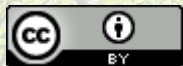


Macro-economic consequences of the energy transition

Session 1

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What is macro-economic modelling? And why do we use them?

What are the 'undesired' consequences of a policy decision?



What behavioral changes do we expect? And how do these affect the economic structure?

Examples from the news. Where would macro-economic models have been useful:

- *Progressive insight: energy poverty*
- *Predicting second order effects: high food prices*

The role of macro-models in this project?

- Global problem: limiting climate change
- European targets on emissions
- There is a need for energy transition
- Energy models: how to reach this target? Which technologies and which energy carriers are needed by 2050?
- Macro-economic models: given the target and information from the energy models: what are consequences on economy and climate

Two macro economic models and five scenarios



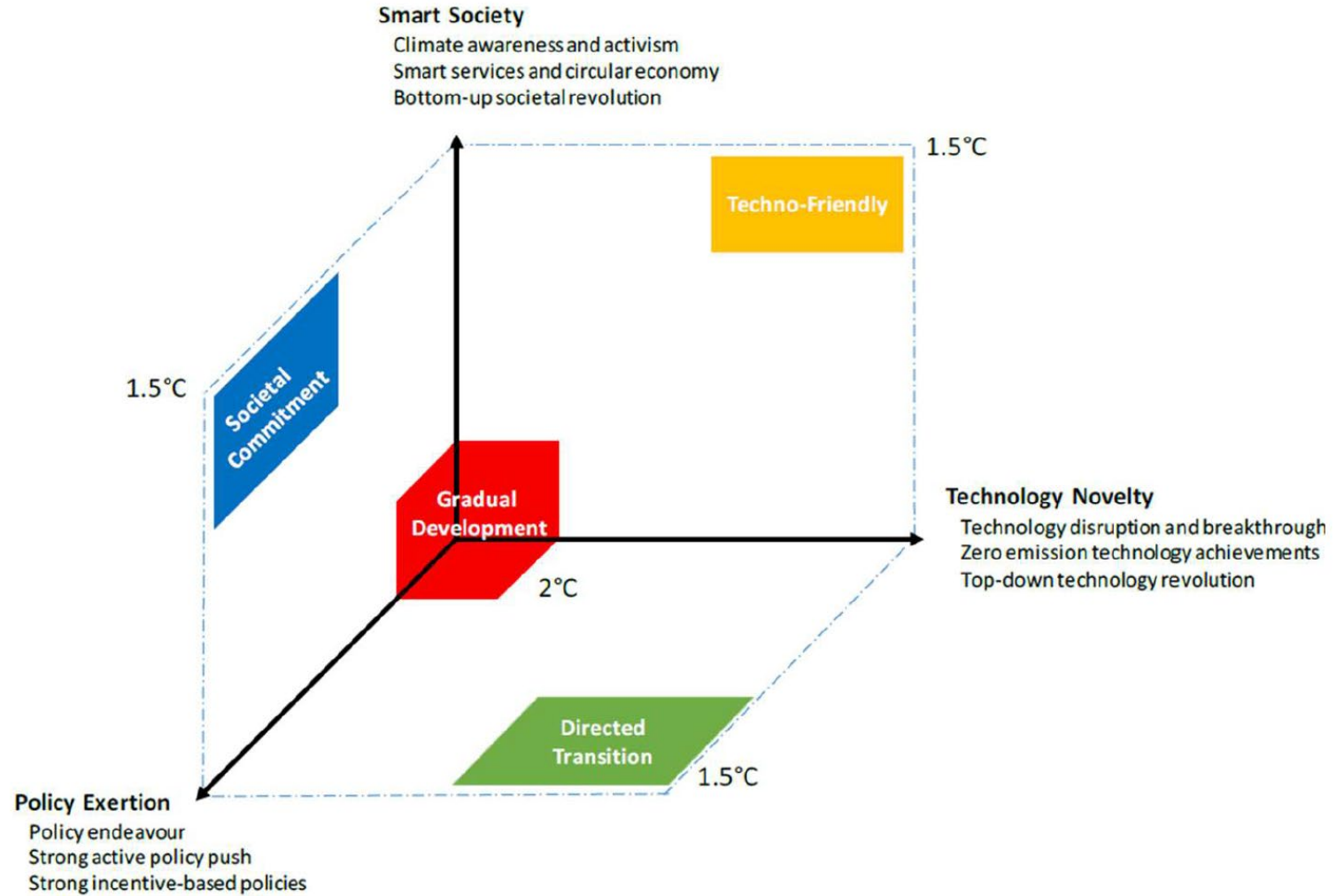
Four decarbonization scenarios are developed in this project. For the macro-economic analysis a fifth scenario (business-as-usual) is added.



Two macro-economic models quantify the effects on economy and environment.



openENTRANCE scenarios





Results – GDP – three ways to calculate GDP

Expenditure method

Income method

Production method

The Components of GDP



Personal Consumption Expenditures

- Goods can be durable (cars, furniture, large appliances) or non-durable (clothing, food, fuel)
- Services include banking, health care, and education



Government Spending



Business Investment

- Divided into two sub-components: fixed investment and change in private inventory



Net Exports of Goods and Services

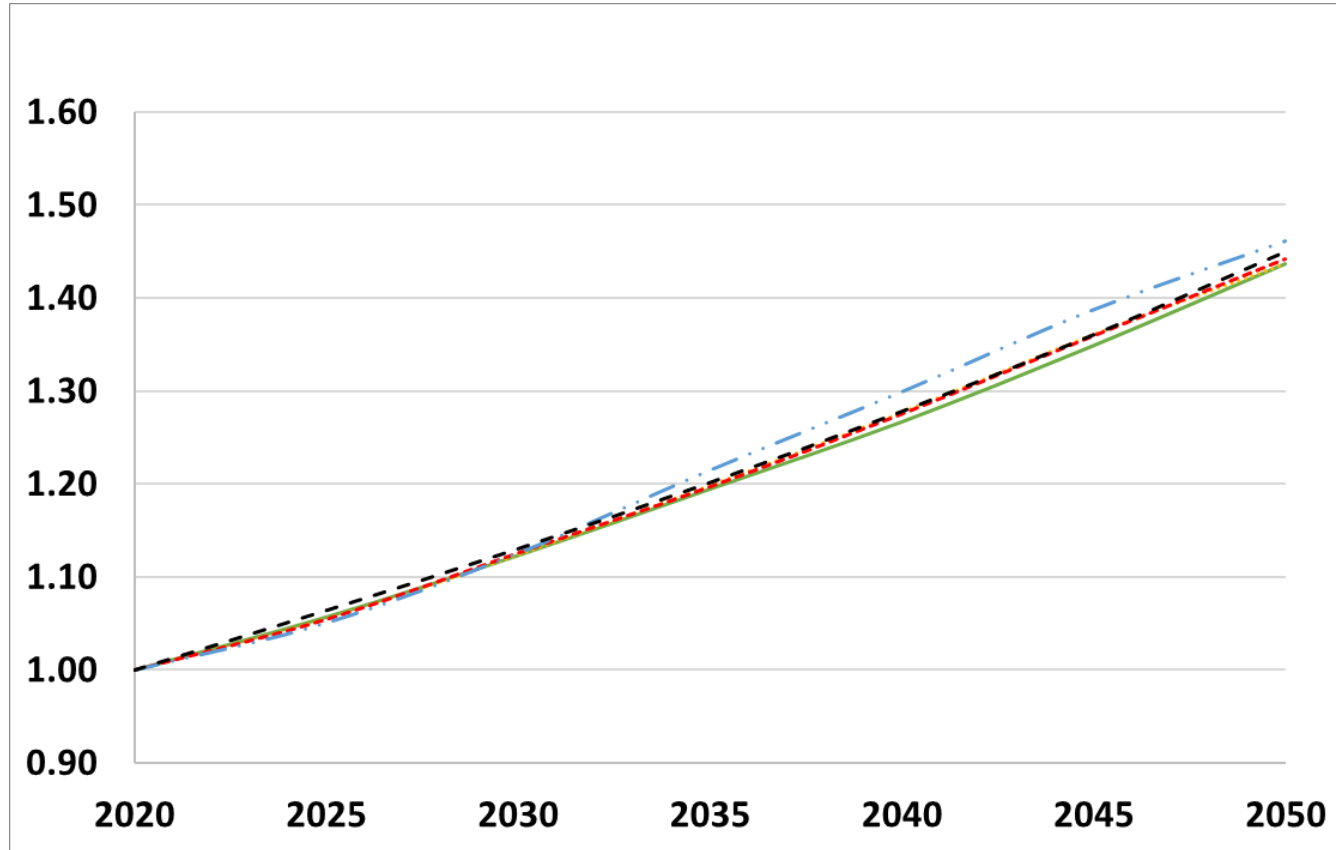
the balance

Wages
+
rental rate on capital
+
Profits
+
Taxes on production

Final value of all goods
and services
-
Intermediate costs



Results - GDP



— Gradual development ··· Societal Commitment - - - Directed Transition
- · - Techno Friendly - - - Reference

