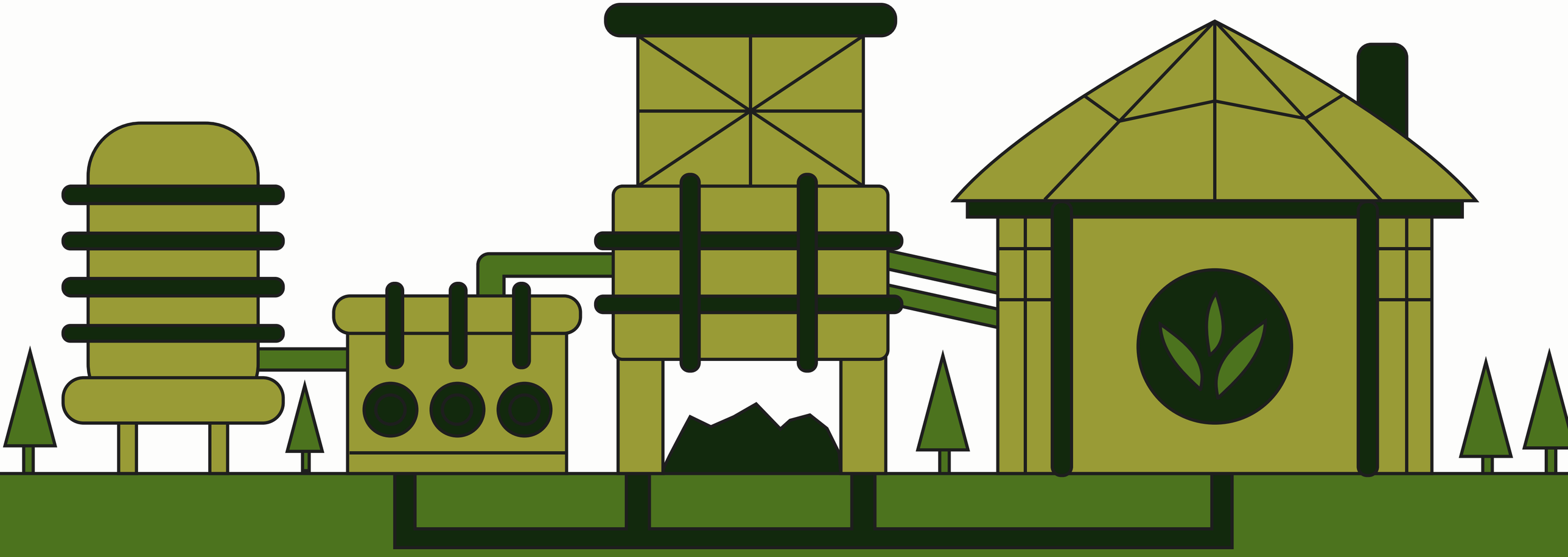
BIOFUELS: CURRENT POLICIES, FUTURE GOALS, FEEDSTOCKS, COSTS

A theory - based evaluation by Lorena Moret Lopez and Sarah Tutnjevic

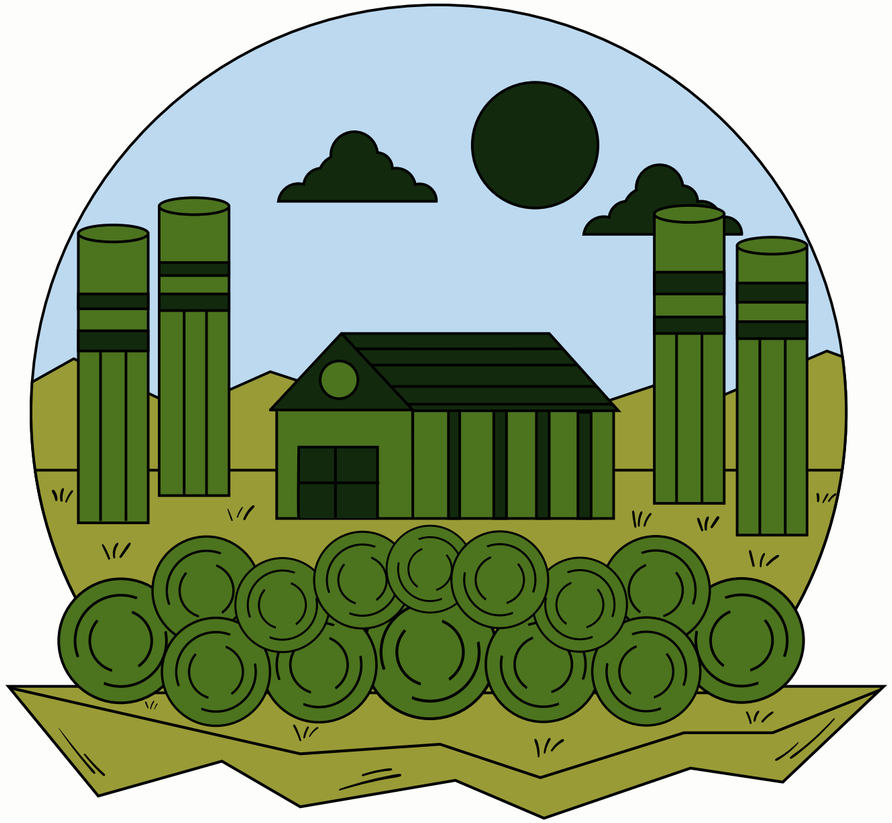


INTRODUCTION

- **Biofuels** are renewable energy sources made from organic materials like crops, forest residues, or waste - different types of **biomass**

- They help reduce greenhouse gas emissions and reliance on fossil fuels, and have a key role in the EU’s 2030 climate goals

- This study compares Austria and the Czech Republic’s biofuel strategies, policies, resources, and challenges



CZECH REPUBLIC – AN OVERVIEW

- Biomass is the main renewable source in Czechia - **58%** of RES use in 2022, mostly in heating and CHP.
- **Forest biomass** dominates, with ~13.5 million tons/year available, but **bark beetle outbreaks** have reduced long-term supply
- Biofuels covered **7.1%** of transport energy in 2021, mostly via B7 biodiesel and E5 ethanol (not bad when it comes to REDII, but not enough for REDIII)
- Advanced biofuels and biomethane are underdeveloped; only 7 biomethane plants exist, few are fully operational.
- Development is slowed by fragmented policy, high costs, and limited infrastructure.

AUSTRIA – AN OVERVIEW

- Biomass is the most important domestic energy source, followed by hydropower and with a wind and solar energy shares growing.
- Around half of the land is forest while 32% is agricultural, being both the main source of biomass production.
- Forests provide the 83% of Austria's biomass volume while the rest comes from the agricultural and waste sectors.
- It intends to move towards a transformation to a highly efficient and climate-neutral energy, mobility and economic system

BIOFUELS IN CZECHIA – TYPES

- **1st-generation**: rapeseed, corn, and sugar beet- used for biodiesel and ethanol; competes with food production
- **2nd-generation**: Forestry residues (wood chips, bark), cereal straw, manure - key for biogas, cellulosic ethanol, and CHP
- **Biogas feedstock**: Maize silage, manure, biodegradable municipal waste - processed in 500+ biogas plants.

