AAU Energy Research Day

Energy system integration of renewable fuel production pathways in Denmark and how to systematically determine optimal site locations

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Project Background

- Industrial Ph.d at COWI
- Part of the LowCarbFuels project

*”Establish clear **technological**, **logistical** and **commercially viable** pathways to bring HTL-derived fuels to market, specifically targeting heavy transport sectors aviation and marine as well as heavy duty transport”*

- One focus point is optimal site selection
- How to do that systematically for different scenarios?

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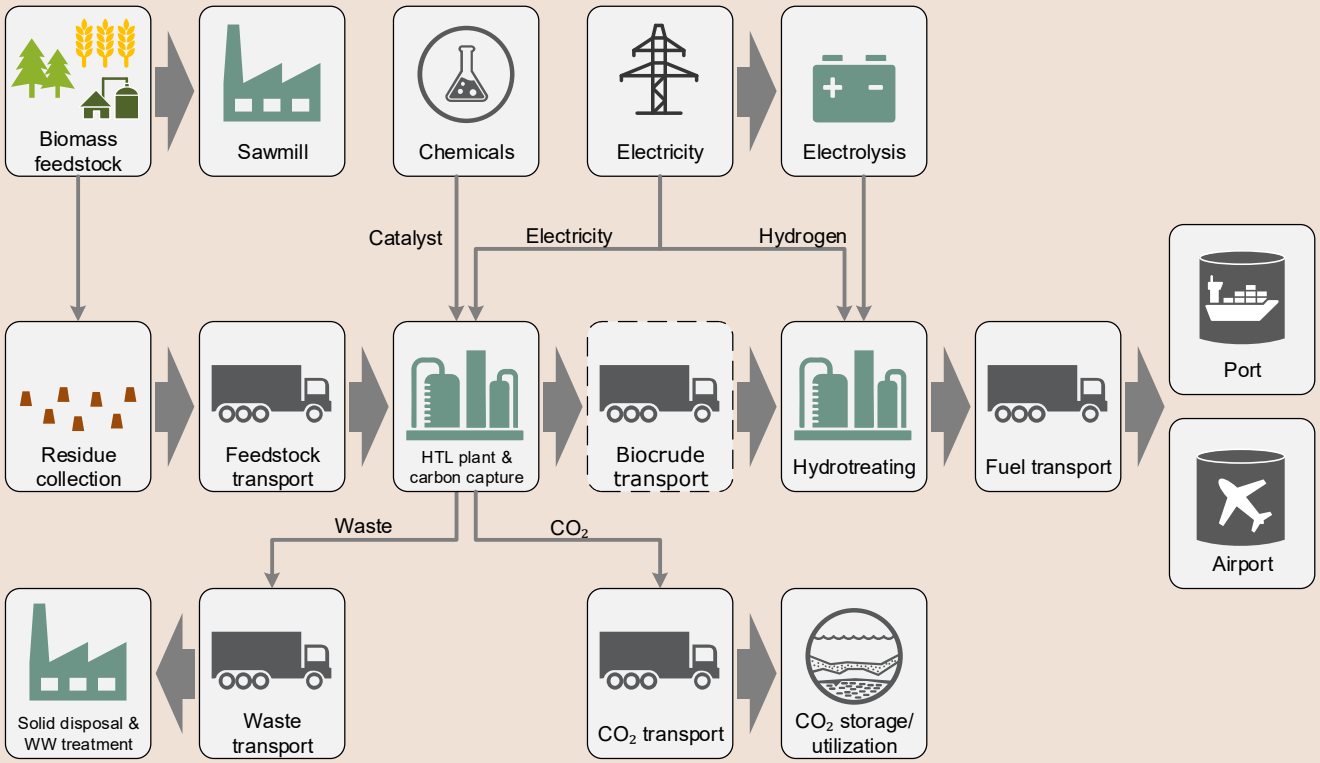
Hydrothermal Liquefaction



- Feedstock
  - Imported forestry residue
  - Agricultural residue
- Centralised value-chain
  - HTL and upgraded being conducted at the same location

