Source: Unknown (Creative commons)

Strategies for dealing with market failures

Dr. Daniel Johnson, Professor for Value-Based Forest Economy
05.11.2024

Eberswalde University
for Sustainable
Development

Who am I?

- Professor for Value-Based Forest Economy
  - Professor as of December, 2024
  - Teaching in Sustainable Business, Forest and Environment (Social-ecological forest management)
- Researcher at the Institute for Ecological Economy Research (IÖW)
  - February 2022 – December 2024
  - Research on water and landmanagement, economics of forest and peatland restoration, sponge city and green infrastructure, ecosystem service valuation
- Researcher at the ESCP Business School Berlin
  - September 2017 – November 2021
  - Doctoral degree (Dr.rer.pol) on economic valuation of ecosystem services
  - Coordinator of SustBusy Research Center
  - Teaching in environmental economics
- Short-term consultant with the World Bank
  - September 2020 – January 2022

INSTITUT FÜR ÖKOLOGISCHE WIRTSCHAFTSFORSCHUNG

ESCP BUSINESS SCHOOL

THE WORLD BANK

Who am I?

- Institute of Applied Systems Analysis (IIASA)
  - Research program in urban heat mitigation strategies
- Leibniz University of Hannover
  - M.Sc. Water and Environmental Management
  - Master‘s thesis on measuring and modeling greenhouse gas emissions in a peatland
- Brandenburg Technical University Cottbus-Senftenberg
  - B.Sc. Environmental Resource Management
  - Bachelor‘s thesis on trading in water markets in California
  - Teaching in environmental economics
- Purdue University, West Lafayette, Indiana
  - Environmental Engineering Program
- Born in the USA
  - Hometown: Alexandria, Indiana

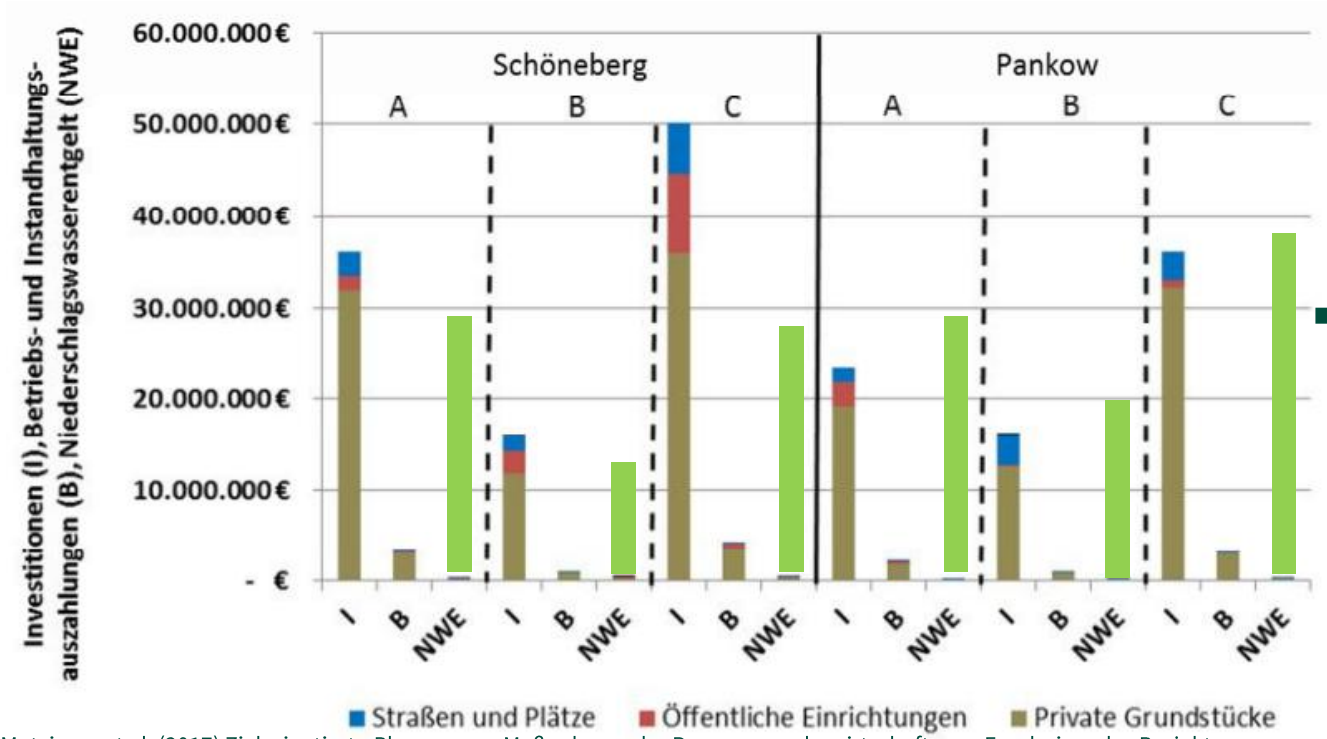
Research and Expertise

- Building an understanding of how social and economic impacts can be calculated
  - Consumption, business, policy making all have social and economic impacts that may not be directly visible and may be positive or negative
  - Various methods can be used to calculate this value
- Some examples:
  - Johnson, D., & Geisendorf, S. (2019). Are neighborhood-level SUDS worth it? An assessment of the economic value of sustainable urban drainage system scenarios using cost-benefit analyses. Ecological economics, 158, 194-205.
  - Johnson, D., & Geisendorf, S. (2022). Valuing ecosystem services of sustainable urban drainage systems: A discrete choice experiment to elicit preferences and willingness to pay. Journal of Environmental Management, 307, 114508.
  - Johnson, D., Schmidt, K., Scholz, C., Chowdhury, L., & Dehnhardt, A. (2024). Valuation of soil-mediated contributions to people (SmCPs)–a systematic review of values and methods. Ecosystems and People, 20(1), 2401945.

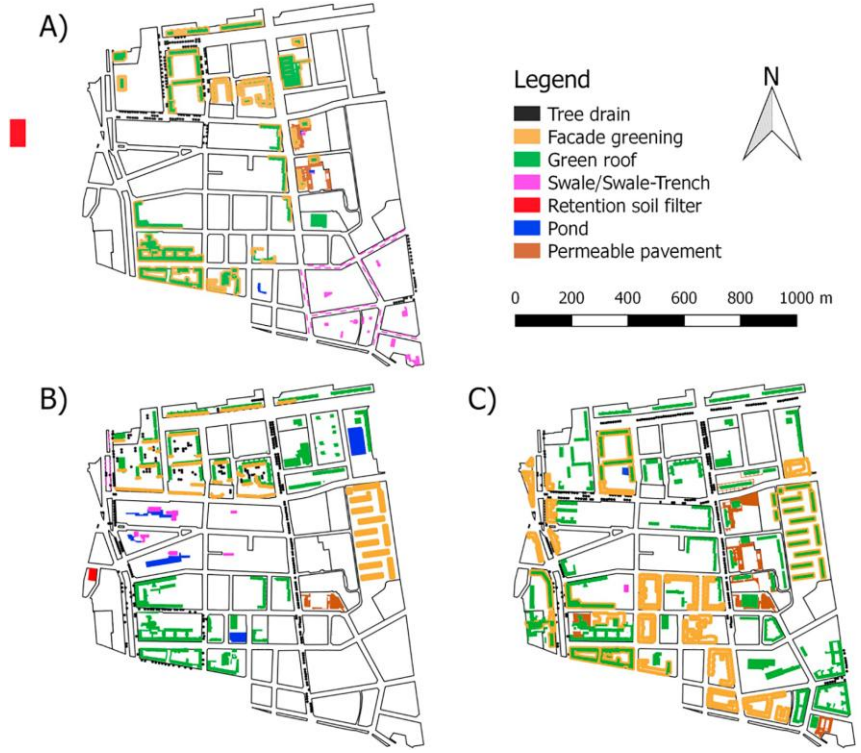
Source: Unknown (Creative commons)

Research and Expertise

- Accounting for the benefits of sustainable urban drainage systems (green infrastructure)



Source: Matzinger et al. (2017) Zielorientierte Planung von Maßnahmen der Regenwasserbewirtschaftung - Ergebnisse des Projektes KURAS. Berlin.



Source: Johnson and Geisendorf (2019)

- **Ground water recharge**
- **Drinking water savings**
- **Air quality improvements**
- **CO_2 sequestration**
- **Energy savings**
- **Building longevity**
- **Habitat creation**
- **Aesthetic improvements**

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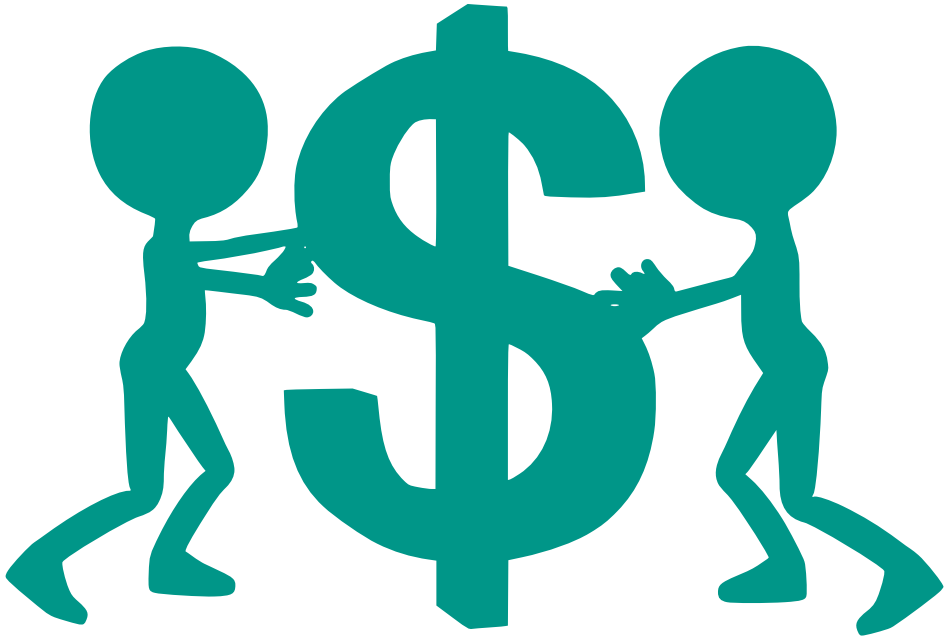
Goals for today

- To reflect on market failures and where/why they exist
- To understand examples of methods to deal with market failures
- To compare strategies to deal with market failures from an economic point of view

Some basic economics



Some basic economics

- **I How people make decisions**

1. People face tradeoffs
2. The cost of something is what you have to give up to get it
3. Rational people think at the margin
4. People respond to incentives

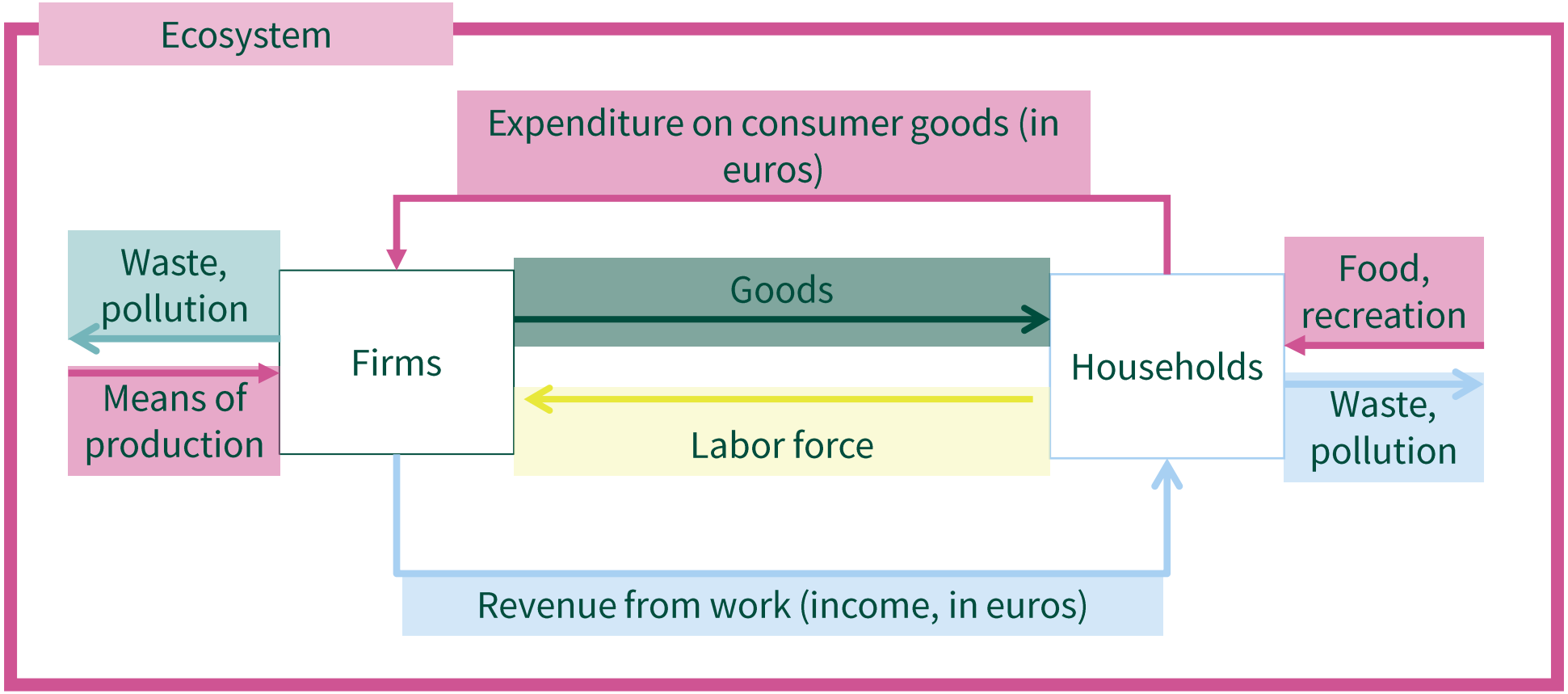
- **II How people interact**

5. Trade can make everyone better off
6. Markets are usually a good way to organize economic activity
7. Governments can sometimes improve market outcomes