- Lower GDP compared to reference scenario due to cap on carbon
- Higher GDP compared to reference scenario due to energy efficiency measures
- Climate effects on labor productivity also has a negative effect on GDP in the reference scenario.



Results - GDP

- Which elements from the scenario have a positive, negative or neglectible effect on GDP?

	Effect on Gross Domestic Product
Growth in population and technological progress	Strong increasing effect
Electricity mix	No or little effect
Energy efficiency	Increasing effect
Shift in household spending	No or little effect
Cap on carbon	Decreasing effect
Servitization	No or little effect
Shift in energy inputs in industries	No or little effect
Climate change feedback effects	Decreasing effect



Results – per driver

Technical drivers

Energy efficiency
Energy use industries
Technology mix electricity

Extra high GDP

Societal driver

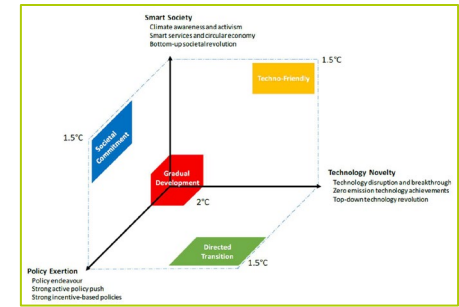
Servitization

- Refurbishing and leasing services result in increase in economic activity in service sector
- Second order effect: less energy demand

Political driver

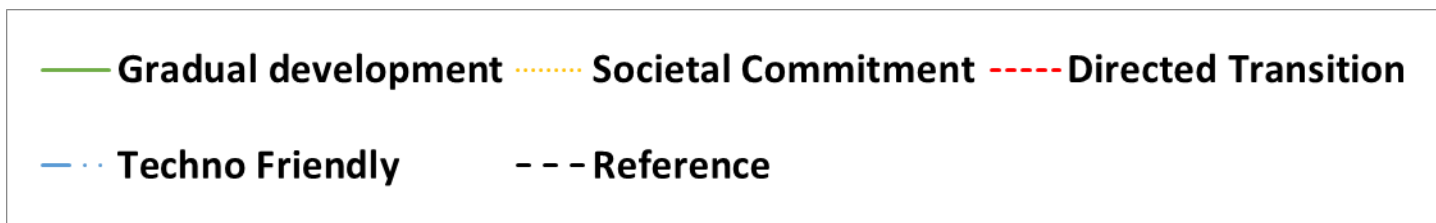
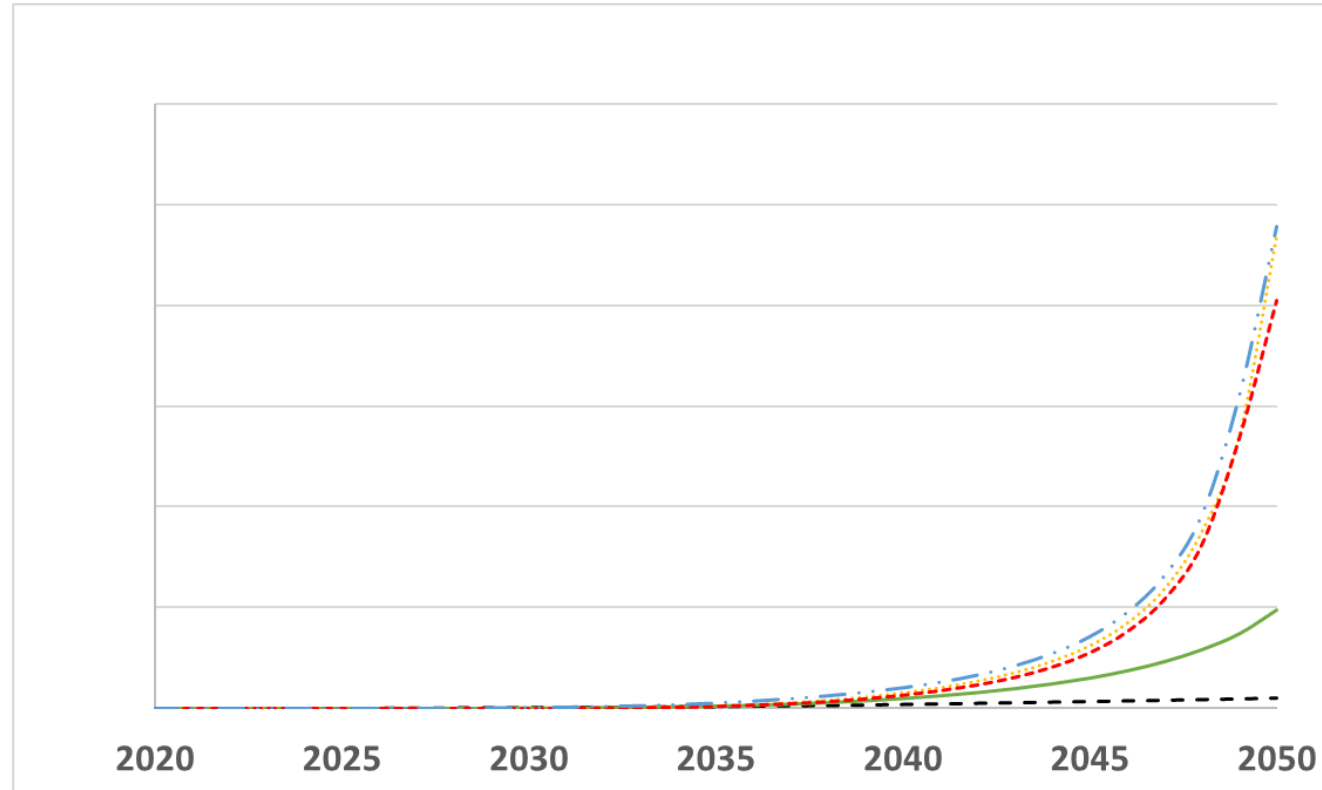
Subsidy and taxes on (clean) energy products