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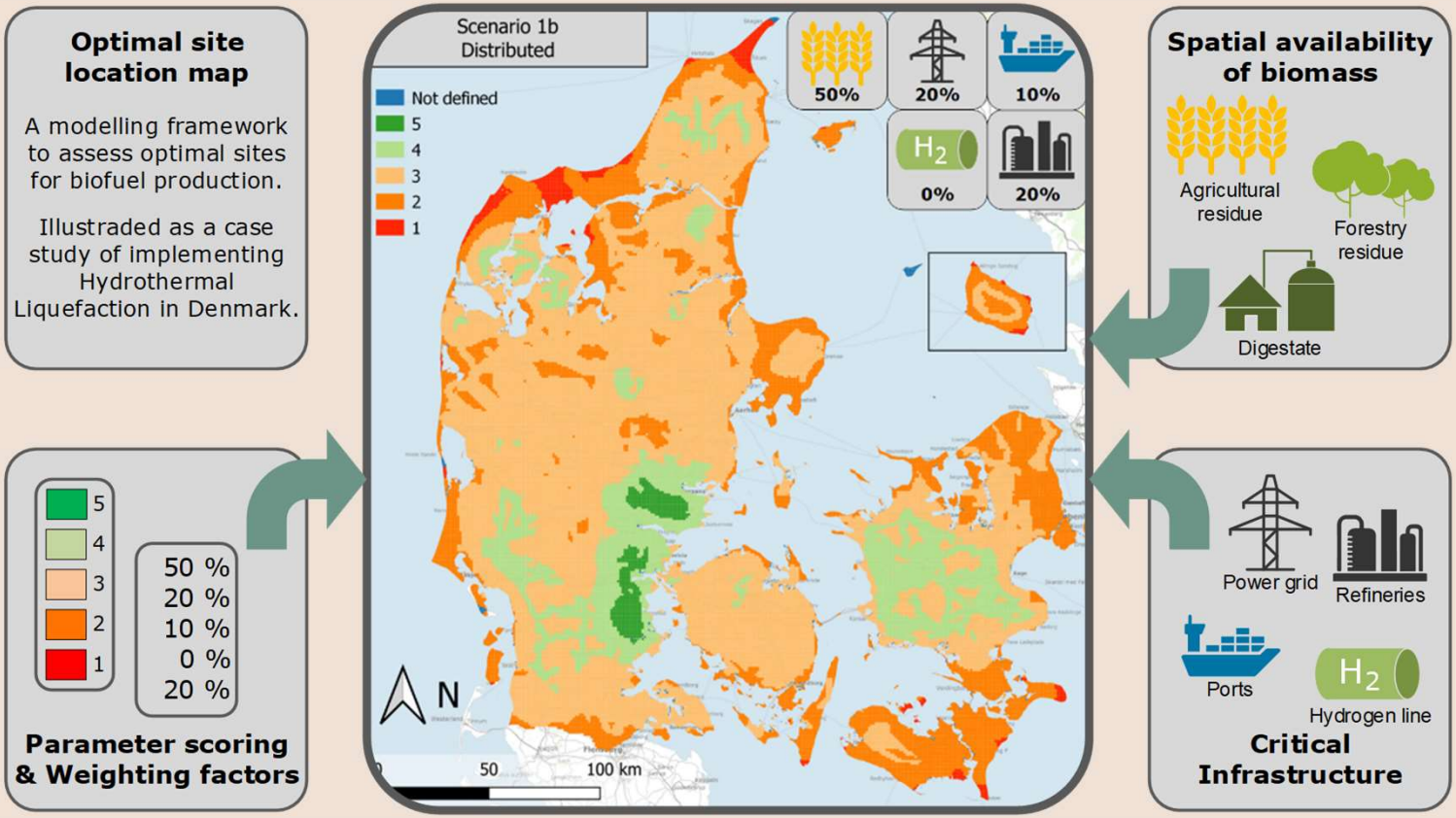
Systematically Site selection - Methodology



