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MODULE 2. LOW EMISSION STRATEGIES

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EINURĐ KORA ΠΛΑΤΩΝ TAL TECH NARVA GÜMNAASIUM BIALYSTOK UNIVERSITY OF TECHNOLOGY STIMMULI for social change

Substantive content:

1. Reasons to move towards sustainable development.
2. Clean energy and sustainable transport – pillars of the UE Green Deal strategy.
3. Theoretical issues of renewable energy sources and sustainable transportation.
4. Good practices of reducing greenhouse gas emissions.
5. Presentation of the 6 hats technique for creative problem solving.
6. Presentation of the scenario analysis for creative problem solving.

GENERAL INFORMATION

Objectives of the training module:

1) Understanding the importance of shifting towards low-carbon emission technologies.
2) Understanding the potential of renewable energy sources and sustainable transportation.
3) Showing examples of good practices referring to reducing greenhouse gas emissions.
4) Developing creative thinking competencies.

Teaching methods: lectures, case studies, practical exercises, self-study of additional literature

Duration: 5 hours

GLOSSARY

biomass (solid biofuels) organic, non-fossil material of biological origin, which may be used for heat production or electricity generation. It includes: charcoal; wood and wood waste; black liquor, bagasse, animal waste and other vegetal materials and residuals
https://ec.europa.eu/eurostat/web/interactive-publications/energy-2023#

carbon footprint - the total greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organization, event or product.”1 It is calculated by summing the emissions resulting from every stage of a product or service’s lifetime (material production, manufacturing, use, and end-of-life).
Center for Sustainable Systems, University of Michigan. 2023. "Carbon Footprint Factsheet." Pub. No. CSS09-05.

climate change can be defined as the shift in climate patterns mainly caused by greenhouse gas emissions
Fawzy, S., Osman, A.I., Doran, J. *et al.* Strategies for mitigation of climate change: a review. *Environ Chem Lett* **18**, 2069–2094 (2020). https://doi.org/10.1007/s10311-020-01059-w

geothermal energy the energy available as heat from within the earth’s crust, usually in the form of hot water or steam.
https://ec.europa.eu/eurostat/web/interactive-publications/energy-2023#

greenhouse gases consist of carbon dioxide, methane, ozone, nitrous oxide, chlorofluorocarbons, and water vapor
https://climate.nasa.gov/faq/19/what-is-the-greenhouse-effect/#:~:text=Greenhouse%20gases%20consist%20of%20carbon,that%20initially%20caused%20the%20warming.

hydropower/hydroelectric the electricity generated from the potential and kinetic energy of water in hydroelectric plants (the electricity generated in pumped storage plants is not included).
https://ec.europa.eu/eurostat/web/interactive-publications/energy-2023#

hydrogen is the most abundant element available on our planet, two-thirds of which is water. This element can be used as a zero-carbon fuel if we separate it.
https://www.greenmatch.co.uk/blog/2021/09/advantages-and-disadvantages-of-renewable-energy#types-of-renewable-energy

low-emission strategies cover a range of approaches aimed at reducing greenhouse gas emissions and pollutants released into the atmosphere. They are implemented across different sectors, focusing on minimizing emissions from human activities. They are commonly deployed in areas such as improving public transport systems and enhancing energy efficiency practices.
Honegger, M.; Michaelowa, A.; Poralla, M. Net-zero emissions: The role of Carbon Dioxide Removal in the Paris Agreement. Policy Briefing Report. Perspectives Climate Research, Freiburg 2019.

photovoltaic (PV) technology is the most efficient technique to convert radiant energy into electrical energy. Solar cells are photoelectric energy conversion devices that employ the photoelectric effect to convert sunlight to electricity. Solar cells and associated components make up a photovoltaic system.

Saleh W.H., Jadallah A.A., Shyraiji A.L. (2022): A Review for the Cooling techniques of PV/T Solar Air Collectors. Engineering and Technology Journal, 40(01): 129-136. DOI:10.30684/etj.v40i1.2139

renewable energy sources, energy sources whose use is not associated with long-term deficit, because their resources are renewed in a relatively short time (renewable raw materials). Such sources are: sun, wind, biomass, biogas and biofuels. Renewable energy also includes heat obtained from the ground (geothermal energy), air (aerothermal energy), and water (hydrothermal energy). Renewable energy plays a vital role for saving environment

Hamed, T. A., and A. J. J. O. S. D. O. E. Alshare. 2022. Water, and E. Systems, environmental impact of solar and wind energy-a review. Journal of Sustainable Development of Energy, Water and Environment Systems 10 (2):1–23. doi:10.13044/j.sdewes.d9.0387.

solar energy reaches the Earth in the form of solar radiation. The sun is currently considered to have the greatest fuel and energy potential. It can be processed in the photovoltaic, photothermal or photochemical conversion process. The advantages of solar energy include: the unlimited nature of its resources and its universality, thanks to which it is used almost everywhere on Earth. Solar energy is already the least expensive source of electricity accessible in several nations throughout the world.

Shiradkar, N., R. Arya, A. Chaubal, K. Deshmukh, P. Ghosh, A. Kottantharayil, S. Kumar, and J. Vasi. 2022. Recent developments in solar manufacturing in India. Solar Compass 1:100009. doi:10.1016/j.solcom.2022.100009.

sustainable transportation refers to low- and zero-emission, energy-efficient, and affordable modes of transport, including electric and alternative-fuel vehicles, as well as domestic fuels.

https://www.energy.gov/eere/sustainable-transportation-and-fuels

tidal energy or ocean energy is the hydropower energy we can get from tides. This energy is sometimes sorted under the category of hydropower, not in a separate one.

https://www.greenmatch.co.uk/blog/2021/09/advantages-and-disadvantages-of-renewable-energy#types-of-renewable-energy

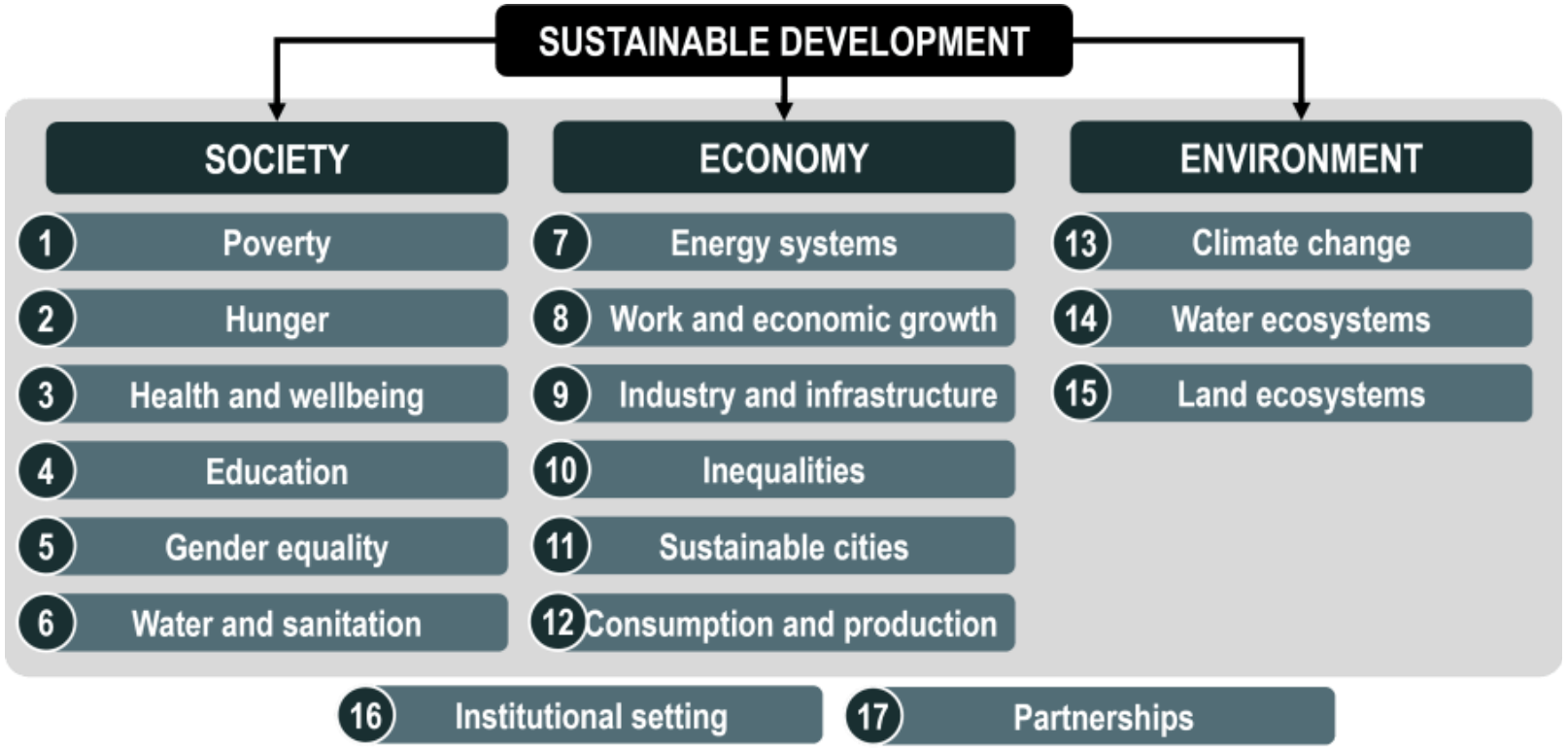
wind energy: the kinetic energy of wind converted into electricity in wind turbines.

https://ec.europa.eu/eurostat/web/interactive-publications/energy-2023#

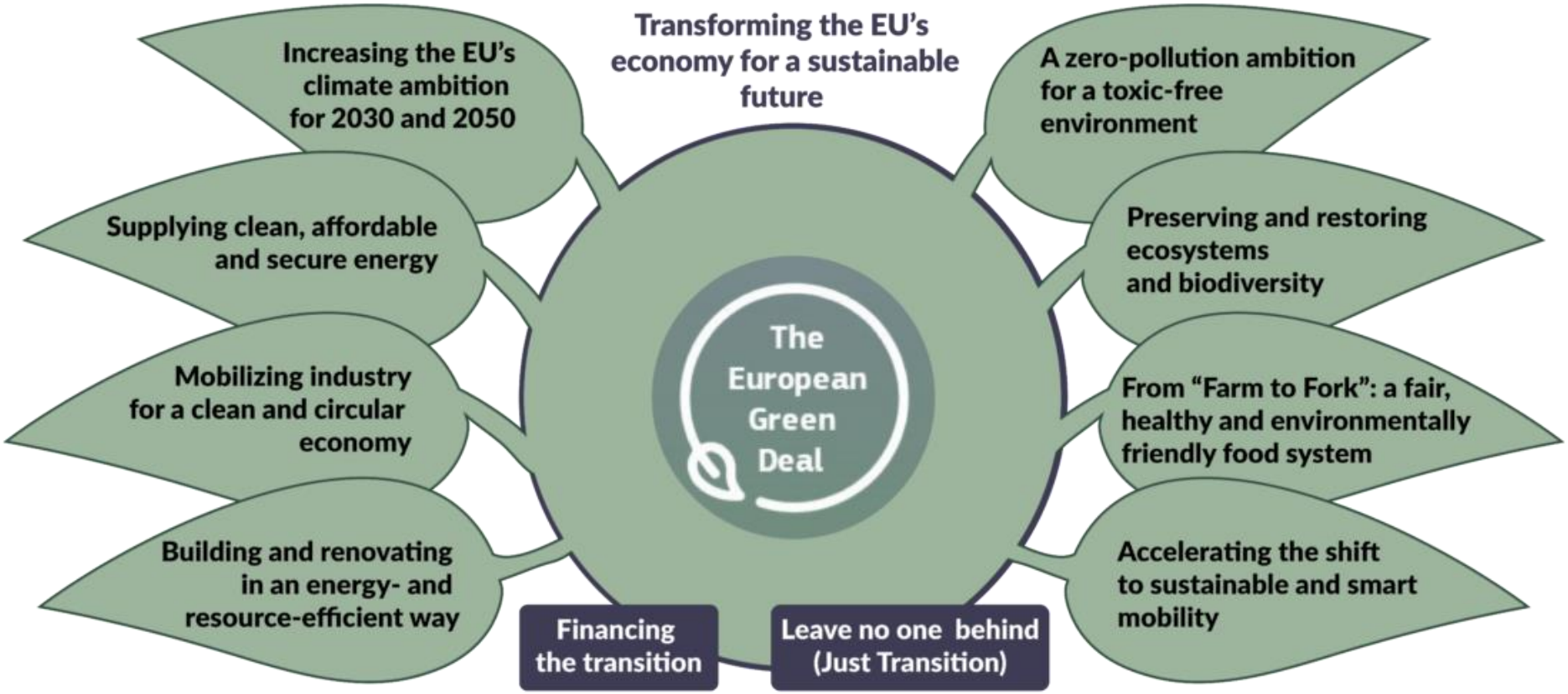
TEACHING MATERIALS

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their needs. It creates an optimal balance between economic, environmental, and social dimensions of sustainability and shows the need to integrate those aspects of development and politics. Environmental sustainability preserves natural resources, minimizes pollutants, and reduces impacts on ecosystems as climate change. Social sustainability considers health and safety considerations, access, and distribution of benefits and costs among community groups, and economic sustainability focuses on economic growth, cost-effectiveness, and financial sustainability.

Heidari I., Eshlaghy A.T., Hoseini S.M.S., *Sustainable transportation: Definitions, dimensions, and indicators – Case study of importance-performance analysis for the city of Tehran,* Heliyon, 9(2023), https://doi.org/10.1016/j.heliyon.2023.e20457

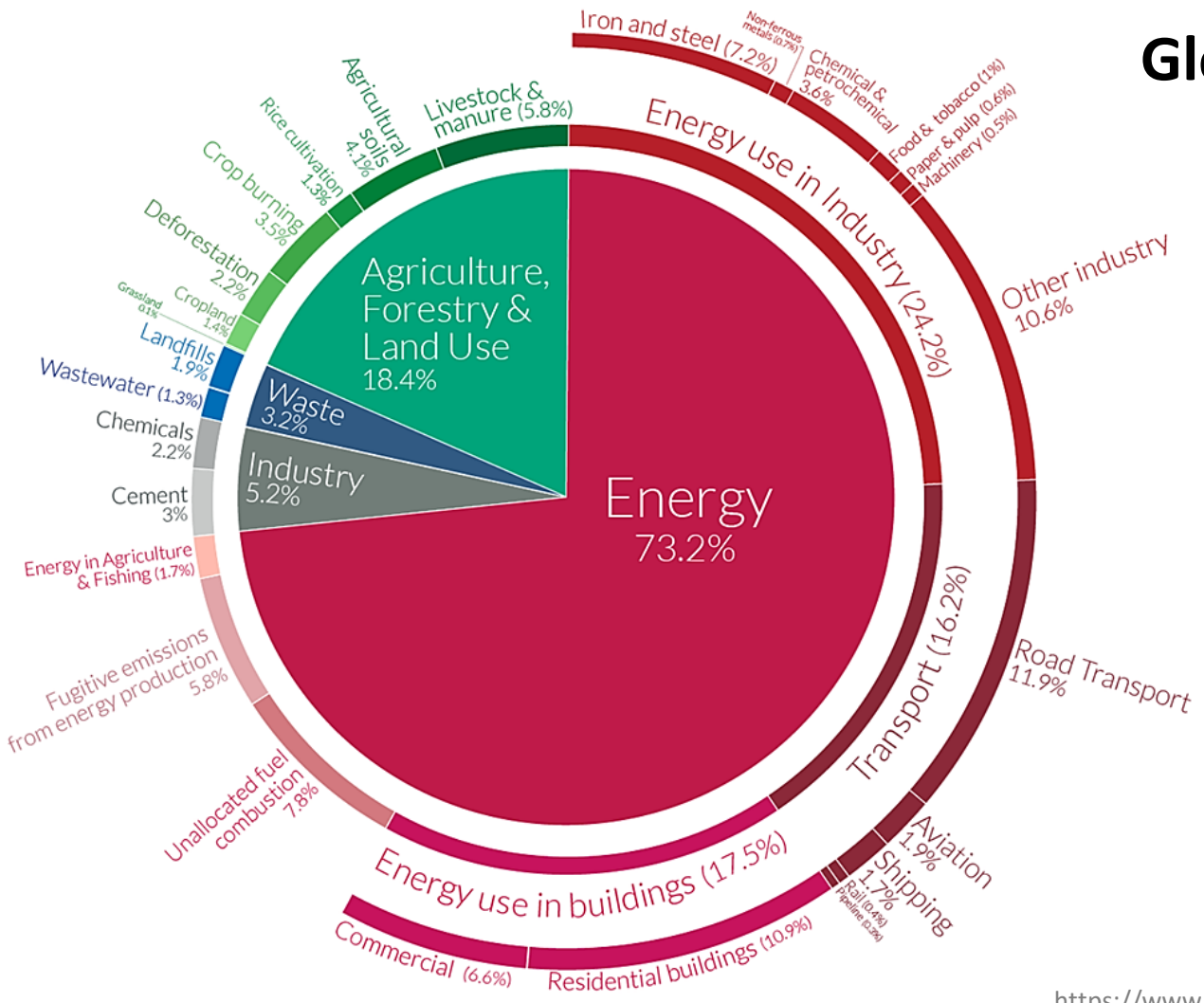


1) UN, Transforming Our World: The 2030 Agenda for Sustainable Development (UN, New York, 2015); http://bit.ly/TransformAgendaSDG-pdf
2) https://transportgeography.org/contents/chapter4/transportation-sustainability-decarbonization/three-e-development/