- **III How economics as a whole reacts**

8. A country's standard of living depends on its ability to produce goods and services.
9. Prices rise when too much money is put into circulation
10. In the short term, society has to decide between inflation and unemployment

Circular flow model of the economy



Source: Ibisch et al. (2019)
Humans in the Global Ecosystem

Definition of market failures

Market failures:
A situation defined by an inefficient distribution of goods and services in the free market

Definition of market failures

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A situation defined by an inefficient distribution of goods and services in the free market

As the founder of modern economics, **Adam Smith** (Scottish economist and moral philosopher, 1723-1790) proposed the idea of the invisible hand

- Free markets allow for self-interested people to demonstrate their preferences
- The market is self-regulating and then adjusts itself for socially desirable outcomes
- **Do markets really behave in this way for socially desirable outcomes?**

Source: https://medium.com/@thadcollins/what-is-the-invisible-hand-98ffe691d6a3

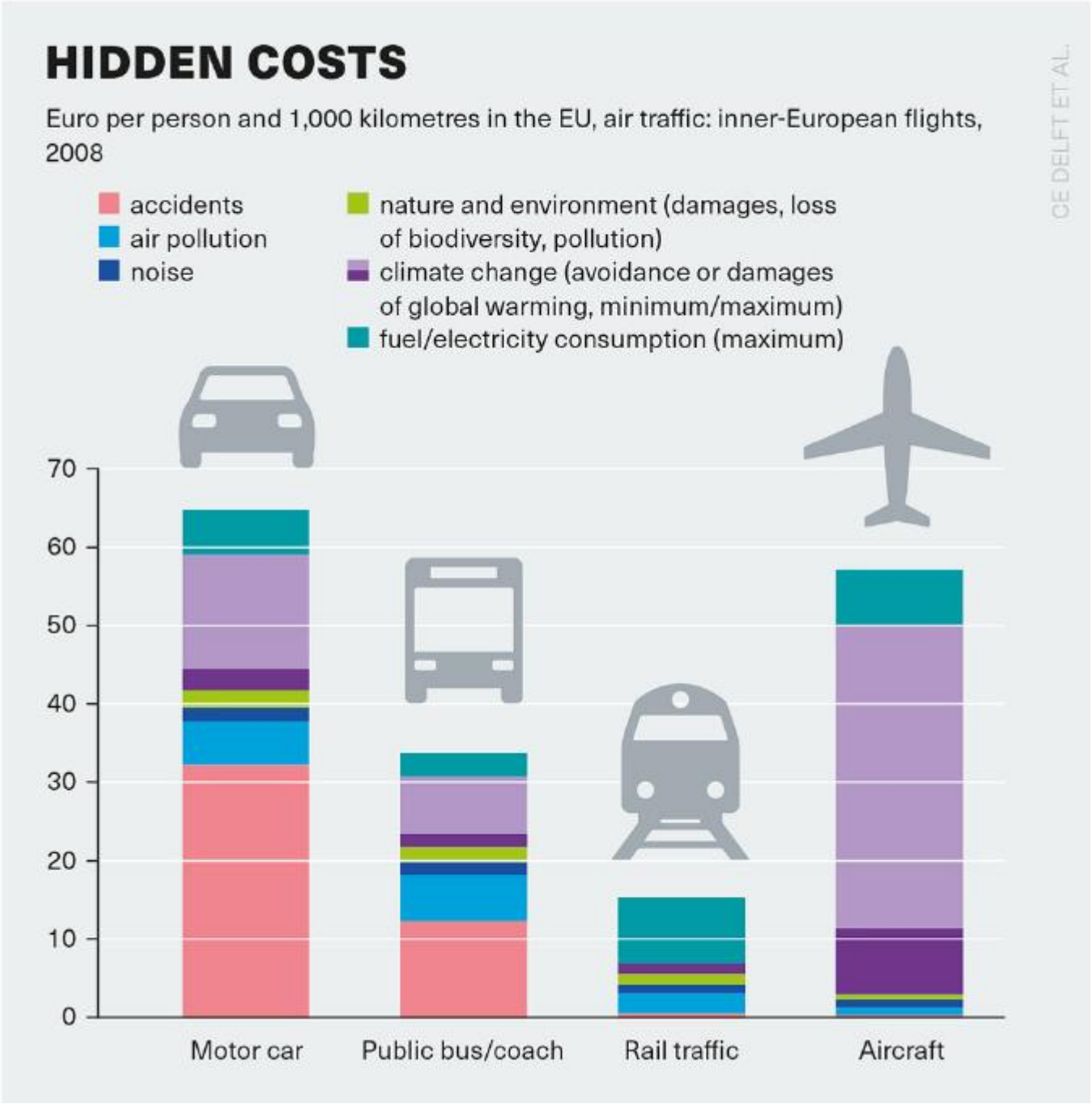
A practical example of market failures

- If goods and services have societal impacts that are not included in the price, these are termed **externalities** (or external costs)
  - Consider the example of the consumption of meat from unsustainable (or unethical) sources
  - The price of meat does not reflect the cost to the environment in terms of water pollution (fertilizer runoff) or greenhouse gas emission
  - **If the true costs of meat were reflected in the price, do you think less people would eat meat? Do you see any issues with such an approach?**

Animal-based agriculture and feed crop production account for ca**. 83% of agricultural land** globally are responsible for ca. **67% of deforestation** → largest driver of greenhouse gas emissions, nutrient pollution and ecosystem loss in the agri sector (Funke et al. 2022)

Source: https://www.heise.de/newsticker/meldung/Discounter-Penny-weist-wahre-Verkaufspreise-aus-4884506.html?utm_source=pocket-newtab-global-de-DE

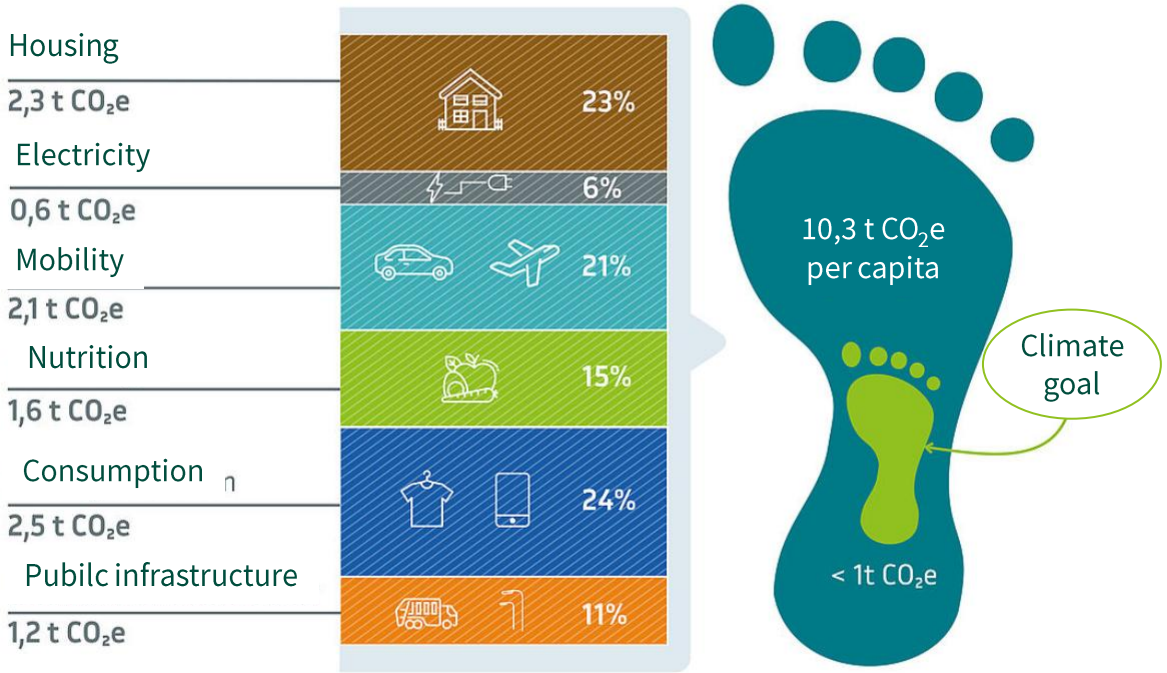
Some more examples



Source: https://farm8.staticflickr.com/7312/27117623264_f91edf6601_b.jpg

Some more examples

Average CO_2 footprint per capita in Germany

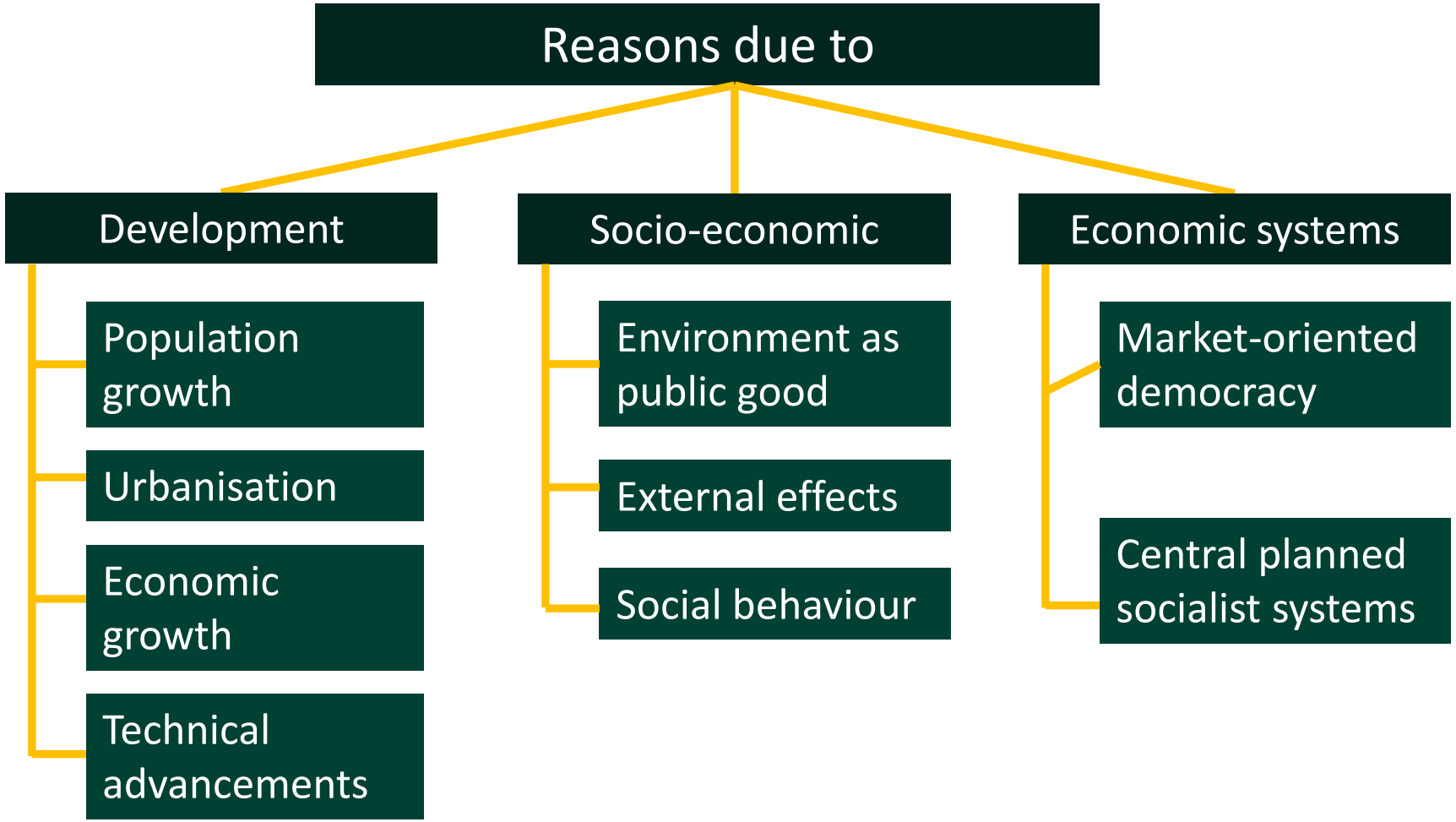


CO_2e: Die Effekte von unterschiedlichen Treibhausgasen (z.B. Methan) werden zu CO_2-Äquivalenten umgerechnet und in die Berechnung einbezogen.

