A Method for Geographic Placement of Power to Gas Plants

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Harmonized Integration of Gas, District Heating and Electric Systems (HIGHE)

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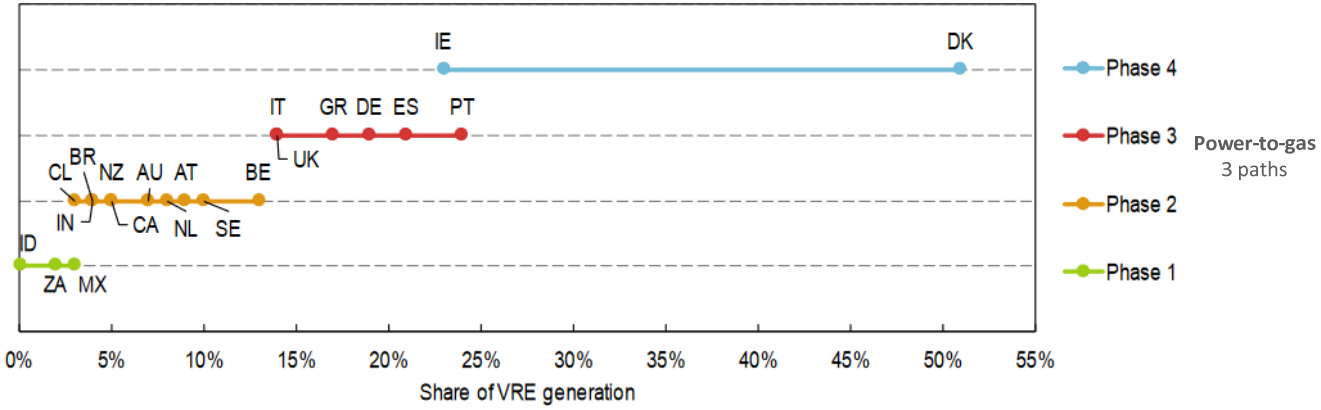
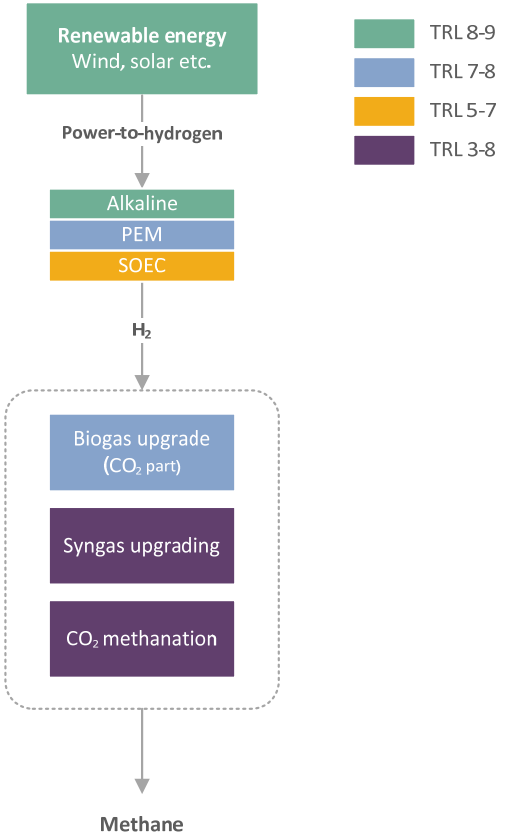
http://www.et.aau.dk/research-programmes/wind-power-systems/activities/highe/

Background

1. Long-term goal 100% RE in many countries
2. Transition towards 100% RE requires integration of energy sectors
3. Power-to-gas is a technology that provides this