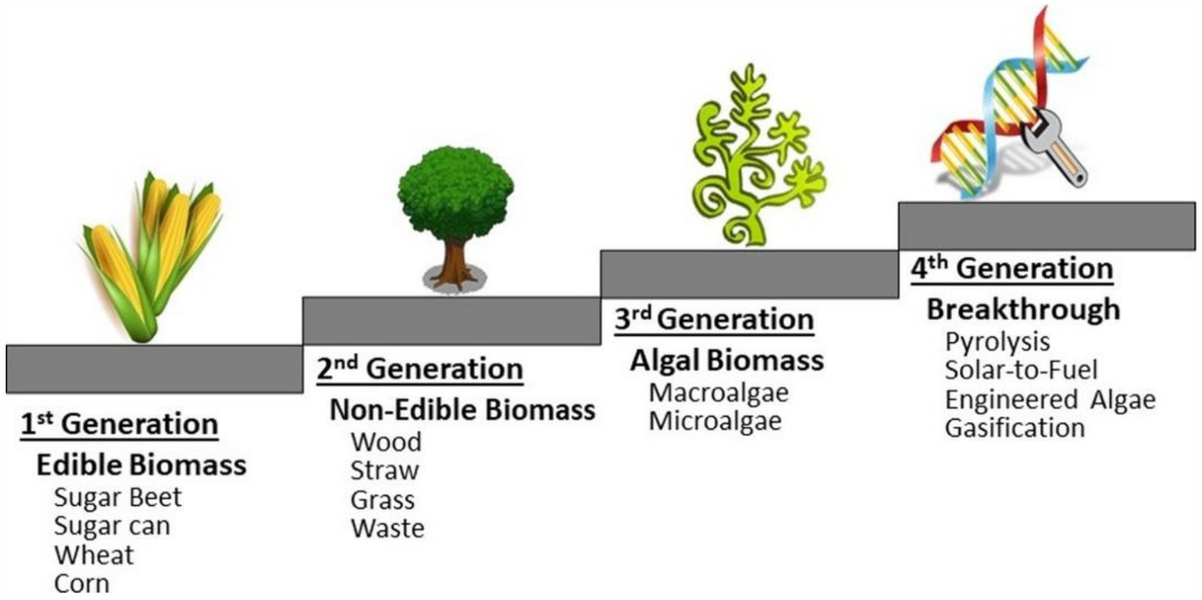
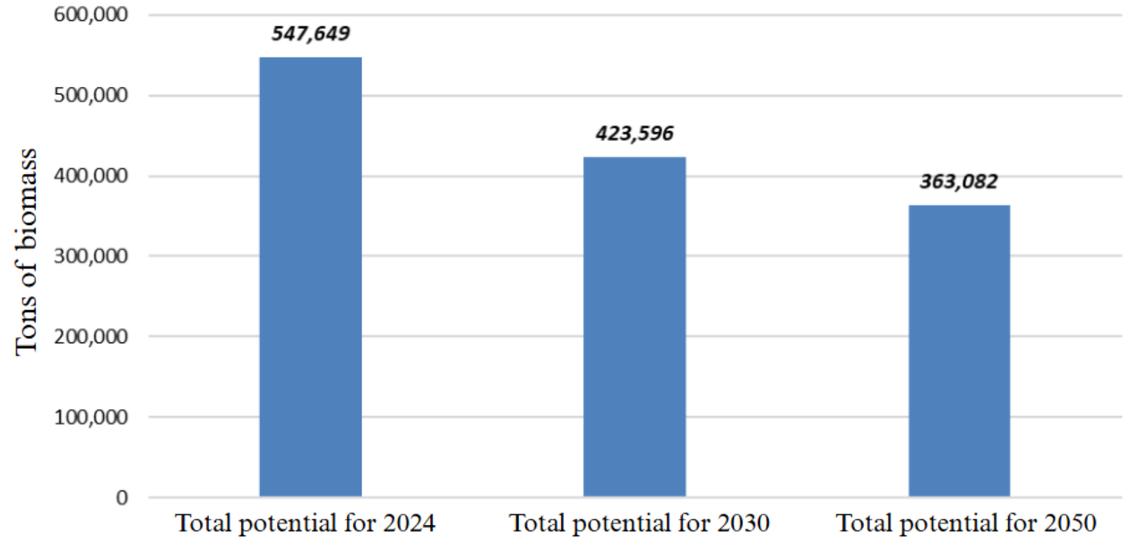
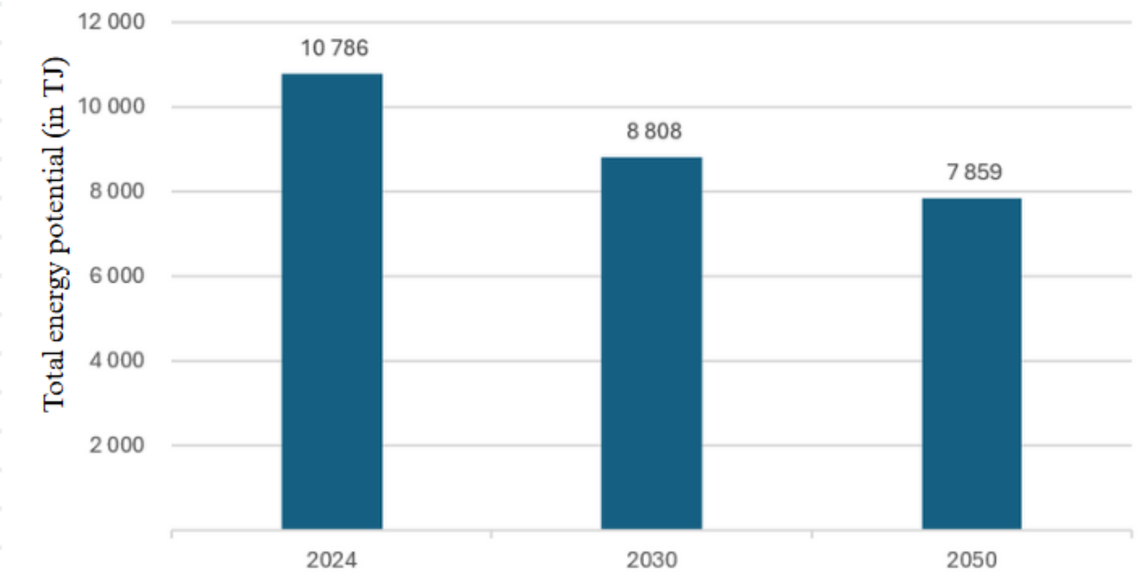


Image source: "Promising evolution of biofuel generations: Subject review"
by H. A. Alalwan, A. H. Alminshid, and H. A. S. Aljaafari (2019)

BIOMASS IN CZECHIA – LIMITS

- Only **~50%** of biomass is usable due to ecological protection, terrain, and land fragmentation.
- Bark beetle outbreaks caused a projected **36% drop in forest biomass by 2050**.
- **Regional mismatch**: High availability ≠ high demand → costly logistics.





Source for the images: "Analýza potenciálu a využitelnosti biomasy z lesního hospodářství pro výrobu energie"
by K. Vávrová et al. (2024), Project TK04010166, TAČR THÉTA.

BIOFUELS IN AUSTRIA – TYPES

- **1st-generation**: Agricultural residues as oil crops, sugar crops, starch crops and used cooking oil and animal fats for liquid bioenergy for transport.
- **2nd-generation**: Fuel wood, wood chips, wood pellets, bark and saw,ill by-products.
- **Biogas feedstock**: Municipal and industrial organic waste - processed in the biogas plants.