Quelle: Umweltbundesamt CO_2-Rechner (Stand 2024)
© Kompetenzzentrum Nachhaltiger Konsum

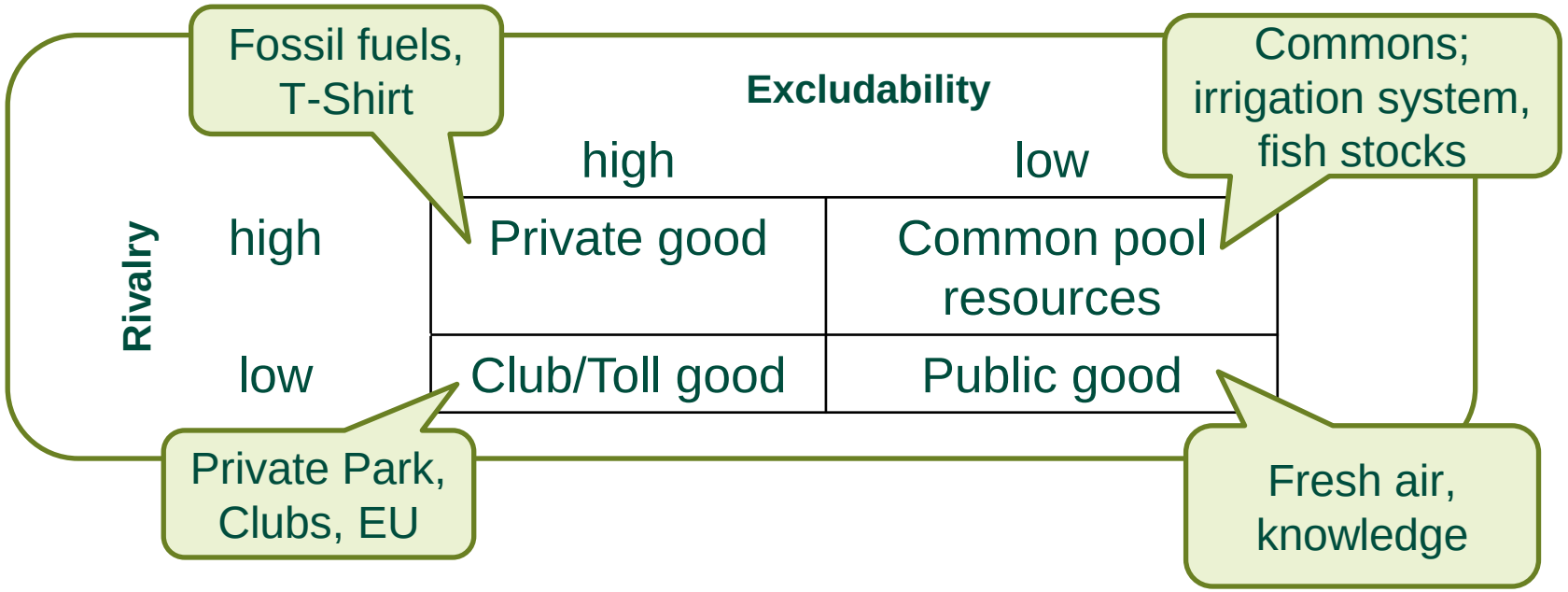
Source: https://www.bmuv.de/media/kohlenstoffdioxid-fussabdruck-pro-kopf-in-deutschland

How do market failures emerge?



Different types of goods

Ecosystems and their services are sometimes private goods (such as sources of food sold in markets) and sometime public goods



Public goods have no market price and are not traded in markets

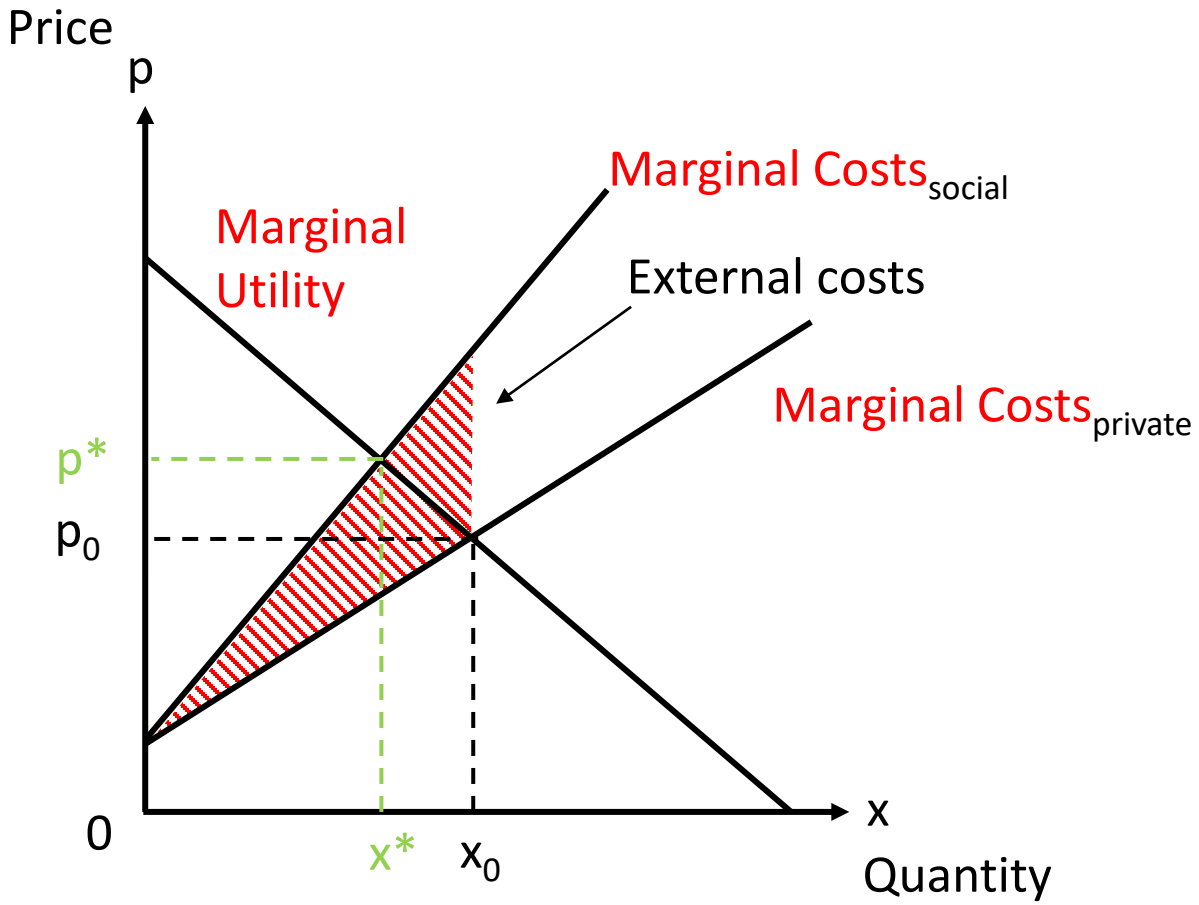
Excludability: Good providers can prevent people who do not pay for it from consuming it.

Rivalry: Good cannot be consumed by more than one person at the same time

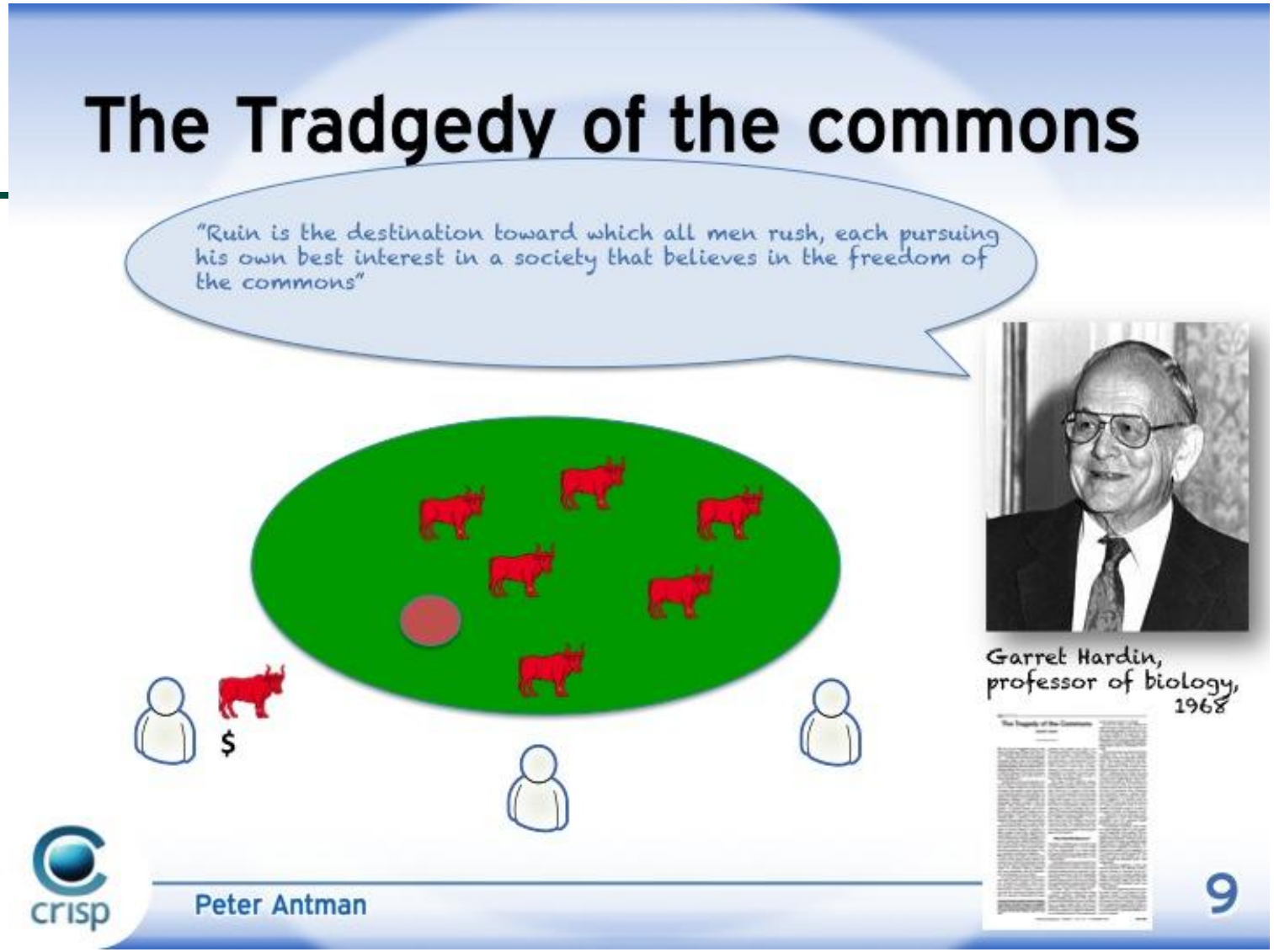
Consequences for public goods?