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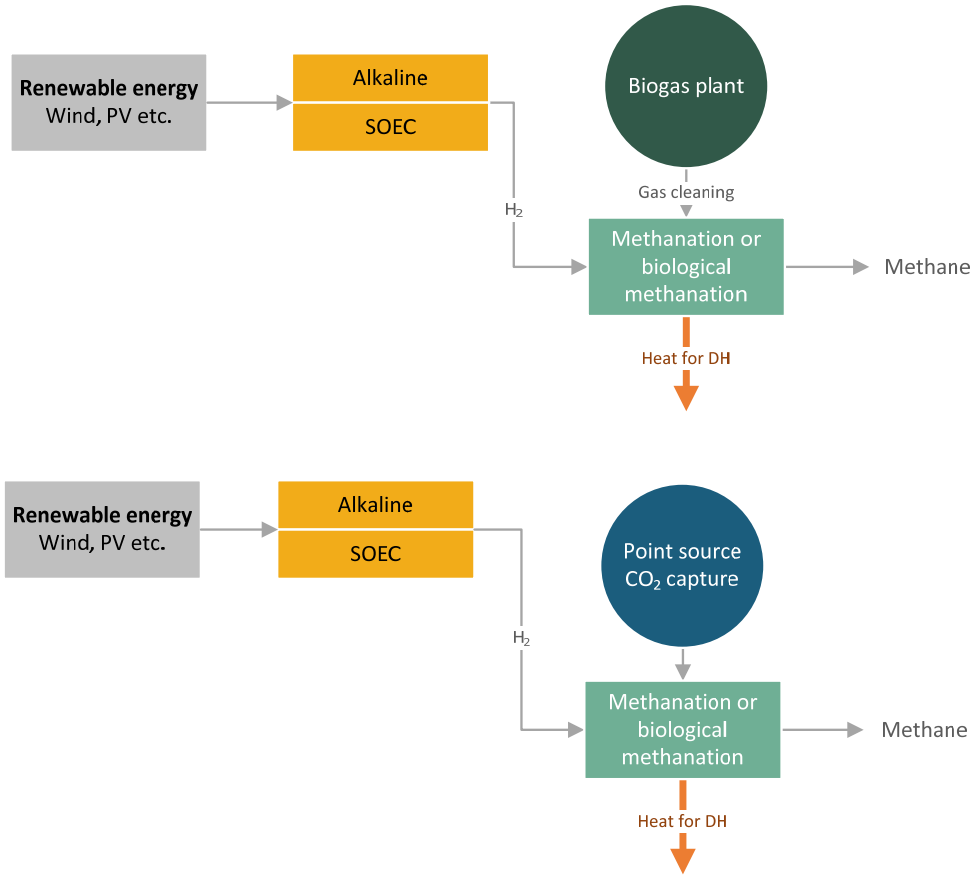
www.4dh.eu www.reinvestproject.eu www.heatroadmap.eu

Aim of the paper

In the paper we develop a method to find the potential location of power-to-gas plants for 2 out of 3 paths

Furthermore, we use Denmark as a case to give an idea about the data requirements and what type of results the method produces.

Scenarios



A. Biogas upgrade with electrolytic hydrogen via alkaline electrolysis

B. Biogas upgrade with electrolytic hydrogen via solid oxide electrolysis (SOEC)

C. CO_2 capture from point sources (power plants and industrial plants) with electrolytic hydrogen via alkaline electrolysis

D. CO_2 capture from point sources (power plants and industrial plants) with electrolytic hydrogen via solid oxide electrolysis (SOEC)