Extra high demand for electricity and lower demand for fossil fuels





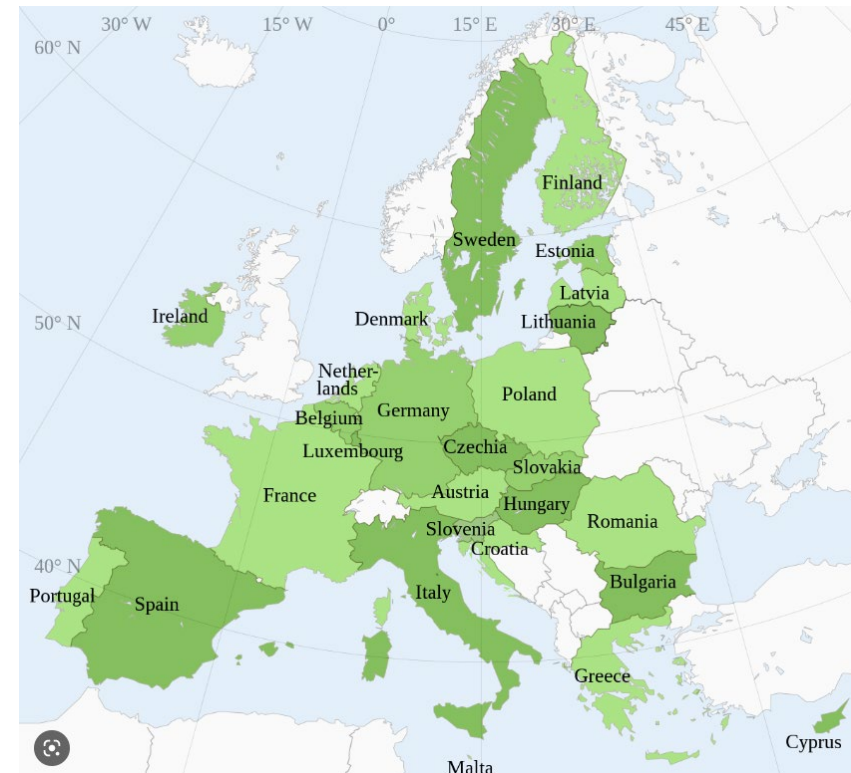
Results – CO2 prices



- CO2 prices increase quite fast as the cap on carbon is getting more strict – shown by both models

Effects on individual member states

- Results so far: macro-economic effects on EU level
- Results in next couple of slides: some differences on the country level

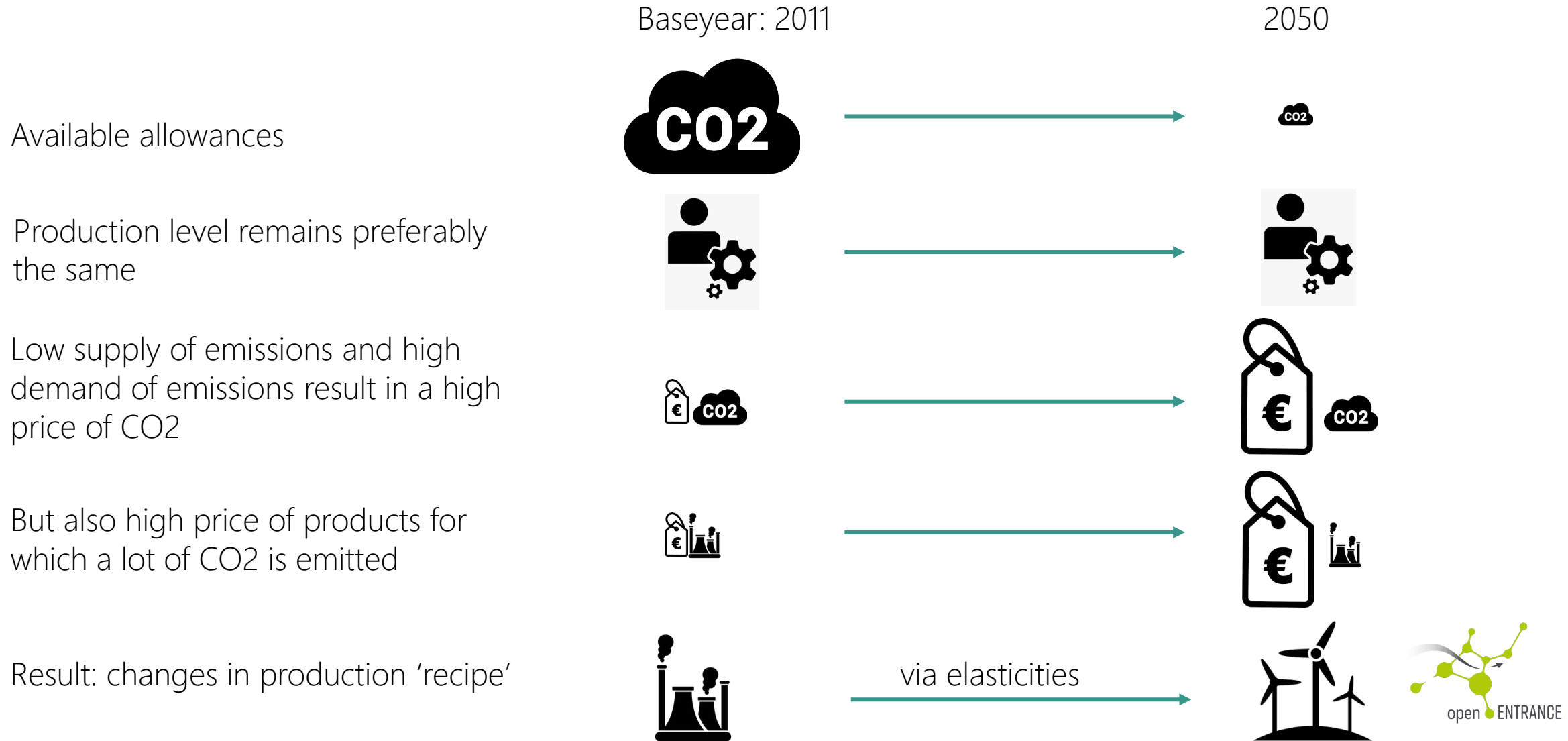


Country level results for two topics

- A cap and trade system
- Effects on manufacturing and service sectors

A cap and trade system

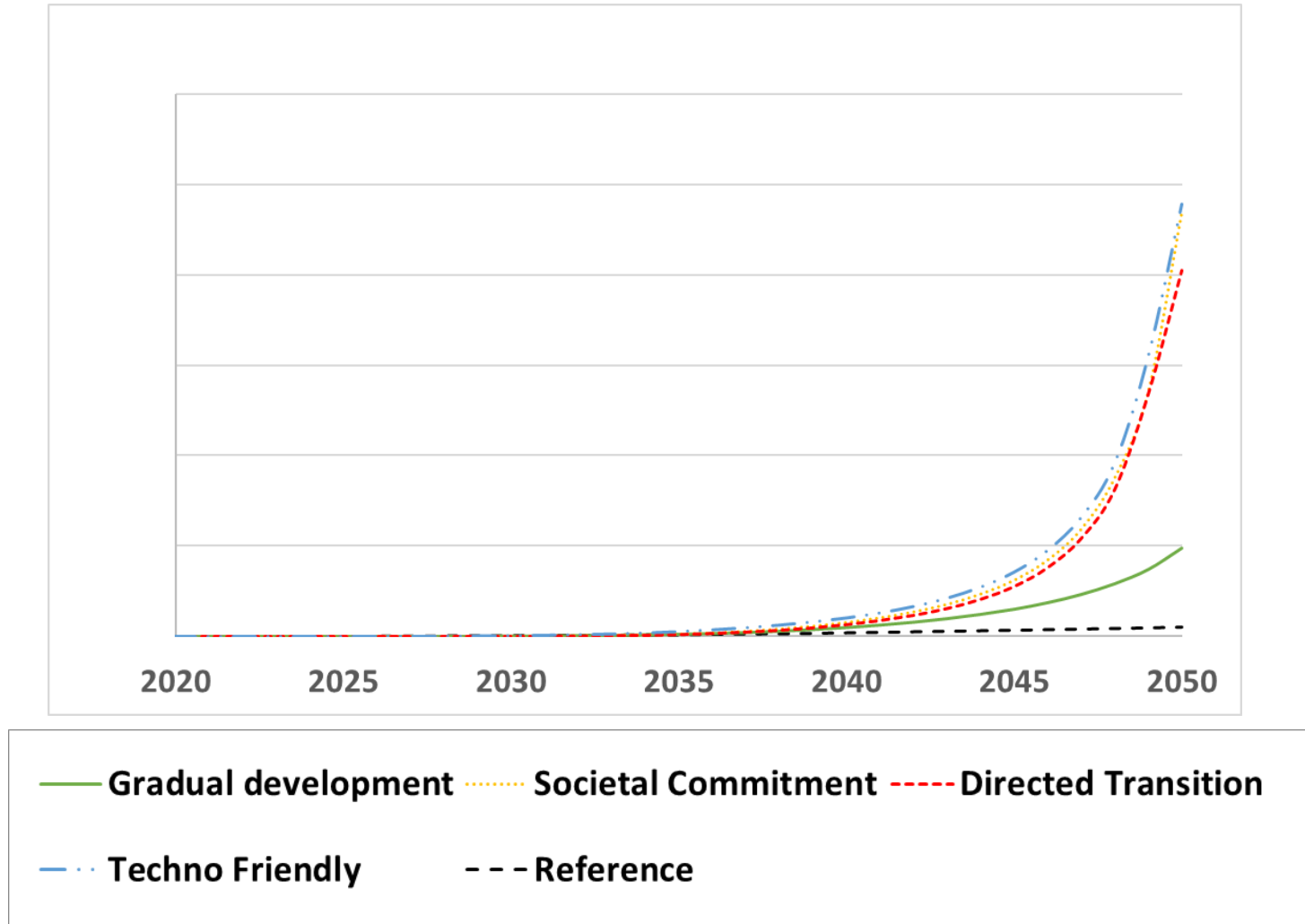
Mechanism of Emission Trading System (ETS) in macro-economic model (1)