1) Communication from The Commission to The European Parliament, The European Council, The Council, The European Economic and Social Committee and The Committee of the regions. The European Green Deal. COM (2019) 640 Final, 11.12.2019.
2) Website of the Geopolitical Intelligence Services AG, https://www.gisreportsonline.com/r/european-green-deal/

Global greenhouse gas emissions by sector



Sector	Global GHG Emissions Share
Energy Use	73.2%
Agriculture, Forestry & Land Use	18.4%
Industrial processes	5.2%
Waste	3.2%

Sub-sector (Energy Use)	GHG Emissions Share	Further breakdown
Transport	16.2%	• Road 11.9% • Aviation 1.9% • Rail 0.4% • Pipeline 0.3% • Ship 1.7%

https://www.visualcapitalist.com/a-global-breakdown-of-greenhouse-gas-emissions-by-sector/

Strategic objectives

- To achieve climate neutrality by 2050 (a 90% reduction in transport emissions is needed by 2050 since transport accounts for a quarter of the EU's greenhouse gas emissions).
- Decarbonizing the energy system is critical to reach climate objectives in 2030 and 2050
  - The production and use of energy across economic sectors account for more than 75% of the EU's greenhouse gas emissions.
  - A power sector must be developed and based on renewable sources, complemented by the rapid phasing out of coal and decarbonizing gas.
- New technologies, sustainable solutions, and disruptive innovation are critical to achieve the objectives of the European Green Deal.

Source: 1) Communication from The Commission to The European Parliament, The European Council, The Council, The European Economic and Social Committee and The Committee of the regions. The European Green Deal. COM (2019) 640 Final, 11.12.2019.
2) Communication from The Commission to The European Parliament, The Council, The European Economic and Social Committee and The Committee of the regions. Sustainable and Smart Mobility Strategy – Putting European transport on truck fot the future. COM (2020) 789 Final, 9.12.2020.

Low-emission strategies encompass a diverse array of approaches and initiatives specifically crafted to mitigate the release of greenhouse gases and other pollutants into the atmosphere. These strategic measures are commonly deployed across various sectors, emphasizing the reduction of emissions linked to human activities. Notably, two key domains where low-emission strategies are extensively employed are in enhancing **public transport systems** and optimizing **energy efficiency practices**.

Honegger, M.; Michaelowa, A.; Poralla, M. Net-zero emissions: The role of Carbon Dioxide Removal in the Paris Agreement. Policy Briefing Report. Perspectives Climate Research, Freiburg 2019.

Focus in on:

>> Low Carbon Growth
- Avoid ecologically sensitive impacts of transportation by ensuring lower emissions from direct and indirect processes.
- Reduce average emission factor per ton km

>> Climate Resilient Growth
- Build transport system immune to effects of climate change – climate proofing transport infrastructure

>> Access and mobility

https://www.slideshare.net/aishwarykgupta/sustainable-transportation-71408026

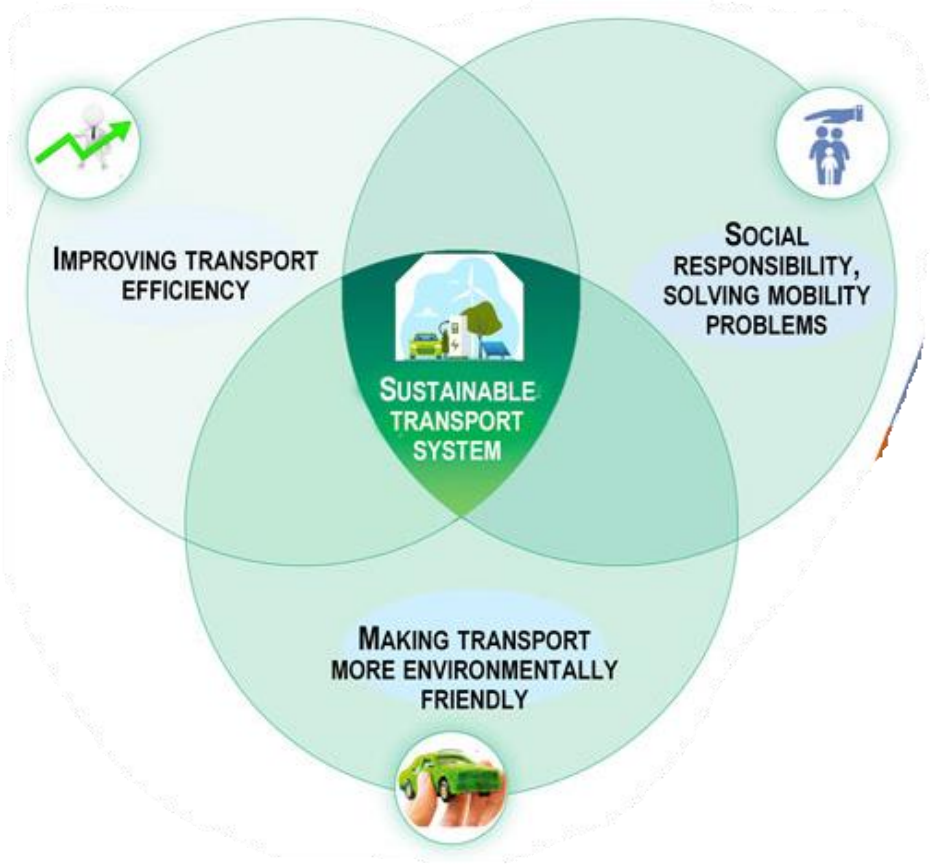
What can be done?

- A key objective is to boost considerably the uptake of clean vehicles and alternative fuels
- The deployment of recharging and refuelling points where persistent gaps exist
- The low-emission energy transformation ensures the implementation of the so-called European triad of goals (energy security, energy competitiveness and climate protection)

Jałowiec T, Wojtaszek H, Miciuła I. Analysis of the Potential Management of the Low-Carbon Energy Transformation by 2050. *Energies*. 2022; 15(7):2351. https://doi.org/10.3390/en15072351

- Fossil fuels as an energy source are replaced by non-fossil/ renewable energy sources (e.g. geothermal, solar, hydro, wind, nuclear), which do not release CO2 emissions to generate energy

Cadez S., Czerny A., Climate change mitigation strategies in carbon-intensive firms, Journal of Cleaner Production, 112, Part 5, 2016, 4132-4143, https://doi.org/10.1016/j.jclepro.2015.07.099.



Makarova I, Buyvol P, Shubenkova K, Fatikhova L and Parsin G (2023) Editorial: Sustainable transport systems. *Front. Built Environ.* 9:1161361. doi: 10.3389/fbuil.2023.1161361

Sustainable transportation

The Canadian Department of Transportation believes that all transportation activities must be sustainable from three aspects: economic, environmental, and social.

The main focus of (ST) has been on reducing resource consumption and controlling the environmental degradation and pollution caused by the consumption of petroleum derivatives in cars, and it is the result of people's widespread concern about global warming, which is part of sustainable development. Zhou J., *Sustainable transportation in the US: a review of proposals, policies, and programs since 2000*, Front. Archit. Res. 1 (2012) 150–165

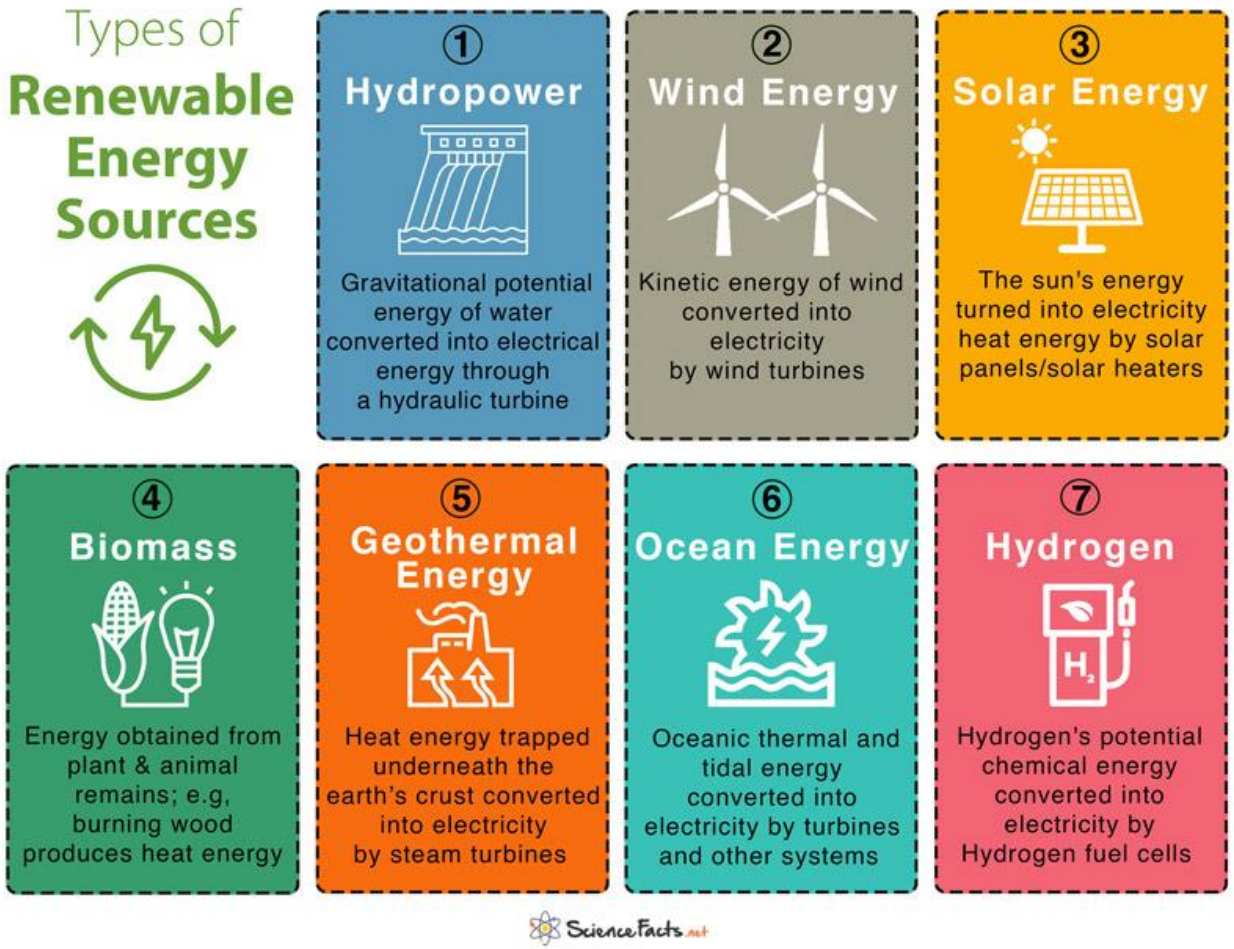
Considers economic and social well-being, equity, human health, and environmental integrity.

Pålsson, H., Kovács, G. (2014), *Reducing transportation emissions : A reaction to stakeholder pressure or a strategy to increase competitive advantage*, International Journal of Physical Distribution & Logistics Management, Vol. 44 No. 4, pp. 283-304. https://doi.org/10.1108/IJPDLM-09-2012-0293

Renewable energy sources

Energy sources are those whose use is not associated with long-term deficit, because their resources are renewed in a relatively short time (renewable raw materials). Such sources are: sun, wind, biomass, biogas, and biofuels. Renewable energy also includes heat obtained from the ground (geothermal energy), air (aerothermal energy), and water (hydrothermal energy). Renewable energy plays a vital role for saving the environment.

Hamed, T. A., and A. J. J. O. S. D. O. E. Alshare. 2022. Water, and E. Systems, environmental impact of solar and wind energy-a review. *Journal of Sustainable Development of Energy, Water and Environment Systems* 10 (2):1–23. doi:10.13044/j.sdewes.d9.0387.



https://www.sciencefacts.net/types-of-renewable-energy.html

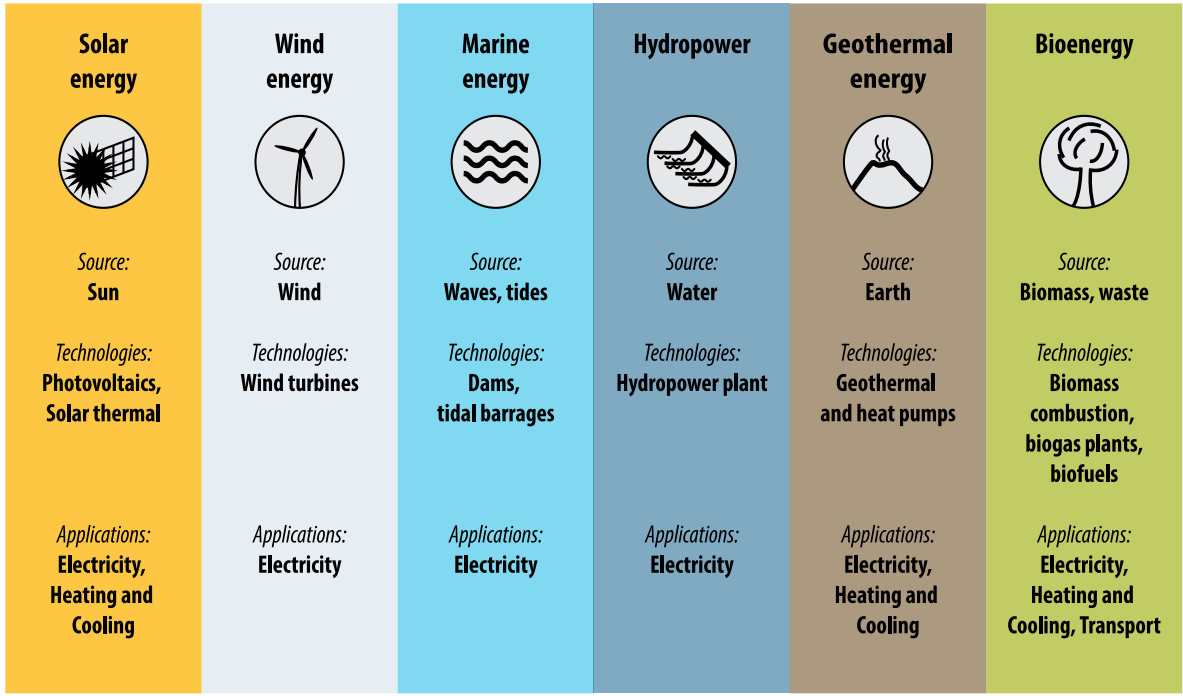
Applications

Hydroelectric Energy

- Electric power generation through hydro-electric power plant

Wind energy

- Electric power generation
- Pumping underground water using windmills
- Milling grain employing gristmills



https://op.europa.eu/webpub/eca/special-reports/renevable-energy-5-2018/en/

Solar energy

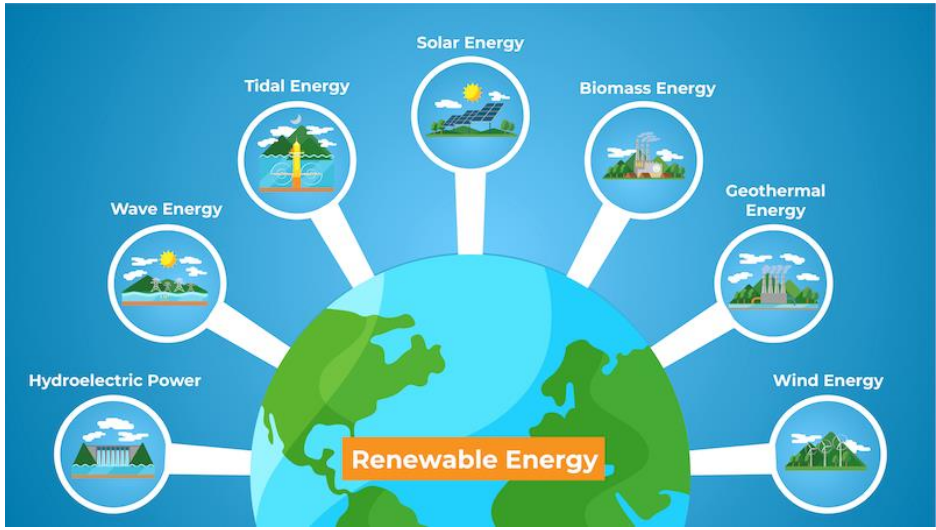
- Producing electricity by converting solar energy using photovoltaic cells
- Cooking using solar cookers and heaters
- Running solar pumps

https://www.sciencefacts.net/types-of-renewable-energy.html

Applications

Biomass

- Production of biodiesel and alcohol to be used as a replacement for traditional automobile fuels
- Producing methane gas that can be used to generate heat, electricity, and organic chemicals



https://www.sciencefacts.net/types-of-renewable-energy.html

Geothermal Energy and ocean energy

- Electricity generation

Hydrogen Fuel Cells

- Hydrogen fuel cells can be used to drive automobiles instead of petrol or diesel engines

