case 1

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SEA for a land use plan in Denmark

Renewable energy in the land use plan for Skive municipality

Type of impact assessment	Mandatory Strategic Environmental Assessment (SEA)
Type of project/plan	Land use plan (spatial planning)
Climate change related issues	Greenhouse gas emissions and risk of flooding
Influence of the SEA	Clear mitigation measures and choice of a more climate smart alternative

In the Skive municipality, an SEA including a Life Cycle Assessment was done for proposed renewable energy activities. The comparison of six alternatives led to selection of a 'climate smart' alternative with more production of wind energy than initially planned. The SEA also led to measures against flooding.

Climate change in Skive

Part of the land use plan for Skive municipality is 'GreenLab Skive', a renewable energy project. The purpose of GreenLab is to integrate multiple renewable energy technolo-

gies in order to reduce greenhouse gas emissions from the energy sector. Renewable energy sources, electrolysis, and biogas production will be combined in one system. The symbiosis consists of 1) sources of energy supply (electricity and heat): photovoltaic plant, wind turbines, heat pumps, combined heat and power engines; 2) facilities for biogas production & upgrading to methane, and electrolysis facilities; 3) 'grids' for natural gas, electricity and heat that connect the facilities.
Mitigating climate change is the driving force behind the symbiosis planning. Various factors determine how much mitigation is achievable. A key factor is the significant energy use for electrolysis, which needs to be fully based on renewables. Another is the impact of the biogas, which depends on the input.

As part of the mandatory SEA, the municipality had a non-mandatory screening Life Cycle Assessment undertaken to determine the carbon footprint of the system. Hotspots in its life cycle - and thus areas for improvement - were identified. Besides the focus on climate mitigation, the SEA also included an assessment of impacts related to the risk of flooding in the area, and means for mitigation across the different technologies and projects.

Assessing climate change risks for GreenLab

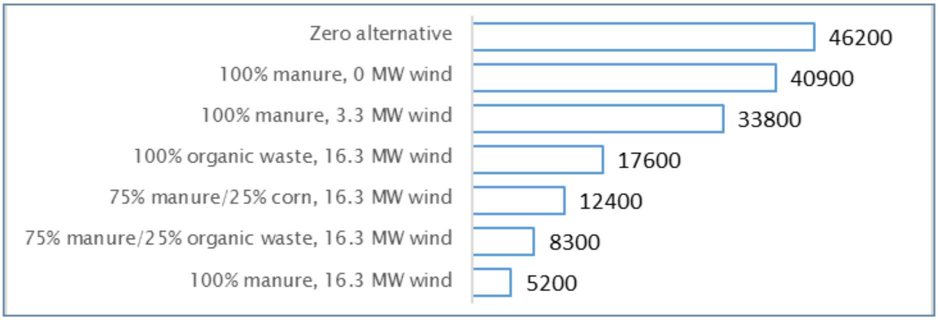
The screening LCA is an initial and basic understanding of the impact category 'Global Warming Potential' (GWP), i.e. a carbon footprint, and builds upon the IPCC 2013 GWP 100a method (IPCC, 2013). The functional unit in the LCA is: "Supply of the amount of electricity, heat, hydrogen, methane and oxygen that GreenLab delivers in a year".

The SEA compares six GreenLab alternatives and a 'zero alternative'.

Climate smart mitigation and adaptation in the SEA

For climate mitigation, the key points from the carbon footprint were (see results in the figure):

- Using manure for biogas production is better than using organic waste or maize.
- The system has a net impact in the first two scenarios because more energy is used than produced. This is taken from the grid, which includes some fossil fuel based electricity productions.



Climate effects for GreenLab alternatives, measured in CO_2-eq/year

- Not installing wind turbines gives impacts comparable to the 'zero alternative'. Wind turbines give the largest environmental benefit.

Regarding climate change impacts in the area, the SEA mapped and analysed the risk of flooding due to cloudburst and increasing ground water level. The SEA recommended adaptation measures of a) locating activities outside the most flood-prone areas – and instead developing nature in these areas, b) avoiding activities below ground level because of a high water table and c) ensuring local drainage of rainwater.

Conclusion: Climate smart design of GreenLab

A major contribution of the SEA is the integration of significant concerns *during* the planning process. The municipality was dedicated to securing the sustainability of the plan, which involved a continuous dialogue and search for solutions between different departments of the organisation, and with incorporation of public concerns and ideas. Another major contribution is the decision to make a non-mandatory master plan for the area. The aim of this is to secure integrity across individual projects – e.g. wind turbines and the biogas plant – before the mandatory local plans and ESIAs for each project are undertaken.

The SEA results also led to the following decisions: a) securing added wind energy, beyond what is needed according to the carbon footprint; b) clear mitigation measures regarding input to the biogas production – and concerning climate adaptation; c) adaptation measures for the whole area built into the master plan.

References

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Characteristics of climate smart(er) plan:

- Three-step approach applied ✓
- Climate smart(er) plan design ✓
- SEA increased commitment for plan ✓

Climate smart(er) because:

- Screening LCA proves to be a valid and efficient tool in planning for assessing the carbon footprint.
- Securing added wind energy to make a significant negative carbon footprint.
- Collective solution for rainwater handling and drainage.
- Flood-prone areas are assigned for nature development.

This case is part of the publication 'Environmental Assessment for Climate Smart Decision Making: Good practice cases', published by the NCEA in 2017. See www.eia.nl for the other cases.