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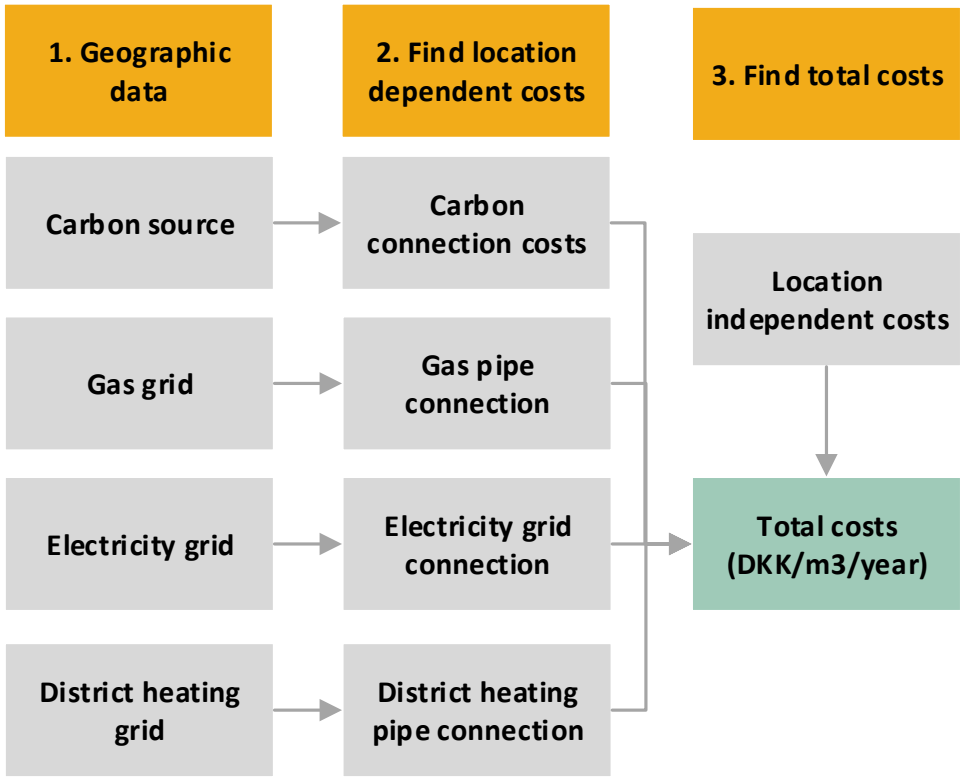
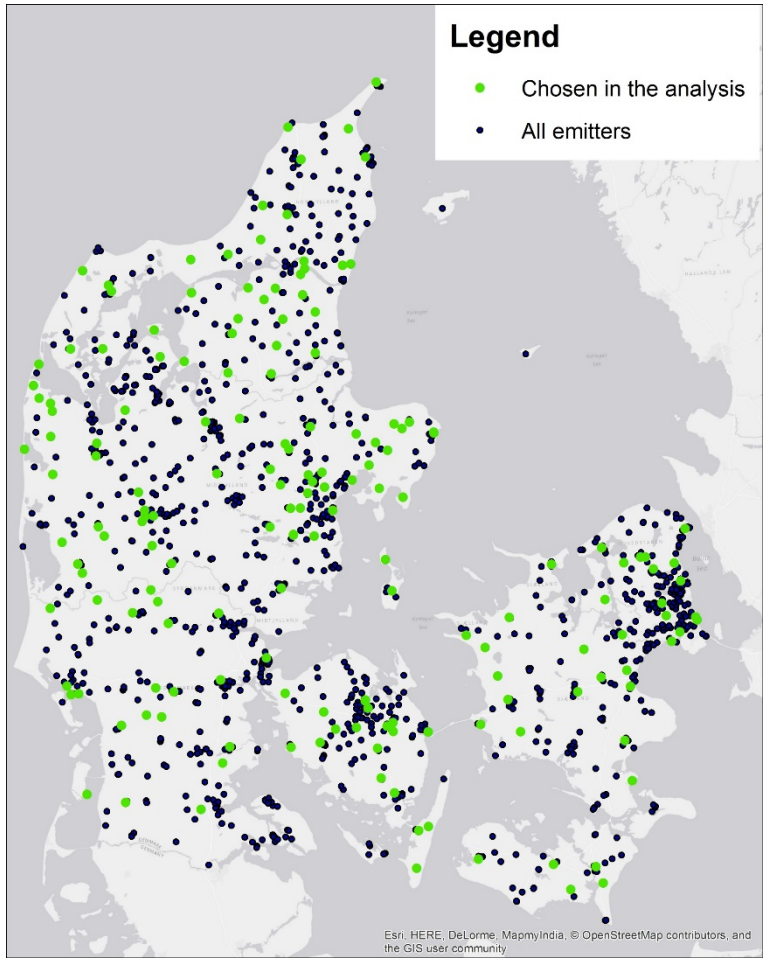
GIS Methodology

