Change log (hidden)

Annex 7 Transport of carbon dioxide to central facility

This file calculates costs for compression and transport of CO2 from the sugar factory to a large scale RWGS facility.

Get libraries

Include << .\Libraries\Units.mcdx

Include << .\Generic data.mcdx

$$p_E = 0.05 \; \frac{€}{kW \cdot hr}$$

Before transport, CO2 needs to be compressed.

Cost of compression

$$C_{compr} := 21.3 \cdot \frac{USD}{ton} = 19.17 \; \frac{€}{ton}$$ Chen and Morosuk (2021)

Transport can be done by truck or ship.

$$C_{truck} := 0.103 \cdot \frac{€}{ton \cdot km}$$ Meulen et al. (2020)

$$C_{ship} := 0.039 \cdot \frac{€}{ton \cdot km}$$

$$dist := 60 \cdot km$$ Cosun Rozendaal naar Shell Pernis

$$C_{truck} \cdot 2 \cdot dist = 12.36 \; \frac{€}{ton}$$ Up and down trip

$$C_{ship} \cdot 2 \cdot dist = 4.68 \; \frac{€}{ton}$$ Up and down trip

Total costs of compression and transport

$$C_{compr} + C_{truck} \cdot 2 \cdot dist = 31.53 \; \frac{€}{ton}$$

In practice

$$\Phi_{CO2} := 5 \cdot \frac{ton}{hr}$$

From sugar beet factory analysis

$$L_{truck} := 40 \cdot ton$$

$$L_{ship} := 700 \cdot ton$$

$$\frac{\Phi_{CO2}}{L_{truck}} = 3 \frac{1}{day}$$

That is 3 trucks a day,

$$\frac{\Phi_{CO2}}{L_{ship}} = 1.204 \frac{1}{week}$$

or one ship per week.

$$C_{ship} \cdot \Phi_{CO2} \cdot 2 \cdot dist = \left(2.051 \cdot 10^5\right) \frac{€}{yr}$$

That would be less than a continuous use of one ship. This makes sense if we assume that 60 km plus on/off loading takes 1 day.

Literature

Chen and Morosuk (2021) [30]
Meulen et al. (2020) [31]