Advantages of renewable energy

- Renewable energy sources will not run out
- Renewable energy is reliable
- Renewable energy is environmentally friendly
- Renewable energy can increase public health
- Renewable technologies create lots of jobs
- Renewable technologies require less maintenance cost
- Renewable energy can reduce turmoil in energy price
- Renewable energy can increase countries' economic independence
- Leftovers can be Used in renewable technologies

Energy benefits

- **25%** of energy generated from local renewables
- **$150M** spent locally vs. remotely
- **$50M** in avoided transmission costs
- **$20M** in avoided power interruptions

Economic benefits

- **$120M** new regional impact
- **$60M** in added local wages
- **1,000** job-years of new near-term and ongoing employment
- **$6M** site leasing income

Environmental benefits

- **46M** pounds of annual reductions in GHG emissions
- **10M** gallons in annual water savings
- **225** acres of land preserved by using roofs and parking lots

https://www.greenmatch.co.uk/blog/2021/09/advantages-and-disadvantages-of-renewable-energy#types-of-renewable-energy

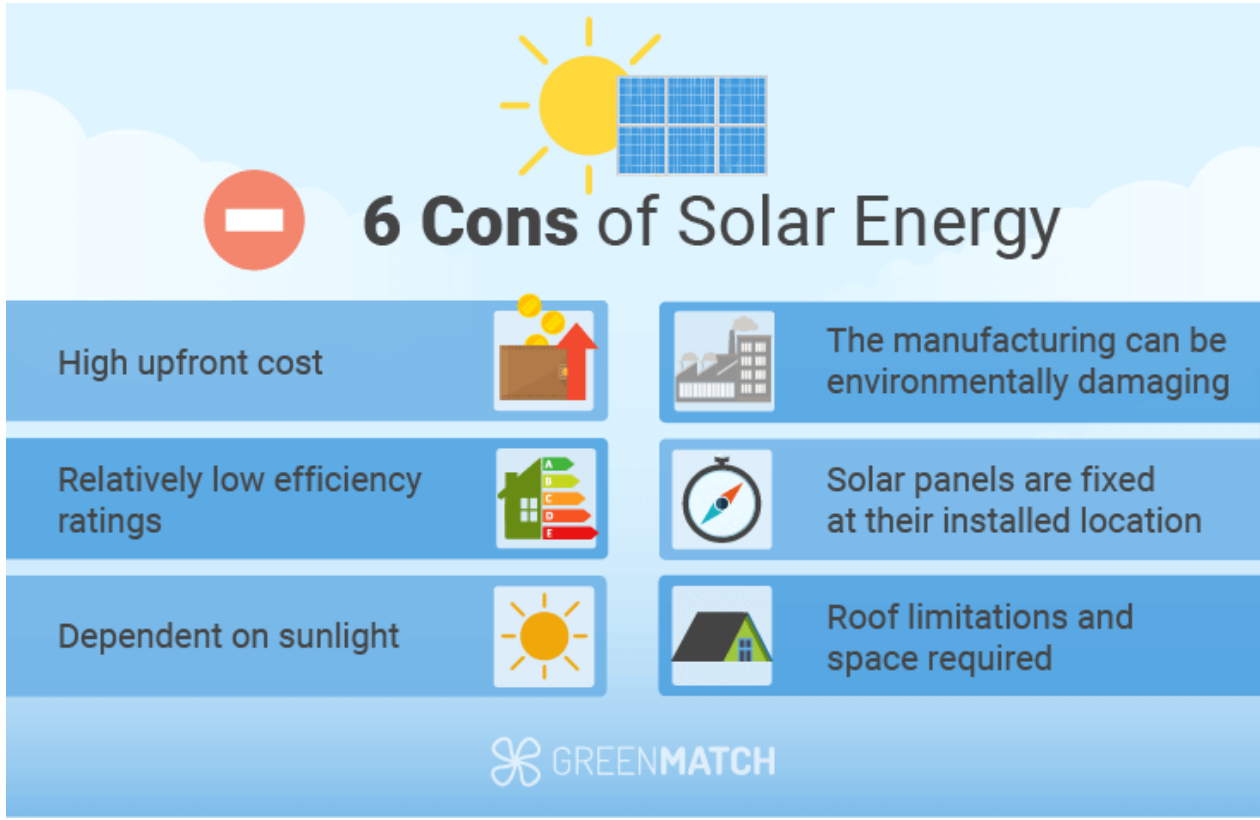
https://clean-coalition.org/value-of-clean-local-energy/benefits/

Disadvantages of renewable energy

- Intermittent availability - renewable energy can be inconsistent due to weather, requiring fallbacks to traditional power.
- Lower efficiency - renewable technologies have lower efficiency rates compared to fossil fuel-based methods.
- High initial costs - the upfront cost of renewable technologies and their installation is often steep.
- Space requirements - renewable energy farms demand large land areas, more so than traditional power stations.
- Recycling challenges - while cleaner, renewable devices can be pollutive at disposal and require effective recycling methods.

https://www.greenmatch.co.uk/blog/2021/09/advantages-and-disadvantages-of-renewable-energy

https://www.greenmatch.co.uk/blog/2014/08/5-advantages-and-5-disadvantages-of-solar-energy

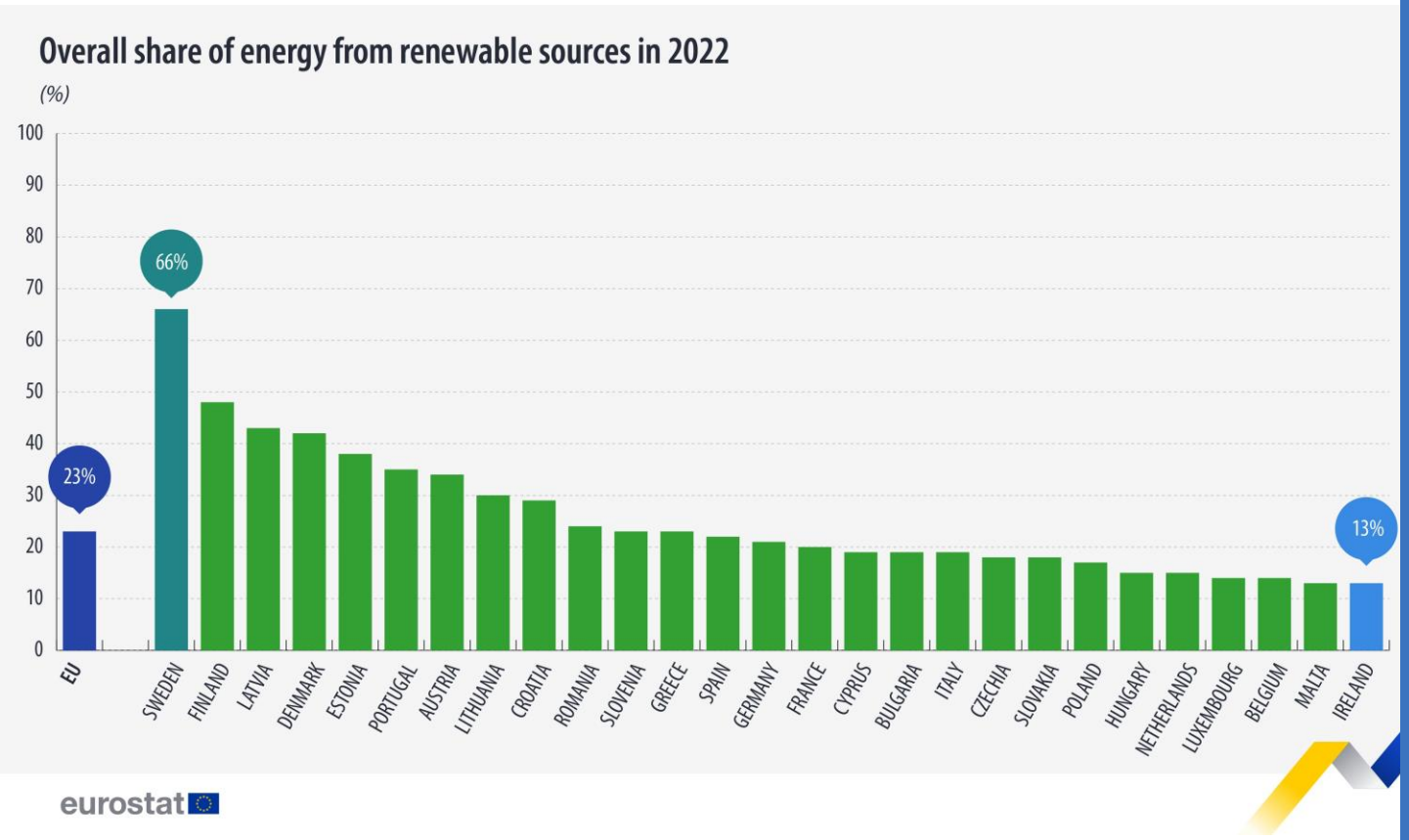


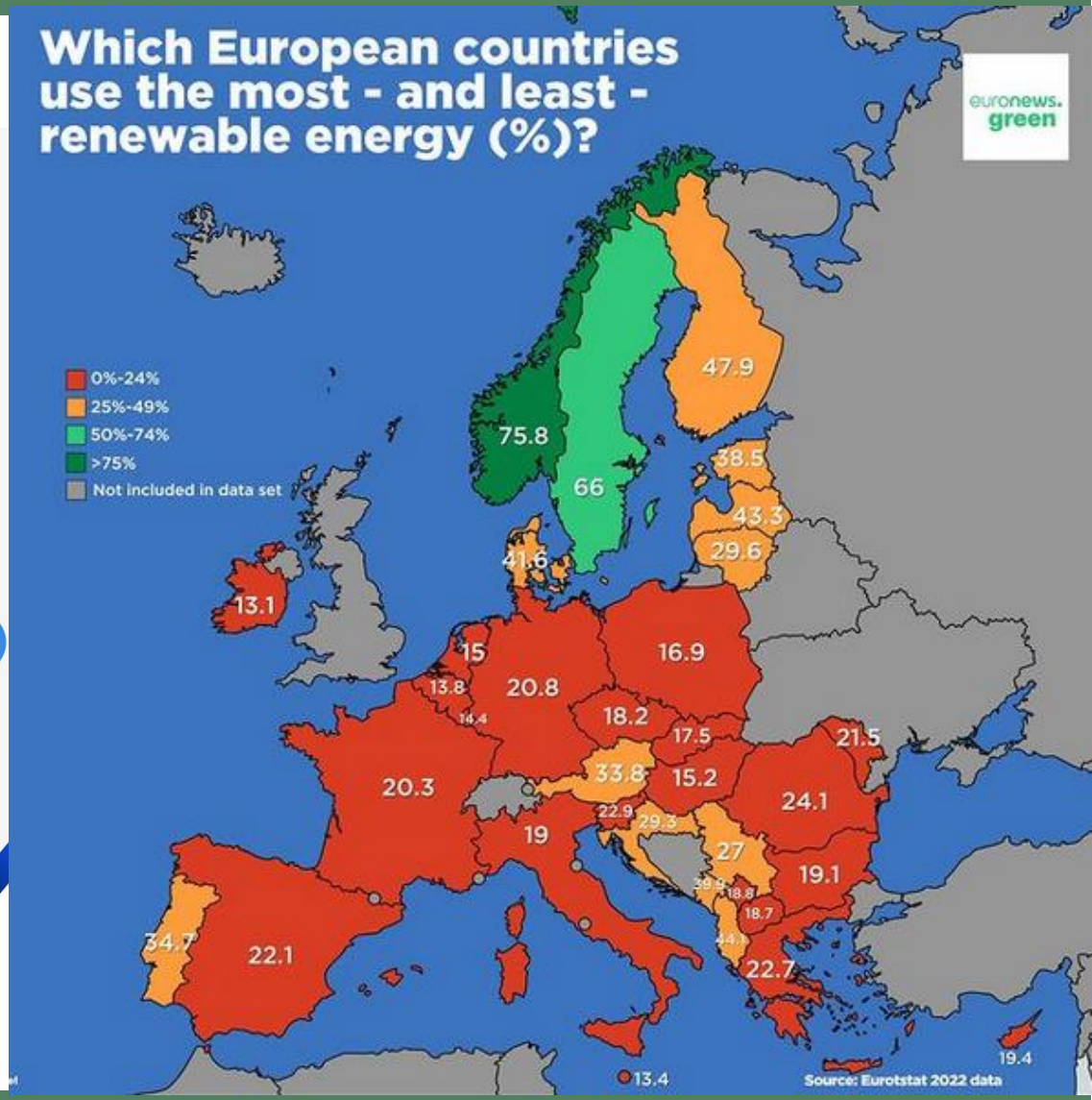
The significance of renewable energy

- Halting global warming: Burning fossil fuels releases significant amounts of carbon dioxide, exacerbating global warming. Renewable energies offer an affordable, plentiful, and never-ending supply that doesn't emit greenhouse gases, making them key to curbing global warming and ensuing climate alterations.
- Strengthening fuel supply stability: With fluctuating energy markets and geopolitical instabilities, ensuring a stable fuel supply is a global priority. Utilizing indigenous renewable resources can help nations meet their energy needs more reliably.
- Economic and employment advancements: Investing in renewable energy infrastructure can spur economic growth and generate new employment prospects, particularly for the younger generation.