Discuss in pairs (5 Minutes)

Theoretical understanding of externalities



- → Such low or not prices as if the goods were in limitless supply
- → Lack of clarity of ownership or no ownership at all (who has the responsibility?)
- → Overuse of ecosystems
- → Too much pollution (no incentive to reduce)
- → Under-provision of ecosystem services
- → Overall, society consumes more of a product/service than if all costs would be considered
  - But wouldn't people just not buy the product if it is damaging???
  - Dilemma of public goods



Source: https://blog.crisp.se/wp-content/uploads/2013/05/Bild09.jpg

→ Because of self-interest and the lack of property rights

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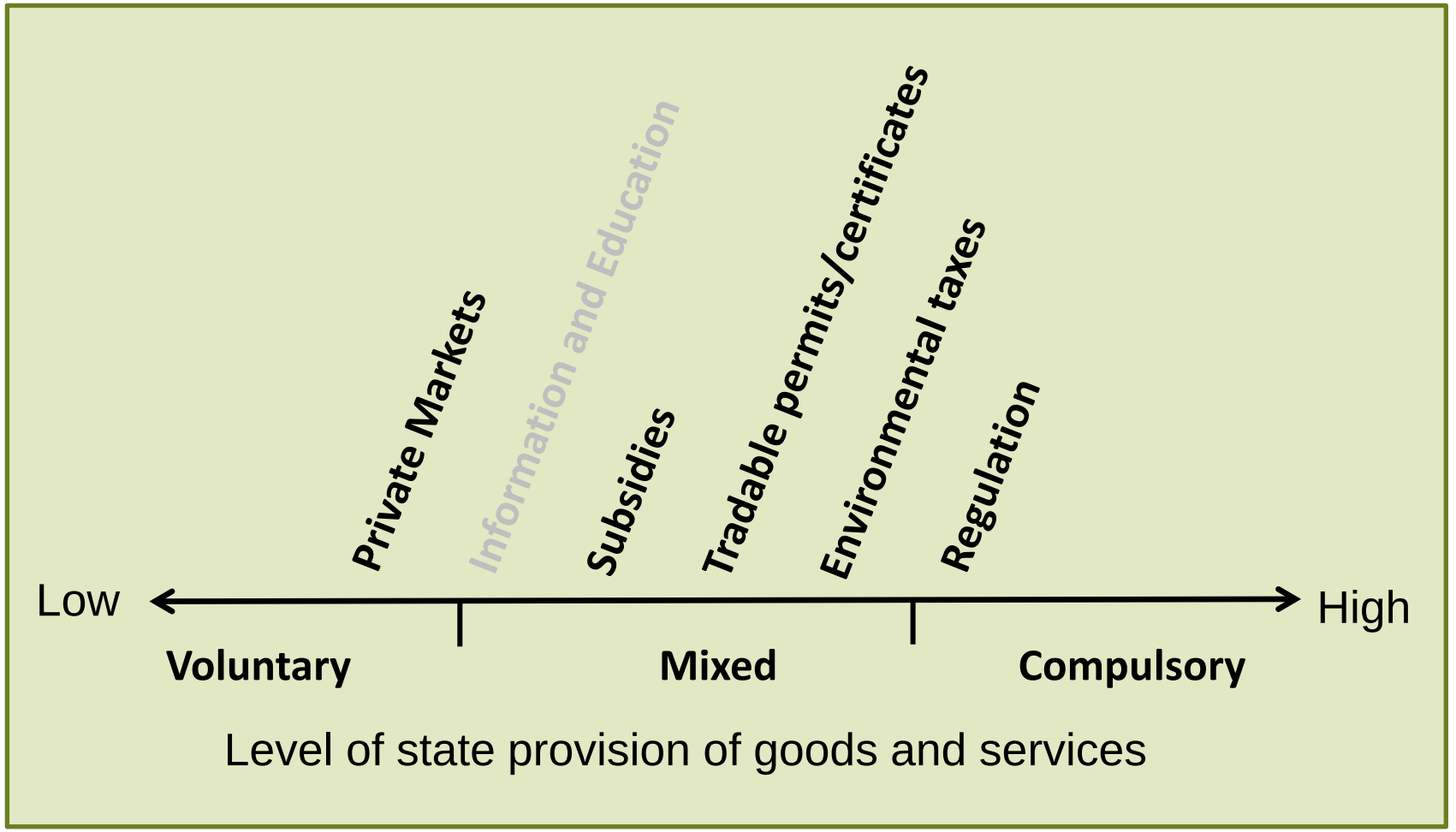
Solutions for market failures

- Allocating or assigning property exclusive and transferable property rights to natural resources
- Incorporating externalities into decision-making
- Designing and/or adjusting suitable institutions
  - “[A] set of rules actually used […] by a set of individuals to organise repetitive activities that produce outcomes affecting those individuals and potentially affecting others” (Ostrom 1992: 19).

Solutions for market failures

=> Different level of state involvement (spectrum)



(Howlett & Ramesh 1995)

Environmental policy instruments

Regulation

- "Command-and-control"
- Either as maximum ceiling or required state-of-the-art technologies

Taxes

- Tax levied on emitters
- Same tax rate for emissions (per emission unit)

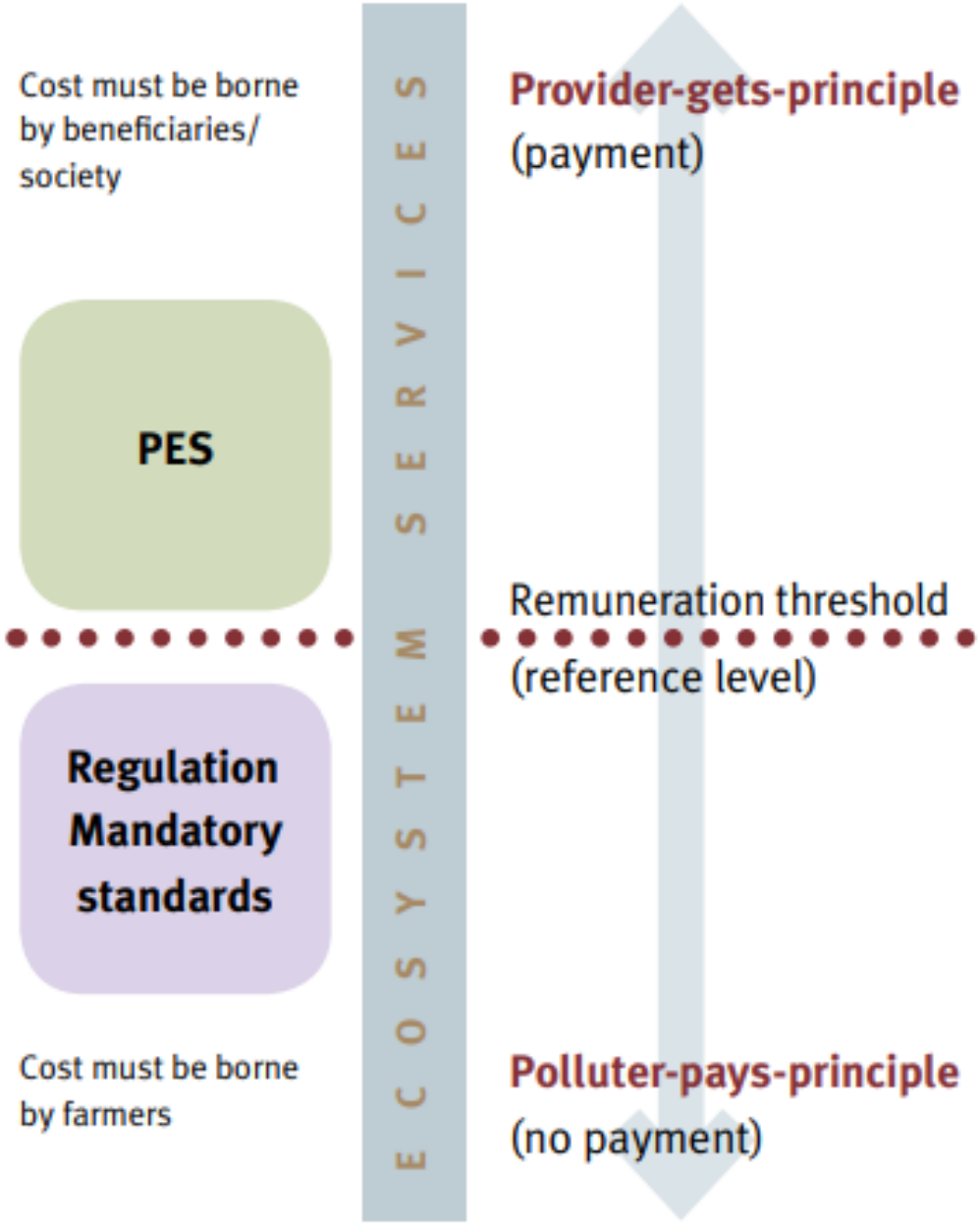
Permit trading

- Allowances for emissions
- Permit allows emissions of specified unit of pollution
- Ceiling on total number of permits
- Permit distribution: auctioning or grandfathering

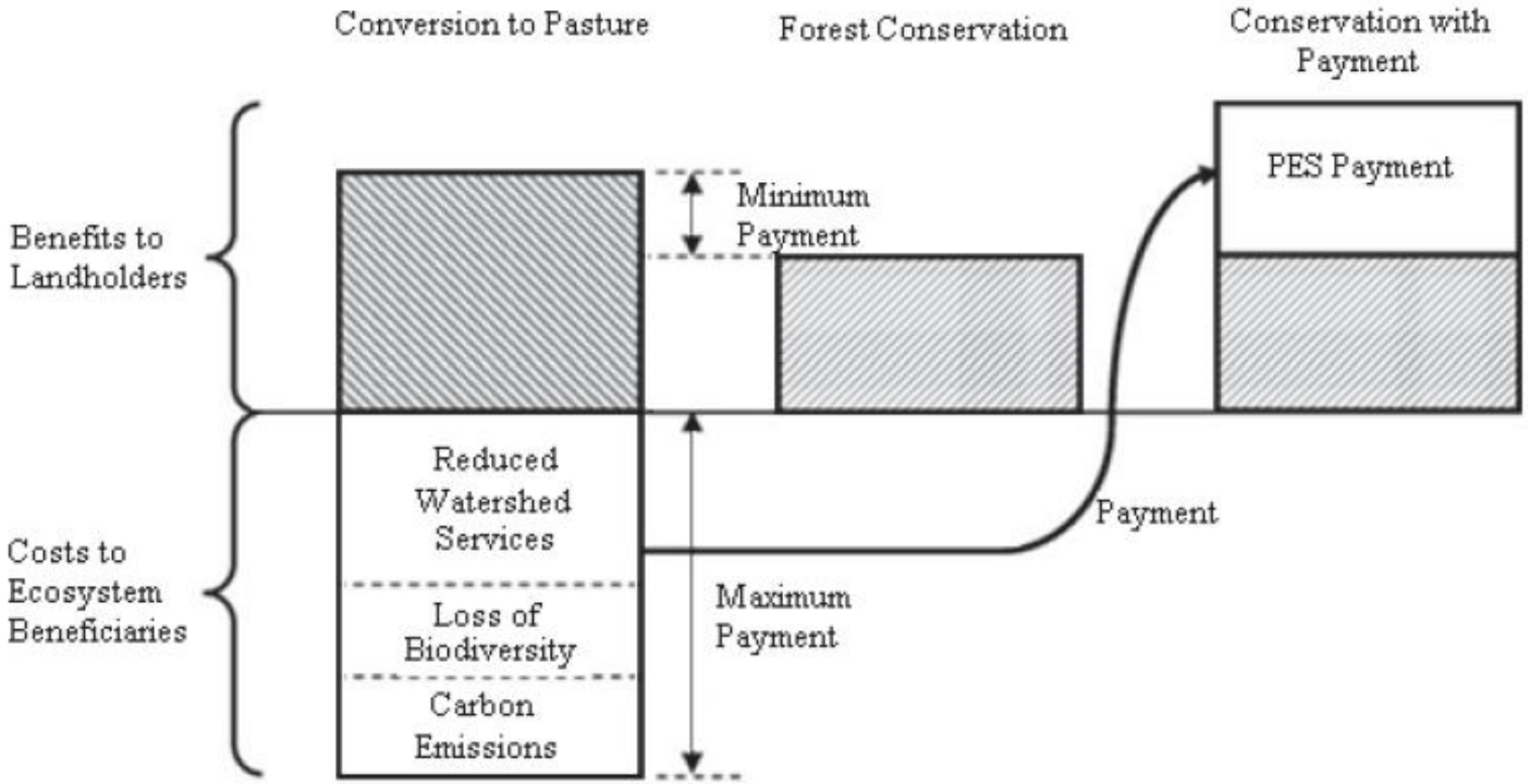
Source: Unknwon (Creative Commons)

Voluntary approaches

- **Payments for ecosystem services (PES)**
- Payments for ecosystem services (PES)
- Agreement between one seller and one buyer over a service
- Property rights are given to the provider of the service



Voluntary approaches



Source: Adapted from Engel *et al.*, 2008.

