GEIR
Groupement Européen de l'Industrie de la Régénération - The Re-refining Industry Section of UEIL

An Environmental Review of Waste Oils Regeneration

Why the Regeneration of Waste Oils Must Remain an EU Policy Priority

Introduction

The European Union (EU) is currently in the process of developing a Thematic Strategy on the Prevention and Recycling of Waste and within this context it is reviewing its approach to the management of waste oils. Based on a recent study by the Institut für Energie-und Umweltforschung (IFEU), in Heidelberg Germany, the following paper examines the regeneration of waste oils from an environmental perspective and demonstrates why it should remain an EU policy priority.

Further to recent investments made by the European regeneration industry, the paper provides an update on the current situation with respect to regeneration in Europe. After a short overview of the factors which have largely led to the review of the EU's waste oils strategy, the paper examines the environmental impacts of regenerating waste oils as compared to the primary production of lubricants. It then goes on to look at the environmental implications of incineration, the main alternative for treating waste oils.

The paper demonstrates that not only should regeneration remain a priority due to its potential to conserve increasingly valuable natural resources but also due to the mitigation of other key environmental impacts, including reduction in emission of fine particles, carcinogenic risk potential and acidification.

Waste Oil Regeneration
Key Facts & Figures

- The European Regeneration industry is comprised of 28 plants treating waste oil and employs between 1000-1200 in re-refining and 2000-2500 people in the collection of waste oil. Seventeen of the plants produce base oils. The industry has a total nameplate capacity of 1.300.000 tonnes/year, total lube oil production of 400.000 t/y and produces 500.000 t/y of other products including fuels, asphalt, gasoil, flux oil etc. It has an approximate total turnover of between € 200-250 million/year.
- The regeneration industry is an important part of European independent lubricant production, which represents one-third in volume of the total European market for lubricants (1.5 – 2 million tonnes of lubricants.) The contribution of regenerated oils to independent production is essential to the creation of competition with the major lubricant producers and, as such, the survival of mid-sized independent companies who are reliant on a second source of base oil.
- The European regeneration industry has made significant investments of approximately € 250 million in improving the quality of regenerated oils, increasing efficiency and reducing environmental impacts. The old acid and clay based systems are no longer in operation in Europe and regenerated oils are now favourably comparable with virgin base oil.
- In relation to six key environmental performance indicators, regeneration brings about important net relief with respect to the environmental burden of primary production of mineral oils. With respect to the same environmental performance indicators, regeneration also out performs incineration.
- Bottlenecks in the development of regeneration are closely linked to the supply of waste oils and more specifically their comparable low cost as a fuel, which is accentuated by the exemption from excise duty of waste oil used as a fuel.

Background

Under article 3(1) of Council Directive 75/469 EEC, as amended by Council Directive 87/101/EEC, Member States are required to take the necessary measures to ensure that priority is given to the processing of waste oils by regeneration. However, the failure of a number of Member States to fulfil their obligations under the Directive has in large part given rise to a review of this priority.

The limited success of the Waste Oils Directive can in part be linked to the fact that it does not set clear recycling targets. Were such targets established, as in other EU waste legislation then this would facilitate implementation into national law.

In addition, as established by European Court of Justice (ECJ) case law, most recently the ECJ's Judgement on the 15th July 2004[1], economic constraints have also played an important role in the failures in the implementation of the waste oils directive. Economic factors are commonly identified to include: the return on investment within a reasonable time period from regeneration plants, crude oil price fluctuations, and supply of waste oils for reprocessing. In practice, however, in view of the need for a constant supply of waste oils in order for regeneration to be viable, security of supply of waste oils represents the overwhelming economic bottleneck in the development of the regeneration industry in Europe.

Regeneration plants struggle to compete for the supply of waste oils due to the untreated or reprocessed combustion of waste oils and industrial sectors such as the cement and lime stone industries, which buy waste oils for energetic use. This results from the relative low cost of waste oils as a fuel, which is further distorted by the present derogation from excise duty of waste oils used as a fuel in eleven of the EU15 Member States .

Environmental Review

From an environmental perspective the regeneration of waste oils makes an extremely positive contribution. Not only does it alleviate the significant environmental burden of the primary production of lubricants and represent the largest and most advantageous recovery option, (ensuring the proper collection of waste oils as opposed to incineration which attracts the unwanted mixing of wastes) but it also has other environmental benefits, for example modern re-refined products fulfil the needs of motor vehicle OEMs, which need high quality products with low sulphur, aromatic and phosphorus content in order to respond to the Kyoto Protocol.

- **Regeneration vs. Primary Production**

As indicated above, the major environmental impact of waste oil regeneration is to relieve the burden of primary production of lubricants. As established by the IFEU study, regeneration brings about important net relief with respect to six environmental performance indicators (resource depletion, greenhouse effect, acidification, nutrification, carcinogenic risk potential and fine particle emissions). Furthermore with the evolution towards an increasing use of synthetic base fluids in lubricants, the omitted environmental burden resulting from regeneration substituting primary production will increase in the future.