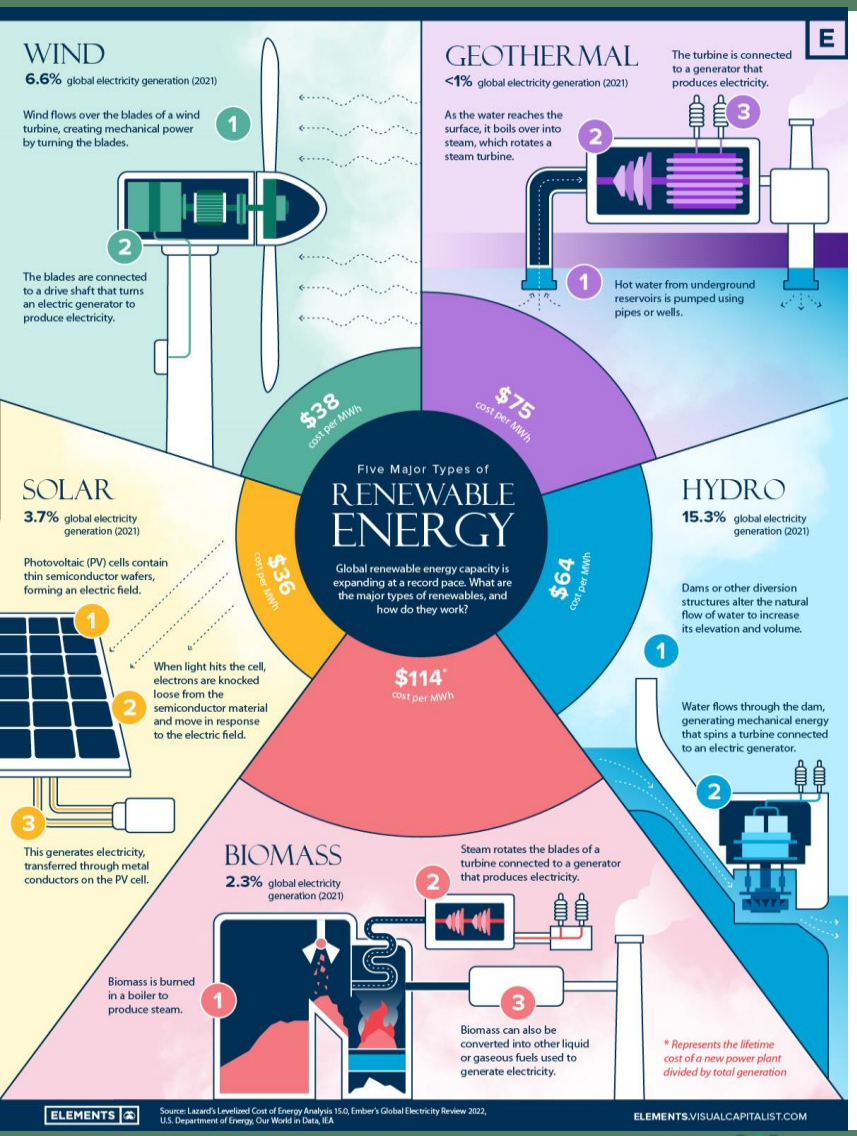
Maradin, Dario (2021). Advantages and disadvantages of renewable energy sources utilization. In: International Journal of Energy Economics and Policy 11 (3), S. 176 - 183. doi:10.32479/ijeep.11027.

https://curiousdesire.com/reasons-why-renewable-energy-is-important/





https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Renewable_energy_2022_infographic.jpg

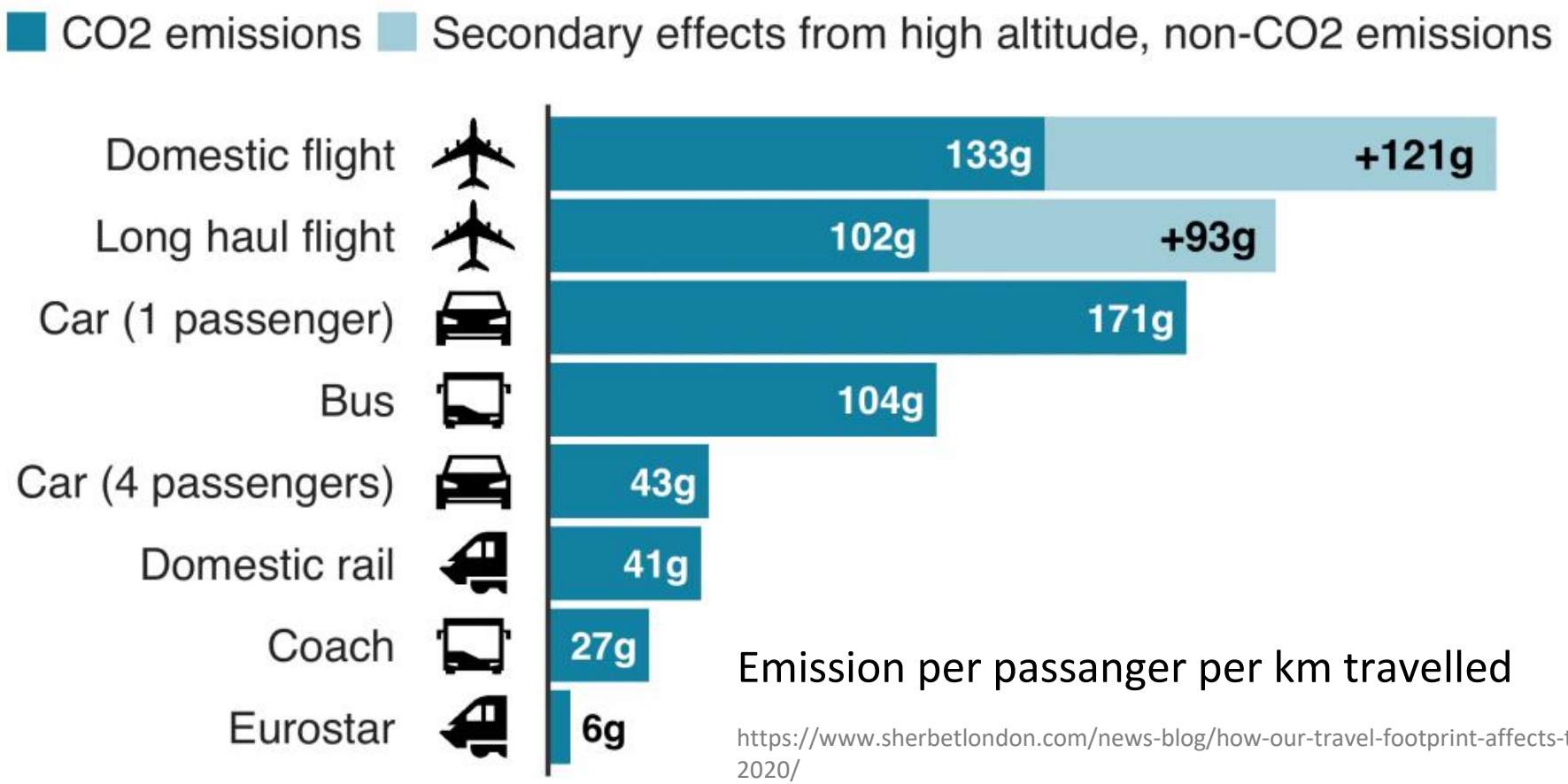


Major Types of Renewable Energy in the world

Energy Source	% of 2021 Global Electricity Generation	Avg. levelized cost of energy per MWh
Hydro	15.3%	$64
Wind	6.6%	$38
Solar	3.7%	$36
Biomass	2.3%	$114
Geothermal	<1%	$75

https://elements.visualcapitalist.com/what-are-the-five-major-types-of-renewable-energy/

Emissions from different types of transport

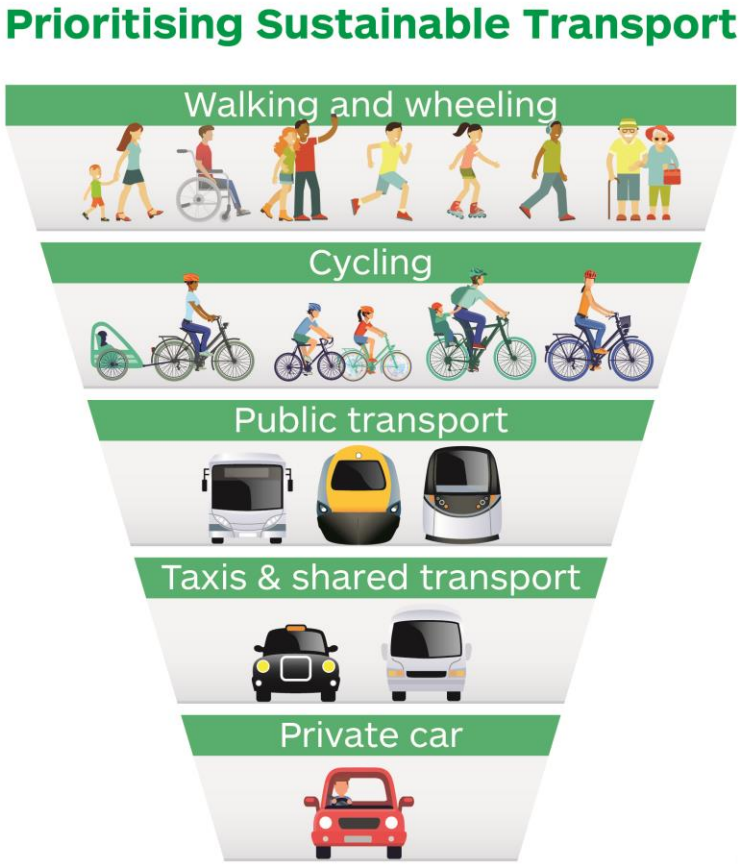


Emission per passanger per km travelled

https://www.sherbetlondon.com/news-blog/how-our-travel-footprint-affects-the-environment-in-2020/

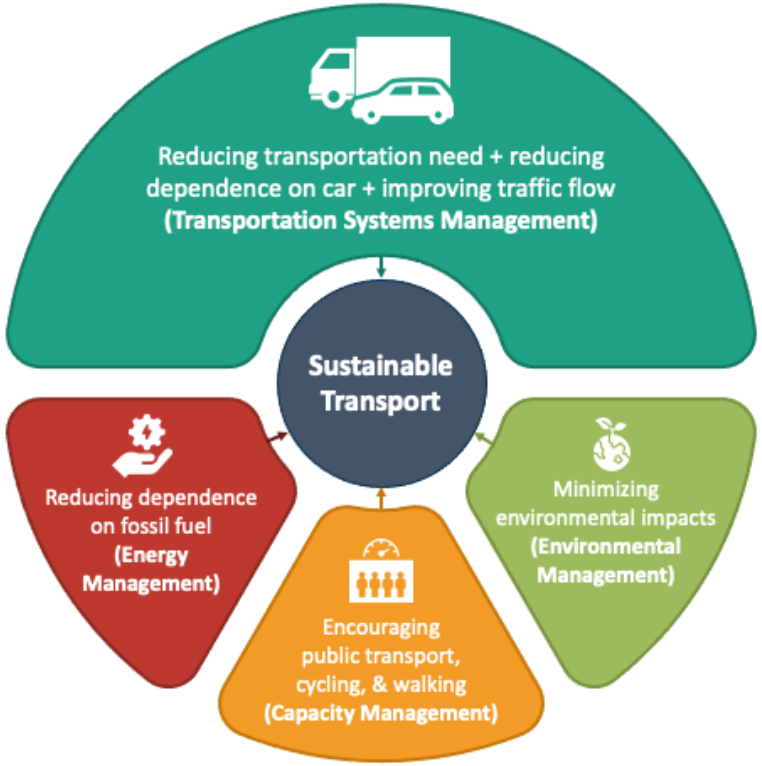
Types of Sustainable Transport

- Electric Vehicles (EVs)
- Hydrogen Fuel Cell Vehicles
- Biofuel Vehicles
- Compressed Natural Gas (CNG) Vehicle
- Solar-Powered Vehicles
- Human-Powered Vehicles
- Electric-Assist Vehicles



Source: https://www.transport.gov.scot/active-travel/developing-an-active-nation/sustainable-travel-and-the-national-transport-strategy/

Sustainable transportation



Source: https://www.sketchbubble.com/en/presentation-sustainable-transport.html

<u>The benefits of sustainable transportation include</u>:

- Cost savings on fuel and vehicles
- Reduced carbon emissions from burning fossil fuels, resulting in less air pollution
- Job creation with increased vehicle and battery manufacturing and fuel production
- Improved accessibility to reliable, affordable transportation options
- Enhanced energy security and independence with less reliance on foreign sources of materials and fuels.

Source: https://www.energy.gov/eere/sustainable-transportation-and-fuels

Low emission strategies for agricultural practices

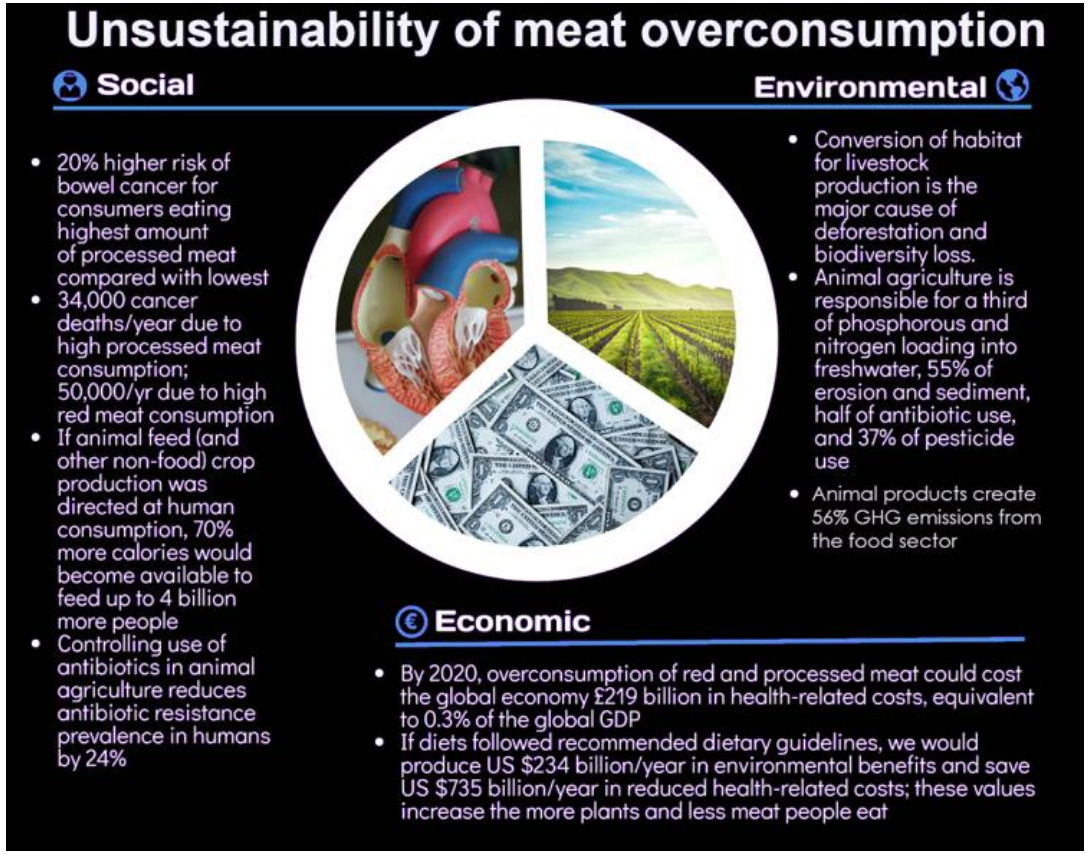
The term ''sustainable agriculture'' (U.S. Code Title 7, Section 3103) means an integrated system of plant and animal production practices having a site-specific application that will over the long-term:

- Satisfy human food and fiber needs.
- Enhance environmental quality and the natural resource base upon which the agriculture economy depends.
- Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls.
- Sustain the economic viability of farm operations.
- Enhance the quality of life for farmers and society as a whole.