Mechanism of ETS in macro-economic model (2)

- In the EU there is one ETS price for all member states
- All countries need to get as close as possible to zero emissions in 2050
- There is an country specific price for CO₂
- This price represents a country-specific cost of decarbonization
- For some countries it is more costly than for others

Results on EU level – CO2 prices



- CO2 prices increase quite fast as the cap on carbon is getting more strict – shown by both models

Some countries face a higher price than others

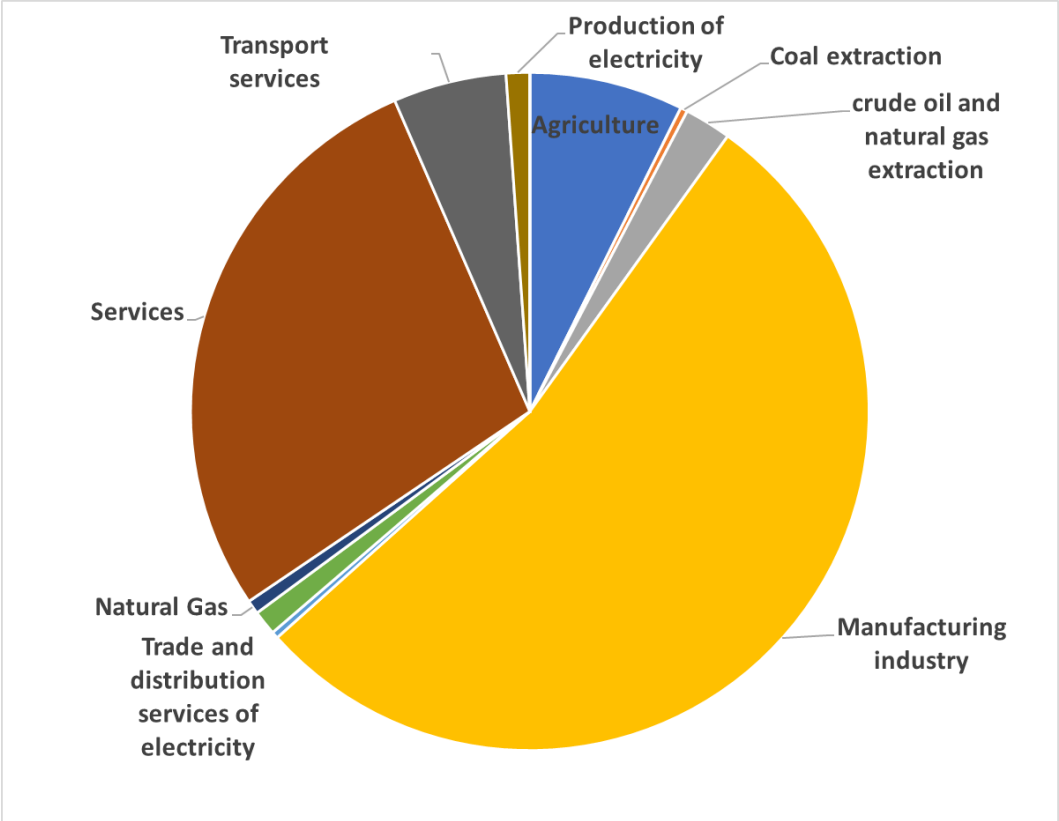
Singling out two member states

- Lets look at two countries that are very different in production structure and uptake of renewables

