Optimal localisation of next-generation biofuel production integrated in Swedish forest industry

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Background

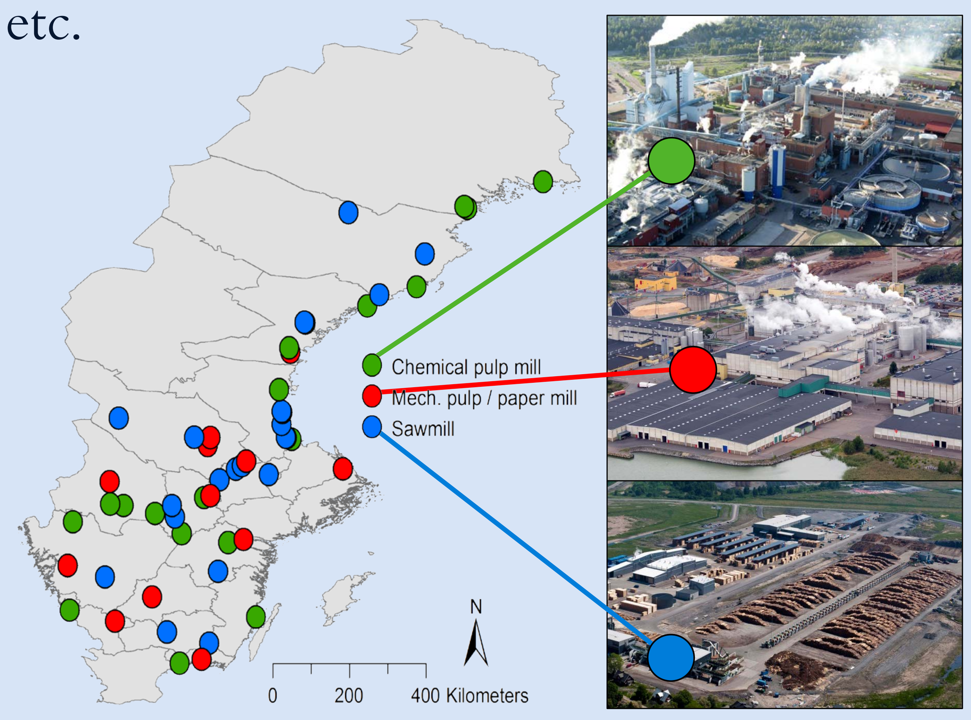
- High availability of forest biomass in Sweden – interesting for large-scale production of next-generation biofuels.
- Feedstock supply chain challenges related to large plant sizes, competition from other sectors, and transport distances.
- Co-location with forest industry enables high total conversion efficiency and benefits related to feedstock handling and industrial know-how.

BeWhere Sweden

- Techno-economic geographically explicit optimisation model.
- Analysis of optimal locations and properties of next-generation biofuel production facilities.
- Focus on integrated biofuel production and forest biomass
- Detailed bottom-up studies of integrated fuel production included in top-down model.

Integration in forest industry

Site-specific conditions and data regarding production, internal energy flows, by-product flows etc.