The European Commission defines carbon farming as “a green business model that rewards land managers for taking up improved land management practices, resulting in the increase of carbon sequestration in living biomass, dead organic matter and soils by enhancing carbon capture and/or reducing the release of carbon into the atmosphere, in respect of ecological principles favourable to biodiversity and the natural capital overall.”

https://climate.ec.europa.eu/system/files/2021-12/com_2021_800_en_0.pdf

Reduction of meat production



Source: N. A. Rust, L. Ridding, C. Ward, B. Clark, L. Kehoe, M. Dora, M.J. Whittingham, P. McGowan, A. Chaudhary, C. J. Reynolds, C. Trivedy, N. West, *How to transition to reduced-meat diets that benefit people and the planet,* Science of The Total Environment, 718

Reduction of monocultures

Monoculture farming means cultivating a single species of plant on a large area of land to increase the production

limiting the variety of plant and animal species

↓

increase the vulnerability of crops to diseases and pests

↓

large population of a single host species makes it easier for the latter to spread rapidly

↓

requires a massive use of chemicals such as fertilizers, pesticides

↓

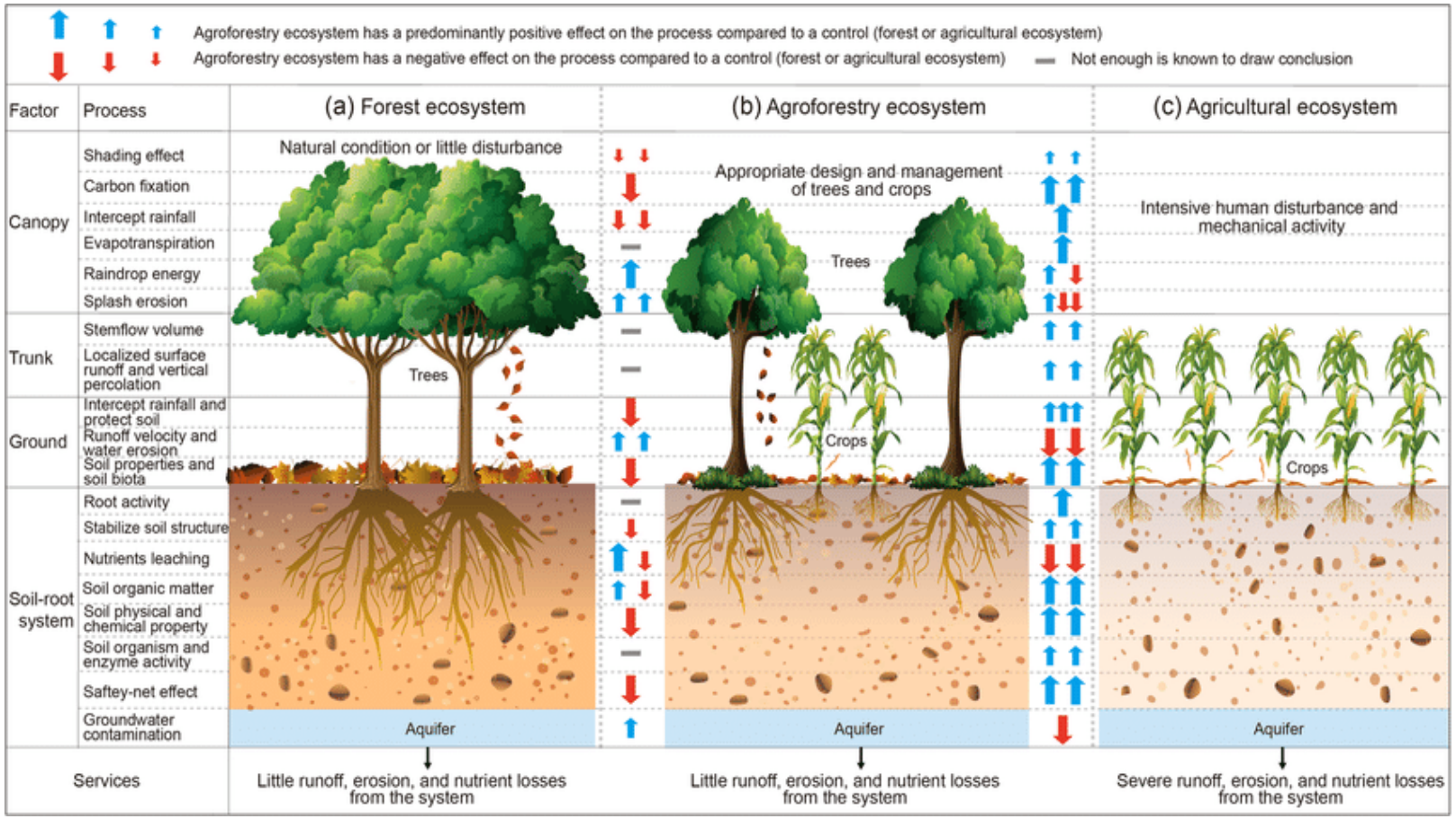
contaminate groundwater and soil, damaging the health of animals (and even people) living nearby

↓

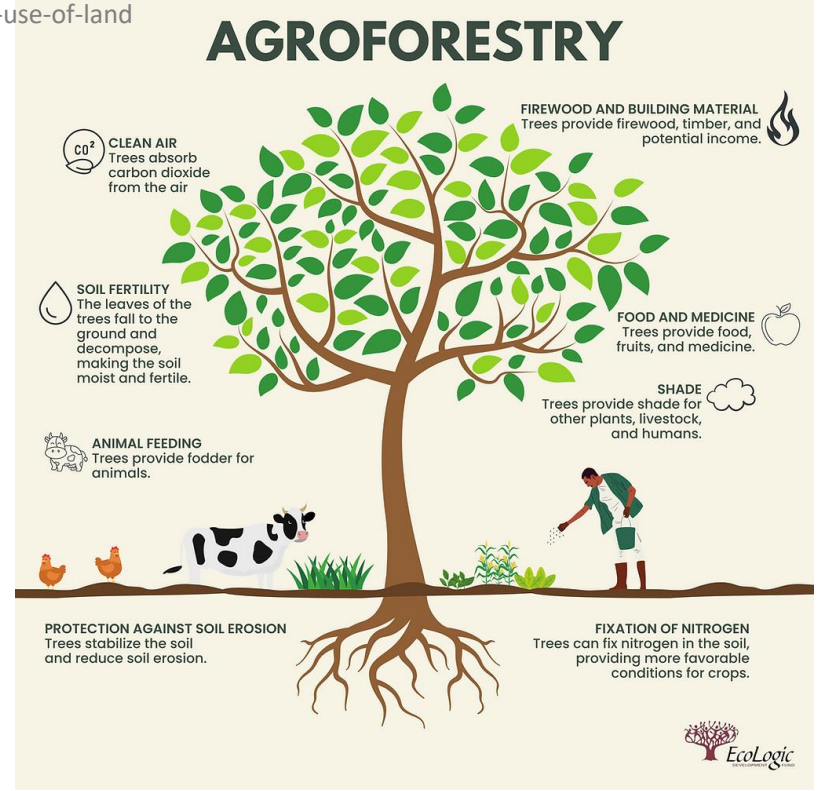
negative impact on the environment and biodiversity

Source: https://www.savingbees.org/en/2023/03/21/why-monocultures-are-not-good-for-the-environnement/

https://www.ecologic.org/post/agroforestry-what-it-is-and-why-it-is-essential-for-sustainable-and-climate-smart-use-of-land



Source: Zhu et al., 2021; Reductions in water, soil and nutrient losses and pesticide pollution in agroforestry practices: a review of evidence and processes, Plant Soil (2020) 453:45–86.



Agroforestry is a land use management system that intentionally integrates trees and shrubs with crops or pasture to create environmental, economic, and social benefits. It combines agricultural and forestry technologies.

ADDITIONAL MATERIALS AND SOURCES OF INFORMATION

1. Application to increase audience engagement: https://www.mentimeter.com/
2. beFORE E-Learning Course, http://futureoriented.eu/ foresight-course/, where you can benefit from lessons dedicated to scenario analysis: http://futureoriented.eu/courses/advanced-course-students/lessons/module-5-lesson-2-future-oriented-methodologies/topic/topic-7-intuitive-logics-school-ofscenario-construction-case-studies/or take the entire Futures Literacy course (http:// futureoriented.eu/foresight-course/)
3. The European Environment Agency (EEA) website, https://www.eea.europa.eu/en/topics/in-depth/climate-change-mitigation-reducing-emissions
4. https://www.oecd.org/agriculture/topics/climate-change-and-food-systems/
5. Dr Edward de Bono introduces Lateral Thinking; https://www.youtube.com/watch?v=hdm3m85M5e8
6. The Indigo Archive - Edward de Bono Tools in Practice; https://www.youtube.com/watch?v=wclCeGutYUo
7. Global Footprint Network: https://www.footprintcalculator.org/
8. Miro board, where you can create a STEEP analysis template as the first step in the scenario method using ready-made output visualisations and work together online: https://miro.com/
9. The coursebook developed within Futures project: Replay your futures – labs for exploring undiscovered pathways course (pdf) https://futuresproject.pb.edu.pl/app/uploads/2023/08/Handbook-Futures-2022.pdf

CASE STUDY

DANONE

Danone is a **manufacturer** and **producer of dairy and nutrition products**. The company offers fresh dairy products, bottled water, baby nutrition and medical nutrition products.

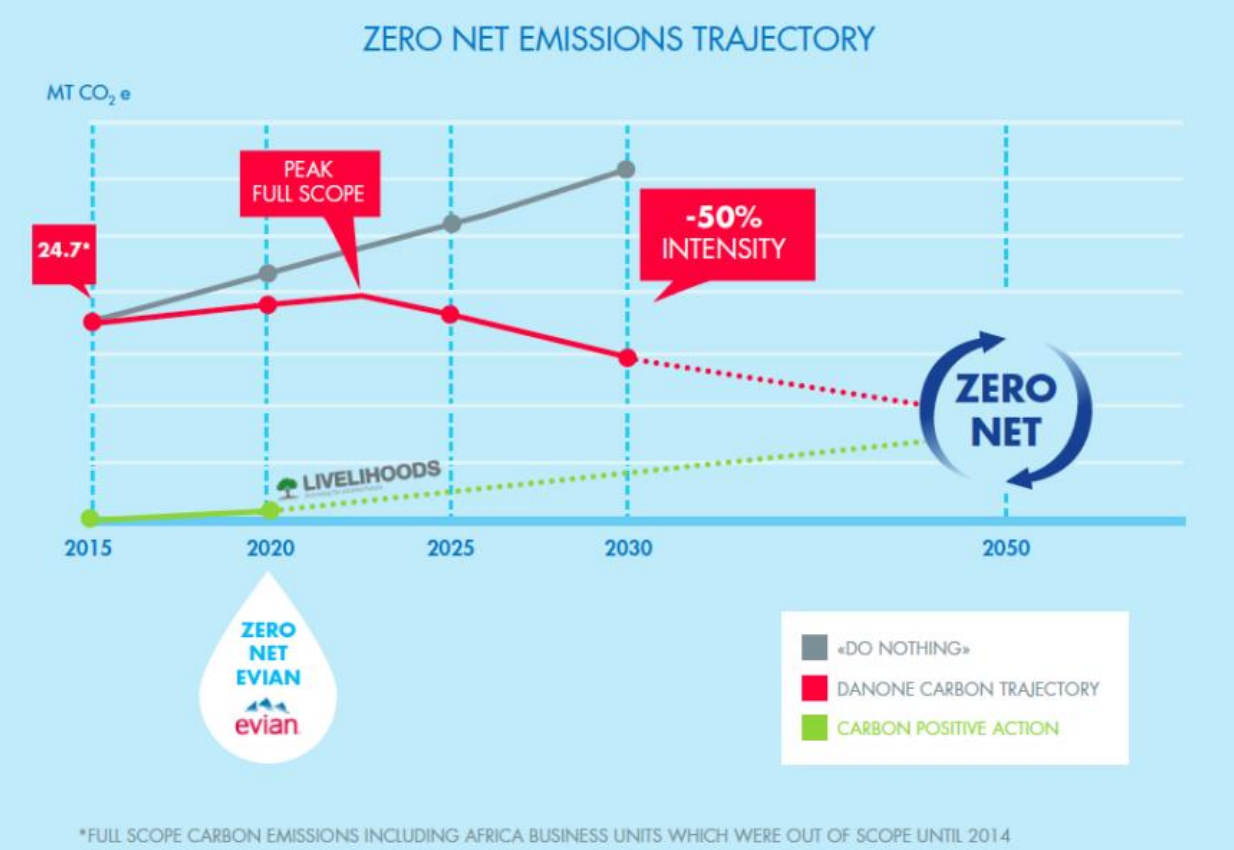
The company sells its products under the **Danone, Activia, Evian, Volvic, Aqua, Gallia, Actimel, Nutricia and Bledina brands.** It distributes its products through retail chains, traditional outlets and specialised distribution channels, including hospitals, clinics and pharmacies.

The company's operations span the **Americas, the Middle East, Africa, Europe and the Asia-Pacific region**. Danone is headquartered in Paris, Ile-de-France, France.

Source: Danone, *About Danone*, https://www.danone.com/about-danone/we-are-danone.html#MISSION

Source: Global Data, *Danone SA: Overview*, https://www.globaldata.com/company-profile/danone-sa/

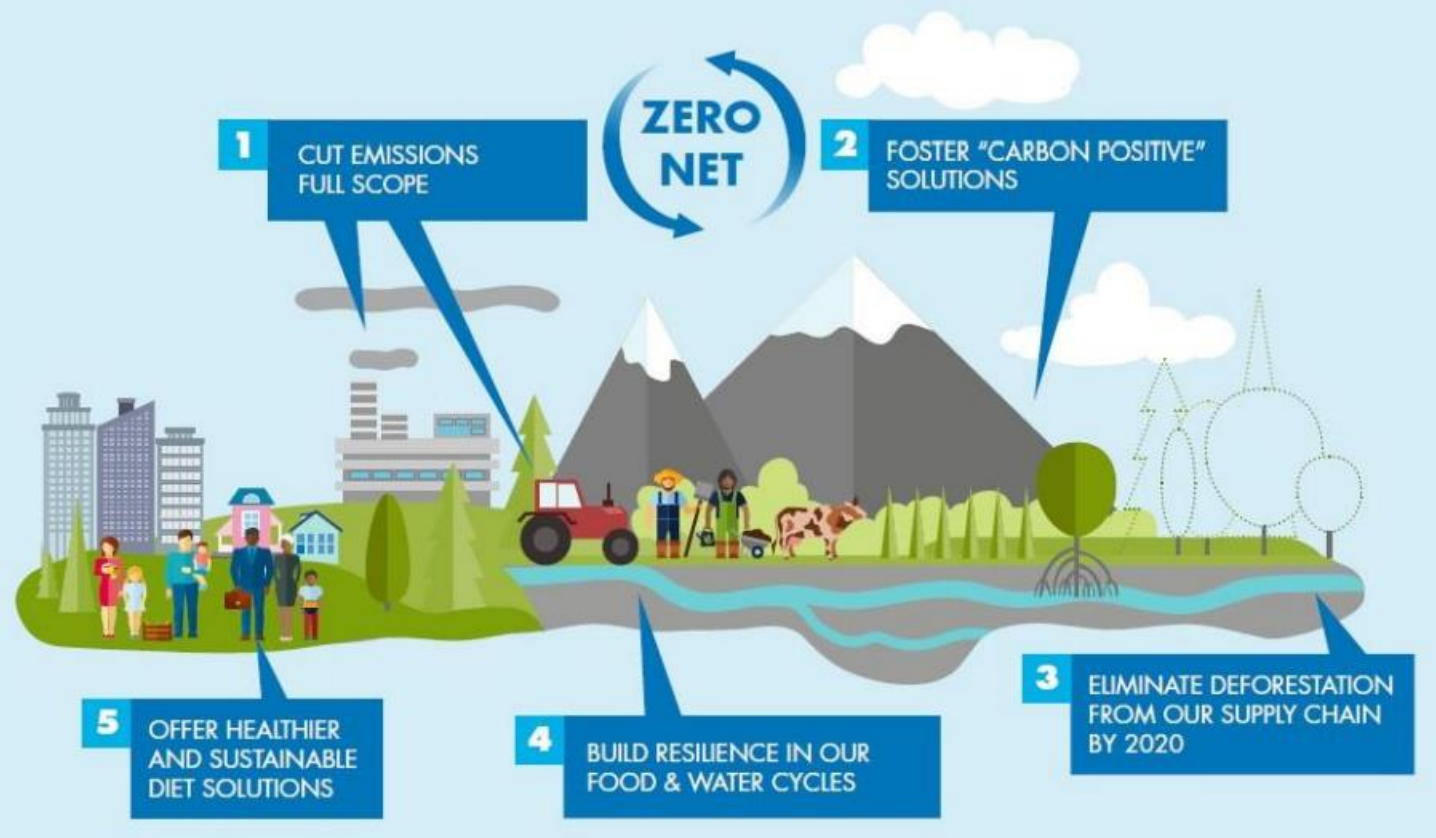
TARGET ZERO NET CARBON EMISSIONS



Healthy food and the water cycle are significantly linked to the climate, which in turn depends on carbon levels in the atmosphere and oceans.

