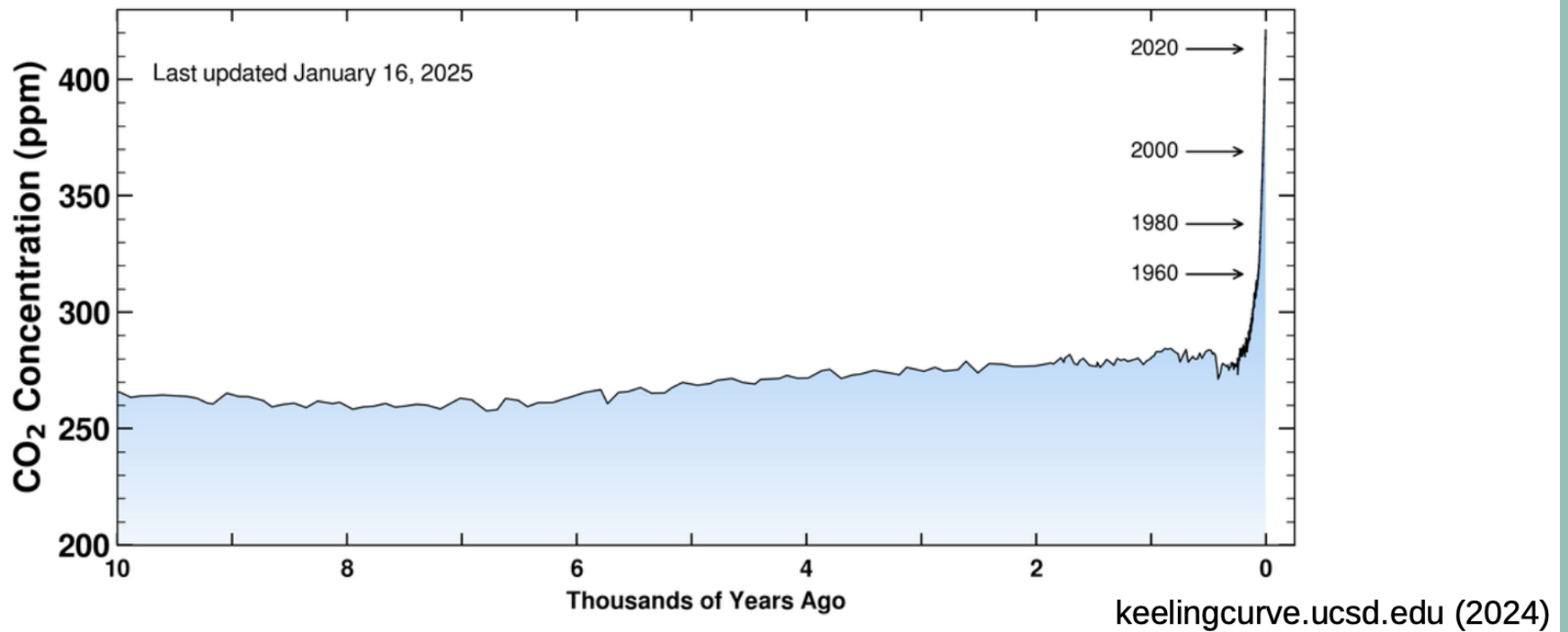
5.302 Active Learning Space
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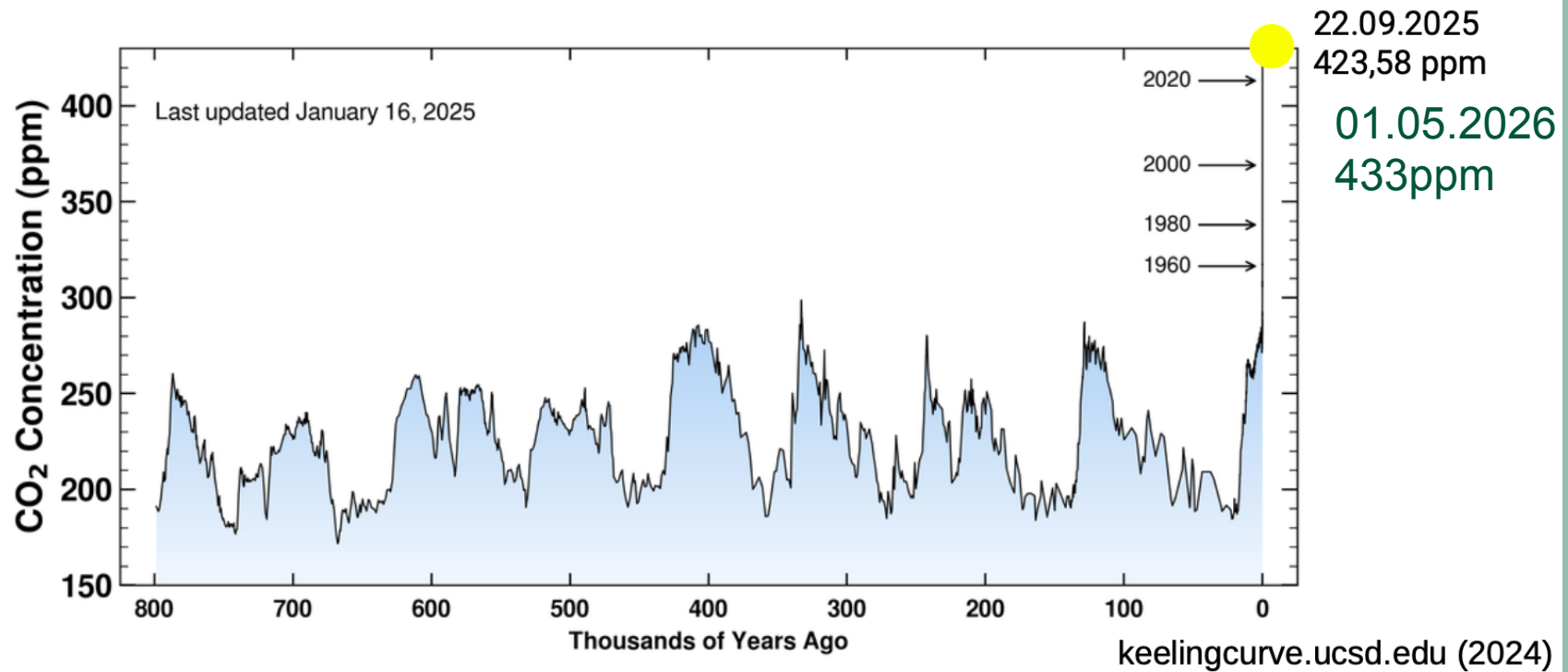
Renewable Energies, Climate and Sustainability