Example of PES

- **MoorFutures (https://www.moorfutures.de/moorfutures-erwerben/)**
- Voluntary carbon market developed by the University of Greifswald
- Businesses and private individuals can offset carbon emissions by purchasing certificates
- Certificates generated by rewetting peatlands (30-70€)

Example of PES

Woodify (https://lets-woodify.de/shop/)

- Voluntary carbon market for protecting forests
- Businesses and private individuals can offset carbon emissions by purchasing certificates
- Certificates cost 50-70€ (or even on m^2 basis)
- Example project: CO_2 sequestration on the Moselschleife (Rheinland-Pfalz)
  - “Our new Moselschleife climate project is surrounded by the Moselschleife, vineyards and castles. In this popular vacation region, we are working with the municipalities of Briedel and Alf to create a climate project for the future. We are giving nature in the forest time and space to recover. The result is a near-natural forest with all the positive effects on the environment and the climate. Our climate forest binds measurably more CO_2, stores more water, cools its surroundings more and strengthens local species protection and vital biodiversity.”

Source:https://lets-woodify.de/wp-content/uploads/2024/01/Moselschleife.jpg

Example of PES

Woodify (https://lets-woodify.de/shop/)

- Example project: CO_2 sequestration on the Moselschleife (Rheinland-Pfalz)
  - "The project is based on the forest biology concept of our scientific partner, the Centre for Econics and Ecosystem Management (CEEM), headed by Professor Dr. Dr. h.c. Pierre Ibisch: Giving nature space to regenerate and provide ecosystem services that are essential for survival. The project is validated by the external testing service provider TÜV Nord Cert according to validation standard: ISO 14064-2:2019."
  - Total area: 285.2 hectare
  - CO_2 sequestration in 30 years: 49,526 tons (change between project and base scenario)

Source:https://lets-woodify.de/wp-content/uploads/2024/01/Moselschleife.jpg

Example of PES

Woodify GmbH (https://lets-woodify.de/shop/)

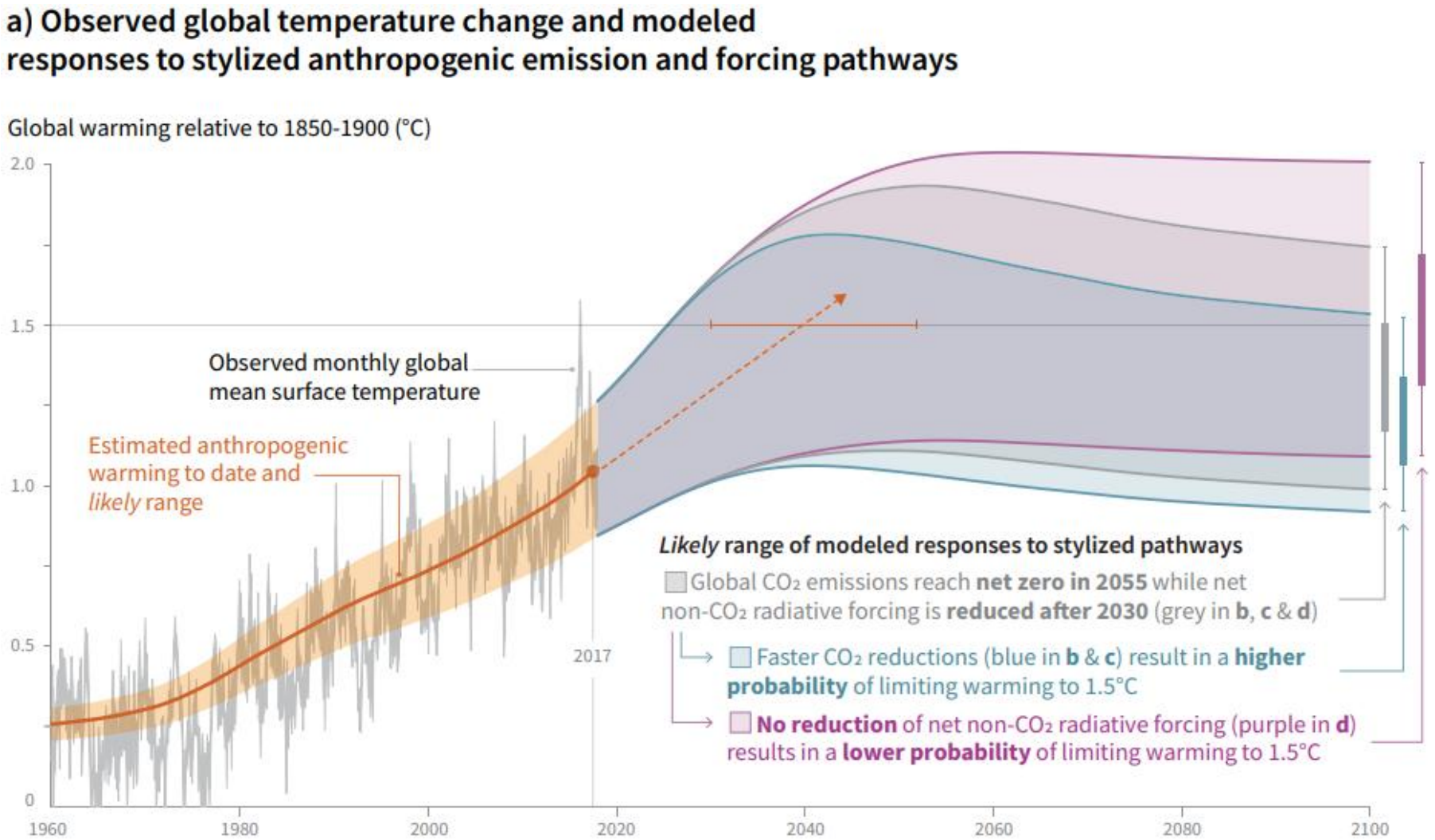
- What does your contribution support?
  - Contractually fixing the ecological management concept on the project areas (leases)
  - Regular monitoring with local forest district management (ensuring compliance)
  - Monitoring of ecosystems, minimally invasive interventions
  - Scientific project support at the HNEE
  - External validation of project and climate performance by TÜV Nord Cert
  - Certification of the acquired climate performance through blockchain-backed woodify climate certificates

Source:https://lets-woodify.de/wp-content/uploads/2024/01/Moselschleife.jpg

Problems of certification schemes? Ensuring additionality

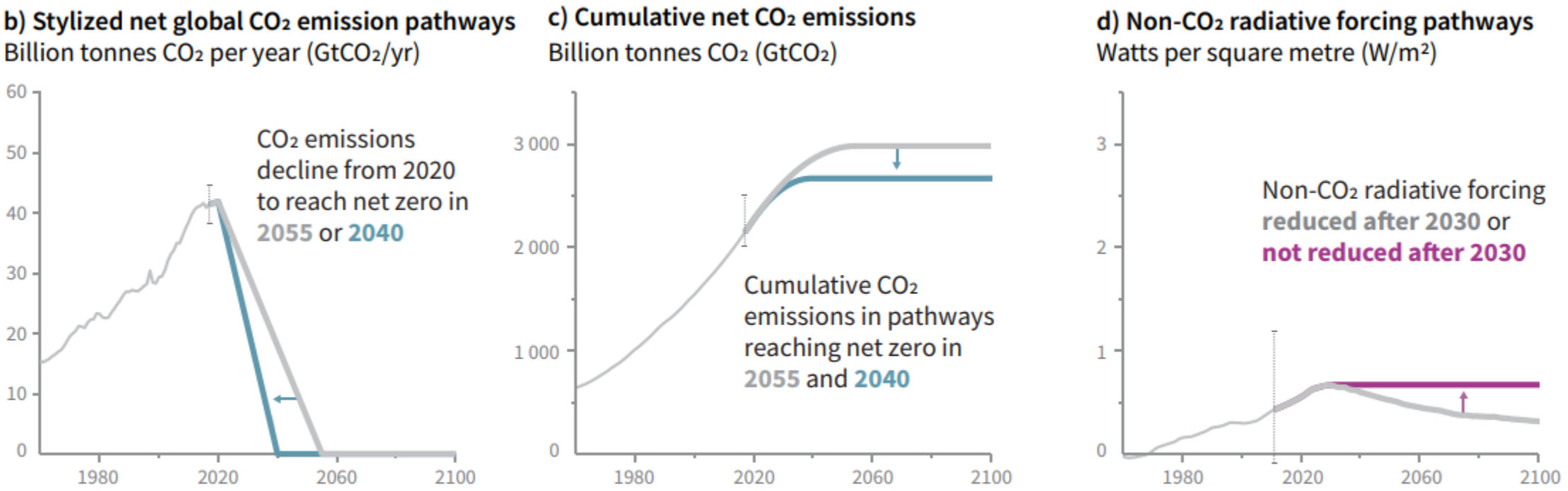
Source: https://www.youtube.com/watch?v=6p8zAbFKpW0&t=1s

Offsetting helps, but isn't enough: 2018 IPCC Reports—1.5 C Warming



Source: https://www.ipcc.ch/sr15/chapter/spm/

Offsetting helps, but isn't enough: 2018 IPCC Reports—1.5 C Warming



Faster immediate CO_2 emission reductions limit cumulative CO_2 emissions shown in panel **(c)**.

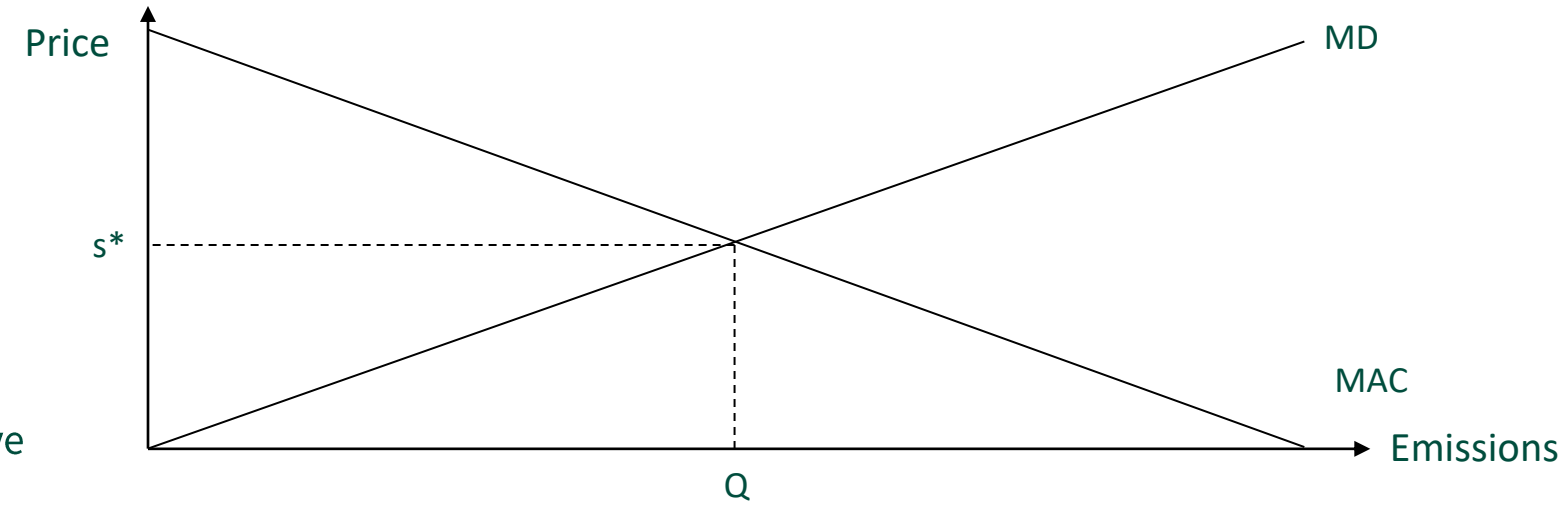
Maximum temperature rise is determined by cumulative net CO_2 emissions and net non-CO_2 radiative forcing due to methane, nitrous oxide, aerosols and other anthropogenic forcing agents.