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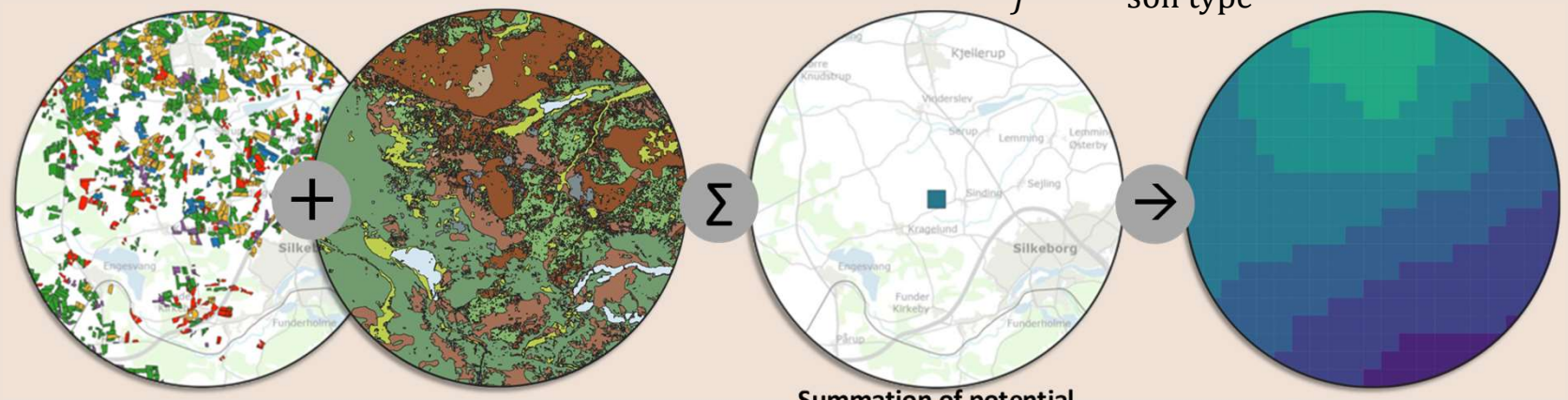
Biomass Resources – Agricultural residue

- Spatial estimation of residue potential
  - Wheat
  - Rye
  - Barley
  - Oats
  - Rape seed

$$\text{Total residue} = \sum A_{field,ij} \cdot Y_{ij} \cdot RPR_i \cdot SRR_i$$

A_{field}	area of a single field
Y	crop yield
RPR	residue to product ratio
SRR	sustainable removal rate
i	crop type
j	soil type



Field data | Soil map | Summation of potential within 10 km radius | Full nationwide grid

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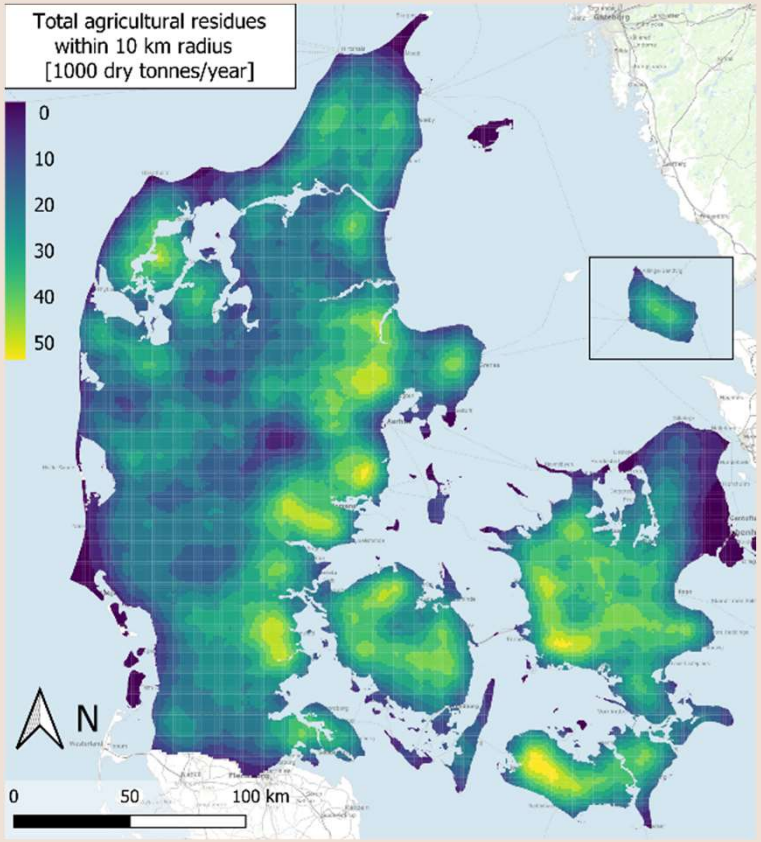
Biomass Resources – Agricultural residue