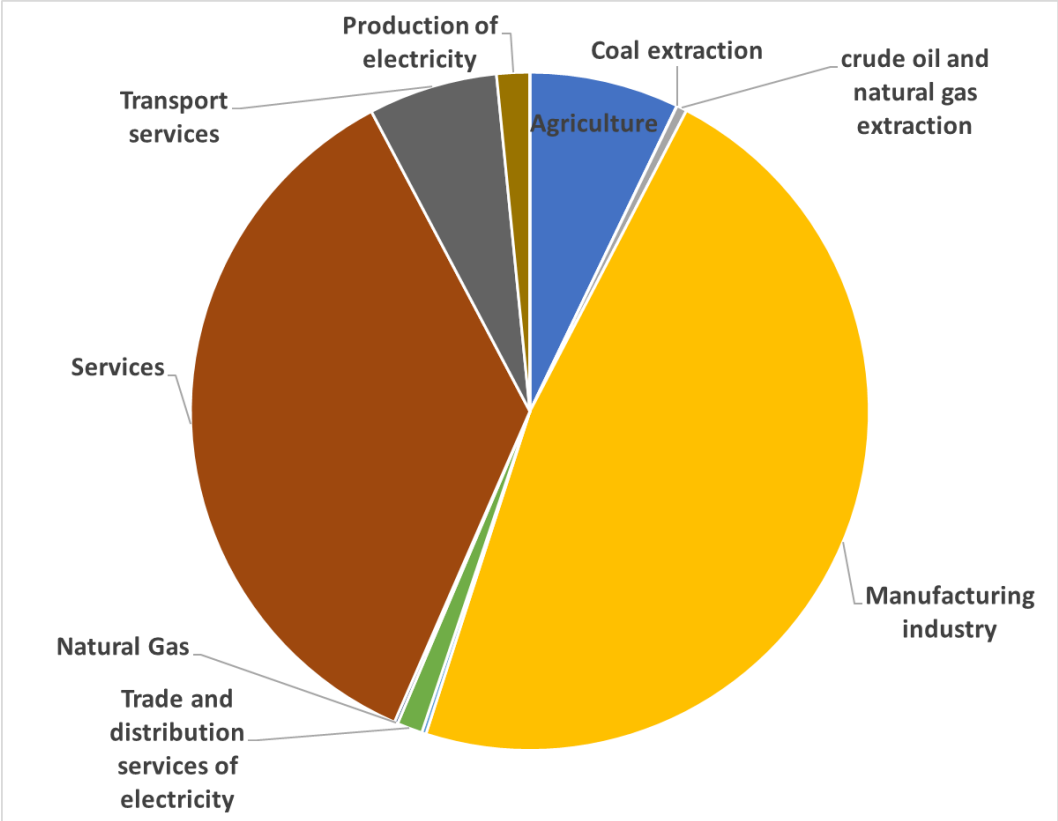


Romania – value of production

2011

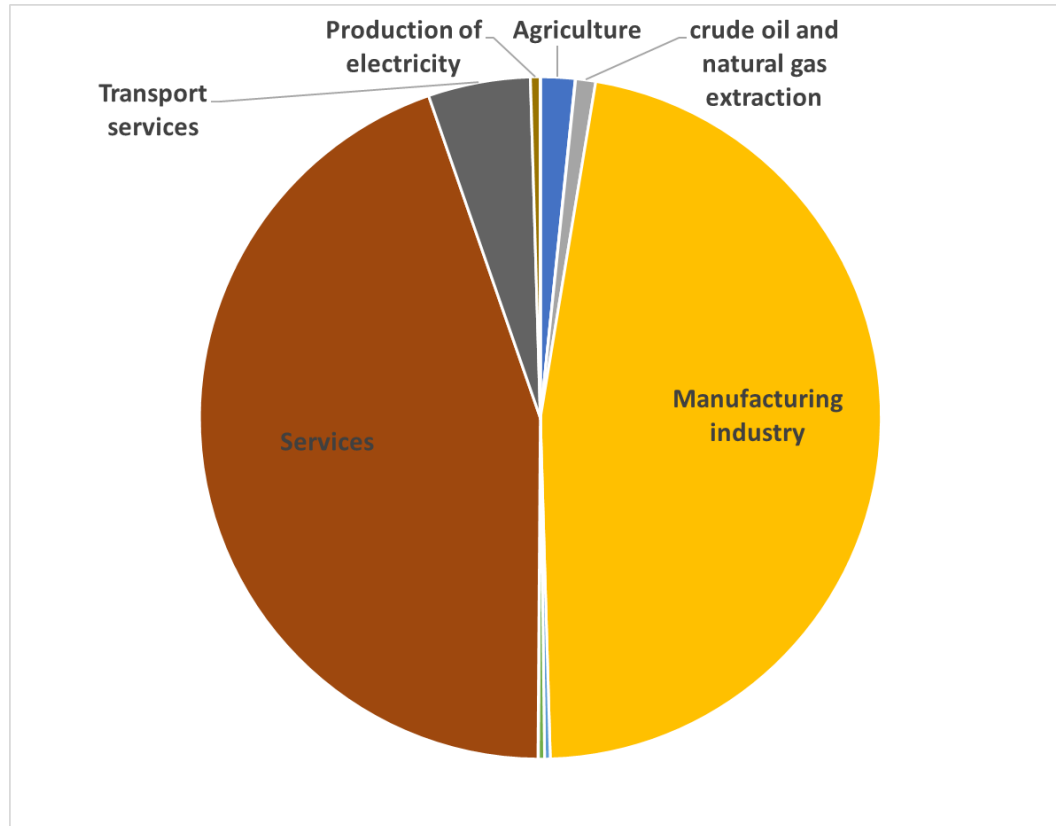


2050 projection

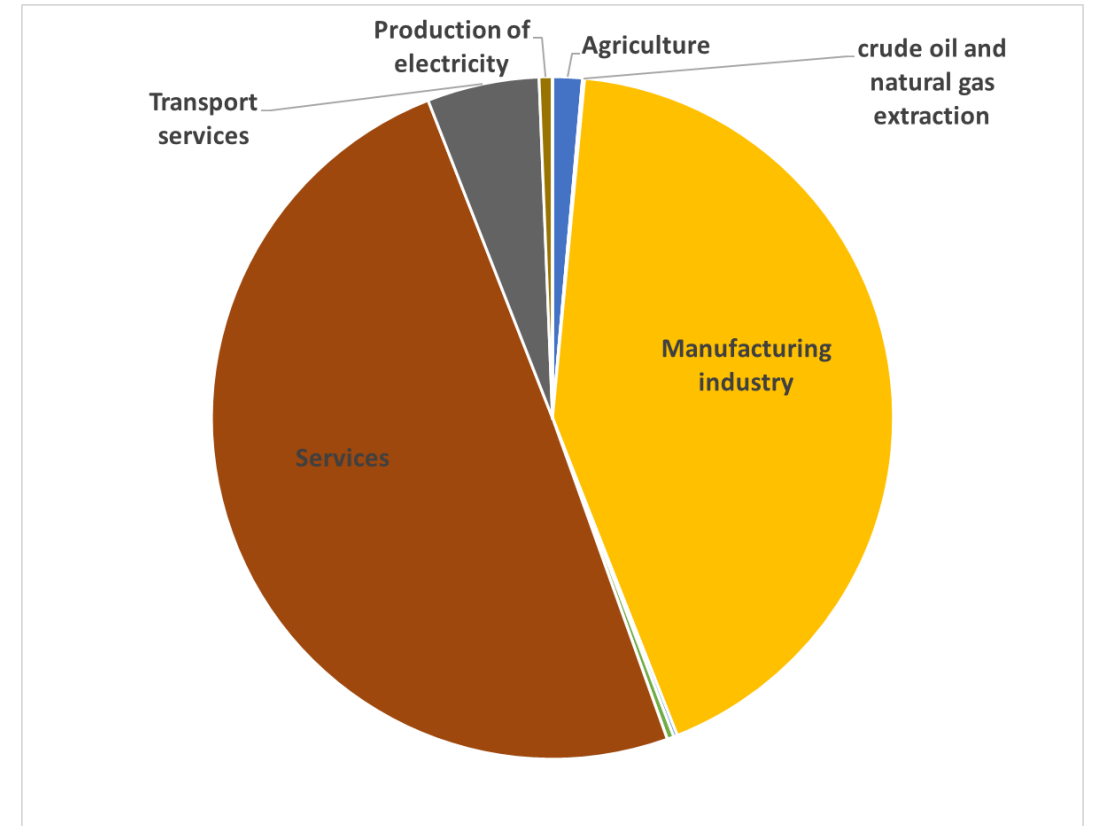


Sweden – Value of production

2011



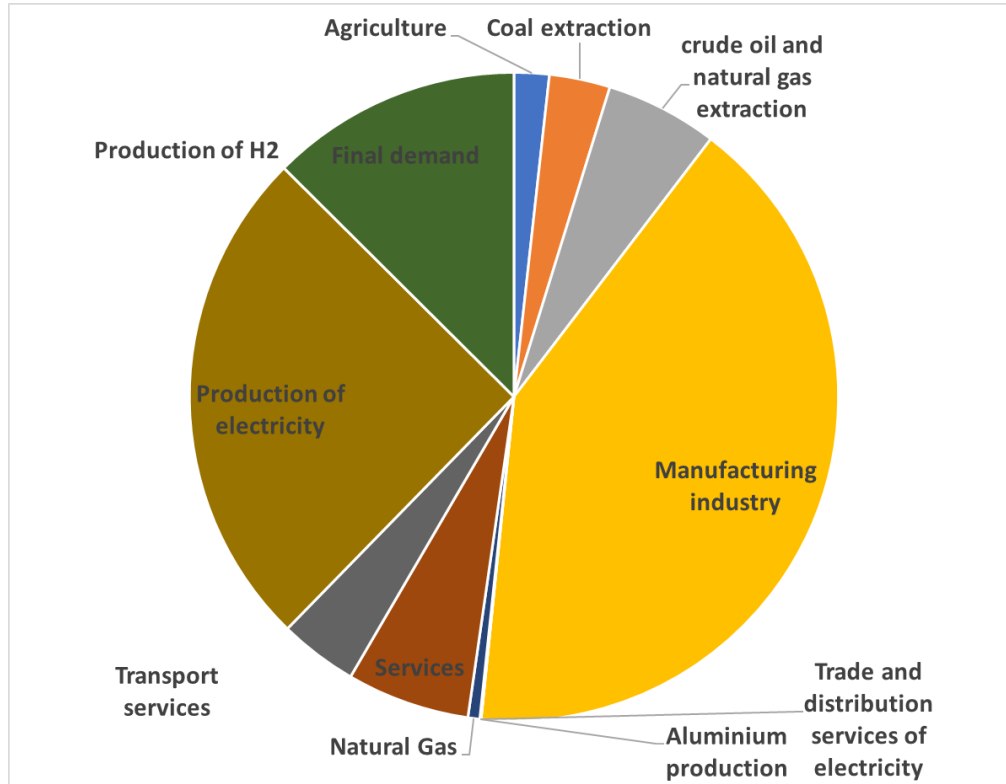
2050 projection



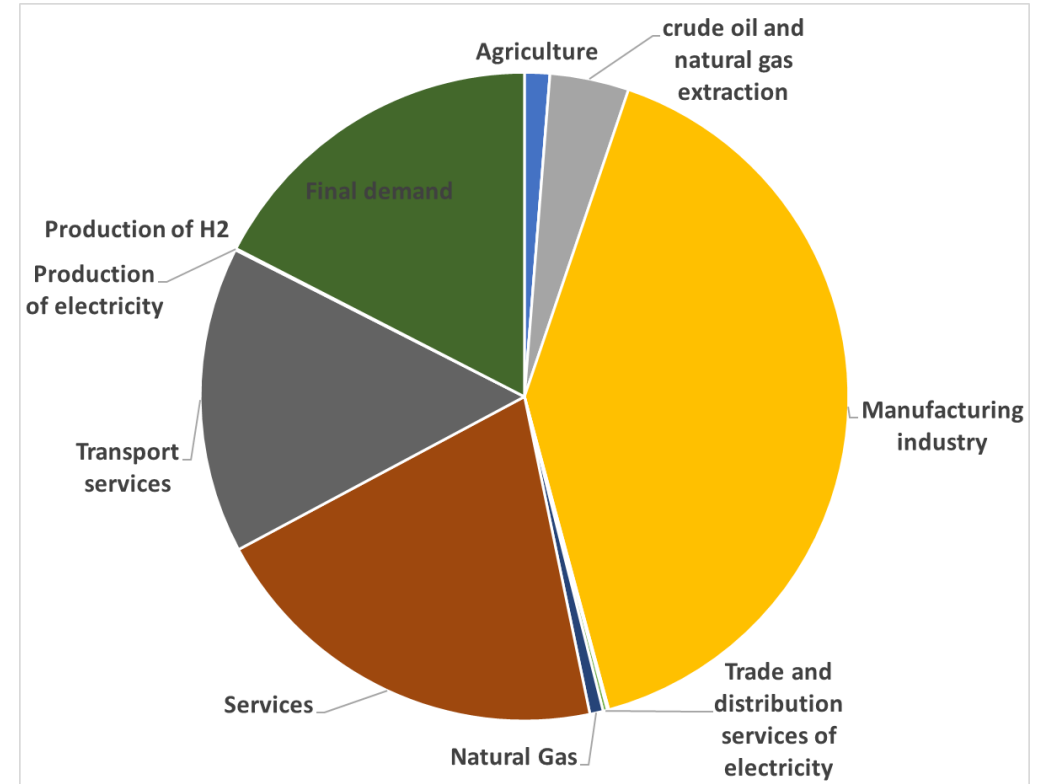
Source: EXIOBASE 3.0 (Baseyear 2011, projection 2050)

Which sectors produce the biggest chunk of CO2 emissions?

Romania: 90 Mton CO2



Sweden: 53 Mton CO2