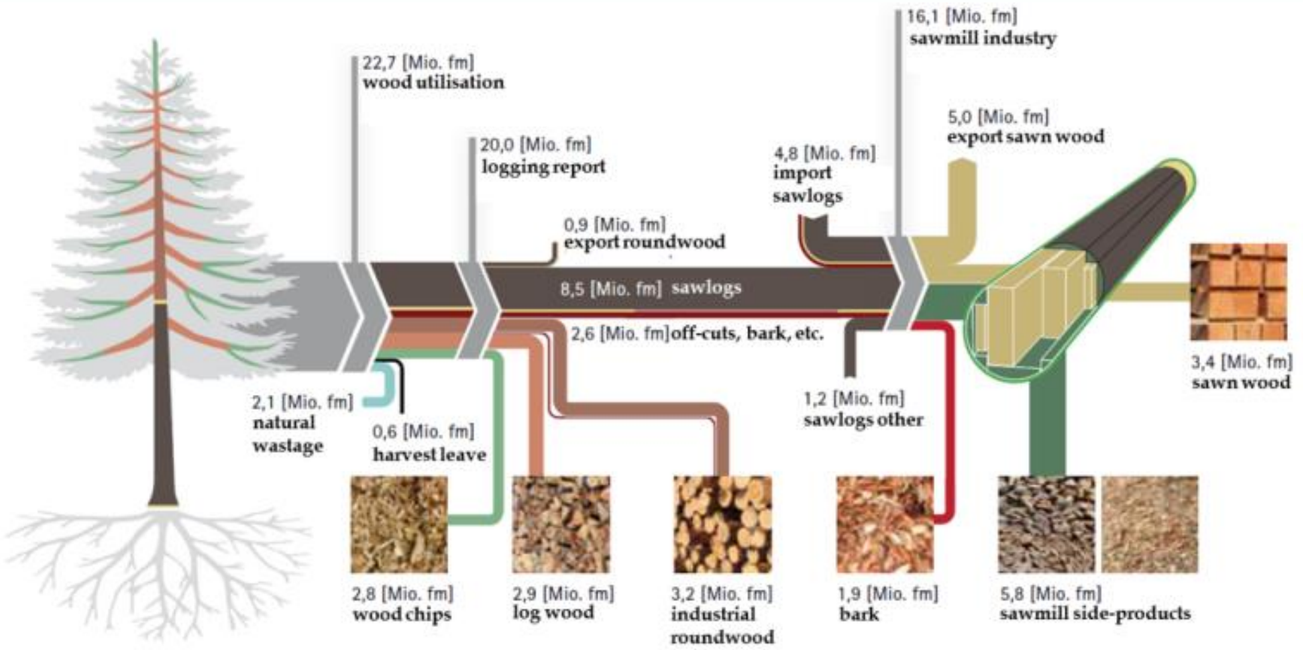


Image: Wood flows in Austria (https://nachhaltigwirtschaften.at/resources/nw_pdf/schriftenreihe/schriftenreihe-2019-52-bioenergy-in-austria.pdf)

BIOFUELS IN AUSTRIA – LIMITS

- Austria is an active participant in the **IEA Bioenergy Technology Collaboration Programme**, which aims to promote the use of environmentally sustainable and competitive bioenergy.

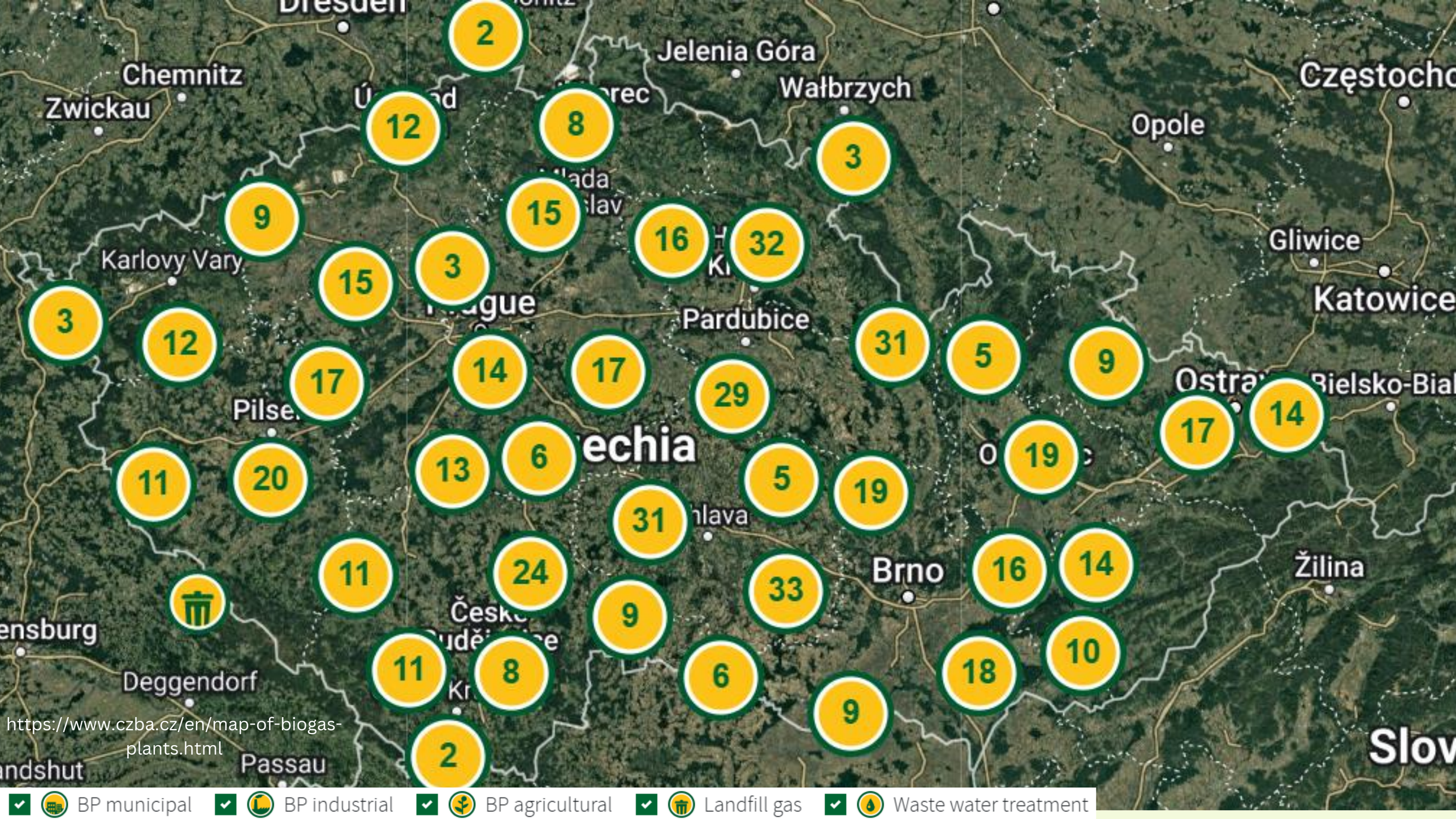
- The Austrian Climate Change Act sets a **maximum threshold** for greenhouse gas emissions on a yearly as well as sectoral basis.

- It applies to agriculture, buildings, energy and industry, fluorinated greenhouse gases, transport, and waste and **defines rules** for the development and implementation of **effective climate mitigation measures**.