- Residue potential within 10 km

  [1000 dry tonne/year]
- Competing use in straw fired CHP and boilers



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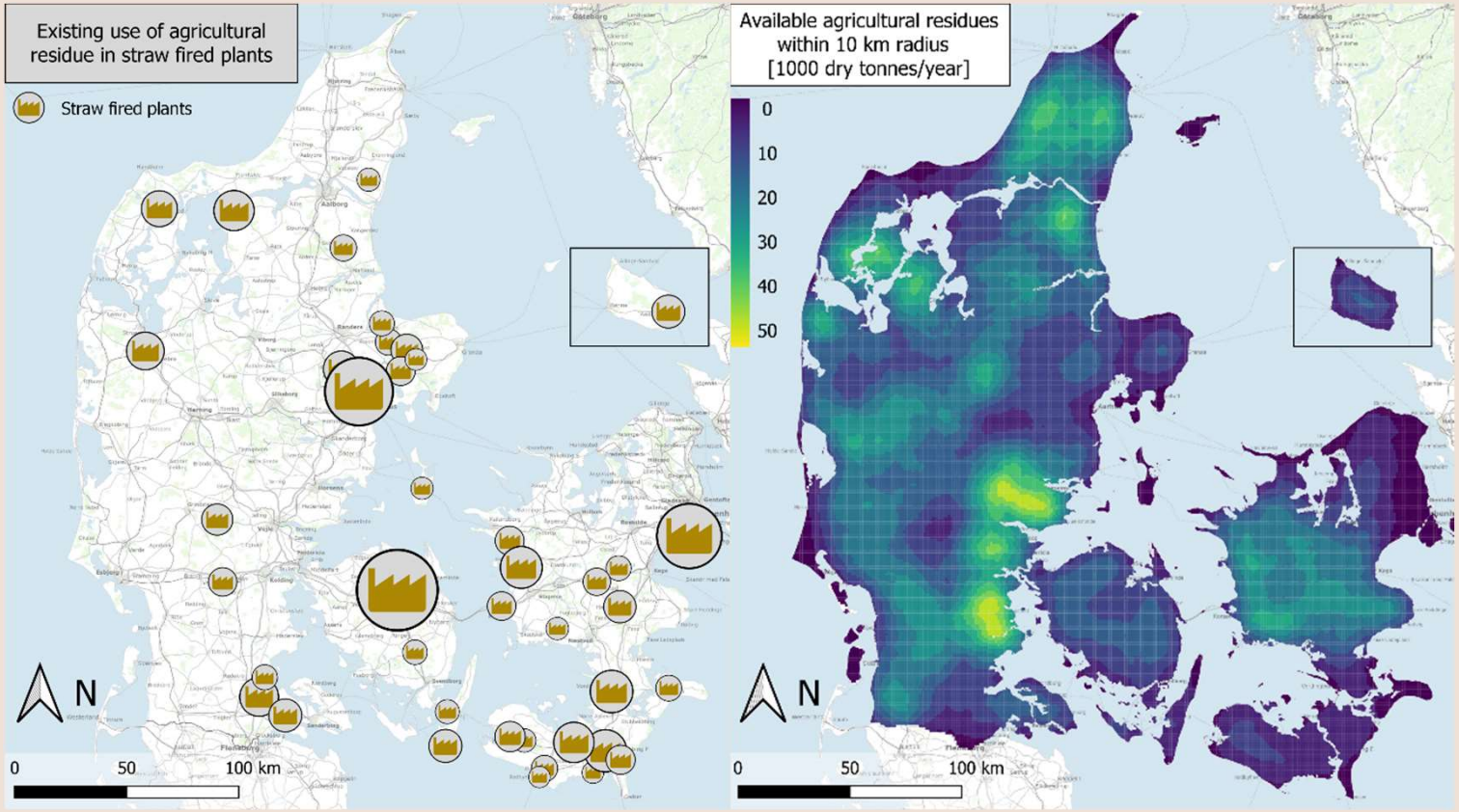