Agenda

1. Climate change
2. Energy Consumption
3. Energy Sources
4. Energy Costs
5. Energy Storage
6. Sustainability of assessment of energy systems
7. Sources







Why should we (still) talk about climate (change)?



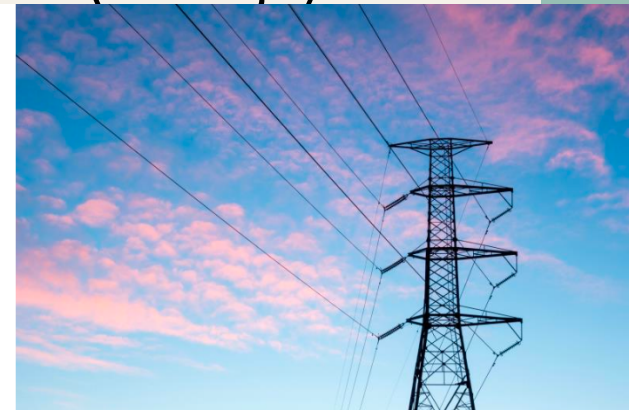
Floods, Draughts, heavy rains,
heat waves

Climate change effects us all



Economy is already on its way to
sustainability

You need those skills!



Renewable energies
secure energy safety
and power everywhere

Photo credit:
Hochschule Harz
Harz University of Applied Sciences

Christof Stache/AFP/Getty Images

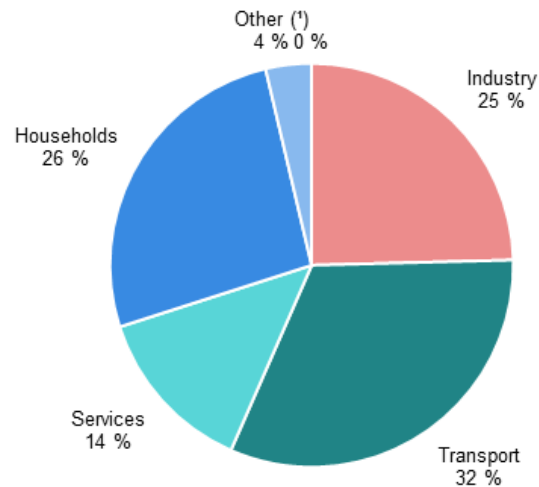
Photo credit:
Andreas Gebert/Bloomberg
via Getty Images

