Updated Life Cycle Assessment (LCA) for Regeneration of Waste Oil to Base Oil

MAIN FINDINGS FROM THE INSTITUT FÜR ENERGIE (IFEU) STUDY

October 2024

European Grouping of the Regenerative Industry (GEIR)
A member of the Union of the European Lubricants' Industry (UEIL)

INSTITUT FÜR ENERGIE (IFEU)

LCA studies was per-formed by ifeu on behalf of the GEIR (Fehrenbach (2005), Abdalla & Fehrenbach (2018)). This latest iteration of an LCA to evaluate different treatment options considers the current state of technologies available on the market as well as key developments in the industry and (background-) data. This study therefore represents an update to the previous studies conducted by the same author(s).

The goal of this study is to provide an updated and forward-looking view on the environmental aspects of the treatment of waste oil. The conclusions of the earlier study refer to the situation of the last decades and comprise a selected and significant number of participating companies. Information regarding the regeneration processes draws upon the conditions practiced at six leading companies operating across Europe **(Avista, Itelyum, LPC, Puraglobe, Tayras, Tec-Oil).**

This study has been reviewed by a panel of experts in accordance with ISO 14040 section 7.3. The review process was started after the finalization of a draft report of the assessment.

More info www.geir-rerefining.org

Executive Summary

1. Context
2. Study's goals & methodology
3. Key findings
4. Conclusions
5. Policy recommendations

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Context

Why it matters.

Waste oils represent the world's largest amount of liquid, non-aqueous hazardous waste.

Regeneration and treatment to fuel oil are two most common ways to treat waste oil.

Regeneration refers to the processing of waste oil to produce recycled lubricants, accounting for 62% of treated waste oil in Europe (for 98% in Italy).

Circularity.

At least 96% of the waste oil processed is transformed into products, returned to the environment as purified water or recovered by third parties.

67% Base oil

12% Bitumen

8% Gasoil

8% Depurated water

1% Recovery (third parties)

4% Disposal (third parties)

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Study's goals and methodology

Goal

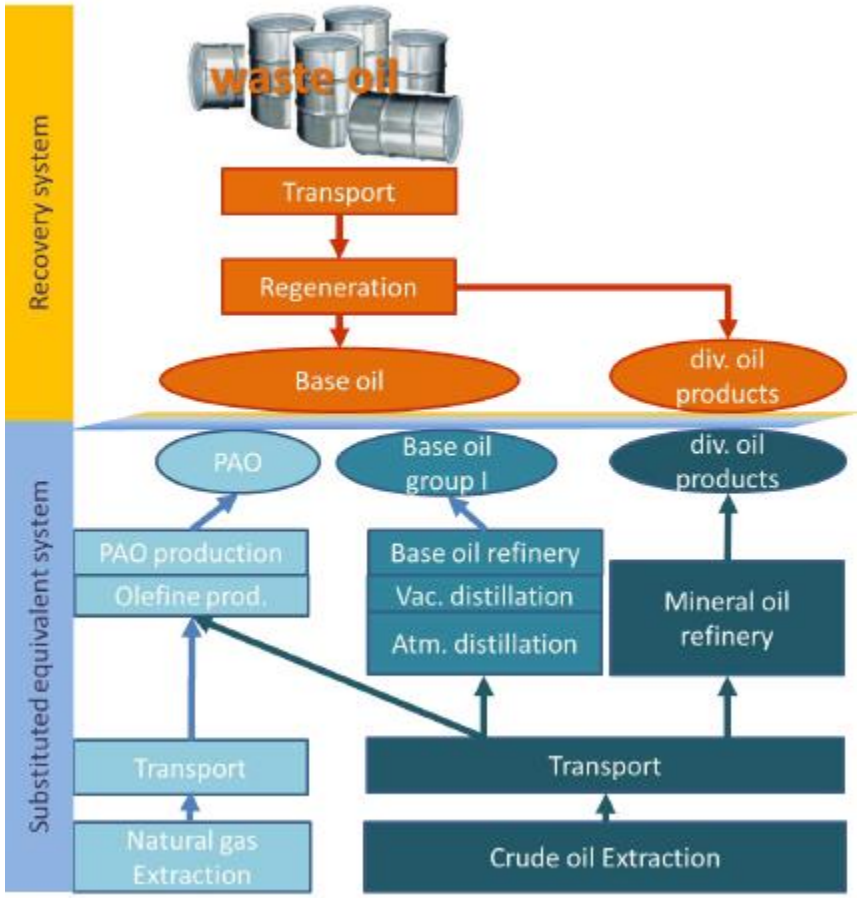
- Provide an updated and more robust view on the environmental impacts of the treatment of waste oil.

Methodology

- Comparison of regeneration with (1) the production of virgin crude oil (primary raw materials) and (2) the treatment to fuel oil.
- Update from previous studies* with the latest data and current state of technologies. (GEIR has been committed over the last two decades to measure the performance of its activities by third parties).
- Extension of the scope from 4 to 6 companies, covering about 50% of regenerated waste oil in the EU.
- Comparison between 6 different regeneration techniques.
- LCA (Life Cycle Assessment) Analysis.

*Fehrenbach (2005) and Abdalla & Ferenbach (2018)

Simplified scheme of the system boundary for regeneration and its substituted equivalence system



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Key findings

Impact reduction of regenerated waste oil compared to **virgin crude oil**.

Regeneration is significantly better for the environment than the process of virgin crude oil.