Increase in renewables is expected to increase further



The last two months have seen a surge in 'prosumers' in Romania as the energy crunch sways the government into financing solar panel use.

As the winter season looms over Europe with little hope of the Ukraine conflict ending anytime soon, one country is gearing up for the challenge in a different way.

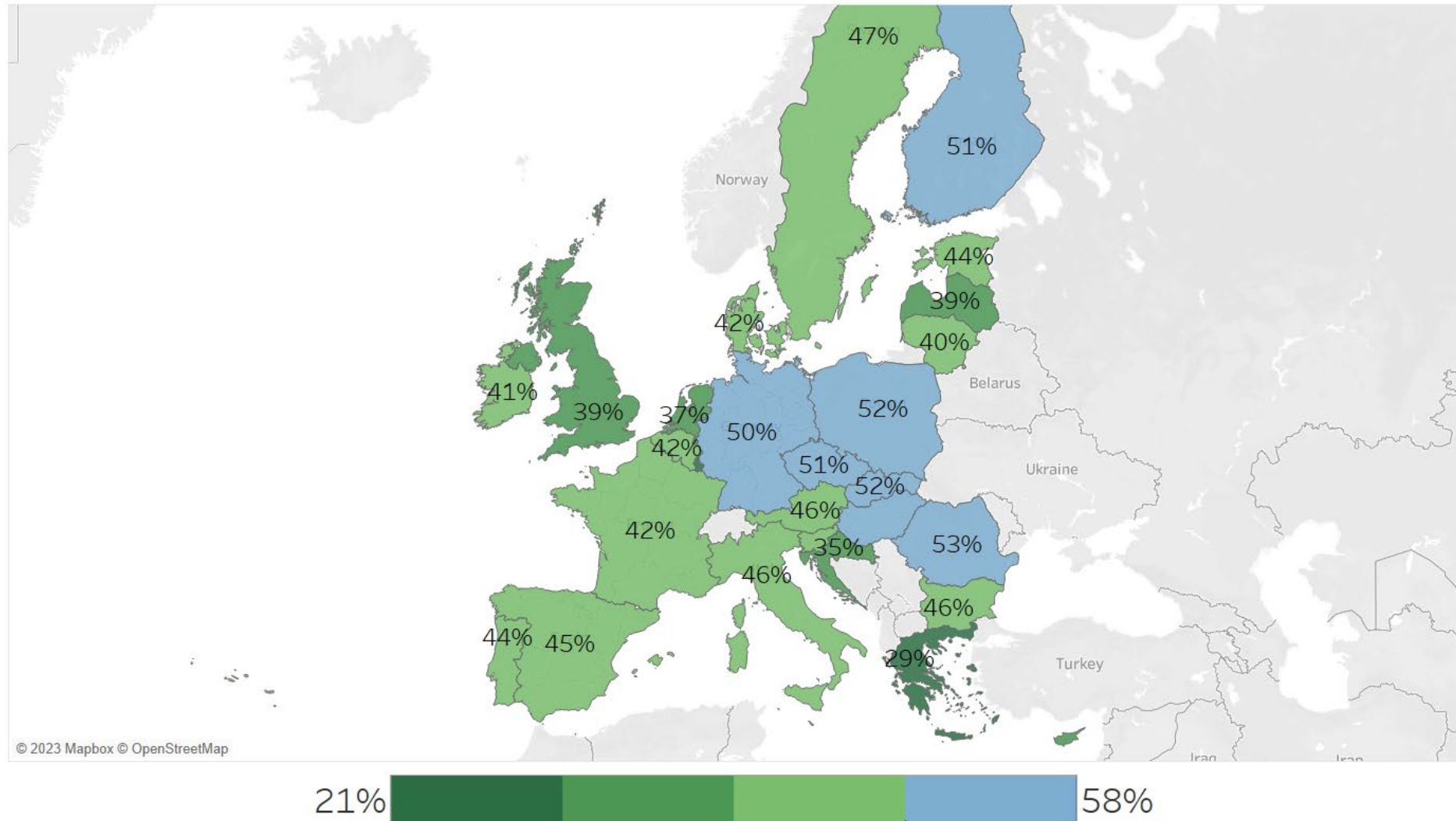
Romania is racing ahead with its transition to renewable energy as a way to tackle spiralling energy prices and upcoming shortages.