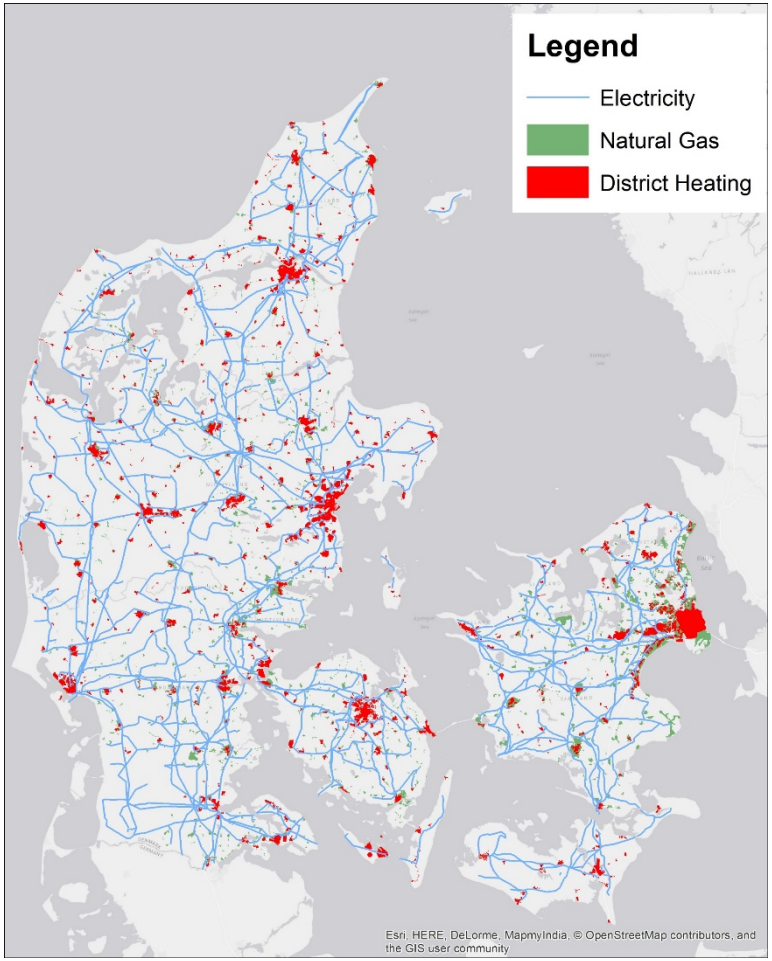


Geographic data input

Energy producers

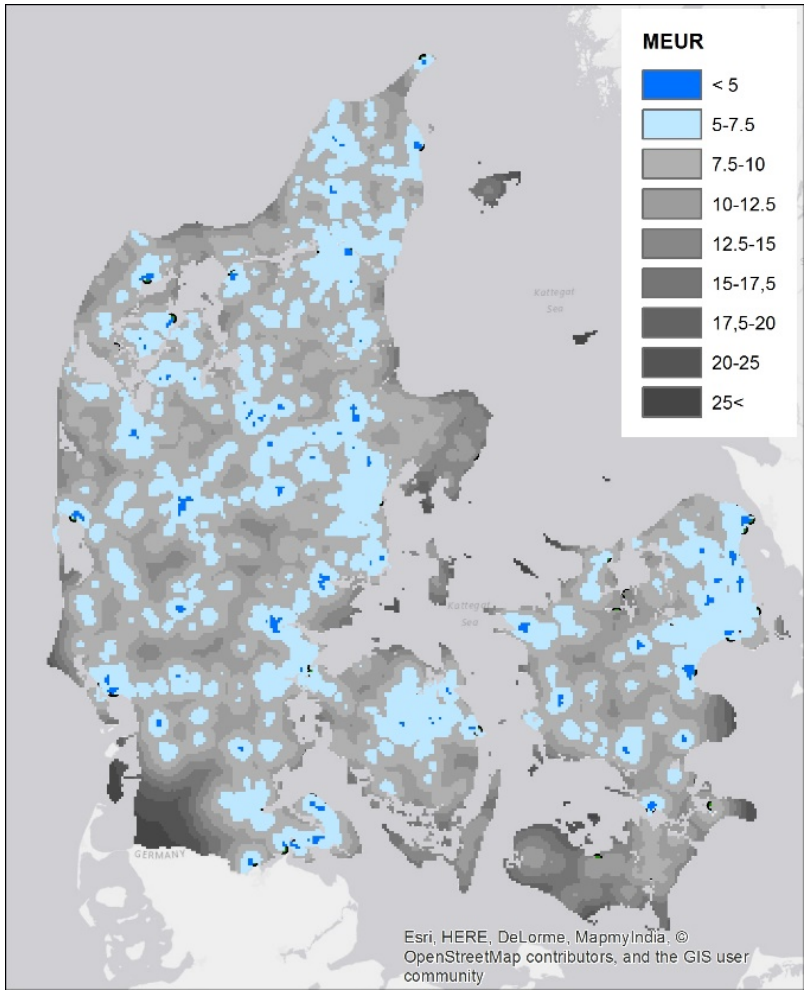