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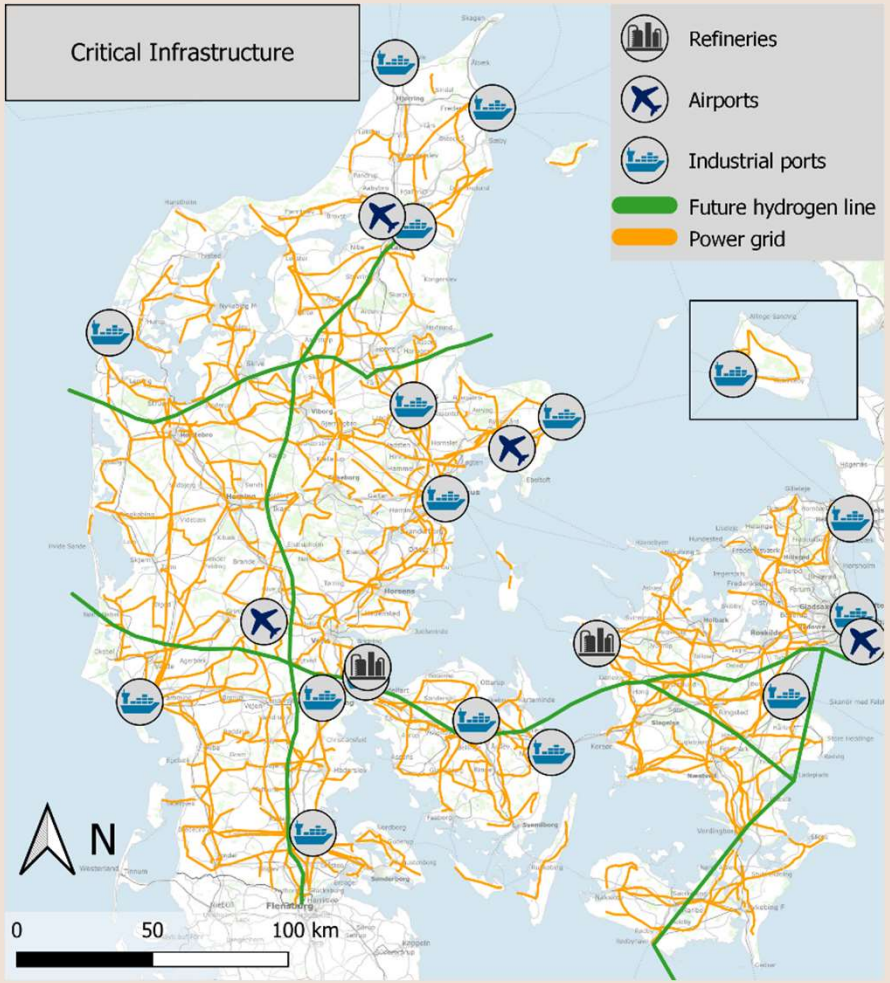
Critical Infrastructure

- Refinery
- Industrial ports
- Airports
- Future hydrogen line
- Power

Score	Biomass within 10 km radius [dry ton/year]	Distance to min 50 kV powerlines [km]	Distance to industrial port [km]	Distance to hydrogen pipeline [km]	Distance to existing refinery [km]
5	> 40 000	< 1	< 10	< 3	< 40
4	30 000 - 40 000	1 - 3	10 - 20	3 - 8	40 - 80
3	20 000 - 30 000	3 - 5	20 - 30	8 - 13	80 - 120
2	10 000 - 20 000	5 - 7	30 - 45	13 - 18	120 - 160
1	< 10 000	> 7	> 45	> 18	> 160



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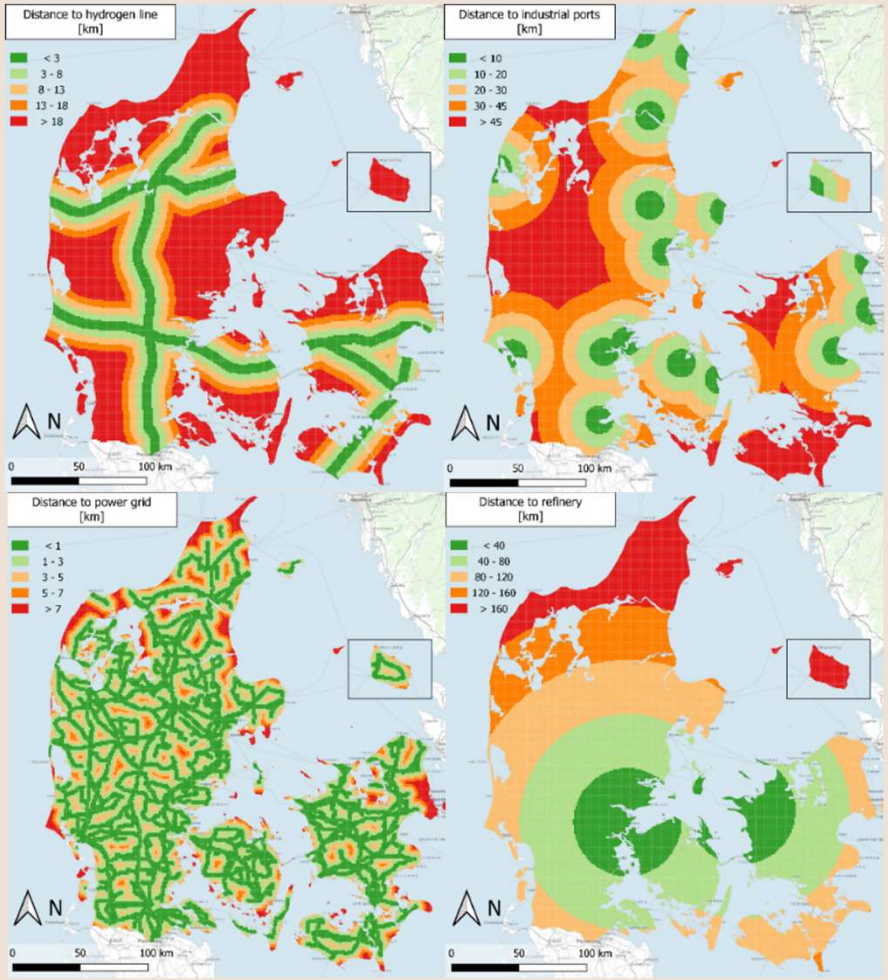