Relation country characteristics and CO2 price

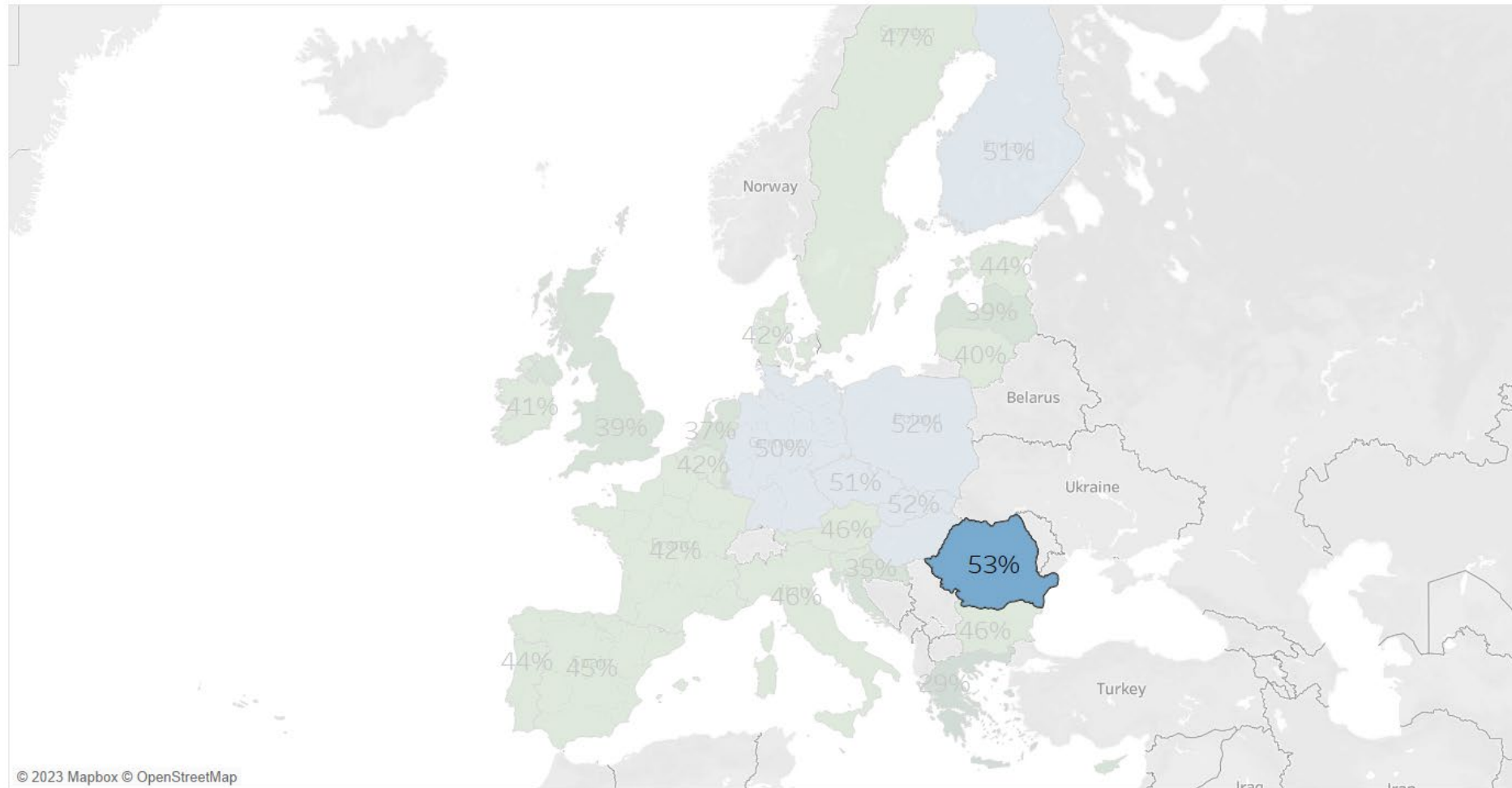
- Both countries have to reduce emissions as much as possible.
- **Romania** has the opportunity to reduce many emissions via making electricity production from renewable sources.
- In **Sweden**, electricity production did not emit many emissions. Thus, the decrease in emissions needs to come from decarbonisation of other industries. This is more costly.

Effects on manufacturing and service sectors

Share of manufacturing sector as percentage of all economic activity



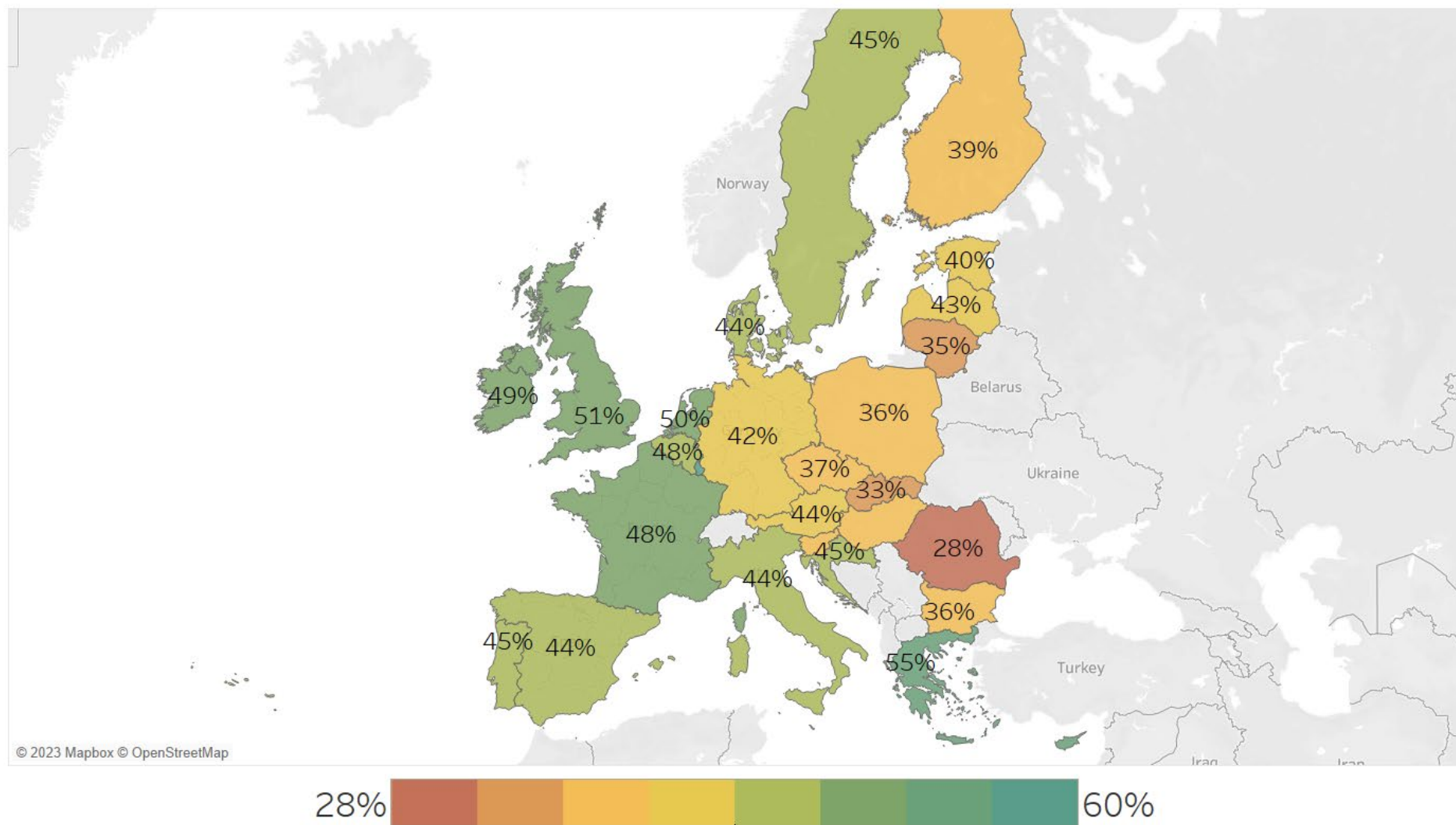
Share of manufacturing sector as percentage of all economic activity