Source: https://www.ipcc.ch/sr15/chapter/spm/

Environmental policy instruments

Subsidies

- Theoretically equivalent to a tax
- Subsidies have to be financed by taxes
- Emitters receive payments instead of paying a tax
  - Makes the market seem attractive → other firms join the sector
  - Lower prices from competition forces → higher demand, more emissions



MD: marginal damage
MAC: marginal abatement costs
Q: quantity
S*: subsidy

Environmental policy instruments

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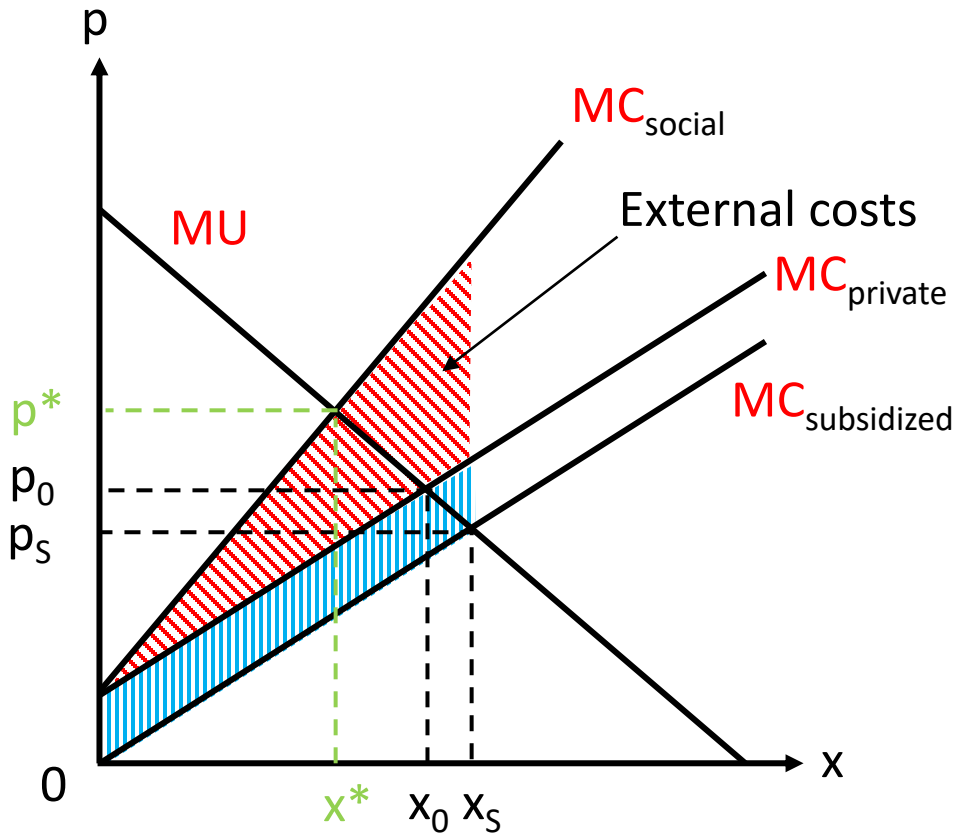
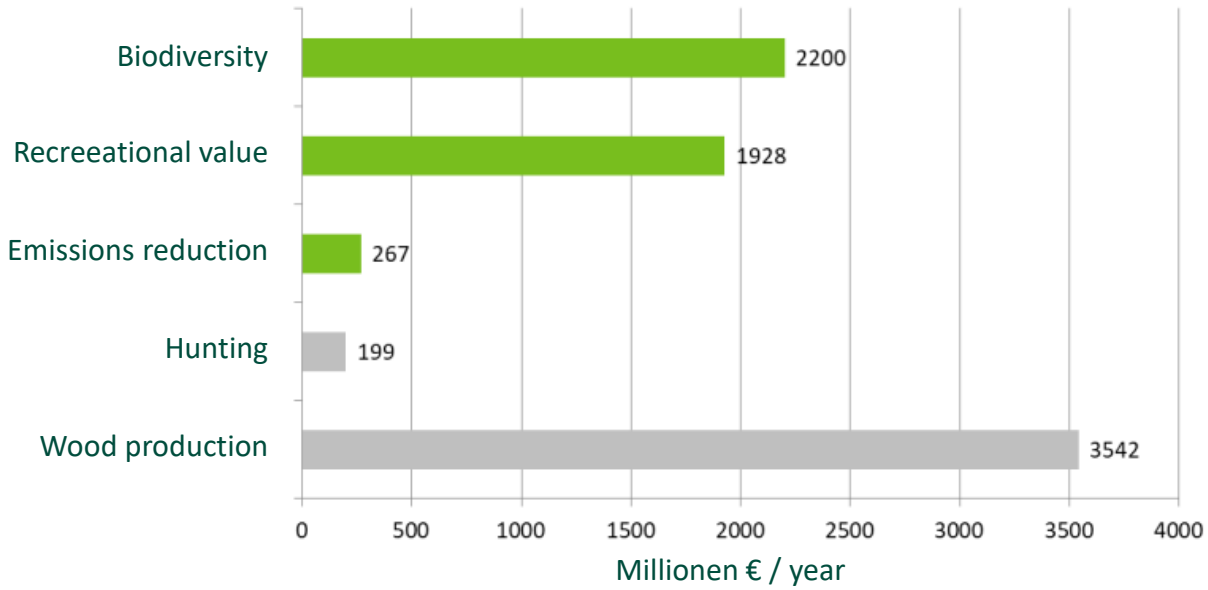


Environmental policy instruments

Rewarding systems for ecosystem services

- Research funded by the Federal Ministry of Nature Conservation (Bundesamt für Naturschutz) to develop rewarding systems for provision of ecosystem services in forests and peatlands
  - Current study being carried out by the Institute for Ecological Economy Research and biota Institute for Ecological Research and Planning
  - Valuation of ecosystem services following restoration → monetary flows for forest and peatland owners/users to compensate for restoring ecosystems and maintaining services
- "Climate-adapted forest management" funding for forestry is one example that rewards the more protection of climate in biodiversity in forests in Germany (Klimaangepasstes Waldmanagement)

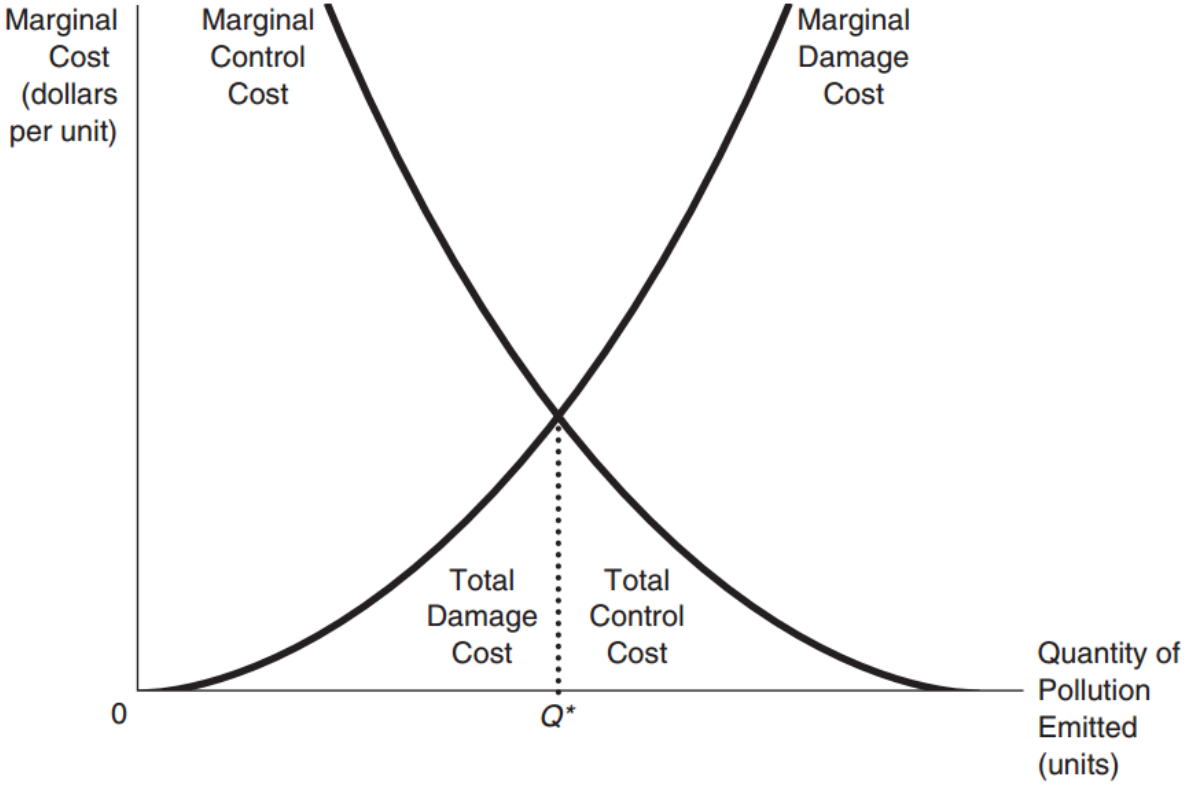


Source: Naturkapital Deutschland – TEEB (Hartje et al., 2015; von Haaren & Albert 2016)

Goals of instruments

Goal: efficient allocation of pollution

- High levels of pollution may cause death
- Low levels of pollution are costly
- With no instruments → inefficiency as society bears the cost of pollution
- Efficiency is achieved when the marginal cost of control is equal to the marginal damage caused by the pollutants



→ Is there a case when Q* might be very close to zero?

Criteria for evaluation

Discuss in pairs (5 Minutes)

Goal attainment / Ecological effectiveness

- Does the instrument bring about the desired result?

Cost effectiveness

- Is the goal reached in a cost-effective manner?

Incentive effect / Initiating environmental innovation

- Are the emitters induced to bring about progress through development of environmental technologies?

Distributional effect

- Who is worse or better off than before?

Political feasibility

- How does the society/industry react?

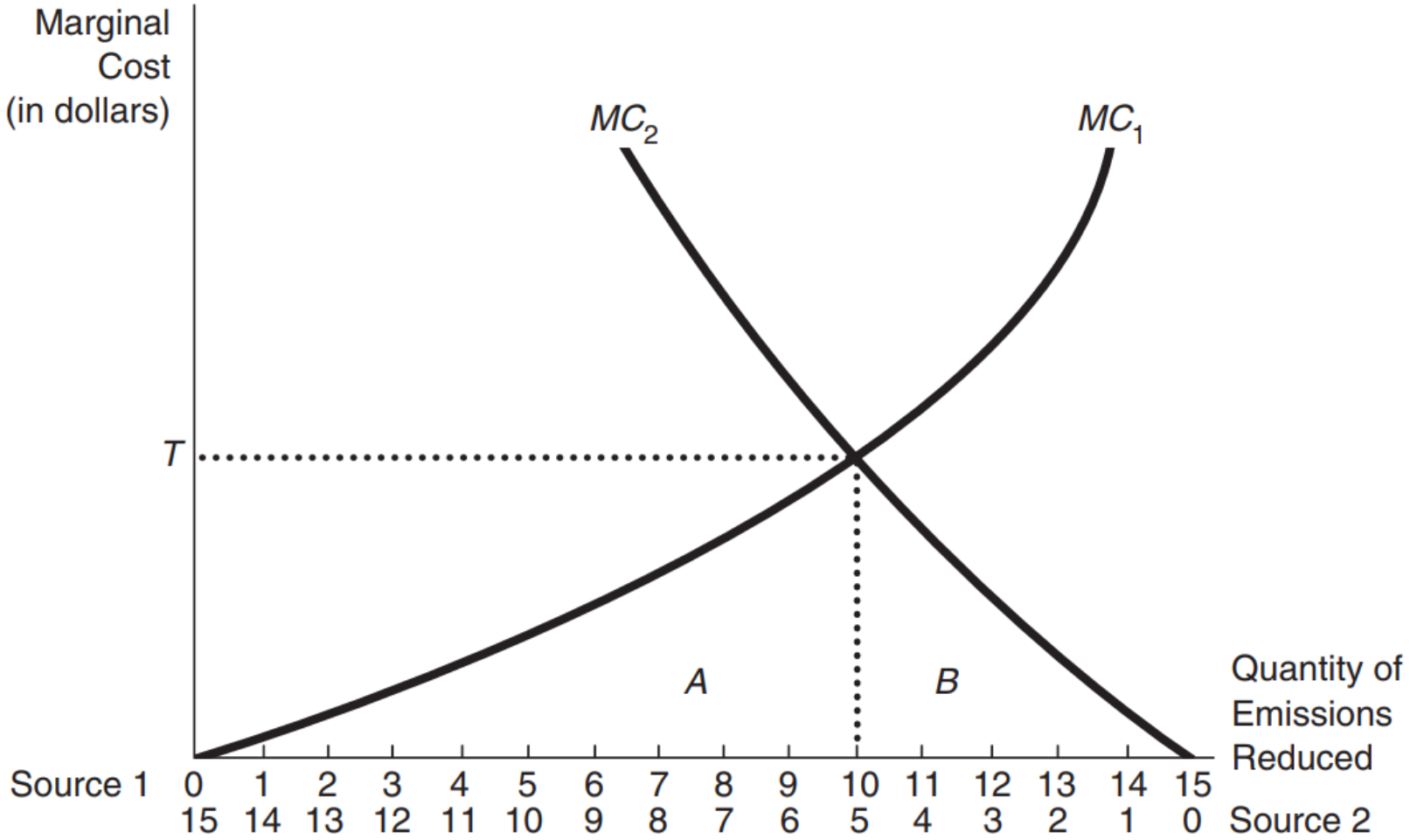
Cost effectiveness

Example:

2 firms are emitting uniformly mixed pollutants (e.g. CO_2) and have two different marginal cost (MC_1, MC_2) curves for abatement. Each firm emits 15 tons for a total of 30 tons. The controlling authority aims for a 15-ton reduction in emissions.

