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Long-Term Storage of Solid Fuels: An LCA Study

This project looked at how storing solid fuels for long periods of time affects the environment. To do this, a simplified life cycle assessment (LCA) was carried out, with the goal of better understanding the environmental impact of fuel storage. Forest wood chips were compared with peat and hard coal.

The study focused on three main questions:

- How does long-term storage affect the environment for different types of fuels?
- How important is storage compared with other steps in the energy supply chain?
- Do different ways of storing fuels lead to noticeable differences in environmental impact?

The analysis followed the fuels from the extraction of raw materials, through transport and storage, to combustion and the handling of residues such as ash. The calculations were carried out using the LCA software SimaPro. To make fair comparisons between the fuels, all results were related to the same amount of useful energy: 1 megawatt-hour (MWh) of heat produced.

What do the results show?

The results reveal clear differences in environmental impact between the different fuels, while differences between storage methods for the same fuel are relatively small. In the comparison of long-term storage of forest wood chips, peat, and hard coal, hard coal is by far the most climate-intensive fuel. Almost all its environmental impact occurs during combustion, with extraction included as part of the process. Producing 1 MWh of heat results in emissions of about 476 kg of CO_2 equivalents for hard coal. Long-term storage and use of peat lead to approximately 460 kg of CO_2-eq per MWh. In contrast, forest wood chips result in much lower emissions: 31.5 kg, 37 kg, and 45 kg of CO_2-eq per MWh for small-scale storage, large-scale storage, and terminal storage, respectively.

Figure 1 shows the combined environmental impact, where several environmental impact categories are merged into a single value (*single score*) expressed in milli points (mPt). A lower value indicates a lower overall environmental impact. The coloured segments illustrate the contributions from different impact categories.

Hard coal dominates all impact categories, particularly climate impact and resource use. Forest wood chips have the lowest total environmental impact regardless of storage method, while hard coal has the highest.

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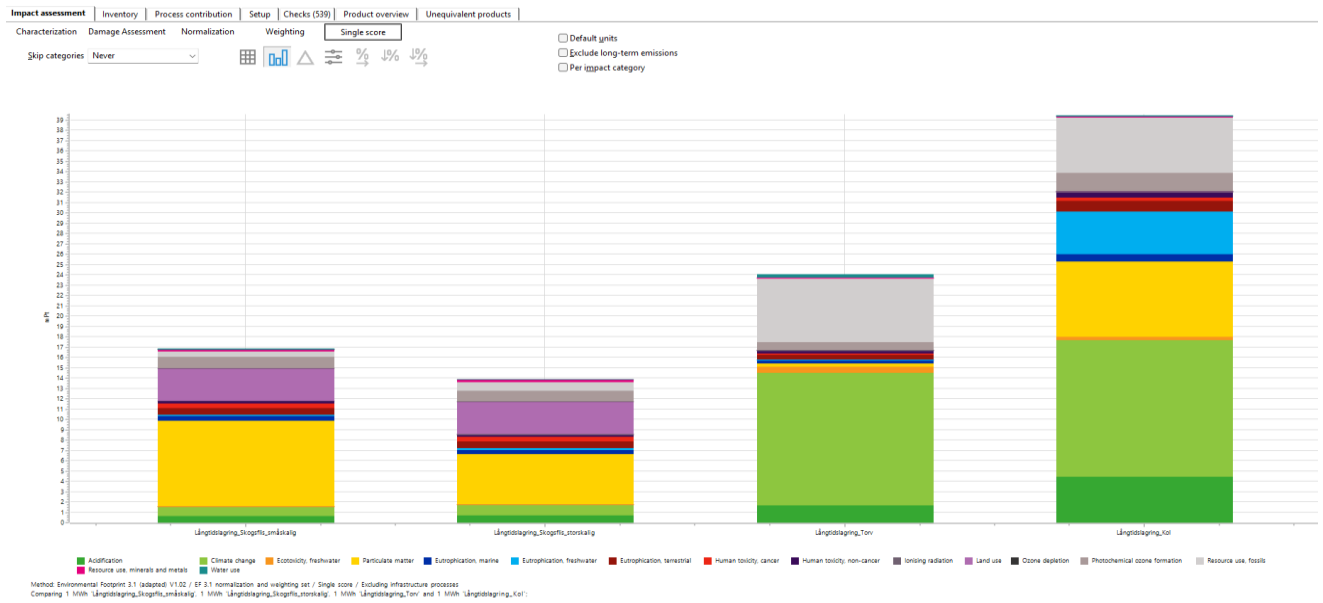

Figure 1. Single-score results for long-term storage of forest wood chips (small-scale and large-scale), peat, and coal. The total height of each bar represents the combined environmental impact expressed in milli points (mPt), where a lower value indicates a lower overall impact. The coloured segments show contributions from the individual environmental impact categories.

Large-scale storage of forest wood chips shows a slightly lower environmental impact than small-scale storage, but the difference is minor. Peat has a significantly higher environmental impact than forest wood chips, mainly due to its high climate impact and use of fossil resources. Hard coal dominates all environmental impact categories.

Overall, the differences between storage options for forest wood chips are small compared with the large differences between the fuels themselves. This indicates that the choice of fuel is far more important than the choice of storage method. Large-scale systems may offer some advantages through more efficient combustion and logistics, but both small-scale and large-scale storage of forest wood chips appear to be environmentally competitive options.

Summary of conclusions and recommendations

- Combustion and fuel choice are the main drivers of climate impact, while emissions from storage are minor in the overall life cycle.
- Forest wood chips have a much lower climate impact than peat and hard coal, regardless of storage scale.
- Environmental differences between storage solutions for forest wood chips are small, though further research is needed to reduce storage losses through improved storage techniques and handling practices.

Read more:
Asplund, K. & Åkerback, N. (2026). Långtidslagring av Fasta Bränslen.

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SECURE-BIO-SUPPLY Development of long duration storage of solid biofuels to enable a sustainable energy

Contact us:
abo.fi/secure-bio-supply

Project information:

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The goal of the **SECURE-BIO-SUPPLY** project is to analyse the challenges and opportunities that changes in long-term fuel storage can create in Ostrobothnia.

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