Energy infrastructure

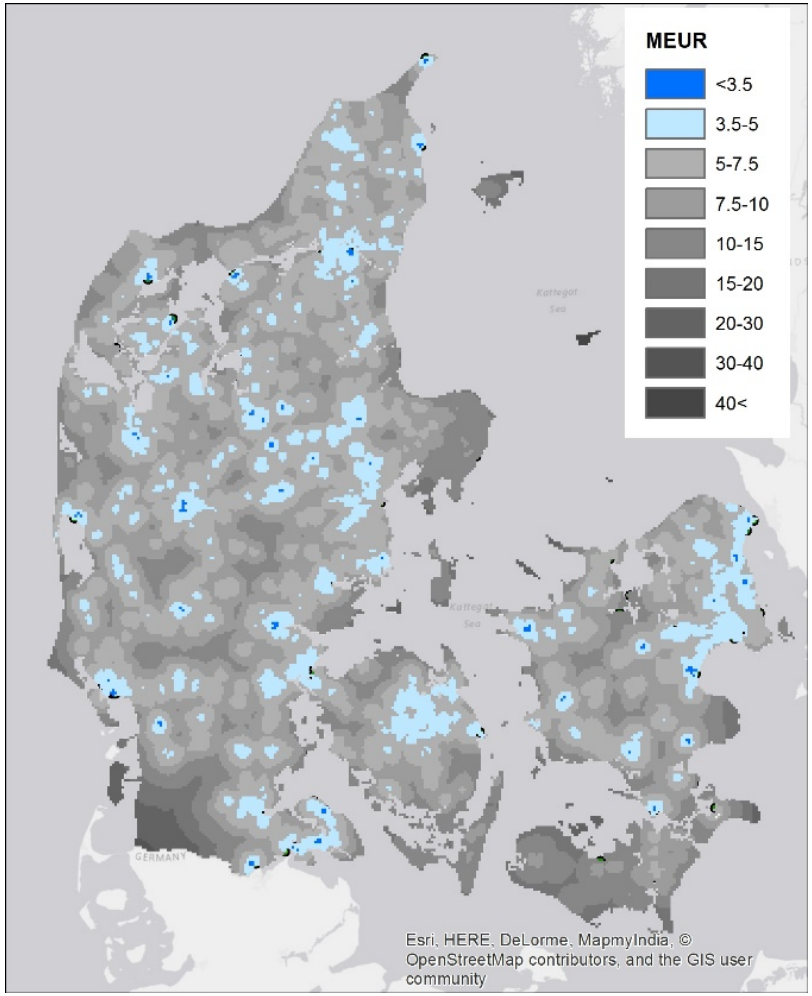


Results Scenario A & B (Biogas)