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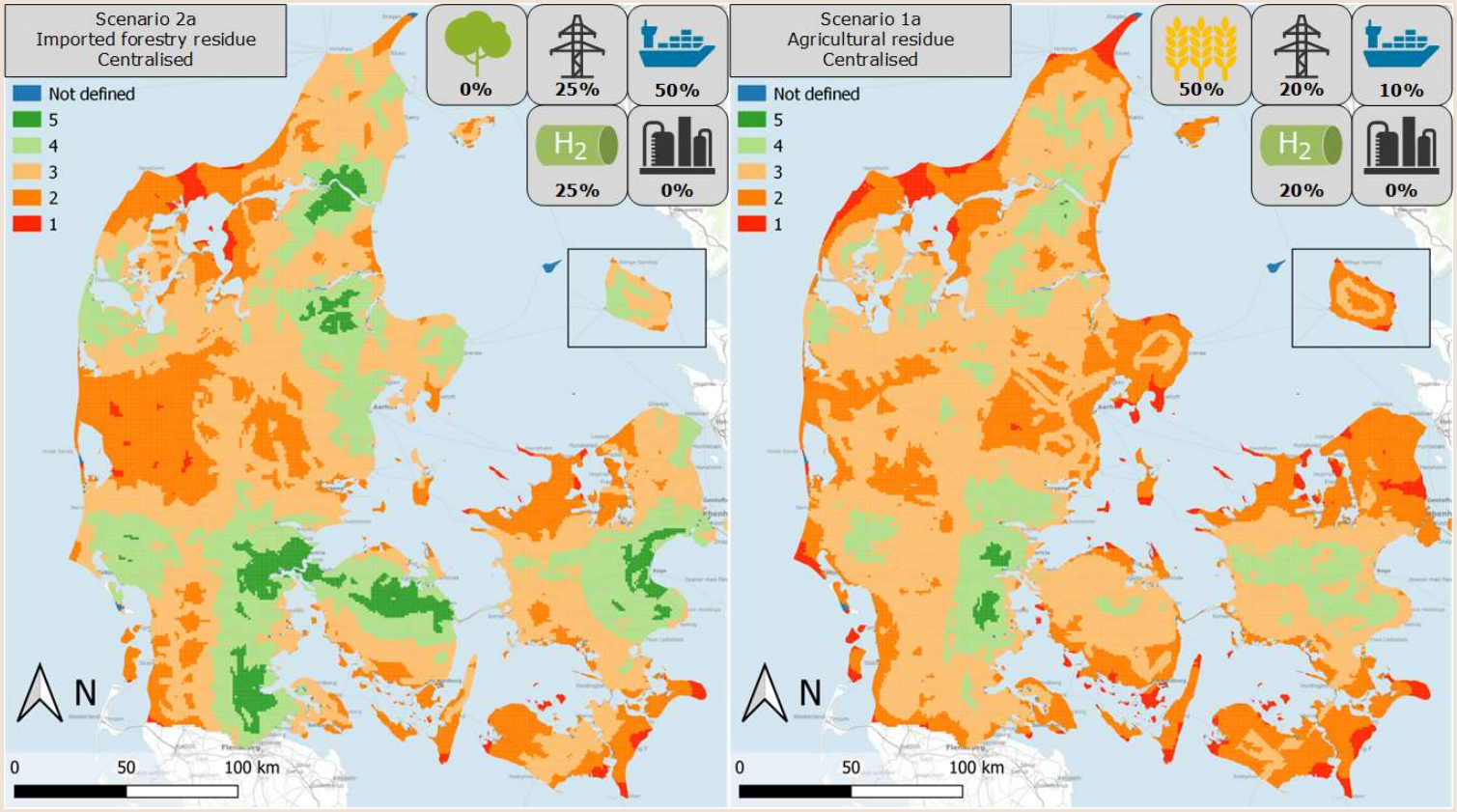
Systematically Site selection – Results