- 71% CO_2 emissions

- 90% acidification

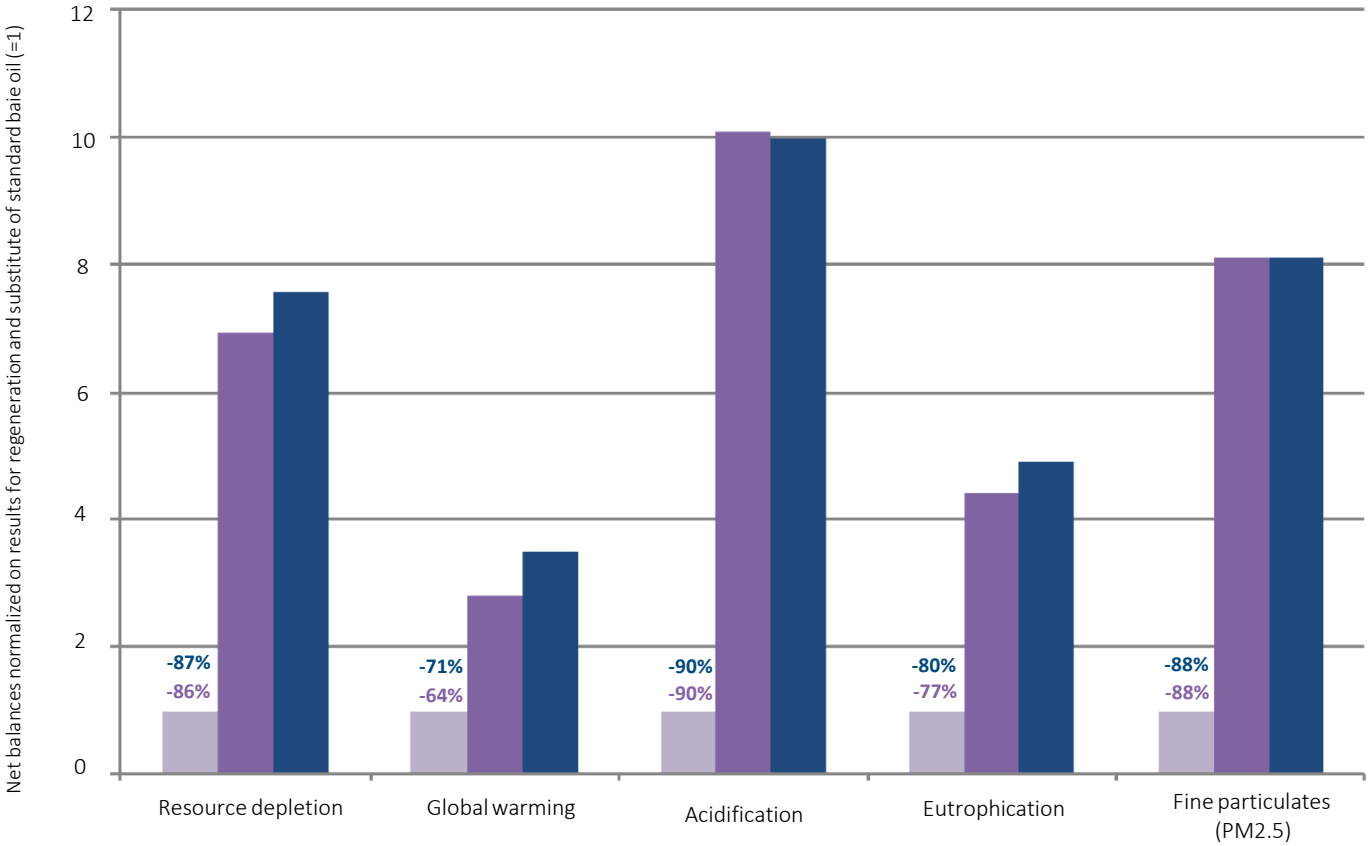
- 88% fine particles

- 80% eutrophication

- 87% resource depletion

Source
Abdalla, Fehrenback, Theis, *Life Cycle Assessment for Regeneration of Waste Oil to Base Oil*, Institut für Energie (2022)

Impact reduction of regenerated waste oil compared to **virgin crude oil**.



Reduction of impact of regenerative is indicated as a per centage, referring to savings in each impact category for regeneration of both base oil qualities against their primary product equivalents.

Source
Abdalla, Fehrenback, Theis, *Life Cycle Assessment for Regeneration of Waste Oil to Base Oil*, Institut für Energie (2022)

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Conclusions

Main conclusions

- ✓ Clear advantage observed in favour of regenerated oil when compared to virgin crude oil.
- ✓ This LCA study thus confirms and strengthens the findings from previous studies – that is, regeneration is still the best environmental option.

Source
Abdalla, Fehrenback, Theis, *Life Cycle Assessment for Regeneration of Waste Oil to Base Oil*, Institut für Energie (2022)

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Policy recommendations

Policy recommendations

- Regeneration shall be the favoured way because it has the less environmental impact across all categories.

- The EU waste hierarchy needs to be respected. The study supports the higher ranking of regeneration/recycling versus energy recovery – in line with the waste hierarchy required by EU policies.

About recycled lubricants: getting Europe to move sustainably

Lubricants are oil-based products that improve mechanical equipment's lifetime by lessening materials' wear and tear while reducing binding and friction.

GEIR member companies, representing 80% of the European waste oil regeneration industry, are active throughout Europe in supporting the collection and regeneration of waste oils back to valuable base oils for the lubricant market.

Our industry is thus entirely integrating the circular economy philosophy into its daily business. This help significantly reduces fossil fuel consumption , import dependencies and CO2 emissions.

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