Photo credit:
Nikola Johnny Mirkovic
via Unsplash

2. Energy Consumption

Final energy consumption by sector, EU, 2023

(% of total, based on terajoules)

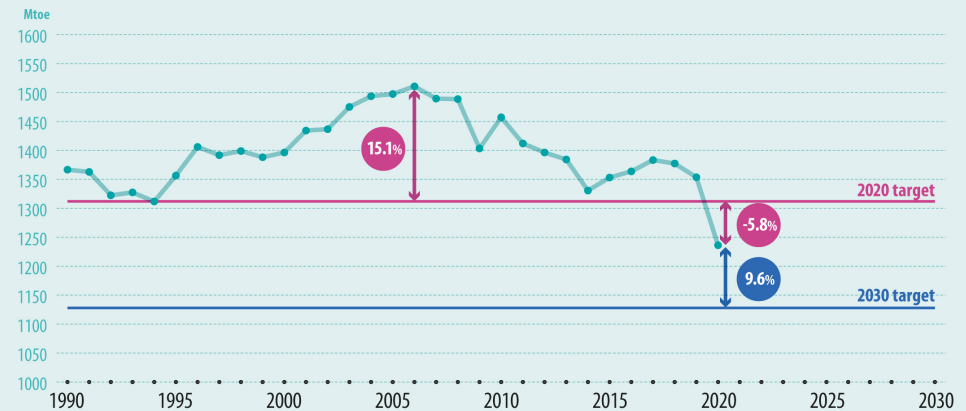


(*) International aviation and maritime bunkers are excluded from category Final energy consumption for transport.

Source: Eurostat (online data code: nrg_bal_s)

eurostat

Primary energy consumption in the EU, distance to 2020 and 2030 targets



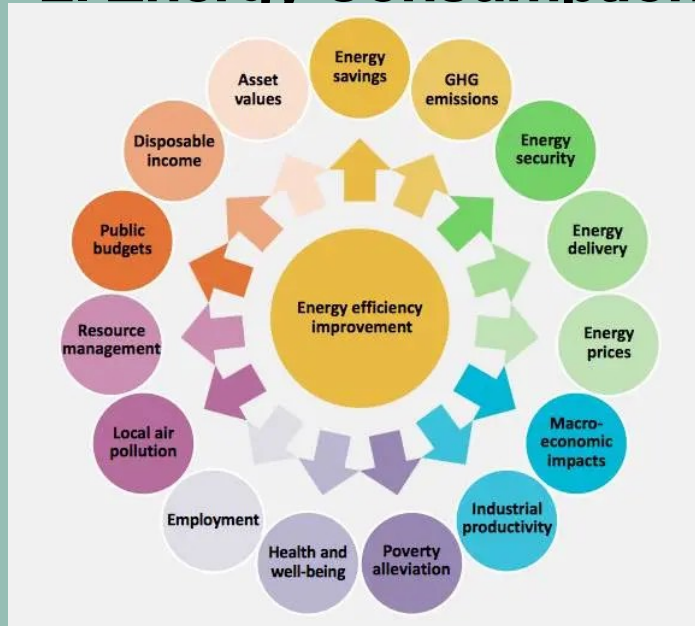
ec.europa.eu/eurostat

Primary energy: measures the total energy demand of a country. It covers consumption of the energy sector itself, losses during transformation and distribution of energy, and the final consumption by end users.

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Final energy: is the total energy consumed by end users, such as households, industry and agriculture excluding energy used by the energy sector and conversion losses.

2. Energy Consumption - Efficiency



Source: <https://getwarmhome>

Energy efficiency is called the “first fuel” in clean energy transitions, as it provides some of the quickest and most cost-effective CO2 mitigation options while lowering energy bills and strengthening energy security. Together, efficiency, electrification, behavioural change and digitalisation shape global energy intensity.