CZECHIA – BIOMASS UTILIZATION & BIOGAS

- Biomass is used in district heating, CHP, and biogas plants (>500 nationwide)
- Biogas relies on maize silage, manure, and some biowaste
- Biomethane potential remains underused - only 7 plants, with low support for grid injection and vehicle fuel use
- Pelletization, combustion, and anaerobic digestion are key processing methods

Image: Litomyšl biomethane plant - https://zajimej.se/biometanova-stanice-litomysl/

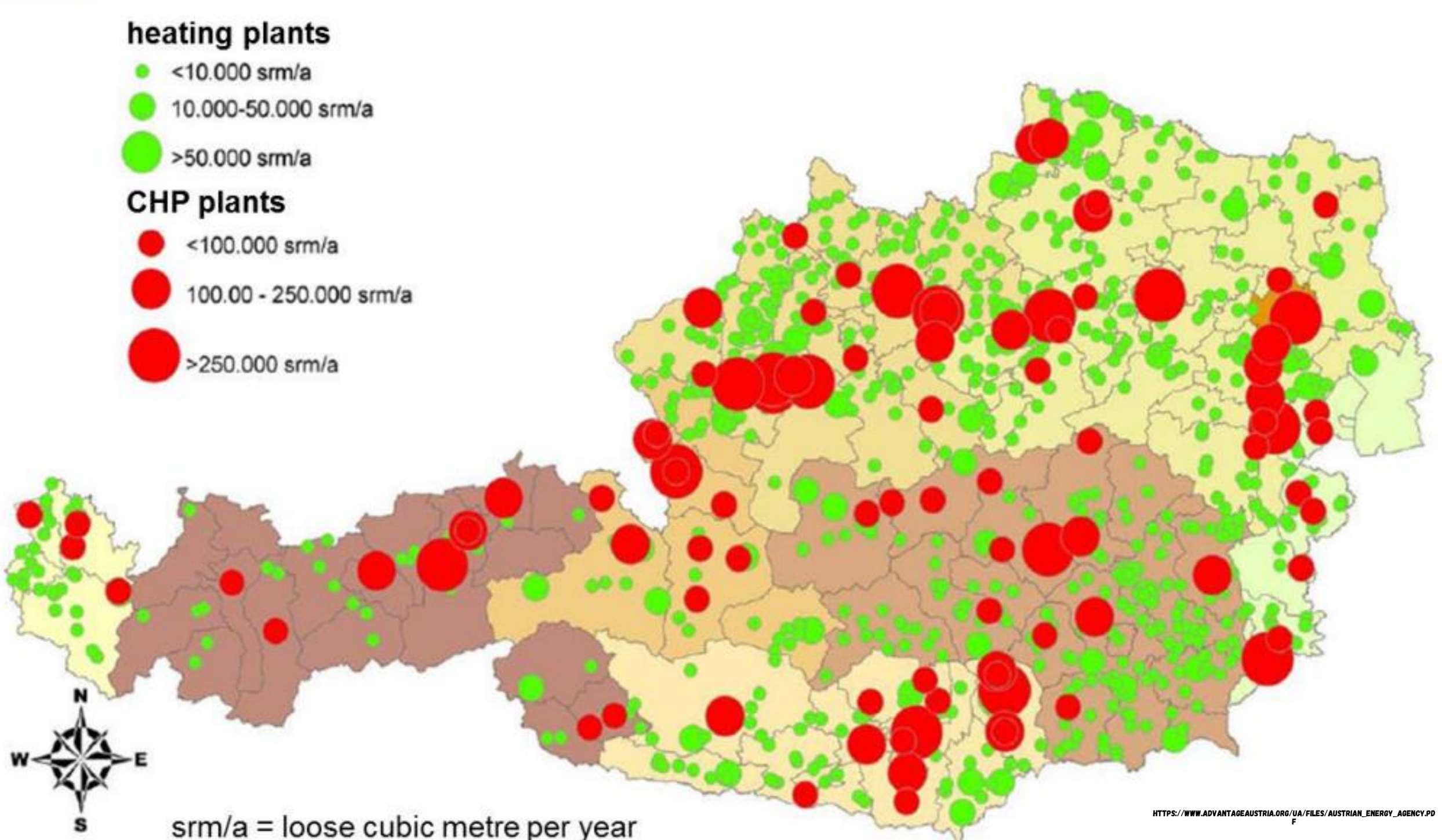


https://www.czba.cz/en/map-of-biogas-plants.html

AUSTRIA – BIOMASS UTILIZATION & BIOGAS

- Austria has over 300 biogas plants, which is used for heat, electricity or upgraded biomethane for injection into the gas grid.
- Biomass is the third most important producer of green electricity.
- New technologies for producing advanced biofuels aim at utilizing dedicated bioenergy crops or agricultural residues.
- Wood gas cogeneration technology allows for high efficiency regarding small-scale power generation.

Image: Lenzing biomass plant (https://sourcingjournal.com/sustainability/sustainability-news/lenzing-tencel-fiber-producer-purchase-biomass-carbon-neutral-renewable-energy-432446/)



CZECHIA – POLICY FRAMEWORK

- Governed by EU RED II/III and national plans (NECP, NREAP).
- RED III: Requires 29% RES in transport or 14.5% GHG cut by 2030.
- Czechia still focuses on first-gen fuels (B7, E5), with limited support for advanced types.
- Policy is fragmented across ministries, which slows implementation and economic deveopment

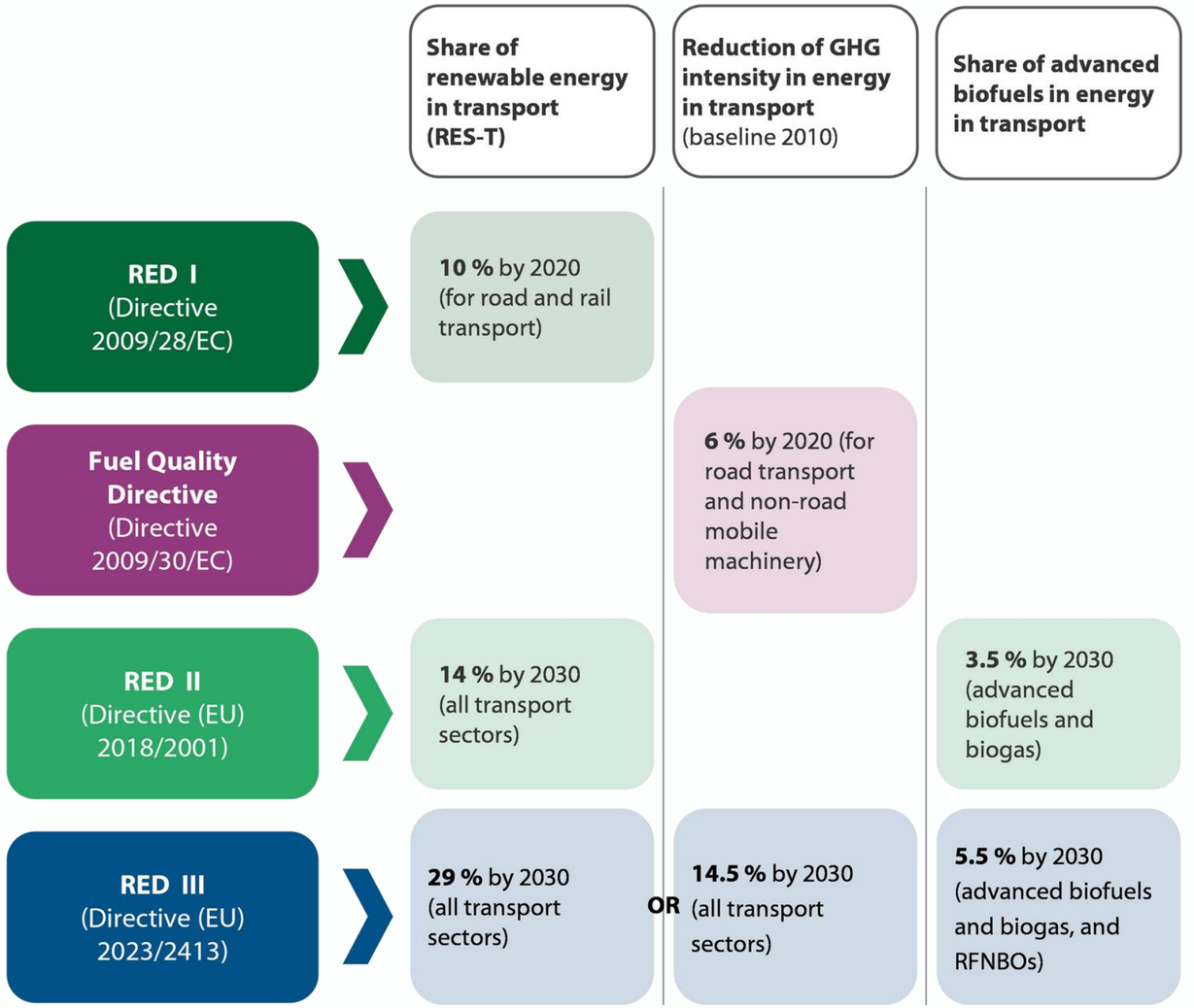


Image source: https://www.eca.europa.eu/en/publications?ref=sr-2023-29

AUSTRIA – POLICY FRAMEWORK

- The energy policy is simultaneously conducted at two levels, the federal and the nine federal provinces.
- All the implementations are grouped in the national energy and climate plan (NECP).
- Austria also must attend the EU legal framework including the RED that has to be implemented into the national laws.