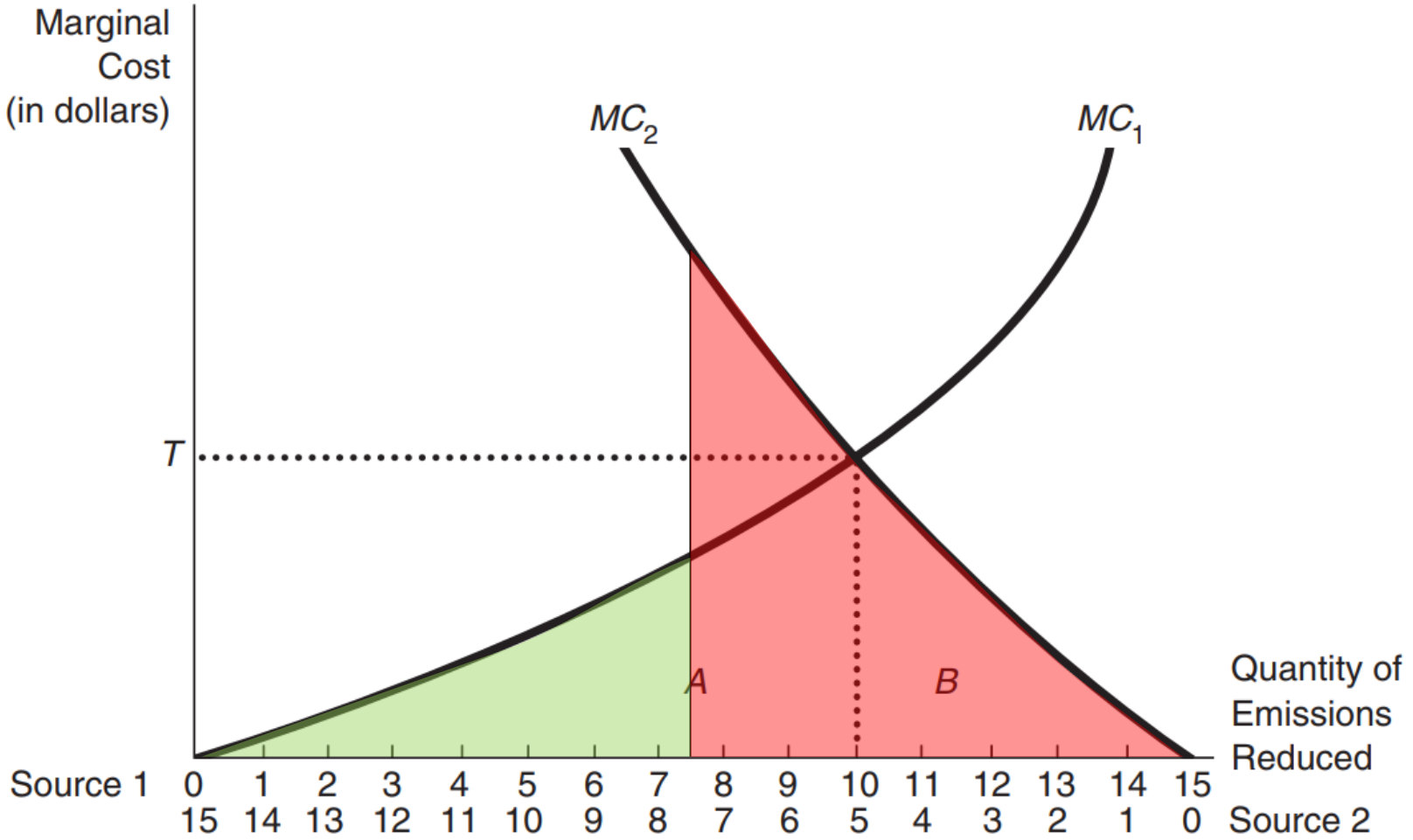
How can a cost-effective allocation of emission abatement be achieved? In other words, how can we reduce emissions by 15 tons and minimize the total cost?

Cost-effective allocation



Cost effectiveness of regulations

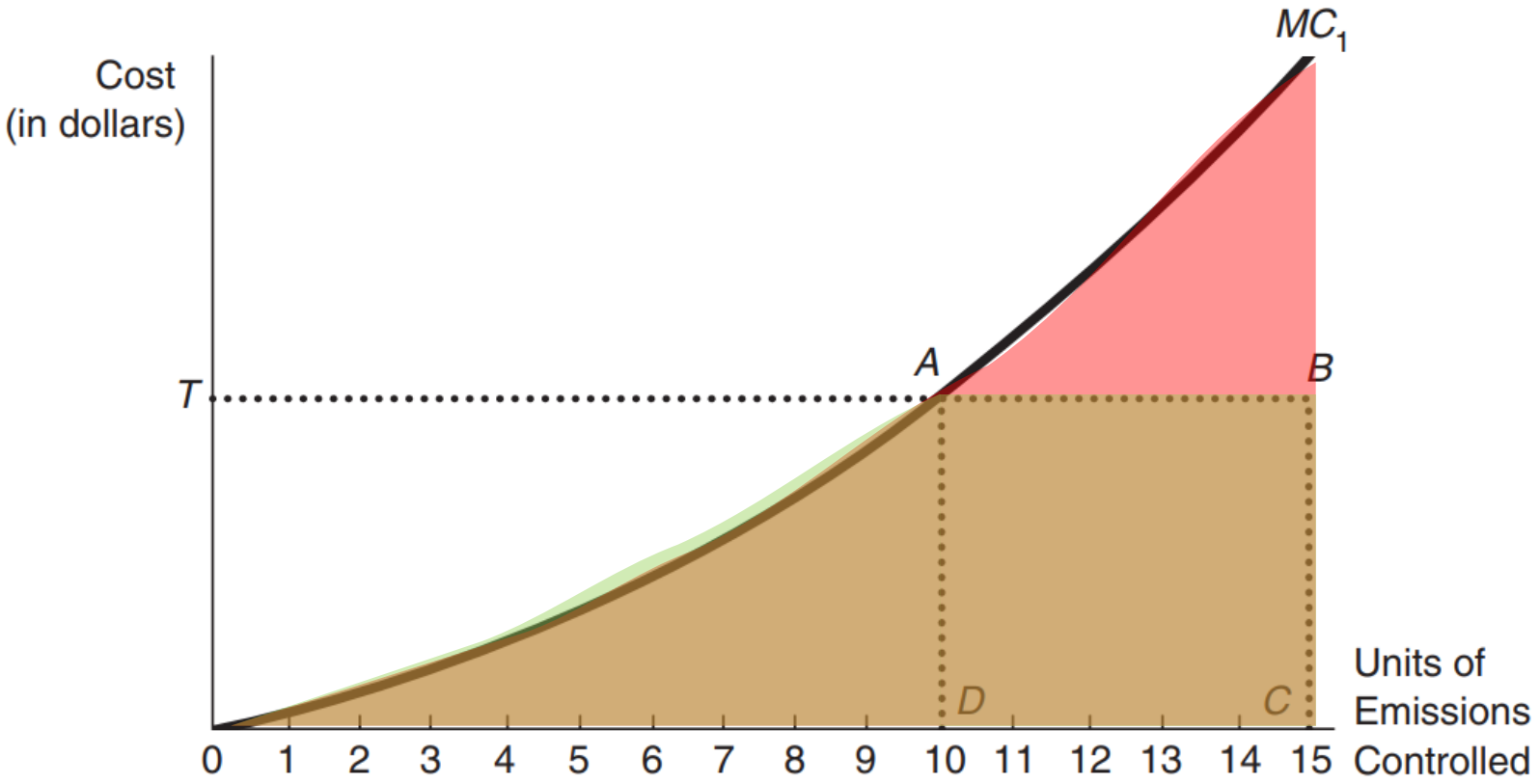
Each firm must reduce 7.5 tons → not a cost effective result since the marginal costs of abatement are not equalized



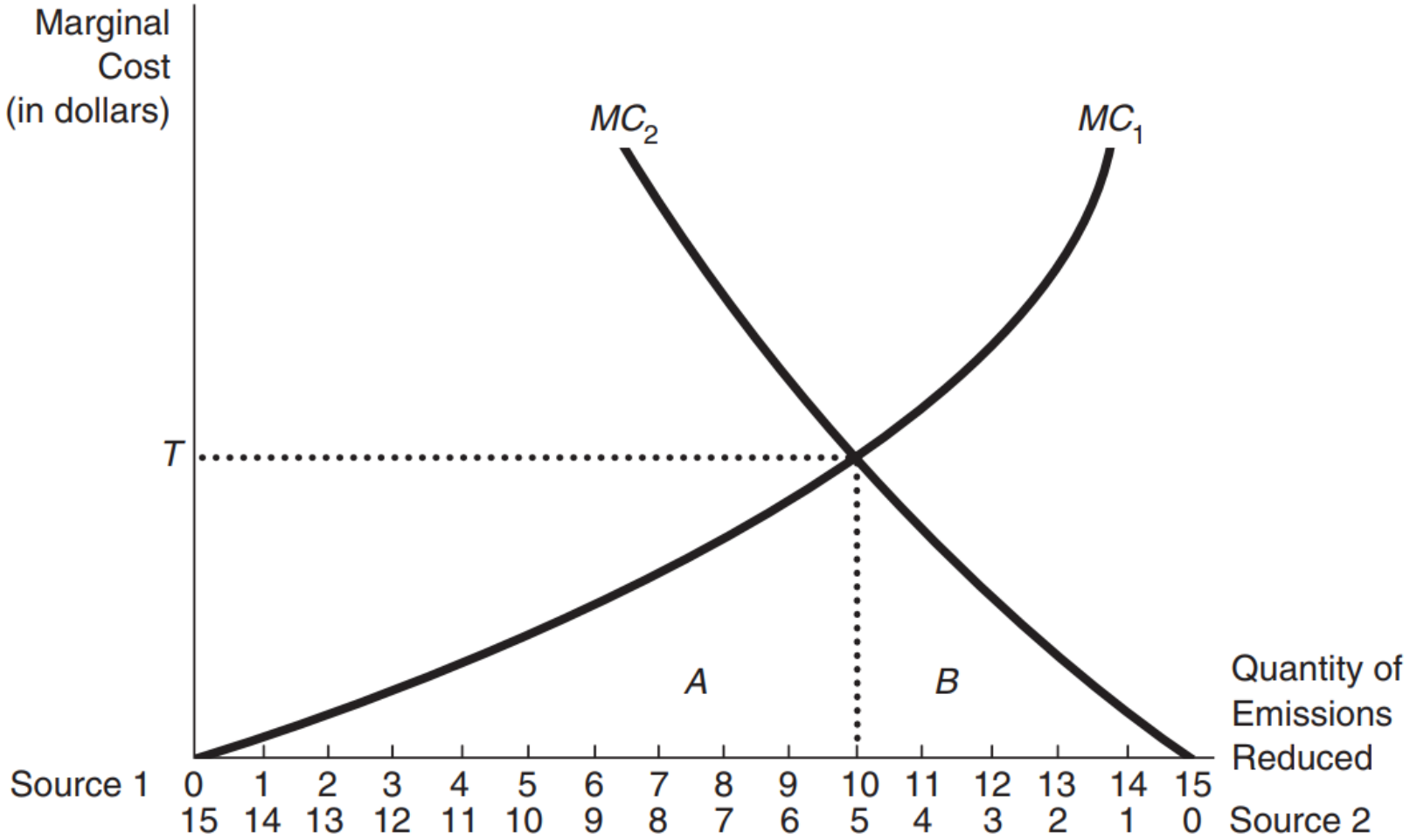
Cost effectiveness of taxes

A profit-maximizing firm must decide which whether to abate or pay the tax. Each firm abates until its marginal cost of abatement is equal to the emission tax.

