

## IEooc\_Application1\_Exercise3: Quantifying price signals of a carbon tax on energy carriers

**Goal:** Learn about the current level of taxation of different energy carriers, estimate price signals of a tax on GHG emissions ('carbon tax')

This exercise uses data for Germany of 2017, but own data can be easily found as used as well.

### Problem setting

The use of fossil fuels and their derivatives is currently too cheap to incentivise industrial and final customers to use energy more efficiently, use less, or switch to other, less carbon-intensive but often more expensive fuels. A carbon tax [1] is a much-debated instrument to install a price signal on fossil fuels, but it needs to be kept in mind that many fuel types and energy carriers are already taxed for various reasons, including the promotion of a transition to renewable and low-carbon energy carriers. Hence, an assessment of the potential impact of a carbon tax needs to consider and be compared to the already existing taxes.

Many countries have high taxes on gasoline and diesel, because demand for these fuel is rather inelastic regarding price changes (people drive and pay taxes anyway) and the tax return is used to finance the road infrastructure. Germany, for example, has an energy tax on various fuel types other than gasoline and diesel, including: natural gas, heating oil, coal, and liquefied petroleum gas (LPG). The country also has a general tax on electricity consumption.

Here, we want to answer the following questions for a number of different energy carriers and bulk materials:

- 1) How much of an energy carrier's price is made up by the energy tax? (tax as % of price)
- 2) How much energy tax per unit of CO<sub>2</sub> emitted from combustion is levied (tax per kg of CO<sub>2</sub>, the 'price' of the CO<sub>2</sub> emitted under current taxation)
- 3) How large is the absolute price increase for an energy carriers, if a CO<sub>2</sub> tax of 30 or 100 EUR/ton is levied?
- 4) How does the price of the energy carriers change (in %) if the CO<sub>2</sub> tax
  - a. is levied INSTEAD of ALL existing taxes
  - b. is levied INSTEAD of ALL existing energy taxes, with road maintenance taxed remaining
- 5) Interpret your results!

**For question 4b:** Use the energy tax levels of light heating oil and natural gas to estimate the road maintenance part of the energy tax of diesel, gasoline, LPG, and LNG.

## Part III: Applications

## Application 1: Sociometabolic regimes and transitions

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To answer these questions, three types of data are given for a number of different energy carriers (cf. Excel workbook IEooc\_Application1\_Exercise3.xlsx)

- Current energy carrier consumer prices in Euro-cent per kWh [Column E]
- The average CO<sub>2</sub>-intensity of each energy carrier, either direct or supply chain (electricity), in kg CO<sub>2</sub>-eq / kWh [Column H]
- Current energy tax levels in Euro-cent per kWh [Column L]

For the materials, the reference unit is not kWh but kg.

The following energy carriers and consumers are considered:

*electricity (household), electricity for industry, coal, light heating oil, diesel, jet fuel, gasoline, LPG (for transport), LPG (for transport), 2019+, natural gas (transport), natural gas (transportation), 2019+, natural gas (household), natural gas for industry,*

as well as four climate-relevant bulk materials

*plastics, steel, aluminium, and cement.*

We distinguish between household and industrial consumers because different tax levels apply to those groups (guess who pays less!).

**References:**

[1] [https://en.wikipedia.org/wiki/Carbon\\_tax](https://en.wikipedia.org/wiki/Carbon_tax)