3. Energy Sources

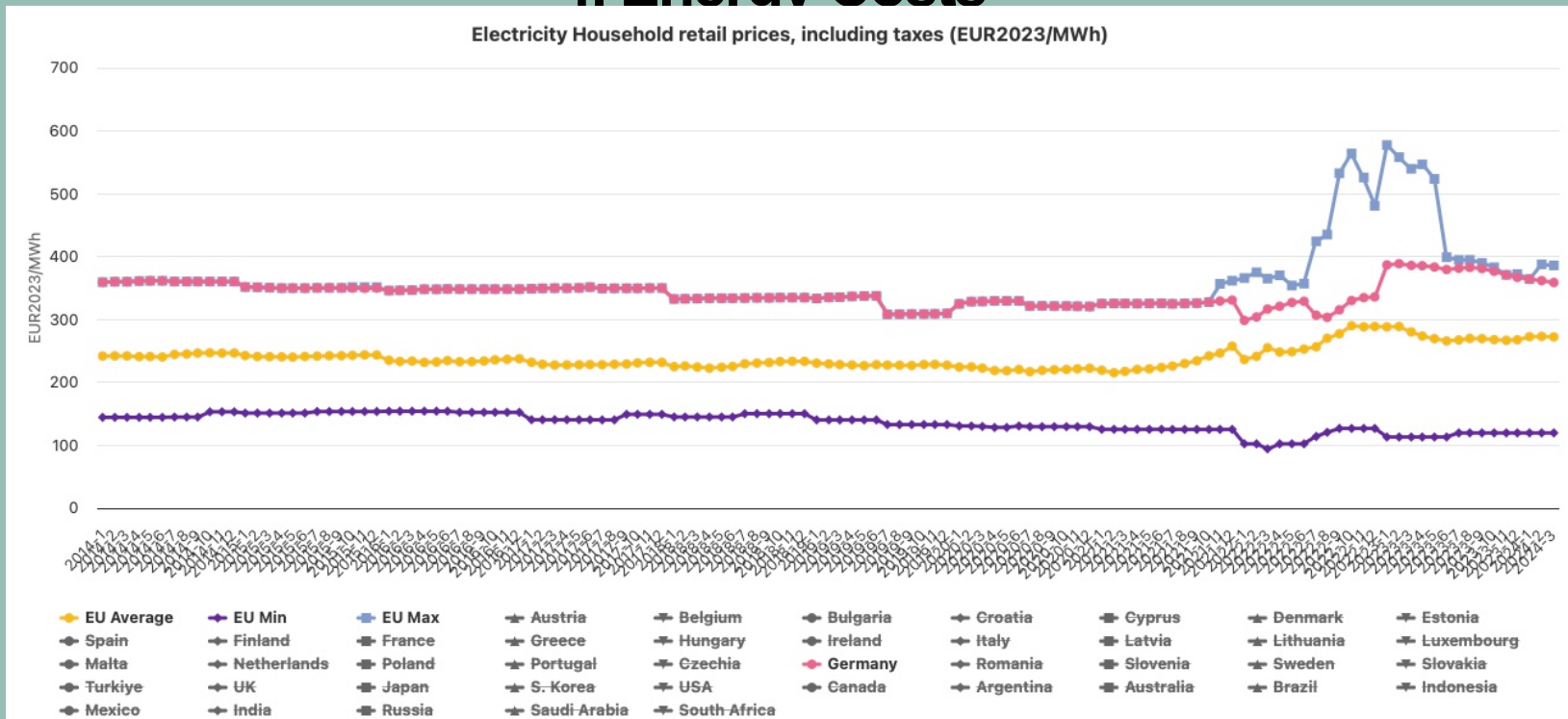
			Renewable	Renewable	Renewable	Renewable
Source	Nuclear energy	Fossil Energy (oil, coal, natural gas)	Wind energy	Solar energy	hydropower	biomass
Use	power	heat and power	power	heat and power	power	heat and power
Efficiency (% input retained when converting fuel to electricity)	290 %	31 %, 29 %, 38 %	1,164 %	207 %	317 %	52 %
Capacity factor (ratio of actual	92 %	11 %, 53%, 56%	35 %	27 %	38 %	

3. Energy Sources

Hydrogen

Types	Grey Hydrogen	Blue Hydrogen	Green Hydrogen	Turquoise Hydrogen	Brown Hydrogen
Process	SMR or gasification	SMR or gasification with carbon capture (85-95%)	Electrolysis	Pyrolysis	Coal gasification
Source	Methane or coal	Methane or coal	Renewable electricity and water	Methane	Coal

4. Energy Costs



Source: https://energy.ec.europa.eu/data-and-analysis/energy-prices-and-costs-europe/dashboard-energy-prices-eu-and-main-trading-partners-2024_en

5. Energy Storage

Energy storage is a crucial technology to provide the necessary flexibility, stability, and reliability for the energy system of the future. It's also important to ensuring security of supply and for advancing energy system integration and the electrification of economy.

System flexibility is particularly needed in the EU's electricity system, where the share of renewable energy is expected to rise around 69% by 2030 and 80% by 2050 (from the Commission Staff Working Document).