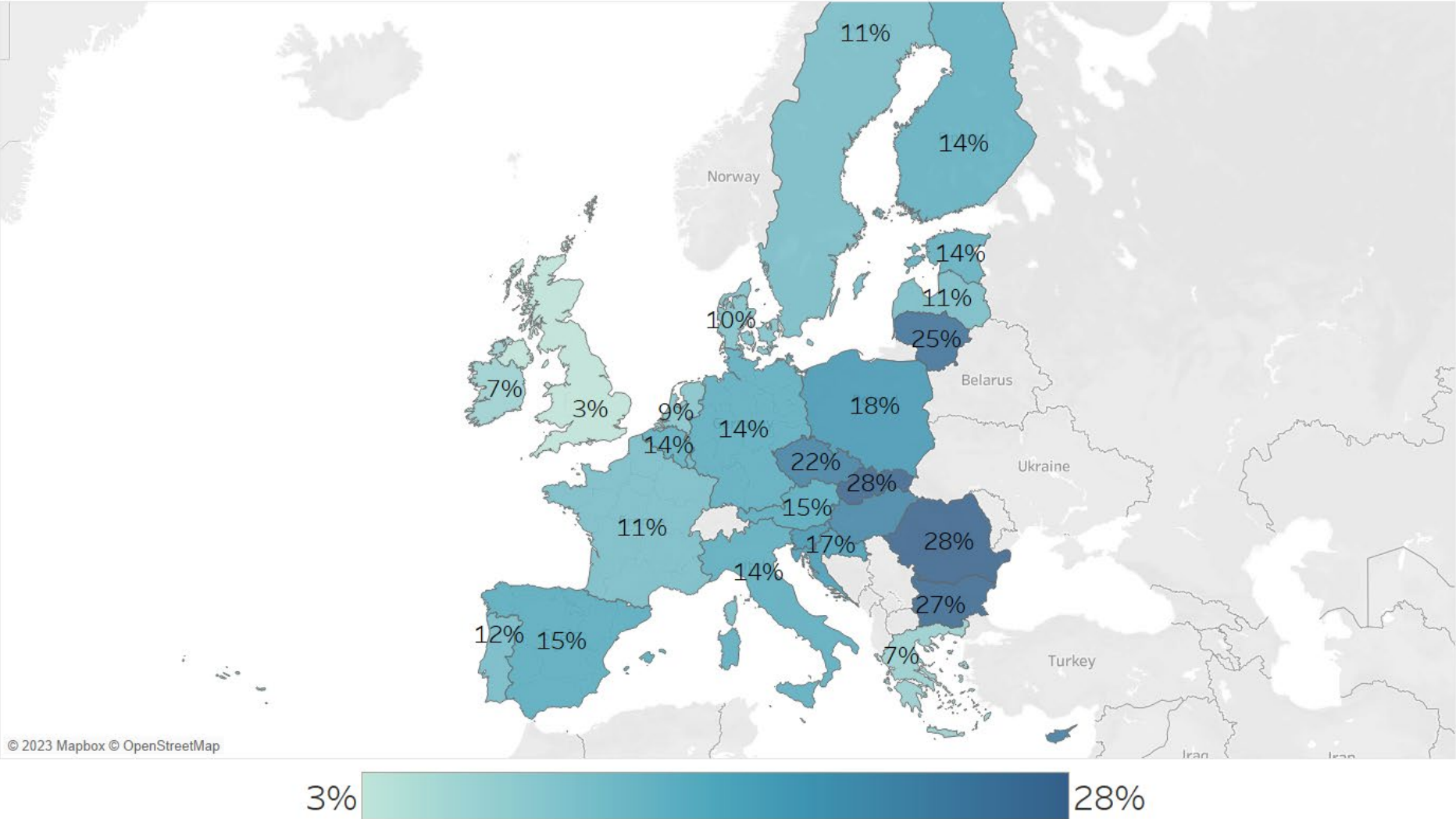
© 2023 Mapbox © OpenStreetMap



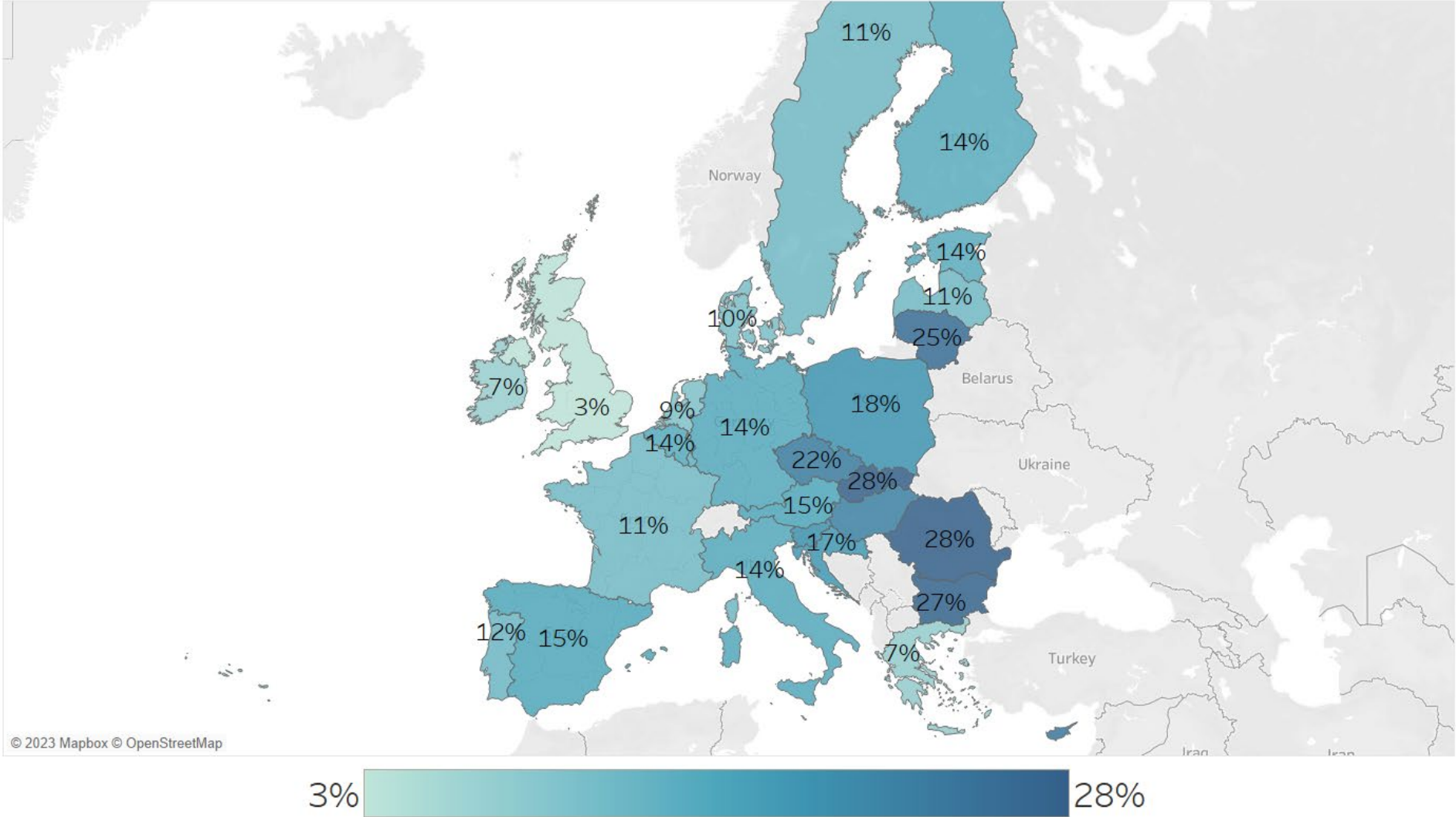
Share of **service sector** as percentage of all economic activity



Effect of decarbonisation scenario on service sector



Effect of decarbonisation scenario on service sector



Some related headlines of the previous few weeks

Is this the end of Made in Europe?

From glass-makers to paper producers, European industries face a struggle to survive. What if they don't make it?

Romania quietly catches up with richer neighbours, helped by EU cash

Questions?

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