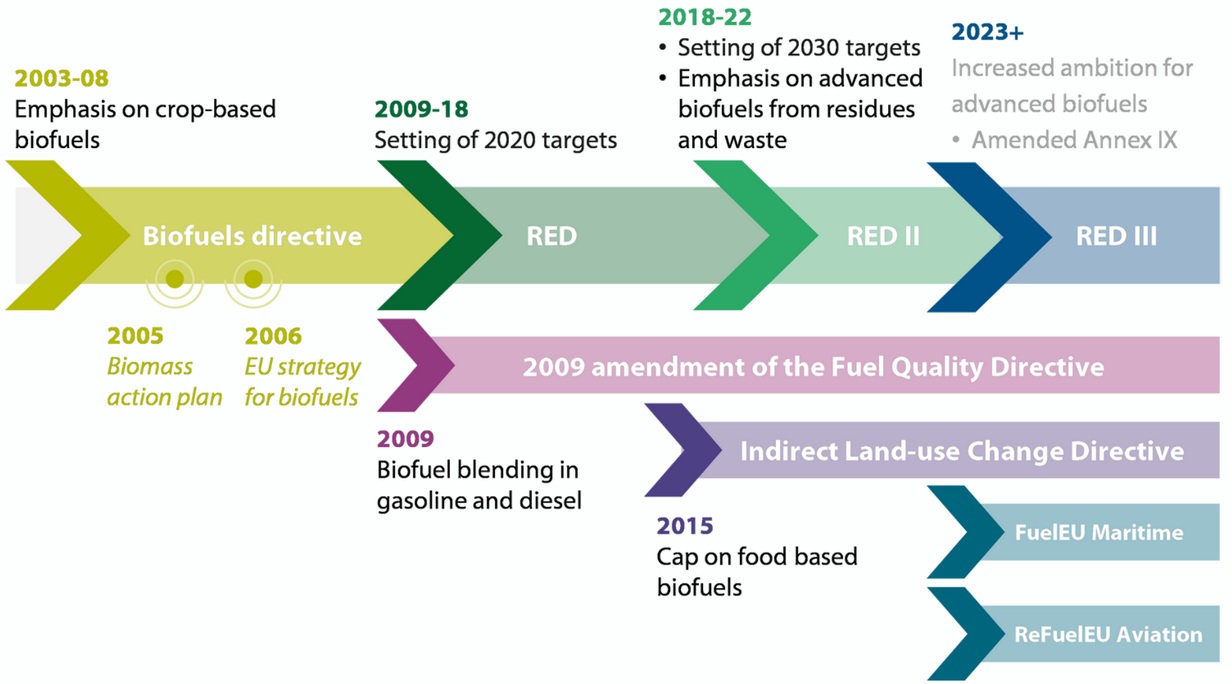


Image: European regulations (https://www.eca.europa.eu/en/publications?ref=sr-2023-29)

CZECHIA – BIOMASS UTILIZATION CHALLENGES

- To meet targets, biomass use must rise by up to several million tons/year, mostly in CHP.
- Real-world use is restricted by sustainability criteria, arable land competition, and regional mismatches.
- Example: Vysočina has high biomass but low demand; Moravskoslezský is the opposite, which leads to high transport costs, low efficiency.

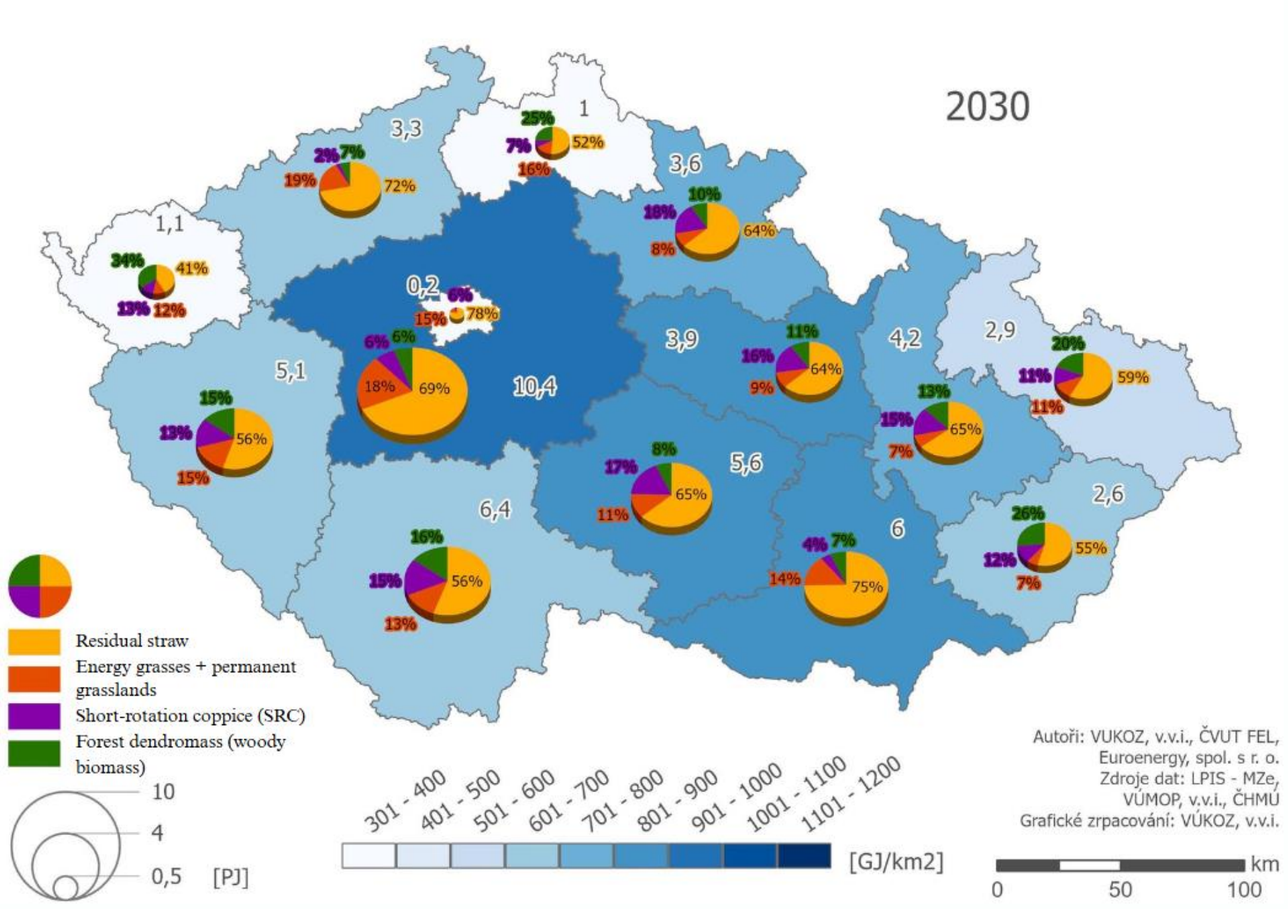


Image source: “Metodika potenciálu biomasy vzhledem ke kritériím udržitelnosti a aspektu využit“Metodika potenciálu biomasy vzhledem ke kritériím udržitelnosti a aspektu využití” by T. Králík et al. (2024), TAČR THÉTA, Ministry of Environment.