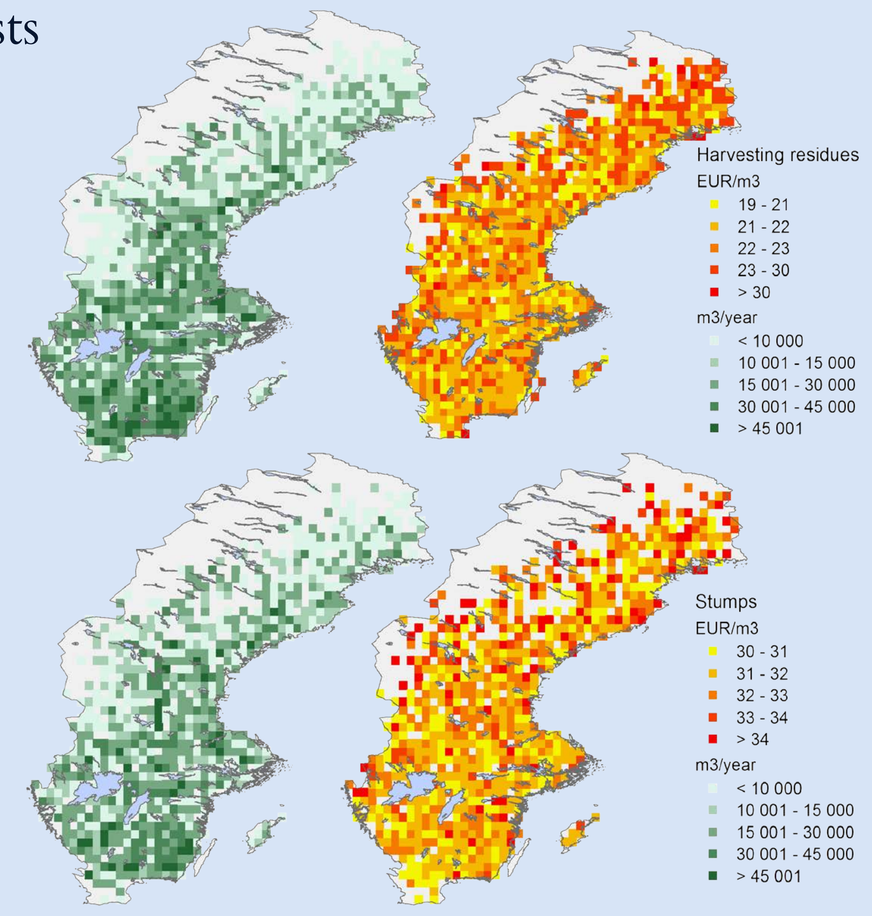


Energy market parameters

- Energy carrier costs and prices
- Policies (carbon tax, green electricity certificates, biofuel tax reduction)

Biomass resources

Bottom-up approach for modelling future forest biomass harvesting potentials and costs



Cost minimisation of the full supply chain to meet targets for overall forest based biofuel use in Sweden

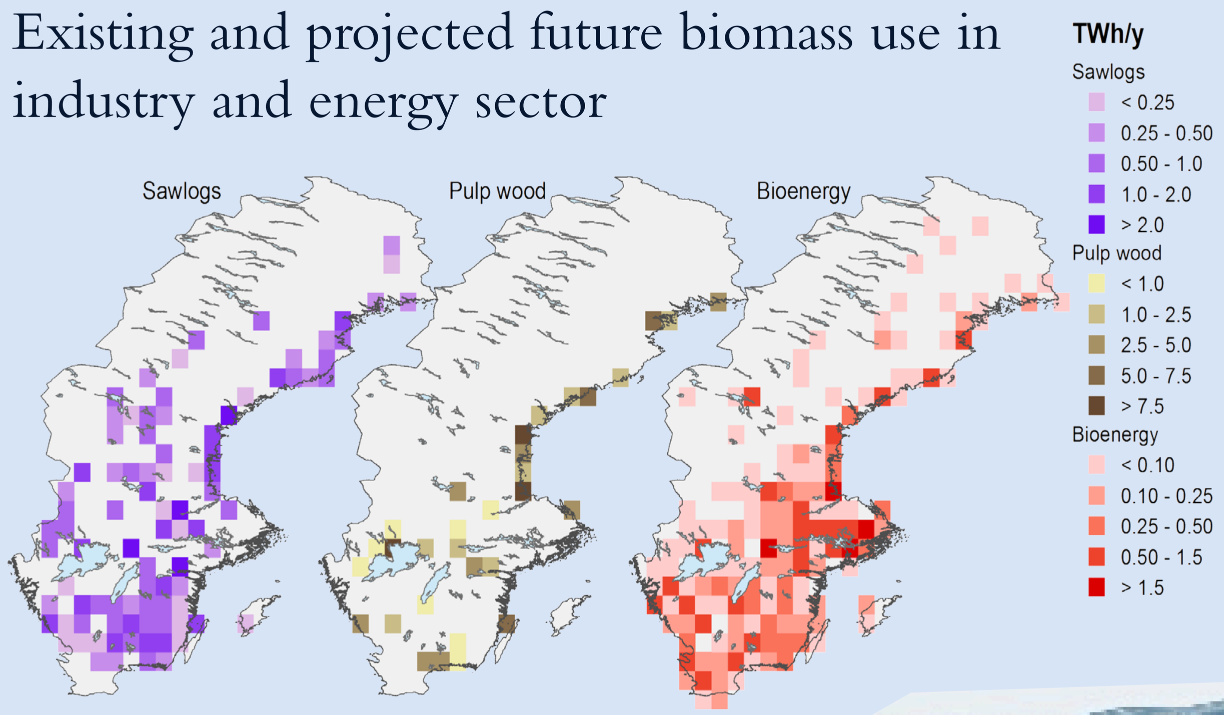
BeWhere

Biofuel production technologies

- Black liquor gasification (BLG) with DME production
- Biomass gasification (BMG) with DME or SNG production
- Hydrolysis and fermentation to lignocellulosic ethanol