Scenario A

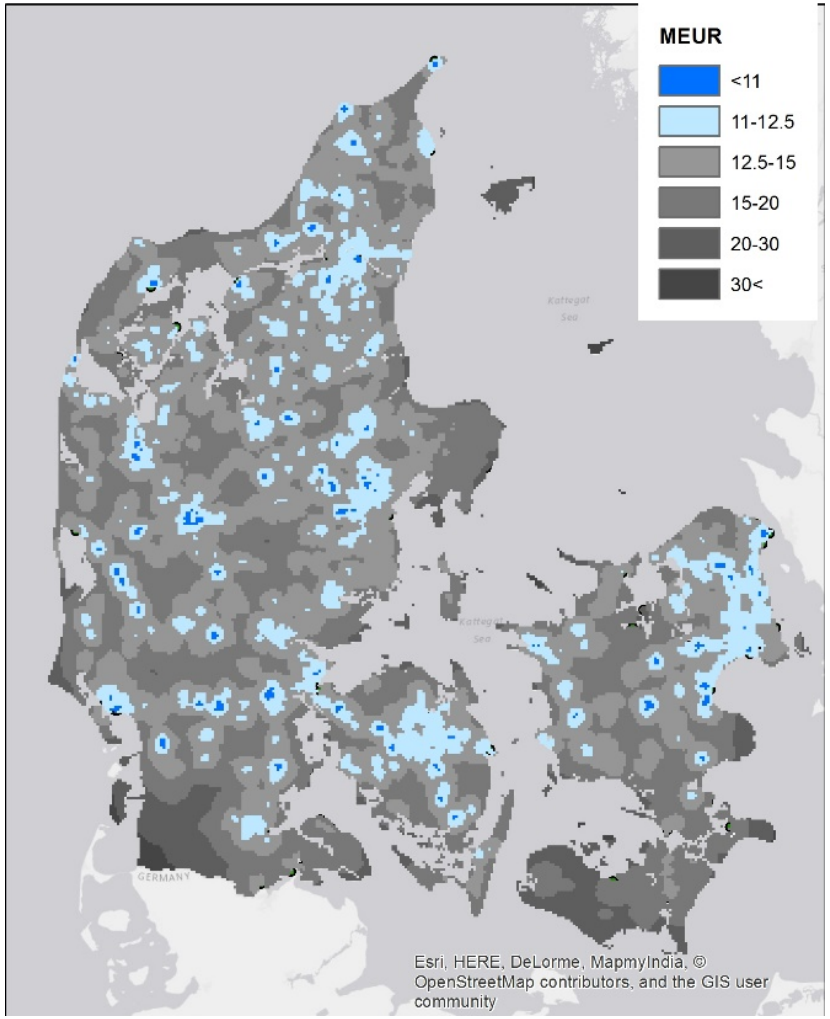


Scenario B

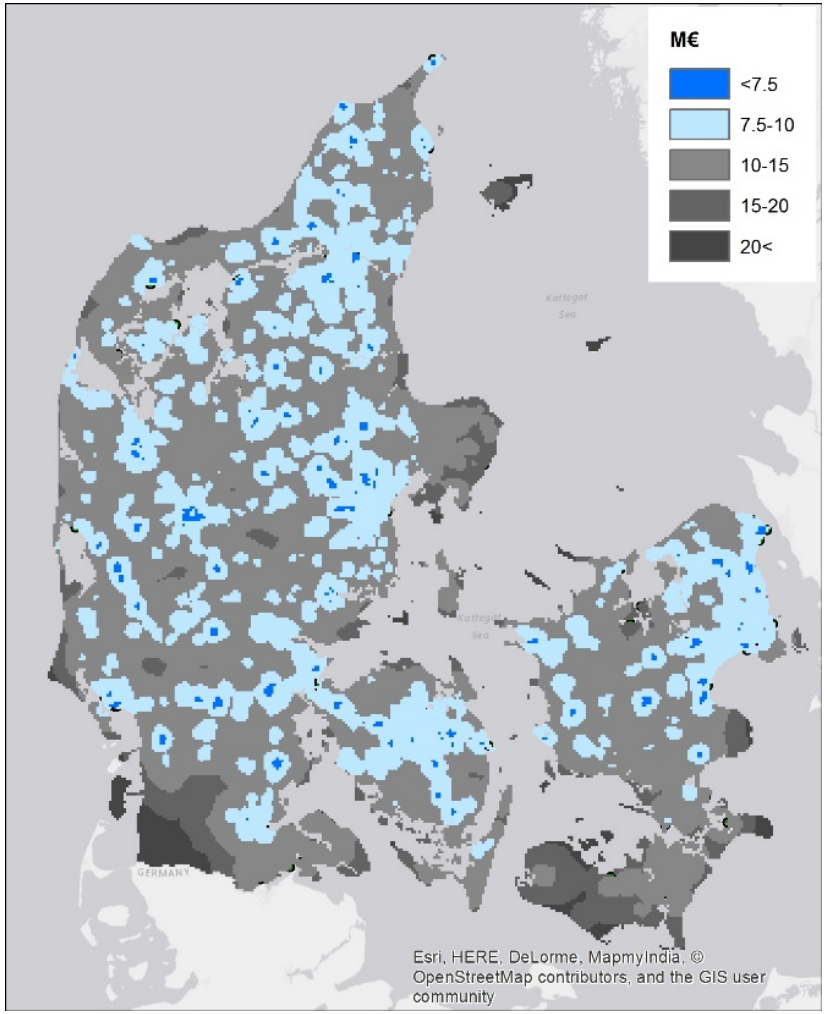


Results Scenario C & D (CO_2 capture)