Danone's ambition is to set a trajectory for reducing greenhouse gas emissions in line with scientific guidelines, aiming to keep temperature increases below 2°C and to support the decarbonisation of the economy. According to the latest UN report on the 'emissions gap', Danone's main goal is to achieve net zero emissions in all emissions areas.

Source: Danone, *Climate Policy*, https://www.danone.com/content/dam/corp/global/danonecom/about-us-impact/policies-and-commitments/en/2016/2016_05_18_ClimatePolicyFullVersion.pdf



Danone's ambition is to:

- **Take action on mitigation and contribute to sequestering carbon** in soils, forests and ecosystems for "net positive" impacts to combat climate change,
- **Take action on adaptation**, building resilient food and water cycles,
- **Be at the forefront of business solutions with healthier diet options** for more people with less carbon.

Source: Danone, *Climate Policy*, https://www.danone.com/content/dam/corp/global/danonecom/about-us-impact/policies-and-commitments/en/2016/2016_05_18_ClimatePolicyFullVersion.pdf

AMBITIONS

Danone has developed the following goals and KPIs:

GOAL	KPIs
Curb GHG emissions in line with 1.5°C, **leading the way on methane reduction**	CO_2 reduction by 2030 in line with 1.5C SBTi
	Net Zero by 2050
	30% reduction in methane emissions from fresh milk by 2030
	30% improvement in energy efficiency by 2025
Pioneer and scale regenerative agriculture, leading the way for **regenerative dairy** farming models	30% key ingredients we source directly will come from farms that have begun to transition to RegAg by 2025
	Zero deforestation & conversion on key commodities by 2025[1]
Preserve and restore watersheds where we operate and drive **water footprint reduction** across the value chain	4R approach will be deployed in all our production sites by 2030
	Watershed preservation/restoration plans in highly water-stressed areas by 2030[2]
Drive the transition to a **circular and low-carbon** packaging system & **recover as much as we use**	100% reusable, recyclable, compostable by 2030
	Halve the use of virgin fossil-based packaging by 2040, with a 30% reduction by 2030, accelerating reuse and recycled materials
	Lead the development of effective collection systems to recover as much plastic as we use by 2040
Cut waste across the value chain	Halve all food waste not fit for human, animal consumption or biomaterial processing by 2030 vs. 2020

Source: Danone, *Danone integrated annual report 2022*, https://www.danone.com/content/dam/corp/global/danonecom/rai/2022/danone-integrated-annual-report-2022.pdf

ACHIEVEMENTS

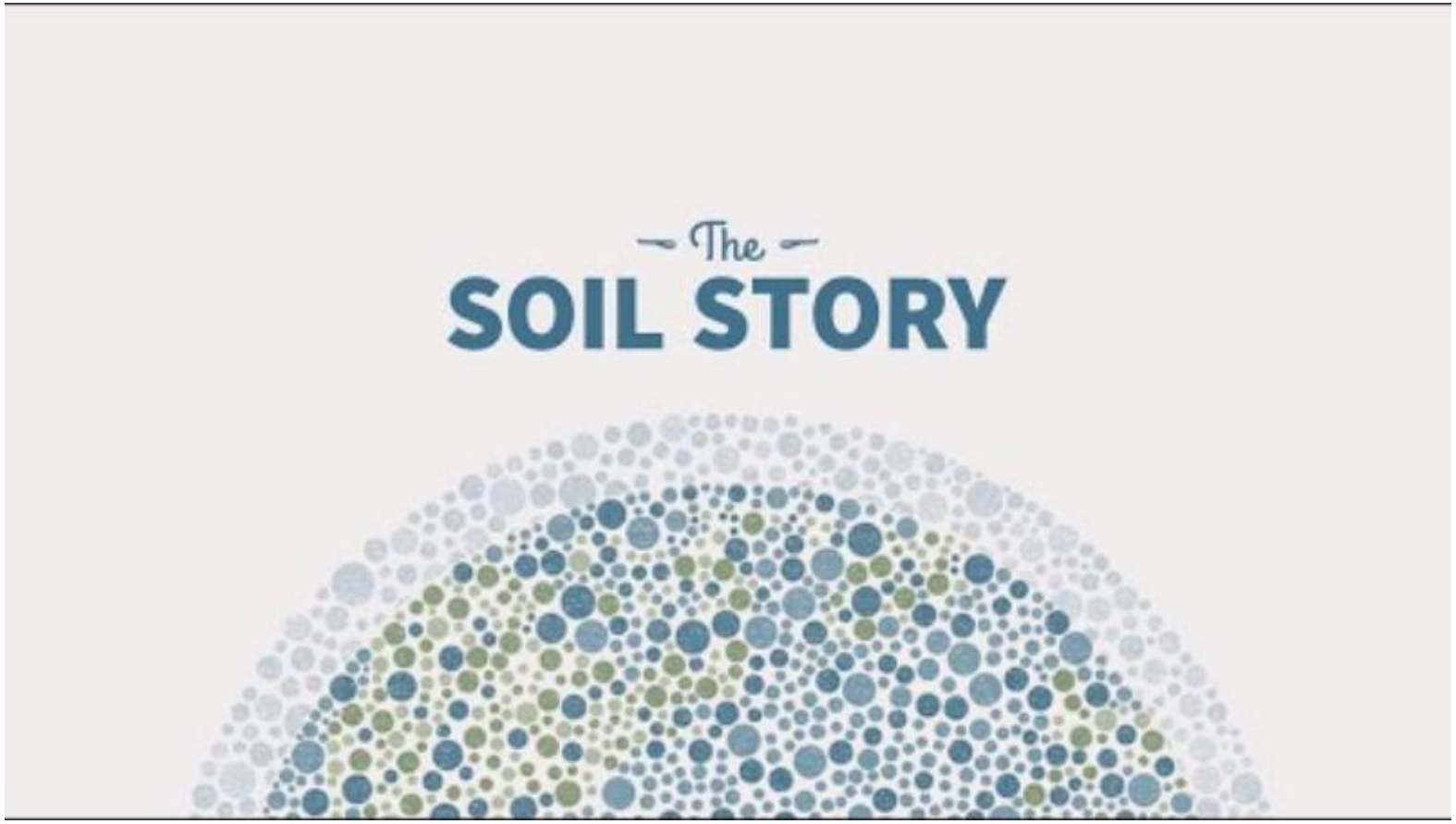
- **Danone was among the first companies to have its 1.5°C Forest, Land and Agriculture (FLAG) target approved** by the Science Based Targets initiative.
- **-8.3% absolute total FLAG emissions reduction since 2020** (2030 science based target: -30.3%).
- **Update of the Danone Regenerative Agriculture Handbook and Scorecard** and launch of associated digital tool.
- **Renewed Forest Policy**, with the ambition to continue and amplify efforts in protecting and restoring forests.

- In Balclutha (New Zealand), **biomass boiler is powered by locally-sourced wood residues** from sustainably-managed forests (waste debris, bark and organic matter), supplying the plant with indigenous, renewable energy. **Combined with the use of 100% renewable electricity at the plant, CO2 emissions will be reduced by 95%.**
- **Danone launched a Global Energy Excellence Program, Re-Fuel Danone**, to transform the energy footprint of its production sites worldwide.
- **70.5% of renewable electricity.**

- **Danone is one of only 13 'Triple A' companies worldwide**, out of almost 15,000 companies scored by CDP.
- Action plans to **convert manure into organic fertilizers through compost and biodigesters**, the **traceability of animal feeds in areas with no deforestation risks** and **improved cow productivity in Brazil.**
- **Switch to renewable electricity sources** in Indonesia, Mexico, and in the Steenvoorde Supply Point in France.

Source: Danone, *Danone integrated annual report 2022*, https://www.danone.com/content/dam/corp/global/danonecom/rai/2022/danone-integrated-annual-report-2022.pdf

Danone is collaborating with several partners to enhance global comprehension of how agricultural practices can contribute to nurturing and safeguarding soil health.



Link to video:
https://www.youtube.com/watch?v=08TI1RKj54g

Source: Danone, *Regenerative agriculture*, https://www.danone.com/impact/planet/regenerative-agriculture.html

„Ziołowy zakątek” agritourism farm

Source: provided by Ziołowy zakątek

The agritourism farm is located in the heart of the cleanest region of Poland - Podlasie.

On an area of almost 20 hectares, it brings together the rich culture and tradition of this area. You can find here buildings typical of the region, handicrafts and, above all, herbs.

An integral element of the herbal and botanical activities carried out is the **Dary Natury company**, which was established almost 30 years ago.

There is a Nature Education Center at the farm. The purpose of the center is to provide knowledge about the organic food, herbal traditions and sustainable development.

The farm uses **traditional, low-emission agricultural practices.**

low-emission practices in crop production

Source: provided by Ziołowy zakątek

- vegetables are grown organically in a traditional way
- herbs are collected from nearby forests and fields
- cultivation of melliferous plants as part of maintaining biodiversity
- use of organic fertilizers
- exclusion from cultivation of areas that are constantly wet,
- covering the soil with vegetation throughout the year - catch crops in crop rotation

The results: high food quality, maintaining biodiversity, reducing greenhouse gas emissions

Low-emission animal housing systems - care for animal welfare

- cows grazing on the pasture (from spring to autumn) - ammonia reduction
- hay feeding in winter
- animal feed with the addition of herbal mixtures (health-promoting activities)
- precise balancing of the food dose
- free-stall animal housing system
- poultry is free-range

Source: provided by Ziołowy zakątek

Tetra Pak

The company is the world's leading provider of food processing and packaging solutions. Working closely with customers and suppliers, the company innovates to provide access to safe, nutritious food to hundreds of millions of people in more than 160 countries, while striving to reduce its environmental impact.

Founder: Ruben Rausing
Headquarters: Pully, Switzerland
Number of employees: >23 000
Founding: 1951, Lund, Sweden

Tetra Pak®
PROTECTS WHAT'S GOOD

Source: Tetra Pak, *Who we are*, https://www.tetrapak.com/en-pl/about-tetra-pak/who-we-are/company

Tetra Pak commits to net zero emissions

Tetra Pak was founded on the idea that a package should save more than it costs, with sustainability always at the core of how the company operates as a business. Since 1999, the company has been collecting data on energy use and greenhouse gas emissions from across the organisation on an annual basis, with its GHG accounts audited by an independent third party since 2013.

Tetra Pak is reaffirming its strategic commitment to promoting sustainability transformation by setting an ambition to achieve **net zero emissions across its value chain by 2050**. In support of this goal, the company has set an interim target for **2030 to achieve zero net carbon emissions from its own operations**. In addition, the **company has set emission reduction targets in line with 1.5°C**, in line with the principles of the Science Based Targets (SBT) initiative.

Source: Tetra Pak, *Tetra Pak commits to net zero emissions*, https://www.tetrapak.com/en-pl/about-tetra-pak/news-and-events/newsarchive/tetra-pak-commits-to-net-zero-emissions

Tetra Pak aims to achieve net zero greenhouse gas emissions by 2030 and meet its 2050 targets by focusing on four key areas:

- **Lowering energy-related emissions** through energy conservation, improvements in energy efficiency, installing on site solar photovoltaics (solar PV) and purchasing renewable Energy. The company has invested more than €16 million in energy efficiency since 2011, preventing a 23% increase in energy consumption. To date, around 2.7 MW of solar PV has been installed, enabling the delivery of low-carbon electricity and reducing operating costs. Tetra Pak has also increased its use of renewable electricity from 20% in 2014 to 69% in 2019.

- **Partnering with suppliers and other stakeholders along the value chain to significantly reduce carbon footprint.** Tetra Pak is committed to working with suppliers to reduce greenhouse gas emissions at various stages of the supply chain. Together, they are setting ambitious renewable energy targets and increasing the use of renewable and recycled materials.

- **Accelerating the development of its low carbon circular packaging and equipment portfolio.** The company is increasing its investment in sustainable innovation to meet targets for recyclable packaging and minimising its carbon footprint.

- **Developing sustainable recycling value chains.** Tetra Pak works with customers, waste management companies and others to ensure that all beverage cartons can be recycled and that the zero ones are properly disposed of or recycled.

Source: Tetra Pak, *Tetra Pak commits to net zero emissions*, https://www.tetrapak.com/en-pl/about-tetra-pak/news-and-events/newsarchive/tetra-pak-commits-to-net-zero-emissions

FOOD SYSTEMS

AMIBITION

Contribute to **secure, resilient, and sustainable food systems** that provide access to **safe, affordable,** and **nutritious food,** and **minimise food loss** and **food waste** across our value chain.

PROGRESS

- **Collaboration with Fresh Start** looking at technical solutions to food systems challenges.
- **New processing method for soya drinks and technology** to transform Brewer's Spent Grain into a plant-based beverage.
- **43,939 farmers** (96.2% smallholders) delivered milk to dairies in 22 Dairy Hub projects.
- **66 million children** in 44 countries participated in **school feeding programmes.**

CIRCULARITY

AMIBITION

Drive circular solutions by **designing recyclable food** and **beverage packaging, using recycled** and **renewable materials,** and **expanding collection** and **recycling** to keep materials in use and out of landfills.

PROGRESS

- **1.2 milion tonnes of carton packages** collected and sent for recycling.
- **8.8 billion plant-based packages** and **11.9 billion plant-based caps sold.**
- **Testing of fibre-based barrier** to substitute the thin aluminium foil layer in aseptic carton packages
- **~ €30 million invested in the collection and recycling of carton packages.**

Source: Tetra Pak, *Sustainability Report FY22 Highlights,* https://www.tetrapak.com/content/dam/tetrapak/media-box/global/en/documents/sustainability-report-highlights-infographics.pdf

CLIMATE

AMIBITION

Take action on **mitigating climate change** by **decarbonising our operations, products, and our value chain**.

PROGRESS

- **Achieved an 'A' for climate change** by the global environmental non-profit CDP.
- **131 kilo tonnes of CO2 saved** by buying more plant-based plastic.
- **84% renewable energy consumption** in our operations.
- **39% GHG emission reduction** in our operations compared to 2019.

NATURE

AMIBITION

Act for nature through **responsible sourcing practices** and **strategic partnerships** to **conserve** and **restore biodiversity, mitigate** and **adapt to climate change**, and **contribute to global water resilience.**

PROGRESS

- **87 hectares of land**, the equivalent of 136 football fields, restored through the Araucaria Conservation Programme in the Brazilian Atlantic Forest.
- **Achieved an 'A' for Forests** by CDP.
- **Completed a water value-chain analysis** to better understand our water footprint and water related risks.
- First Procedure for **Responsible Sourcing of Renewable Polymers** published.

Source: Tetra Pak, *Sustainability Report FY22 Highlights,* https://www.tetrapak.com/content/dam/tetrapak/media-box/global/en/documents/sustainability-report-highlights-infographics.pdf

Co-funded by
the European Union

IMAGINING AND DESIGNING

Scenario analysis

Objective of the training session

- In this topic we will guide you through the **intuitive logic school of scenario construction**.
- You will learn how to identify strategic decision (concerning the use of sustainable transport), identify the factors influencing sustainable transport, select driving forces, elaborate and create scenarios.
- You will identify hopes and fears for the use of sustainable transport in 2040.

Source: www.pexels.com

- Do you know the difference between forecasts and scenarios?

Forecasting vs. scenario building

Forecasting is frequently based on trend extrapolation.

It could be associated with driving from the past to the future but looking at the **rear mirrors.** Either way, we are following the same path. This is what we call trend extrapolation.

TREND EXTRAPOLATION

In scenarios, we assume that there is more than one path into the future!