Competing biomass use

Existing and projected future biomass use in industry and energy sector



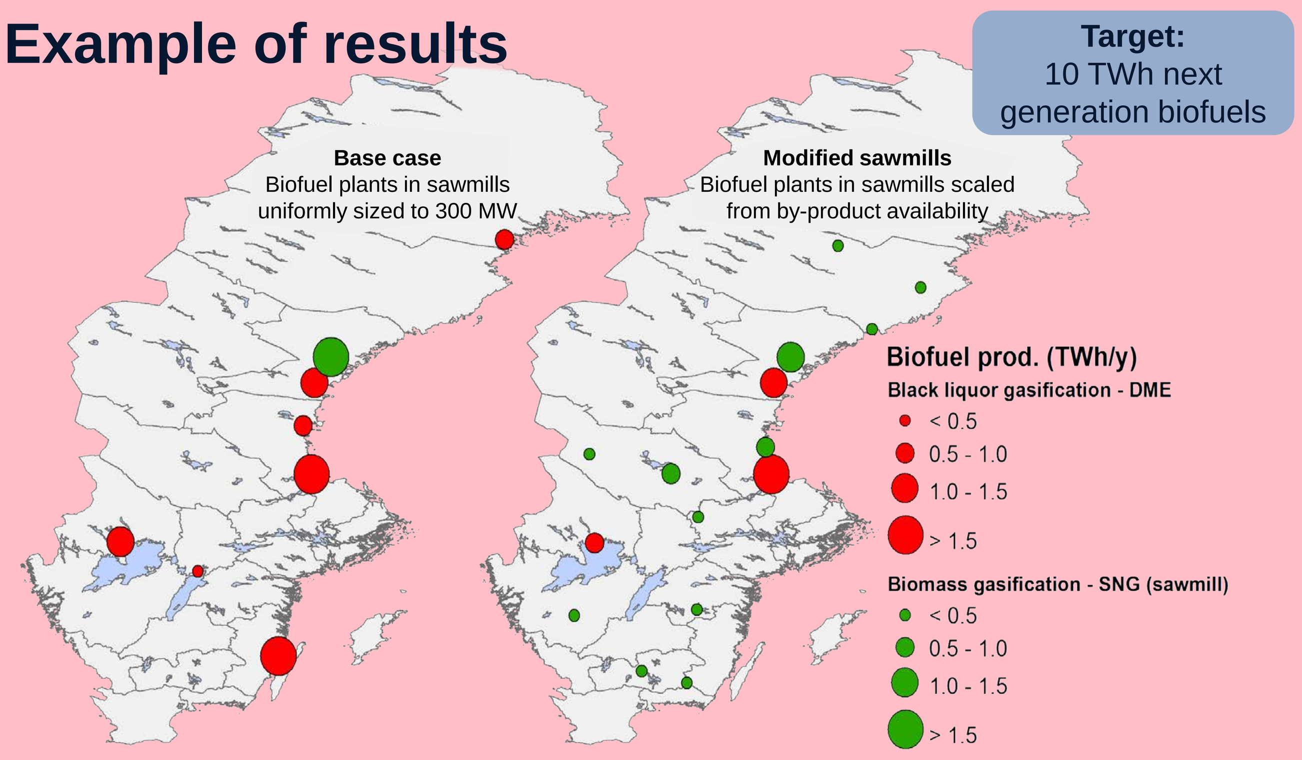
Techno-economic parameters

- Costs for investment and operation
- Production efficiency
- Incremental costs and net energy balances compared to investment in conventional technology

Transportation

- Road, rail network
- Transportation costs for biomass and biofuels

Example of results



Optimal pulp mills for BLG based DME production:

- Low specific investment cost
- Low net biomass transport cost

Optimal sawmills for BMG based SNG production :

- Large production of sawn goods and by-products → Low net biomass transport cost

Conclusions

This study identifies **parameters of high significance for optimal host industries** for integrated biofuel production. Since there is a large variance between different industries of the same type, the results show the advantage of including **site-specific considerations** in this type of energy systems model.

BeWhere Sweden considers the entire **biomass to biofuels supply chain** in a geographical context. The model is used to for example test the implementability of **policy targets** for biofuels and other biomass use. It complements more aggregated overall energy systems models.

Source

Pettersson K, Wetterlund E, et al. (2015), Integration of next-generation biofuel production in the Swedish forest industry – A geographically explicit approach. Applied Energy 154, pp. 317-332.

Acknowledgement

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More information

www.ltu.se/bewhere
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