AUSTRIA – BIOMASS UTILIZATION CHALLENGES

- Austria’s use of biomass could increase by 38% by the year 2030, with about half of this potential associated with the agricultural sector and half with the forestry sector.
- Biomass is expected to overtake oil and natural gas in the medium term.
- By 2050, biomass is expected to be increasingly used as a substitute for natural gas, for electricity generation, high-temperature industrial processes, and the transport sector

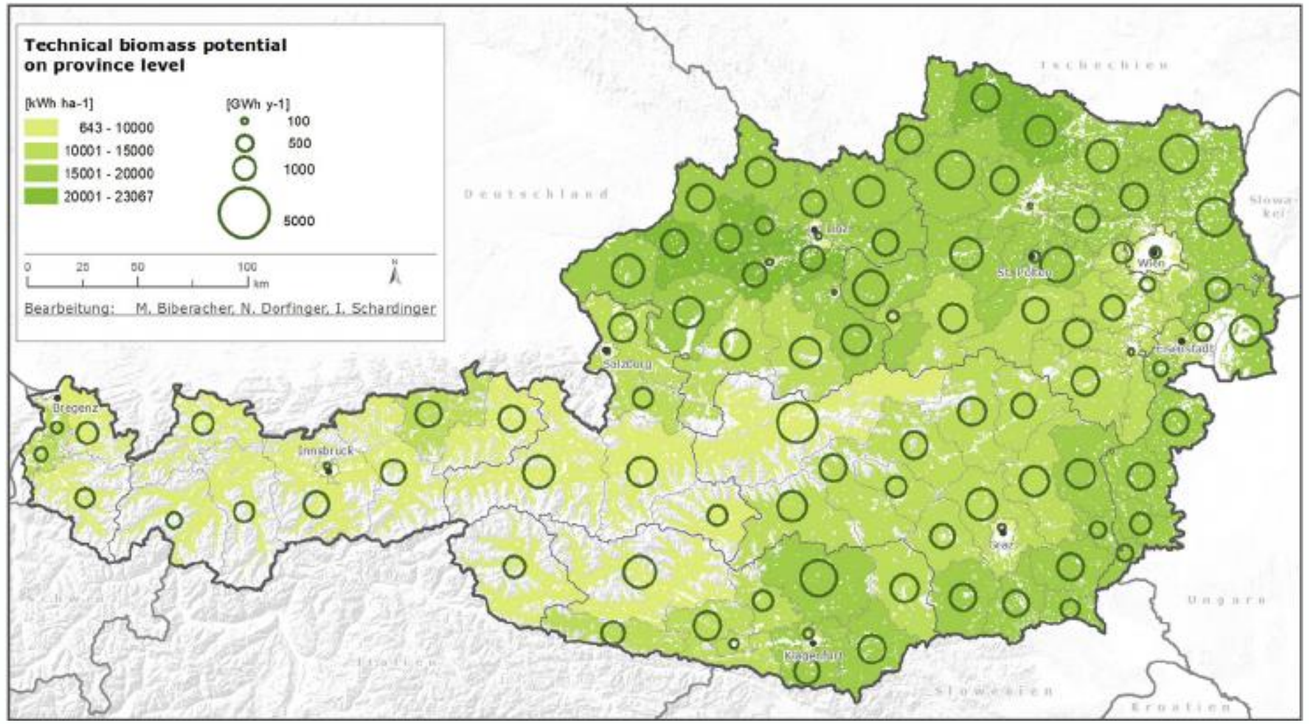


Image: Technical biomass energy potential for Austria aggregated to 250 m cells and for districts (https://www.researchgate.net/figure/e-Technical-biomass-energy-potential-for-Austria-aggregated-to-250-m-cells-raster-in_fig6_257420972)

CZECHIA – BIOFUELS IN TRANSPORT

- In 2021, Czech biofuels met 7.1% of transport energy - close to RED II's cap for first-gen fuels.
- Second-gen ethanol (e.g. Litvínov pilot plant) and biomethane offer promise but have cost and infrastructure barriers.
- Future growth requires **investment** in advanced tech and bio-LNG stations (infrastructure in general) to meet RED III.

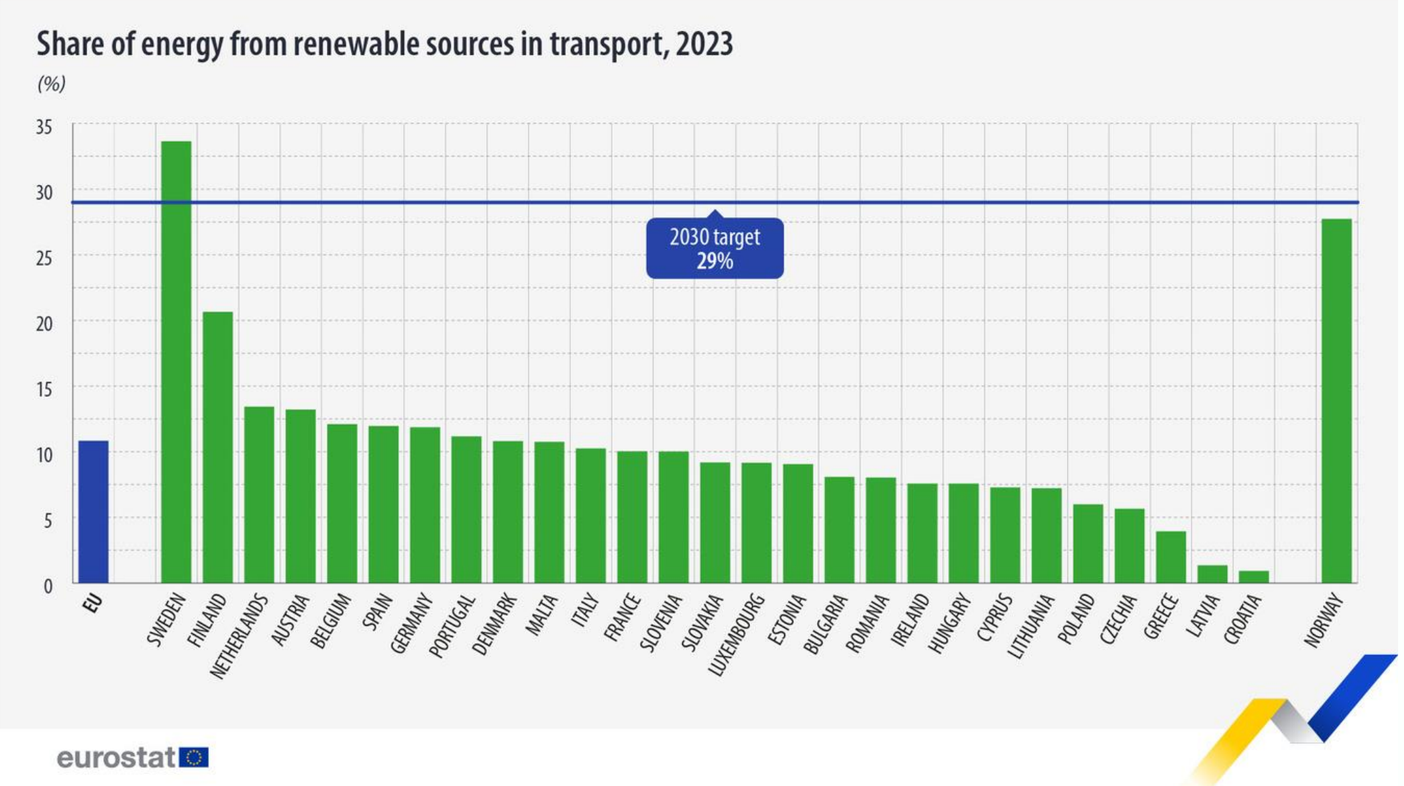


Image source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics

AUSTRIA – BIOFUELS IN TRANSPORT

- The Fuel Ordinance Amendment lays down the Biofuels Directive, the Renewable Energy Directive, and the Fuel Quality Directive in Austrian law, developing some national strategies in the transport area.