[1] Case C424/02: Commission of the European Communities vs. the United Kingdom

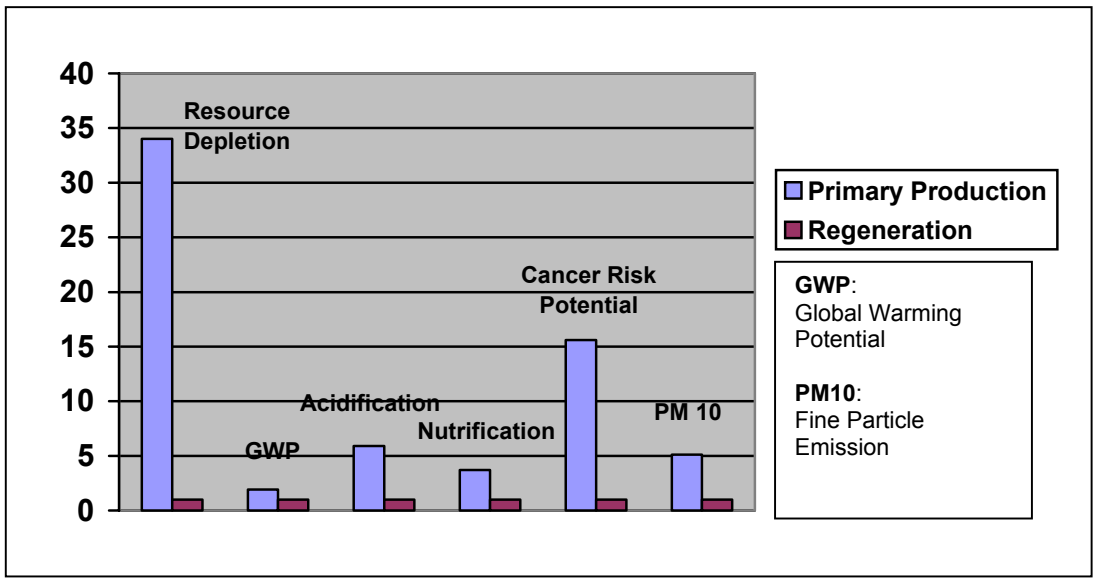


Figure 1 - Overview of the environmental impacts of regeneration versus the primary production

Figure 1 above, illustrates the ratio between the average impact of regeneration in relation to the aforementioned indicators, and the equivalent burden that would result from primary production. It demonstrates that regeneration has a considerably lower environmental burden than the processes it substitutes.

- **Regeneration vs. Incineration**

The ecological performance of regeneration is frequently compared to incineration in cement kilns, an alternative option for the recovery of waste oils. The IFEU study concludes that in relation to the six environmental performance indicators regeneration scores positively from an environmental perspective.

With respect to global warming, incineration in cement kilns scores more favourably. However, the primary reason for this is the substitution of the use of coal and pet coke, which has a relatively high carbon content and low heat value, as the primary fuel in cement kilns. The choice of fuel used is not, however, limited for technical reasons but is related to fuel prices on the world market. It is possible that in the future other fuels are used in cement works and were for example natural gas, which has relatively low specific CO_2 emissions, the substituted fuel in the incineration process then regeneration would also be the better option in relation to global warming.

The effect of the choice of fuel used is demonstrated by figure 2 below, which indicates the different environmental impacts were gas and fuel oil to be the substituted fuel. Figure 2 demonstrates the difference in ecological performance between regeneration and incineration by allocating regeneration an impact of zero and comparing it with the impacts that actually take place (scores above zero, indicating negative effect on the environment) or are omitted (scores below zero, indicating positive effect on the environment) if waste oils are incinerated.

With respect to the other recovery options where waste oils are used as a heavy or light fuel, regeneration outperforms incineration from an ecological perspective in relation to the six environmental performance indicators.