- Combined site selection score
- Parameter scoring multiplied with weighting factors



Imported forestry residue

Agricultural residue

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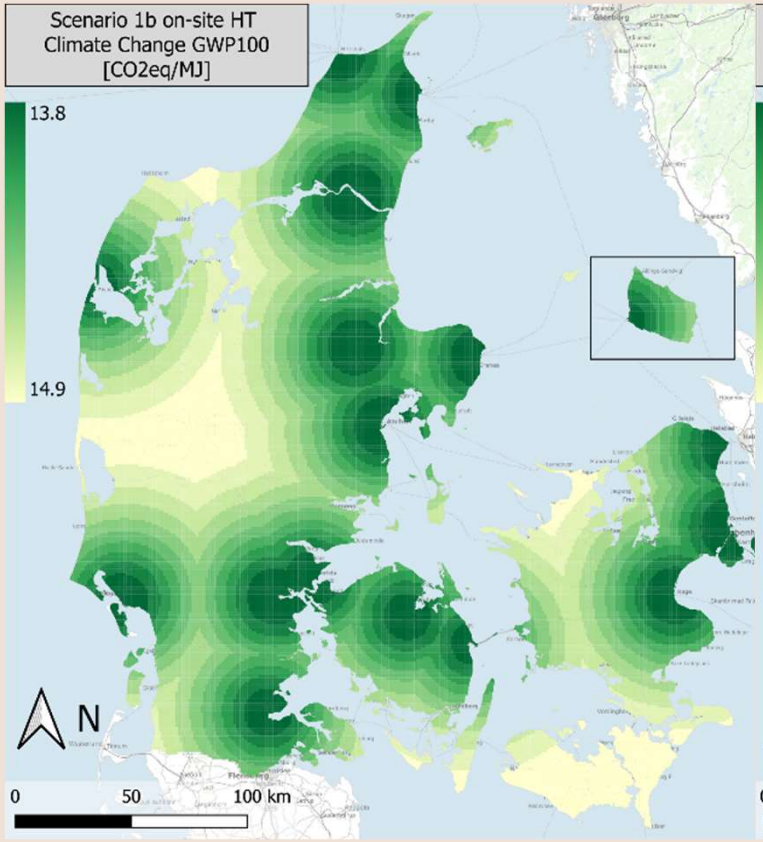
Location variations in life cycle analysis

- Life Cycle Analysis combined with GIS modelling



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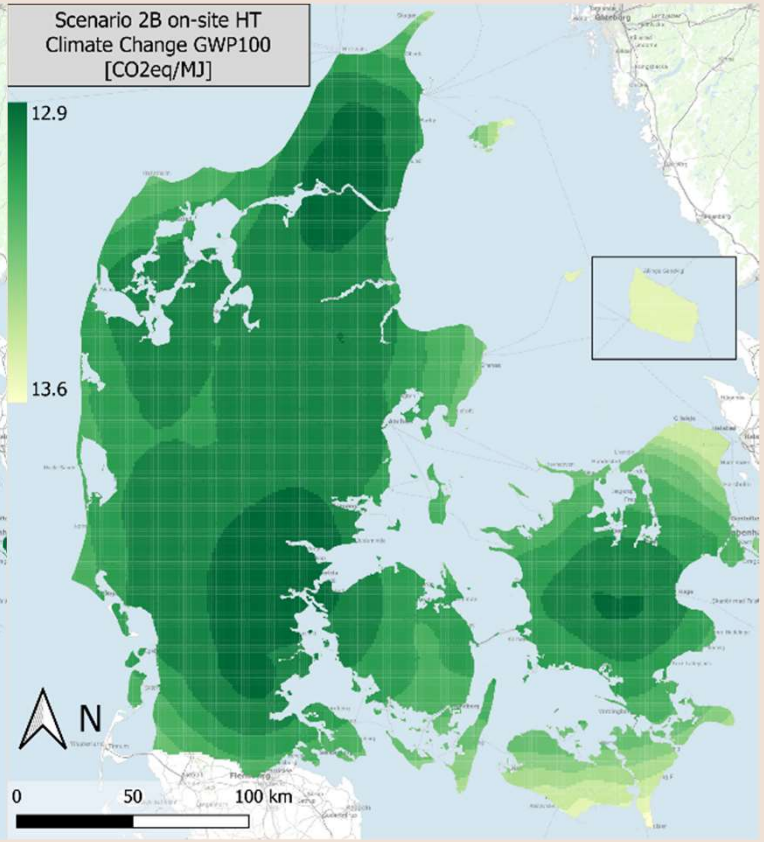