Source: COMMISSION STAFF WORKING DOCUMENT

Energy Storage - Underpinning a decarbonised and secure EU energy system

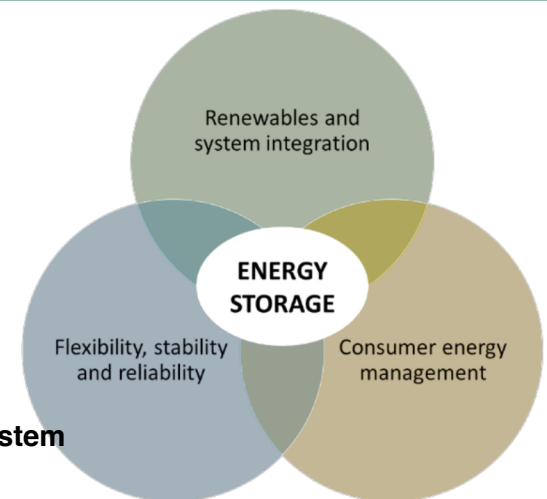


Figure 1. The contribution of energy storage to decarbonisation and security of supply

5. Energy Storage

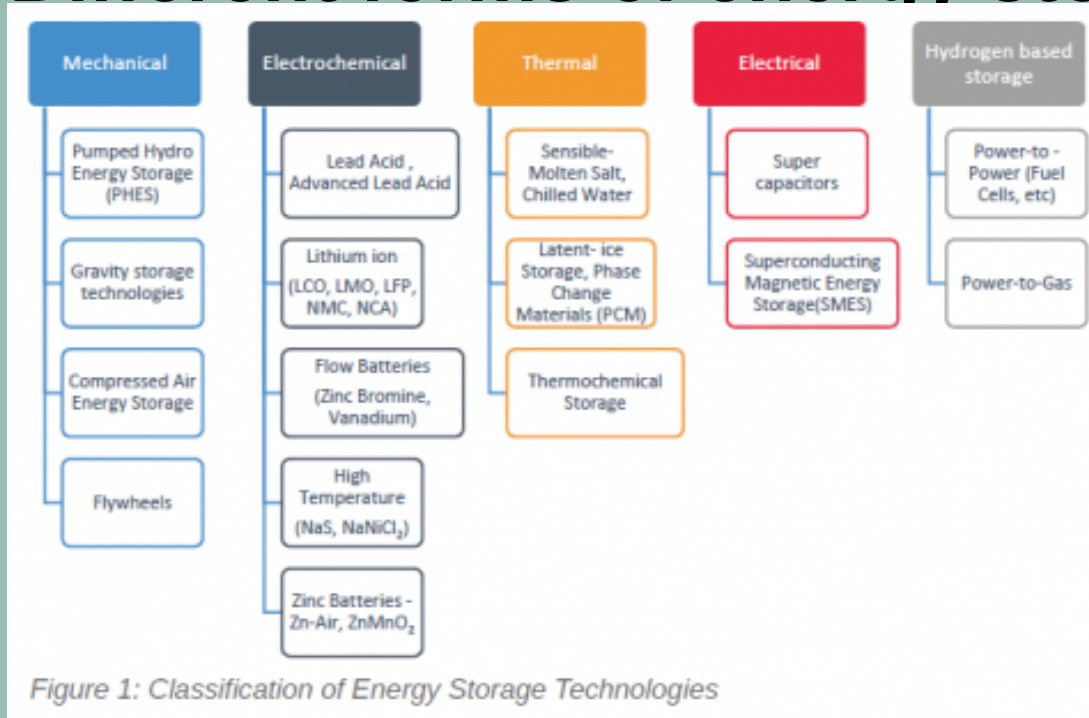
Energy storage markets

Many European energy storage markets are growing strongly, with 4.9 GW (12.1 GWh) of utility-scale (front-of-the-meter) energy storage deployed in 2024, giving an estimated total of more than 13 GW.

System flexibility is particularly needed in the EU's electricity

5. Energy Storage

Different forms of energy storage



Source: <https://etn.news/energy-storage/classification-of-energy-storage-technologies/>

7. Sources

- The Keeling Curve (2024): <https://keelingcurve.ucsd.edu>
- Climate Reanalyzer (2025): https://climatereanalyzer.org/clim/t2_daily/?dm_id=world
- https://www.energy-charts.info/charts/energy_pie/chart.htm?l=de&c=DE&interval=year&year=2024
- <https://repository.tugraz.at/publications/cdb3m-6k122>