Fuel demand side for the Esbjerg case

MarE-Fuel: WP1 T2 💬

Idea

Deriving annual maritime fuel demand profiles for relevant ports located around the North Sea area. Thes fuel demand profiles could be deployed in an energy system model in order to analyse at which costs they can be supplyed, i.e. from production close to Esbjerg. Esbjerg seems to be a favourable location for several reason:

1. In the center of the North-Sea region, very large ports close by
2. Low population density
3. Exceptional good wind conditions
4. Shallow water for near shore wind farms
5. Good infrastructure in place, i.e. port, power and gas grid connection

\rightarrow Five important aspects that potentially lead to low production and transport costs.

Research questions

The analysis aims at answering the following research questions:

- Under which conditions could Esbjerg become an alternative (maritime) fuel hub?
- What electricity prices do we expect?
- What would be the produced volumes?

Method

We use a bottom up data analysis to derive the maritime fuel demand profiles to be served by an Esbjerg production in order to derive the additional electricity demand for producing alternative fuels. This leads subsequently to variable primary energy profiles to be implemented in the regional energy system modelling Balmorel, which includes electricity and heat sectors.

Data

Primary sources in order to derive the energy consumption:

- Cargo based on Eurostat
- Distance based on MarineTraffic
- Energy demand per ship type: Kristensen2015

Countries considered:

- Belgium
- Germany
- Denmark
- Netherlands
- Norway

- United Kingdom

Assumptions

We believe that large amounts on long routes will be the focus area for implementing alternative fuel infrastructure not only in Europe, but also by the trade partner entities.

- Considering only the two largest ports per country
- Considering only long range (> 1000 km)
- Considering only routes with large trade volumes (> 5 Mt/route/year on average)

Implementation

The data processing is implemented in an jupyter notebook (esbjerg.ipynb), using the *panadas* module. The script is released under an open license on github.

Results

According to this study, a preliminary **362 PJ** of maritime fuel could potentially be served by an Esbjerg production, based on data for 2017 and at respective transport work of approx. **5 Gtkm**.

Conclusion

During the second project meeting with the project partners and the advisory board it was consensus that the fuel demand side will not be a limiting factor for the economic production of electrofuels in Esbjerg. Thus, the MarE-Fuel project will not continue deriving high resolution fuel demand profiles for relevant ports around the North Sea area.