Agricultural residue

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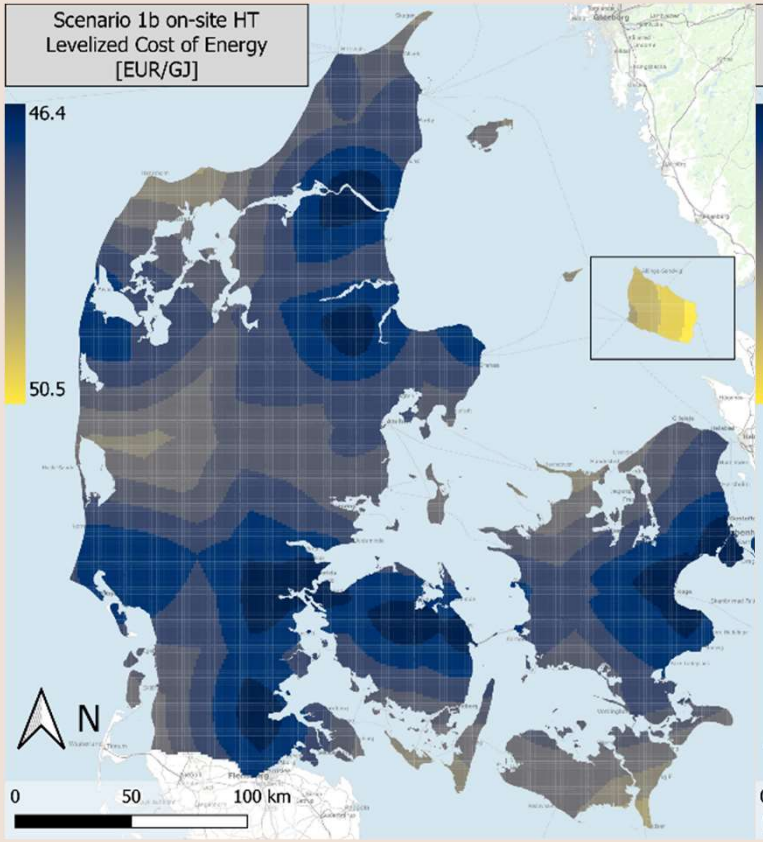
Location variations in techno economic assessment

- Techno economic assessment combined with GIS modelling



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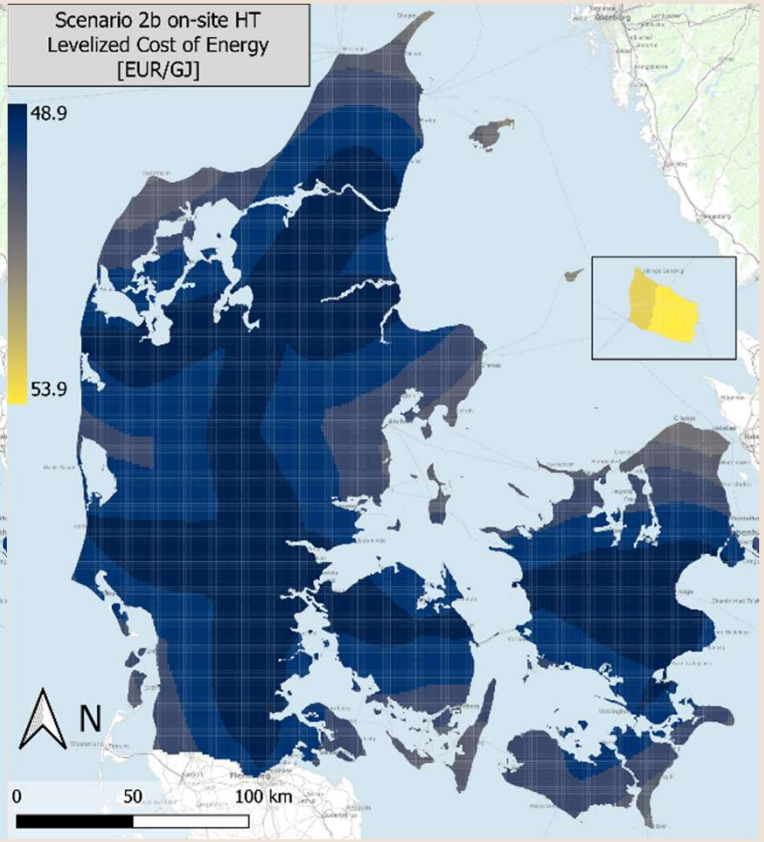

Agricultural residue

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Thank you

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