- Advanced biofuel pathways pursued through Austrian companies and research institutes include cellulosic ethanol, biomethane via gasification, FT-liquids and mixed alcohols from syngas, coprocessing in oil refineries, hydrothermal liquefaction, and electrofuels.

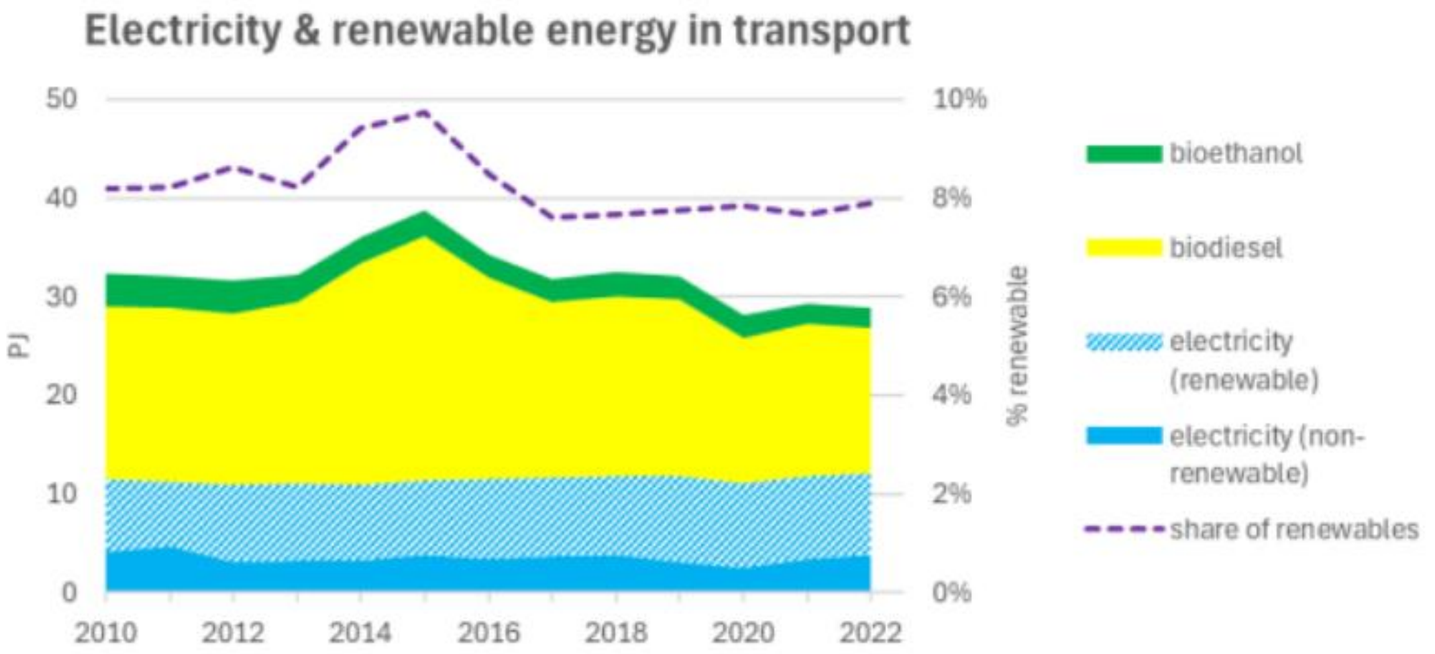


Image: https://www.ieabioenergy.com/publications/country-reports-2024

CZECHIA – ECONOMIC BARRIERS

- **Biofuels cost more:** In 2022, biodiesel was 70–130% more expensive than regular diesel
- **Expensive to build new plants:** Needs a large investment, which investors are reluctant to do
- **Unstable prices**: Feedstock an get expensive due to climate change, food supply issues
- **Transport is expensive**: Biomass is mostly available in rural areas, while energy demand is highest in industrial regions
- **Policies keep changing:** In 2022, the government paused mandatory biofuel blending, which made investors uncertain about the future
- **Import dependence:** so far, a large portion of ethanol and biodiesel used in Czechia is imported

AUSTRIA – ECONOMIC BARRIERS

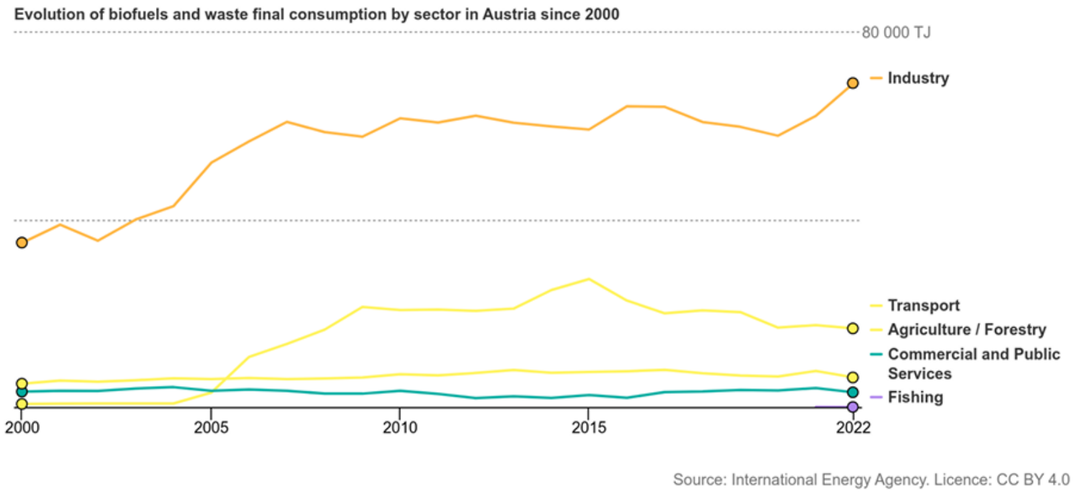
- The institutions play an important role in the economical aspect, particularly in regulating applicable taxes.
- The average export price of Biodiesel in Europe was approximately 1321$ per ton.
- The wholesale price of bioethanol in Austria is between 4.44$ and 6.08$ per kilogram.