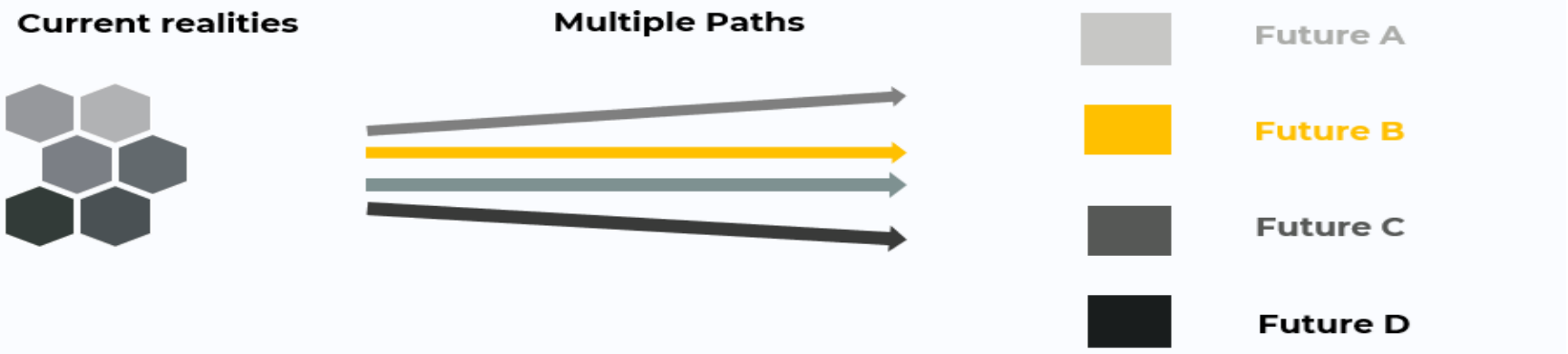
FORECAST

PRESENT

FUTURE

1 future based on assumptions
Linear/ non-linear projection

SCENARIOS



Source: Forum, W. E. (2008). The future of pensions and healthcare in a rapidly ageing world. Scenarios to 2030.

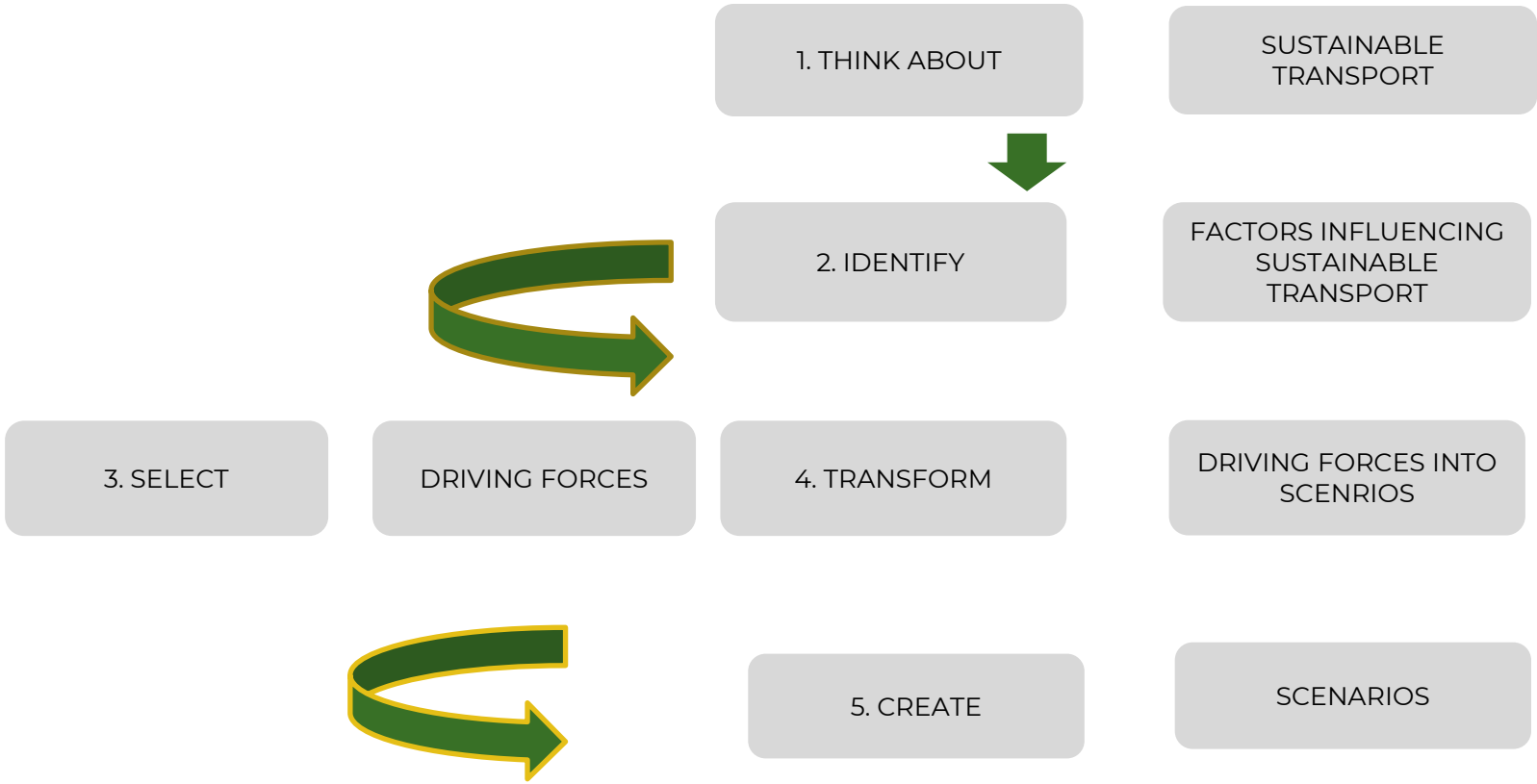
Multiple futures that challenge assumptions
Multiple development

How can I use scenarios for sustainable transport?

- **To assess trends affecting sustainable transport in my city/region/country.**
- To **assess the strength of the impact of trends** on the sustainable transport over a time horizon of several years.
- To **assess the degree of uncertainty of trends affecting sustainable** transport.
- To **develop alternative visions of sustainable transport** according to changing trends.

In intuitive logic school of scenario construction, we assume that scenarios could be created in a structured way!

How to do it? In iterative way as follows….



Stage 1

Think about the **future of sustainable transport in your city/region/country.**

Choose a "time horizon for your analysis (let's assume 10-15 years).

Stage 2

Identify the external factors affecting the sustainable transport

This you can do with the **use of STEEP analysis, which is a checklist of social, technological, economic, ecological and political factors.**

Create a list of your own factors, or use a ready-made list presented in the following slides!

Examples of STEEP factors (social)

Cultural Attitudes and Values: Societal norms and values play a significant role. For example, in some cultures, cars are seen as a status symbol, which can make reducing car usage challenging. Conversely, in places where cycling or public transport is culturally accepted and promoted, there might be a higher inclination towards these sustainable options.

Social Norms and Peer Influence: The behavior and choices of individuals within a social network can significantly influence others. If sustainable transport options like cycling, walking, or using public transport are seen as the norm within a peer group or community, individuals are more likely to adopt these practices.

Accessibility and Inclusivity: The availability of sustainable transport options that cater to people with disabilities, elderly individuals, and those with other special needs is crucial. Designing inclusive transport systems can encourage a broader section of the society to participate in sustainable transport practices.

Examples of STEEP factors (technological)

- **Advancements in Vehicle Technology**: Innovations in electric and hybrid vehicles, including improvements in battery technology, charging infrastructure, and energy efficiency, are pivotal. These advancements make sustainable vehicles more accessible, affordable, and practical for everyday use.

- **Public Transport Technology**: The development of more efficient and reliable public transportation systems, such as electric buses, light rail systems, and the use of renewable energy sources, enhances the appeal and usability of public transport. Real-time data integration into public transport systems can also improve user experience by providing accurate schedules, routes, and availability information.

- **Smart Infrastructure**: Intelligent transportation systems (ITS) that utilize data, sensors, and communication technologies can optimize traffic flow, reduce congestion, and enhance safety. Smart traffic lights, adaptive traffic management systems, and smart parking solutions contribute to a more efficient and sustainable urban transport system.

Examples of STEEP factors (economic)

Fuel Prices: High fuel prices can make driving personal combustion-engine vehicles more expensive, encouraging people to seek out more fuel-efficient or alternative fuel vehicles, as well as public transportation, cycling, or walking.

Cost of Vehicles: The upfront cost of electric vehicles (EVs) and other sustainable transport options can be a significant barrier to their adoption. However, as technology advances and production scales, these costs are decreasing, making sustainable options more accessible.

Public Transport Fares: The pricing of public transport can influence its attractiveness compared to private vehicle use. Affordable and competitive pricing can encourage higher usage of public transport systems.

Examples of STEEP factors (ecological)

Air Quality: High levels of air pollution, especially in large cities, lead to a search for transport solutions that minimize exhaust emissions, such as electric vehicles, bicycles, or walking.

Land Use: Intensive use of land for transport infrastructure leads to soil degradation and loss of green areas, which in turn motivates the search for solutions that minimize the need for new spaces.

Threat to Biodiversity: The construction of new roads and the development of transport infrastructure can lead to habitat fragmentation and pose a threat to biodiversity. Sustainable transport solutions seek to minimize such impacts.

Natural Resource Consumption: The depletion of natural resources, such as fossil fuels, drives the search for and use of more sustainable and renewable energy sources to power vehicles.

Examples of STEEP factors (political)

Government Subsidies and Incentives: Political decisions regarding subsidies for electric vehicles, tax incentives for using renewable energy sources, and financial support for public transport can encourage the adoption of sustainable transport methods.

International Agreements: Participation in international environmental agreements, such as the Paris Agreement, can commit countries to reducing their carbon footprint, thereby promoting policies that favor sustainable transport solutions.

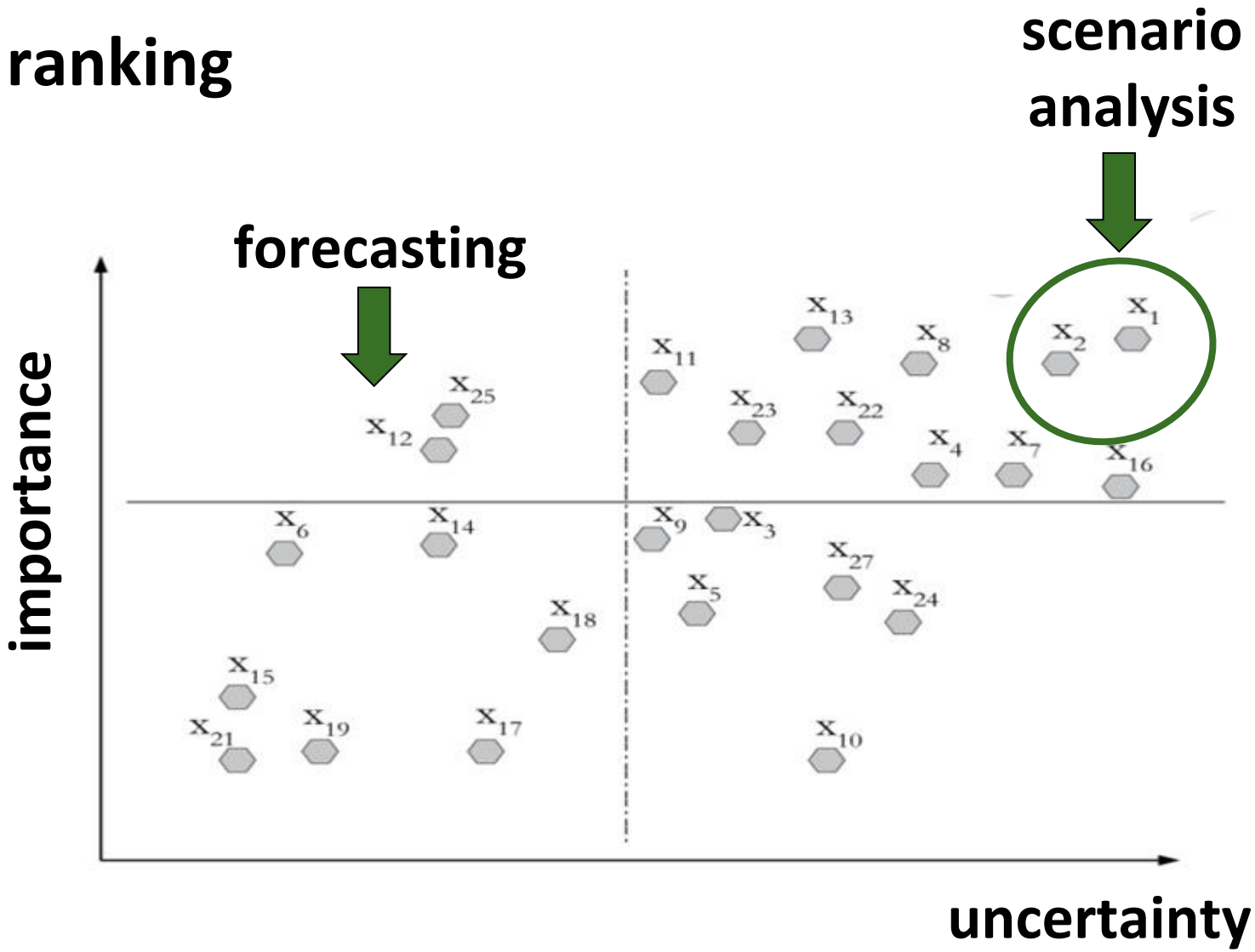
Urban Planning Policies: Political decisions related to urban development and planning can have a significant impact on sustainable transport. For instance, investing in pedestrian-friendly cities and bike can encourage more sustainable mobility patterns.

Political Stability and Will: The political will to implement and maintain sustainable transport initiatives, as well as the stability of political institutions, can influence the consistency and effectiveness of policies and measures aimed at promoting sustainable transport.

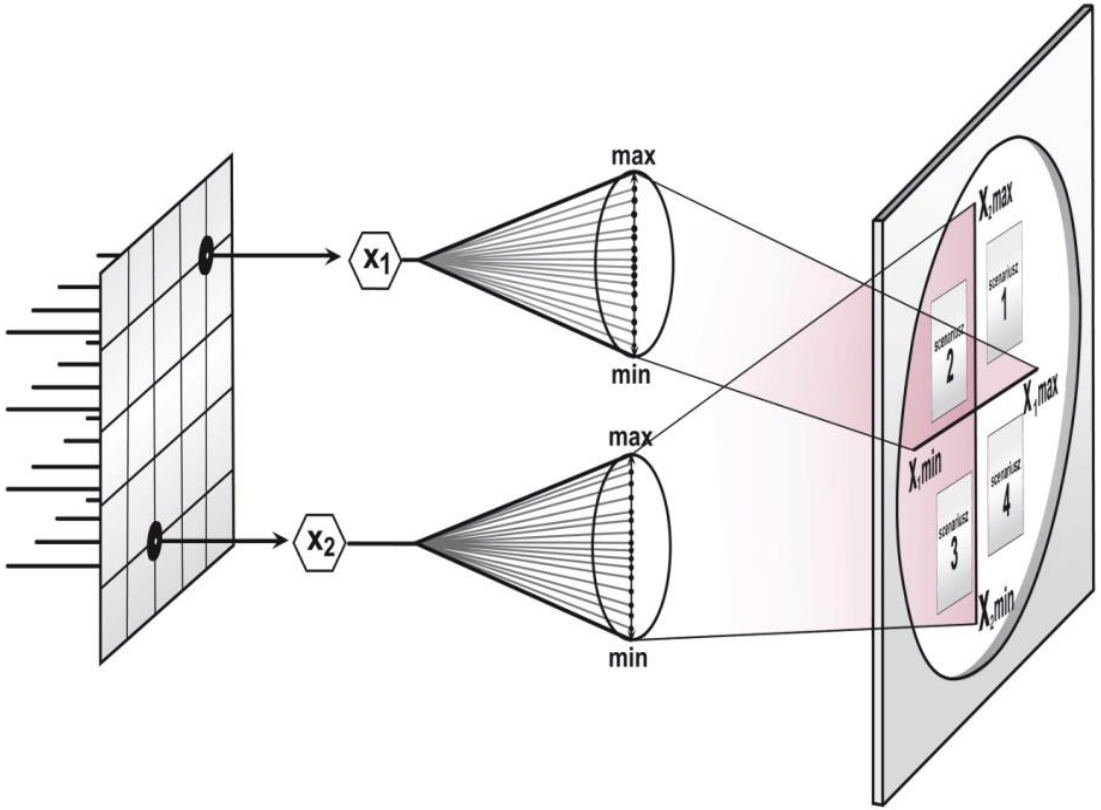
Stage 3

Try to rank all the identified STEEP factors by **importance and uncertainty**. Those factors that are important and predictable could be the subject to forecasting.
Two factors that are at the same time **the most important** and **the most uncertain** are the subject to scenario analysis!