→ Cost effective allocation of emission abatement among firms



Cost-effective allocation



Taxes and level of emission reduction

Costs are minimized, but which level of emission abatement is desired?

- The controlling authority needs information on abatement costs of all firms
- With this information, the equalization of marginal abatement costs can be found → tax level can be determined
- Very difficult and unlikely
- Trial-and-error process can be applied

Is there another method?

Cost effectiveness of permit trading

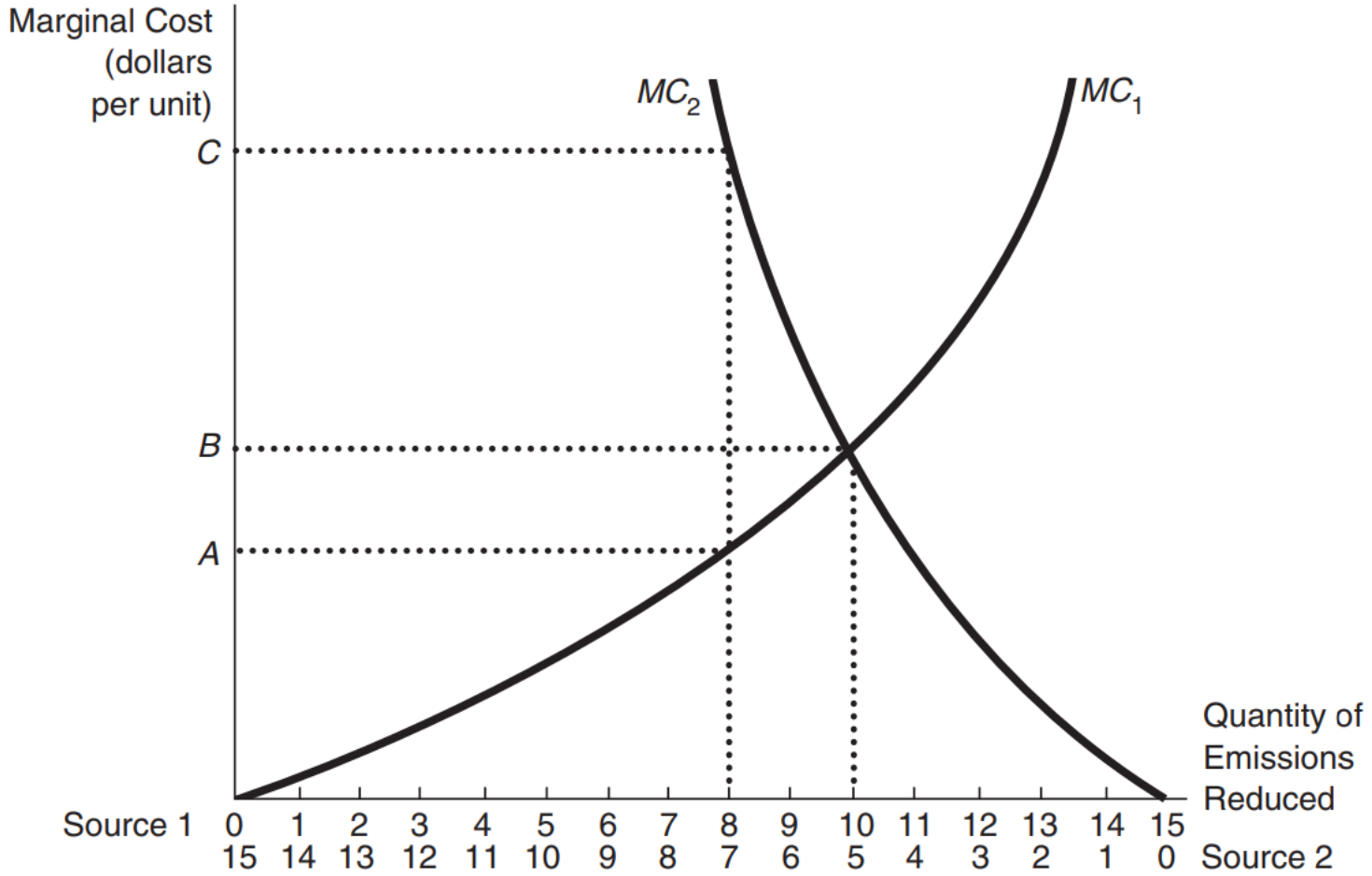
If the first firm was allocated 7 permits, it must abate 8 tons.

The second source was granted 8 permits and must abate 7 tons.

Incentive to trade: MC2 (at C) is much higher than MC1 (at A).

The second firm would be better off to buy permits at any price less than C.

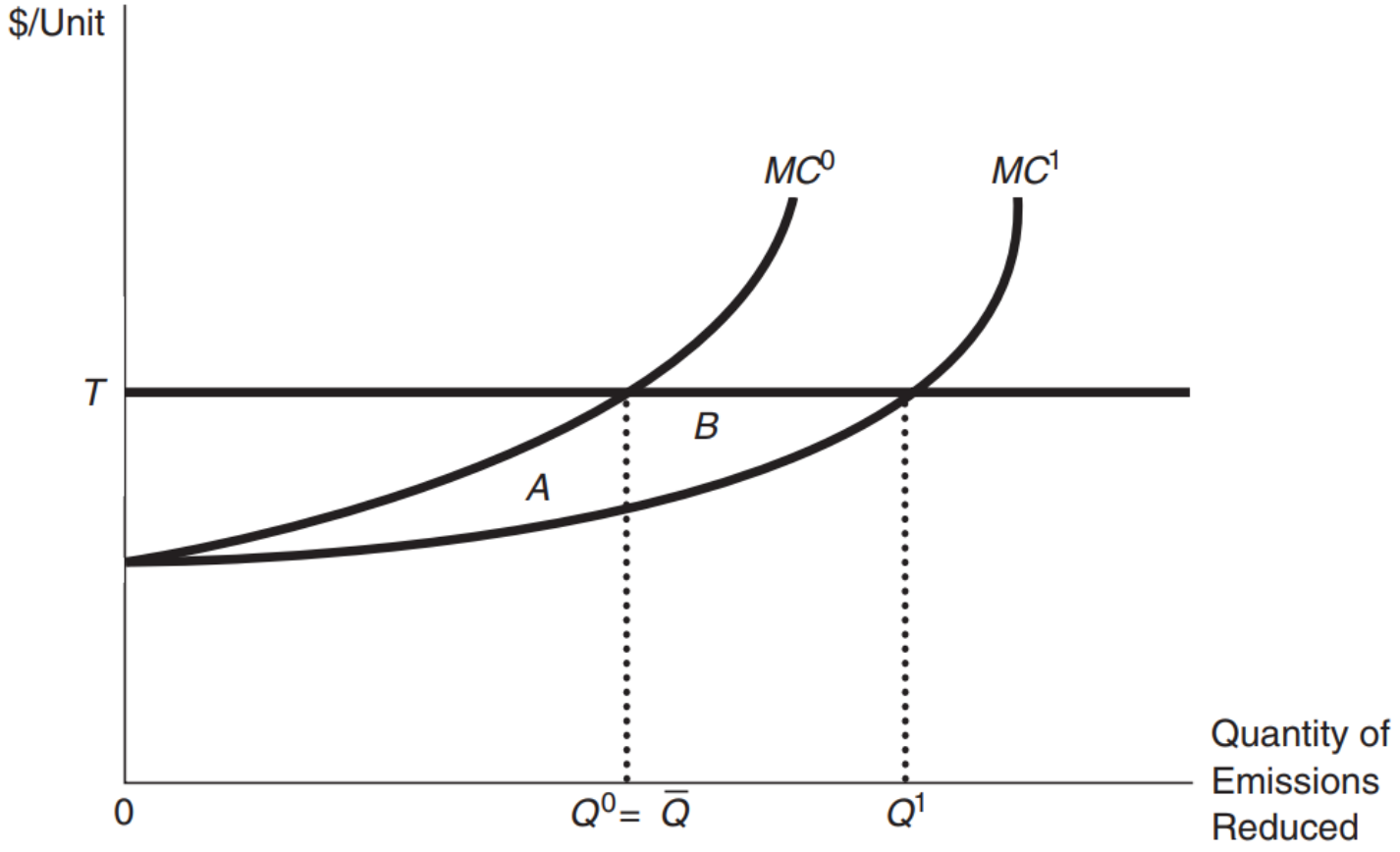
The first firm would be better off abating and selling permits at any price above A.



Incentive for innovation with taxes

Taxes also produce a stimulus for innovaiton

- Firms can save by adopting cheaper new technologies
- A firm can save A and B by adopting the new technology and voluntarily increases its emissions abatement from Q0 to Q1



Goal attainment

Regulations

- With the aim of limited emission reduction → only effective way is with absolute emission limts per firm with no new firms allowed
- As a standard based on a certain unit (e.g. per cubic meter exhaust), not as effective. Depends on intensity and emergence of new firms

Taxes

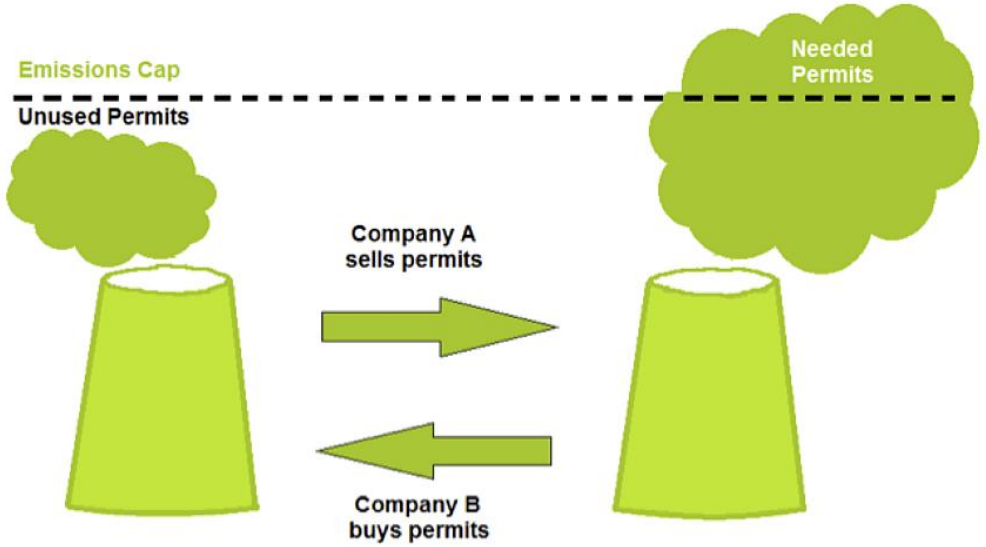
- Marginal abatement costs of polluting firms is needed, but this is unlikely → lower goal attainment
- Trial-and-error could be used, but there is often resistance
- Changes to the tax level because of changing marginal abatement cost, new firms may enter, new technologies, inflation

Source: https://www.pollutionsystems.com/chemical-scrubbers-gas-scrubbers.html

Goal attainment

Permit trading

- Emission limit goal is achieved with overall limit on permits (assuming compliance)
- All the other aspects are addressed with price changes in the market of permits
- However small sources of emission are usually not considered



Source: https://climatepolicyinfohub.eu/eu-emissions-trading-system-introduction

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Summary

- Market failures exist for different reasons, and especially externalities (costs/benefits not included in the price) are a large factor
  - No optimal allocation of resources
  - Often too much pollution
  - Not enough ecosystems and services
- A range of instruments can be used to internalize the externalities (from private to state-led instruments)
- Different criteria for evaluating instruments help to alleviate market failures

What are some wider perspectives for the future in terms of economics within planetary boundaries? What about how to avoid the tragedy of the commons? How do we assess social costs/benefits? → **Next week** ☺

Thank you for your attention!

Dr. Daniel Johnson, Professor for Value-Based Forest Economy