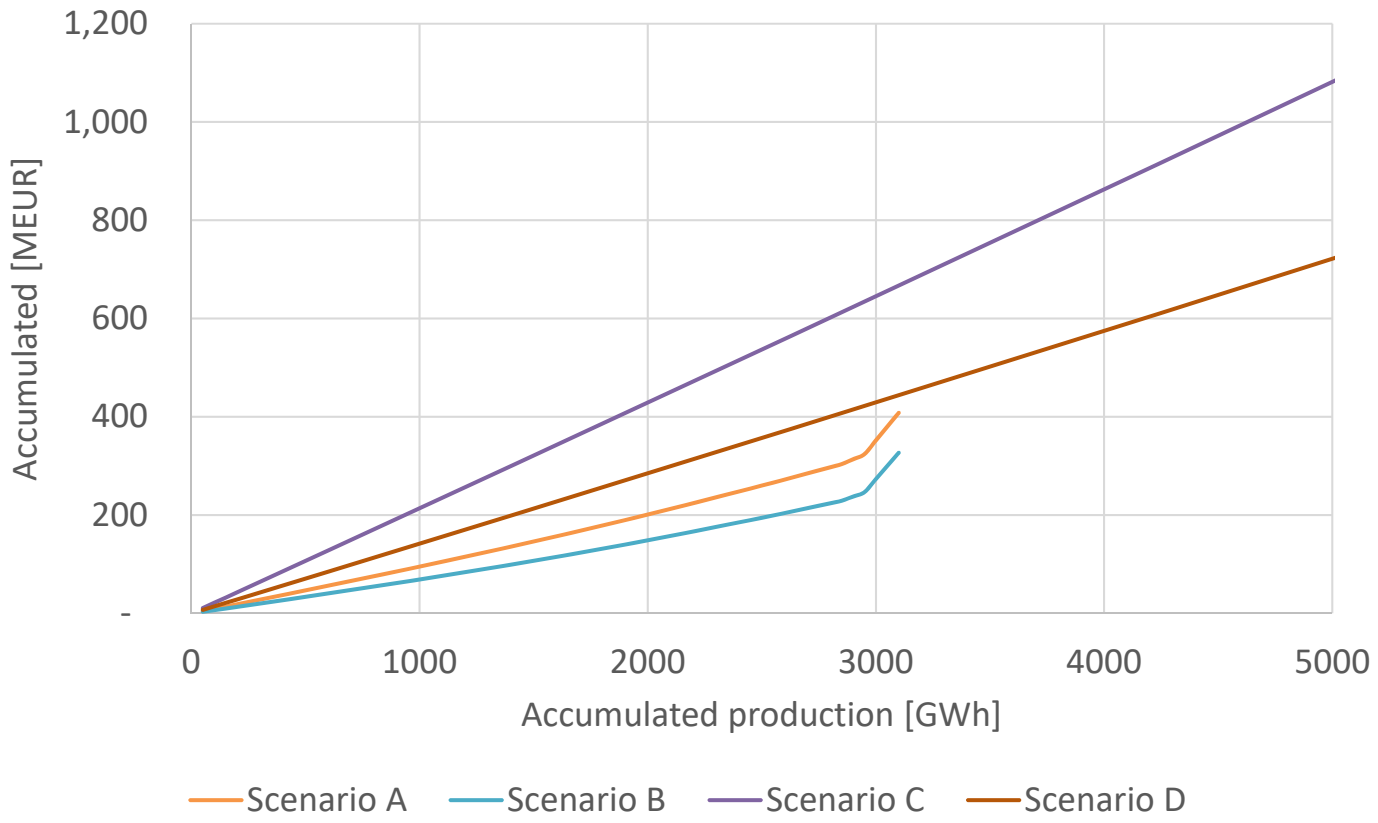
Scenario C



Scenario D



Accumulated costs of all scenarios



Discussion and limitations

- Same size of plants for all cells
- Based on present capacities
- Analysis only look at investments
- Carbon sources could be used for other purposes

Conclusion

- That biogas upgrade paths, at the present cost level, have lower costs of the two paths. However, due to the relatively small number of biogas plants in Denmark, the feasible number of plants is around 55 with the given plant size.
- The CO_2 methanation paths are more costly but has a larger potential of around 800 plants.
- Potential for CO_2 methanation plants can be expected to diminish in the future as more renewable energy is introduced, lowering the need for thermal energy producers while biogas production could see an increase.
- The analysis shows a good indication of the extent of the power-to-gas resources in a country by using a novel approach to the matter.