Factors' ranking



Stage 4: Transform two driving forces into scenarios



- Two factors that are at the same time the most important and uncertain come out into extreme states.
- Think about **high availability of smaty infrastructure** versus **low availability of smart infrrastructure**, high fuel prices versus low fuel prices**.** Two extreme states of two factors are transformed into four scenarios!
- Experiment with other factors!

Stage 5: Develop four possible scenarios
How does this look in practice?

Plot the identified factors x1 and x2 on two orthogonal axes

Assign extreme values to x1 and x2 factors

X1: high availability of smart infrastructure

Scenario 2: Smart Green 2040: Navigating Sustainability Amidst Affluence

Scenario1: „Green Horizons: The 2040 Urban Utopia”

X2: low fuel prices

X2: high fuel prices

Scenario 3: Grassroots Green: The 2040 Community-Driven Eco-Revolution

Scenario 4:"Resilient Mobility 2040: Navigating Through Constraints

X1: low availability of smart infrastructure

Develop your own scenario narratives or refer to the scenario descriptions below!

Scenario 1: "Green Horizons: The 2040 Urban Utopia"

In 2040, the high availability of smart infrastructure has revolutionized sustainable transport, making it more efficient and accessible than ever. With fuel prices soaring, cities have rapidly transitioned to electric and autonomous vehicles, integrated seamlessly with smart traffic management systems to reduce congestion and emissions. Public transportation has become highly reliable and convenient, supported by real-time data and predictive analytics, encouraging a significant shift from private car ownership. As a result, urban environments are cleaner, quieter, and more livable, with citizens embracing a more sustainable and eco-friendly lifestyle.

Scenario 2: „Smart Green 2040: Navigating Sustainability Amidst Affluence"

In 2040, even with low fuel prices, cities thrive on sustainable transport thanks to widespread smart infrastructure. Electric vehicles and renewable energy are the norms, minimizing the allure of cheap fossil fuels. Smart systems enhance efficiency, making green transport the preferred choice. Urban spaces are cleaner and greener, underscoring a global commitment to sustainability.

Scenario 3: "Grassroots Green: The 2040 Community-Driven Eco-Revolution"

By 2040, despite low fuel prices and sparse smart infrastructure, sustainable transport evolves through community-led solar projects and bike-sharing programs. Government and non-profit support helps retrofit infrastructure, enhancing efficiency. A cultural shift towards environmental responsibility fosters a resilient approach to sustainability, focusing on local solutions and renewable energy.

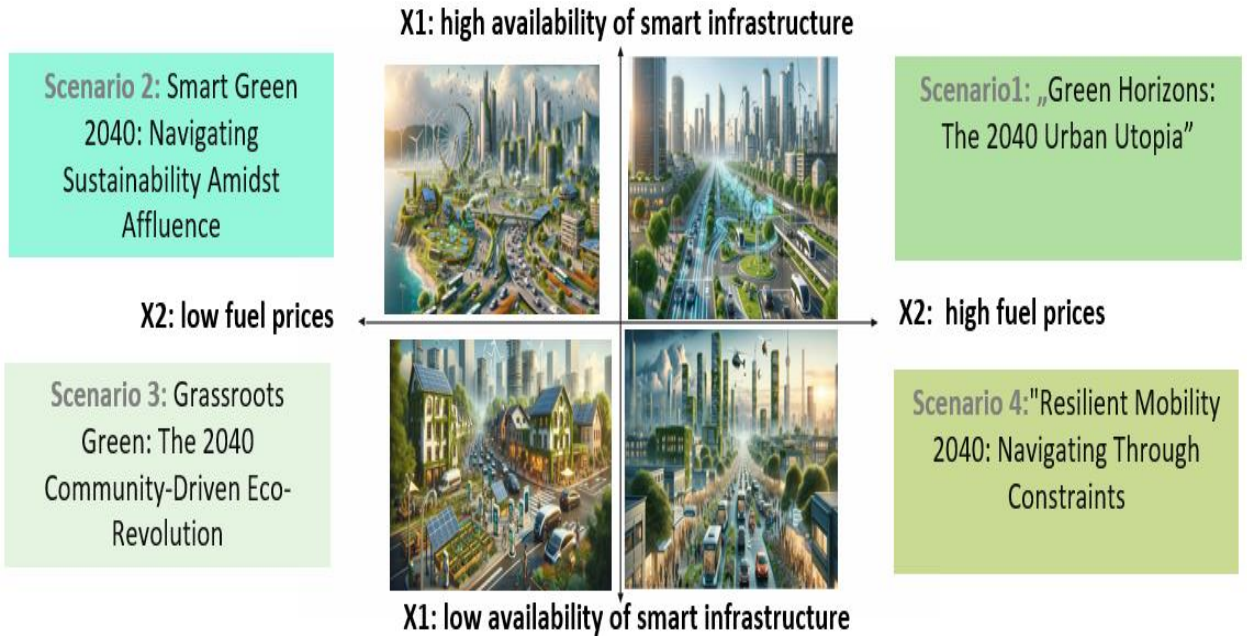
Scenario 4: "Resilient Mobility 2040: Navigating Through Constraints"

By 2040, high fuel prices and limited smart infrastructure prompt a shift towards sustainable transport. Renewed interest in bicycles and enhanced pedestrian paths becomes prevalent, while public transport, powered by renewables, forms urban mobility's core. Carpooling and ride-sharing flourish through local initiatives, fostering a resilient, eco-conscious community amidst technological constraints.

Extension of the exercise

- What are your hopes in relation to the occurrence of scenarios?
- What fears do these scenarios generate?

While working in group



1. Familiarise yoursef with possible future scenarios
2. Identify your fears and hopes in each scenario
3. Assess which of your hopes and fears seem to be the most important, and which are less important?

Have fun! Every answer is correct!

IMAGINING AND DESIGNING

De Bono Six Thinking Hats Technique

Lateral thinking

- The concept of lateral thinking introduced by **Edward de Bono** assumes the assessment of a given phenomenon from various points of view.
- This approach, according to the author, allows for a conscious search for new, alternative solutions by means of creative thinking.

Source: www.pexels.com

The need for lateral thinking

Alternatives

- ❑ learning the ‘how to’ and value of extracting concepts using concepts to breed new ideas

Challenge

- ❑ challenging traditional ways constructively learning to break free of our thinking patterns

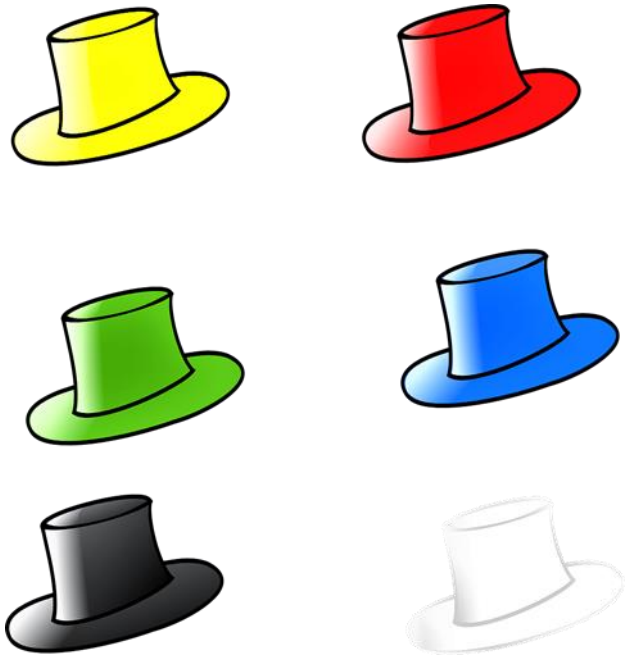
Focus

- ❑ shifting from the single focus on problems
- ❑ learning the importance of redefining the focus
- ❑ developing your own creative solutions of the problem

Source: www.pexels.com

De Bono Six Thinking Hats Technique

- In order to make it easier to remember and use that technique, de Bono assigned each thinking style a hat of the appropriate color: white, red, yellow, black, green and blue.
- These hats are not labels for thinking - they are rather directions in which thinking goes.



Source: https://akademickaedukacja.wordpress.com/2016/04/02/73/

De Bono Six Thinking Hats Technique

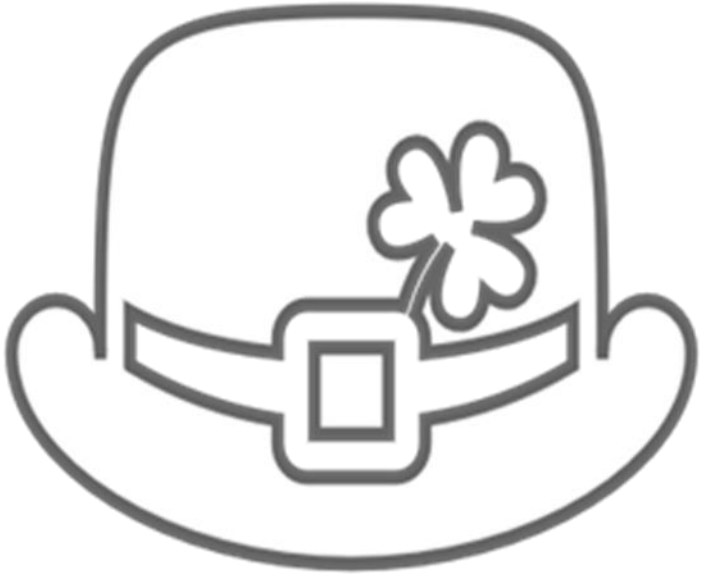
- When we put on a hat, we assume a certain type of thinking.
- Hats cannot be used to assign people to a given category.
- During group work, everyone wears the same hat at the same time.

Source: www.pexels.com

White - the facts

Facts, Figures, Data, Information

- ❑ What do we know?
- ❑ What data do we need to get?
- ❑ What are the specifics?



Green - creativity

Investigating possibilities, inquiry, searching, suggestions, propositions, ideas, innovations, alternative solutions

- ❑ What can you do?
- ❑ Can it be done in a different way?

Yellow - optimism

Benefits, advantages, profits, savings

- ❑ Why is it worth doing this?
- ❑ What will be the benefits?
- ❑ Why will it pay off?

Black - pessimism

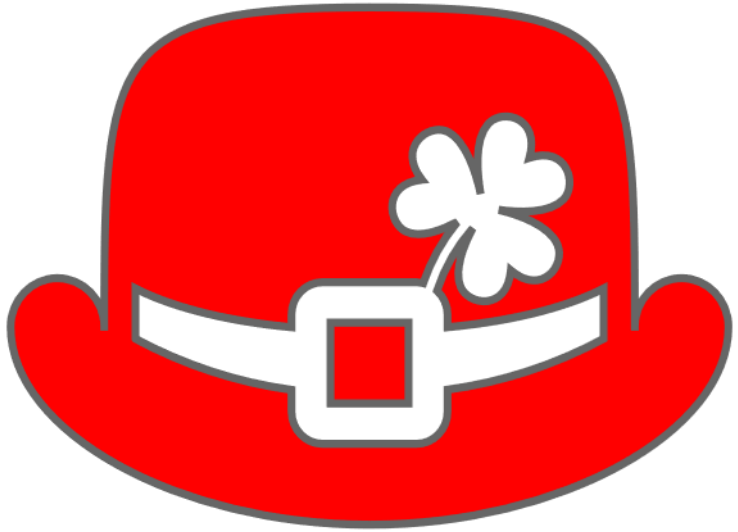
Caution, assessing the truthfulness, judging, checking, verifying the facts

- ❑ Will it work?
- ❑ Will it be safe?
- ❑ Is it possible?

Red - emotions

Emotions, feelings, premonitions, intuition

- What do we feel about this matter when we think about it?

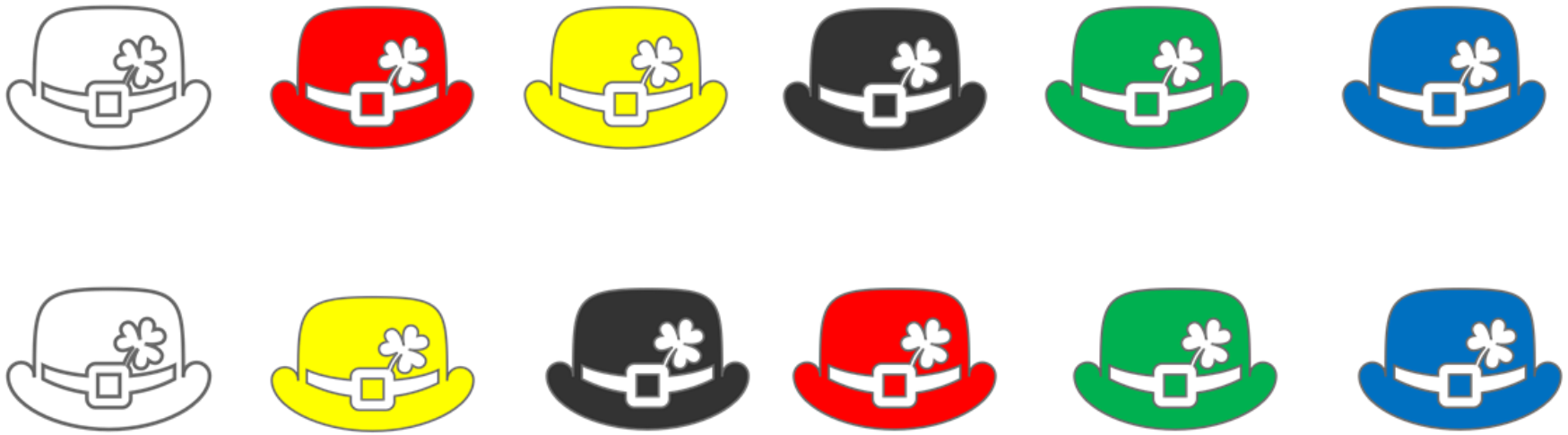


Blue - summary

Control of the thinking process, summary

- ❑ Where have we come?
- ❑ What action should be taken?
- ❑ What is the procedure to solve the problem?

Hat sequence suggestions



Case study – EduNUT Isle

EduNUT Isle is a small island nation with a population of 500,000 people, heavily reliant on imported fossil fuels for its energy needs, which makes its electricity costs high and contributes to significant carbon emissions. The government has set an ambitious goal to transition to 100% renewable energy by 2030 to reduce its carbon footprint, enhance energy security, and stabilize energy costs. The primary renewable options available are solar, wind, and tidal energy.

As EduNUT Isle embarks on its renewable energy journey, it faces a multifaceted dilemma involving environmental, social, and economic considerations:

1. The best locations for wind farms are also key habitats for several endangered bird species. Installing wind turbines could disrupt these habitats, leading to potential ecological imbalance.	2. The initial investment in renewable energy infrastructure, such as solar panels and tidal energy converters, is substantial. The government struggles to secure funding without imposing heavy taxes on its population, which could lead to public discontent.
3. As the nation transitions to renewable energy, there's a risk that remote communities might be left behind due to the high costs of extending	4. The intermittent nature of solar and wind energy requires robust energy storage solutions to ensure a stable power supply. The current technology

Case study - Renewable energy transition dilemma

TASK: Support EduNUT Isle government to decide whether to implement transition to 100% renewable energy by 2030 taking into account the above dilemmas. Use De Bono Six Thinking Hats technique to make a decision.

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