COMPARISON BETWEEN CZECH REPUBLIC AND AUSTRIA

BIOFUEL DEVELOPMENT & USE

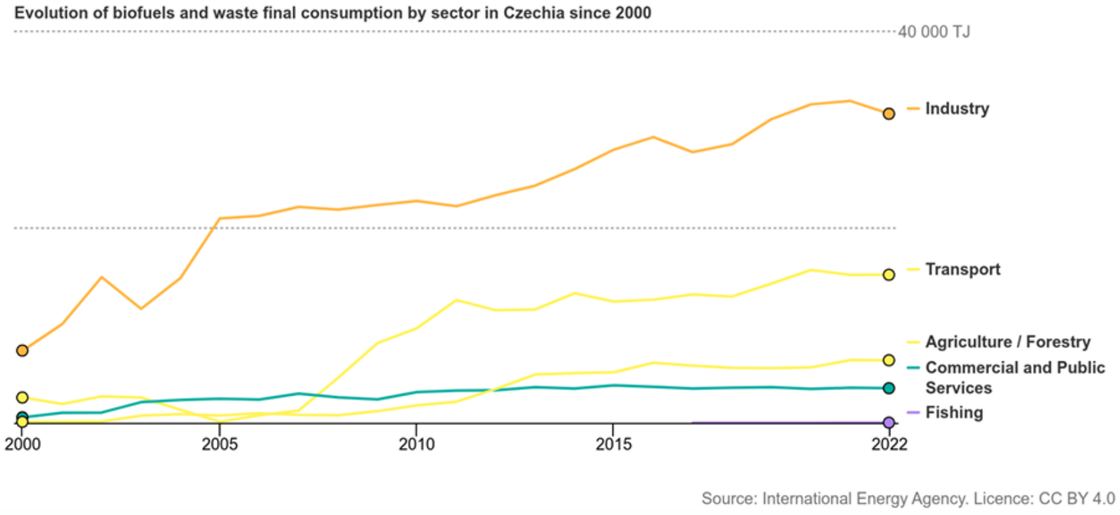
Austria

- Well-developed bioenergy system with 300+ biogas plants
- Blending: 7% biodiesel, 10% bioethanol in transport fuels
- Investing in advanced technologies: cellulosic ethanol, biomethane, electrofuels, FT-liquids



Czech Republic

- Still focused on first-generation blends (B7, E5).
- Few projects for second-gen fuels (Litvínov-ethanol, Litomyšl - biomethane)
- Growth limited by low investment and policy fragmentation

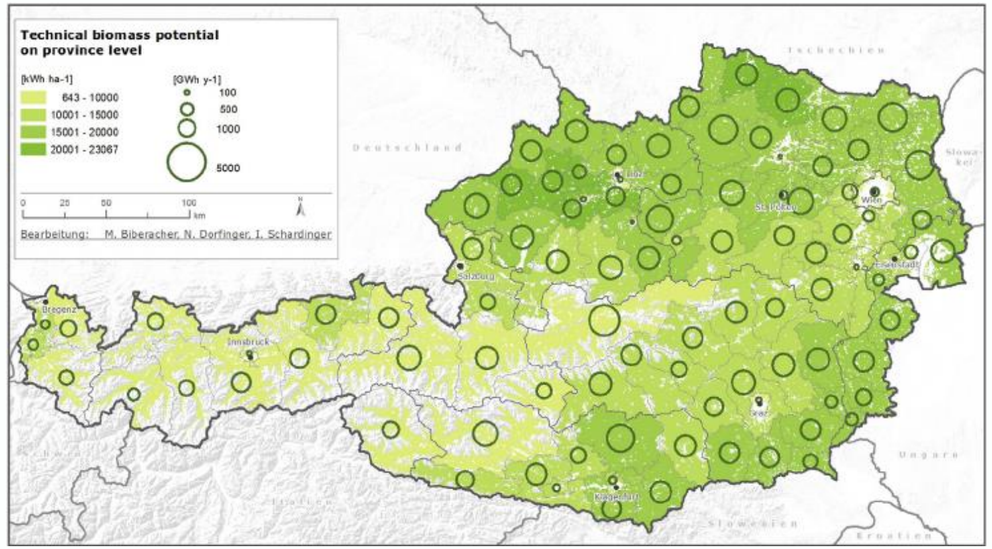


Sources for the images:
https://www.iea.org/countries/austria/renewables
https://www.iea.org/countries/czechia/renewables

BIOMASS POTENTIAL AND DISTRIBUTION

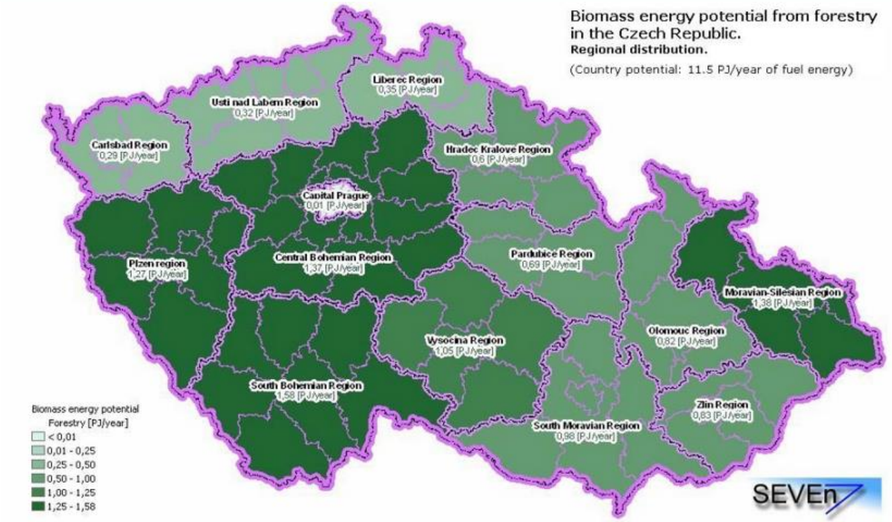
Austria

- Rich, well-distributed resources: ~50% forest, 32% farmland
- Strong integration into district heating, CHP, and biofuel supply chains



Czech Republic

- Forest biomass potential ~13.5 Mt/year, but only ~50% usable
- Bark beetle damage may reduce long-term availability by up to 36% by 2050
- Uneven geography: biomass concentrated in rural areas, far from industrial demand (high transport costs)



Sources of images:

Technical biomass energy potential for Austria aggregated to 250 m cells.
Available at: https://www.researchgate.net/figure/e-Technical-biomass-energy-potential-for-Austria-aggregated-to-250-m-cells-raster-in_fig6_257420972

Biomass energy potential from forestry in the Czech Republic – Regional distribution.
ACCESS Project Deliverable D13: Maps and databases on the biomass potential. European Commission, 2006.

POLICIES AND STRATEGIES

Austria

- Unified energy strategy: NECP, Climate Act, Mobility Master Plan.
- Federal and regional governments work together with clear goals.
- Strong support for both 1st- and 2nd-gen biofuels, with long-term stability.

Czech Republic

- Has a NECP and NREAP, aligned with RED II/III targets.
- Lacks a comprehensive bioeconomy strategy (responsibilities are split across ministries)
- Support policies still mainly favor first-gen fuels; advanced options have limited funding and coordination.

ECONOMIC FACTORS AND CHALLENGES

Austria

- Introduced CO_2 pricing: €30/ton in 2022, rising to €55/ton by 2025 (encourages clean fuel use)
- Stable regulations and clear climate targets support long-term investment
- Exports biodiesel from waste to high-demand markets

Czech Republic

- Biofuels are expensive: In 2022, biodiesel cost up to 130% more than fossil diesel
- Significant share of ethanol and biodiesel is imported
- Transport costs are high due to regional mismatch
- Policy support remains fragmented: energy, climate, and agriculture ministries operate separately

COMMON CHARACTERISTICS

- Both follow **EU directives (RED II and RED III)** on renewable energy and biofuels
- Both use **first-generation biofuels** like biodiesel and ethanol in transport
- **Biomass** is the **main renewable energy source** in both countries, especially for heating
- They both face **limits** on how much biomass can be used due to environmental rules and land use
- **Advanced biofuels** are still hard to develop in both places because of high costs
- Both have **climate plans** that include biofuels as part of their strategy to reduce emissions

THANK YOU!