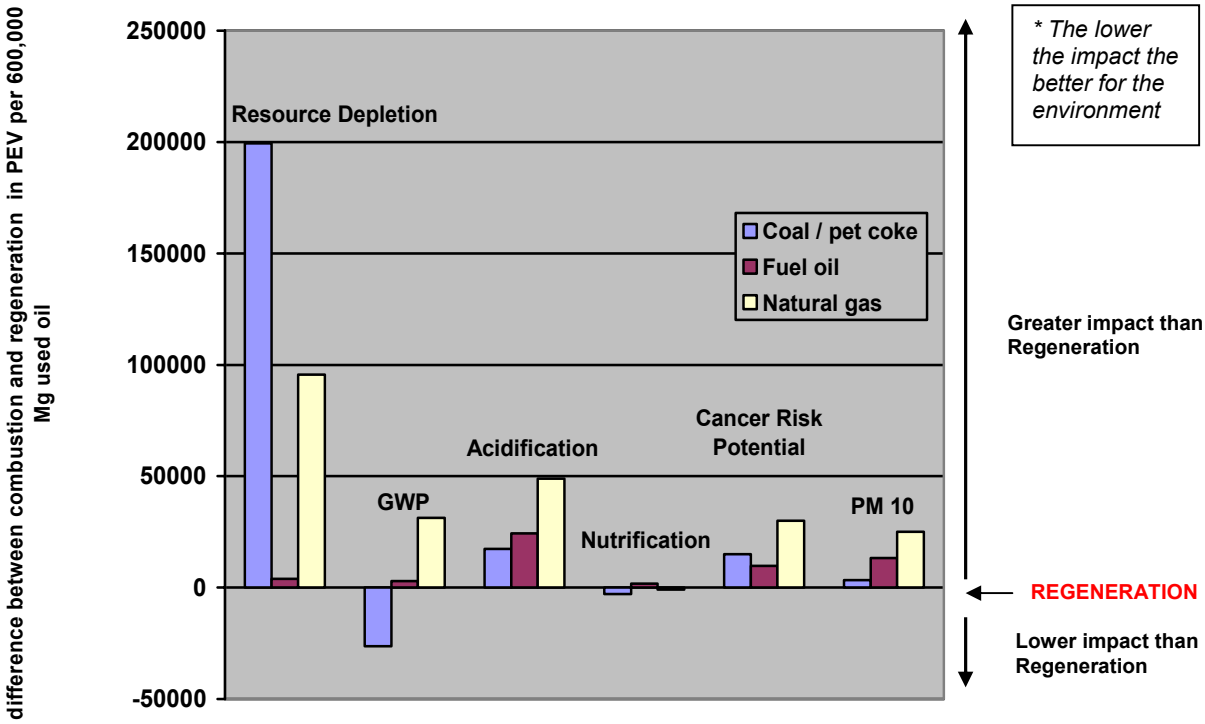


Figure 2 - Overview of the impacts of the incineration of different primary fuels versus regeneration

Conclusion

- Regeneration of waste oils gives rise to a significant reduction in environmental impacts as compared to the primary production of lubricants and as compared to incineration as an alternative recovery option. With the evolution towards an increasing use of synthetic base fluids within lubricants, environmental impacts will be increasingly omitted when waste oils are regenerated.

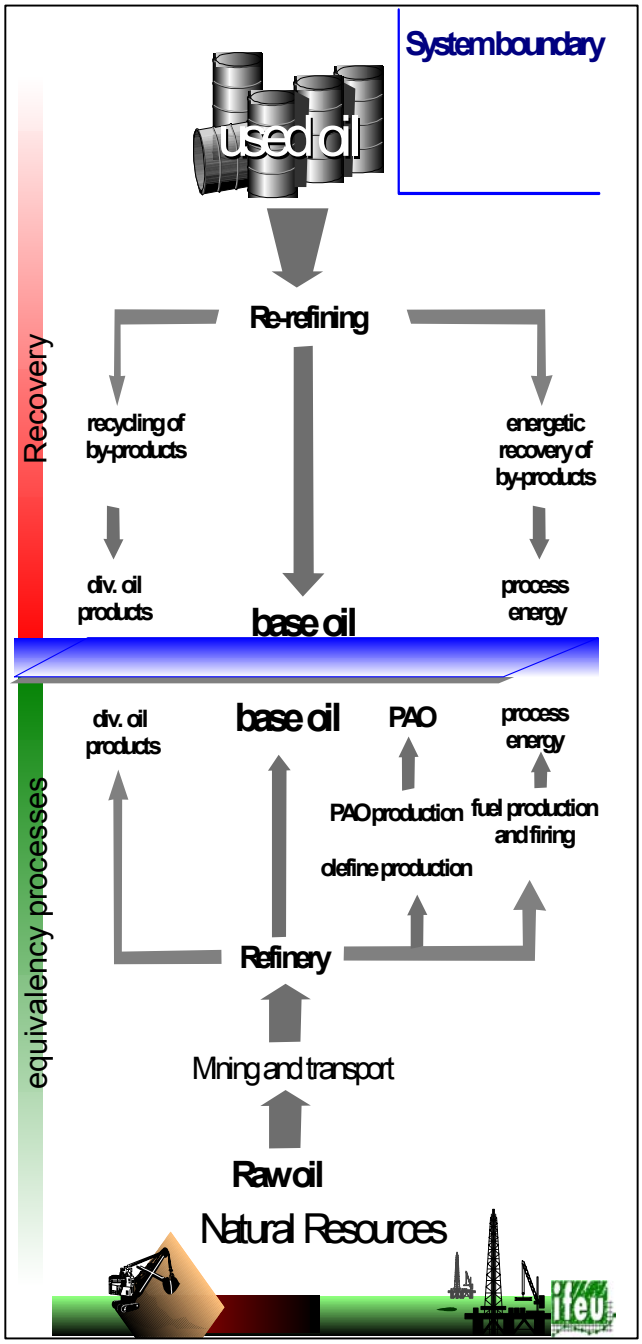
- Unfortunately a lack of clear targets in the Waste Oil directive and fierce competition for the supply of waste oils has hampered regeneration's development. This has largely been triggered by the low cost of waste oil as a fuel, which is further accentuated by the distorting exemption from excise duty of waste oil used as a fuel.

- While incineration represents an important recovery outlet today, the long term future of this recovery option is dependent on the price of other energy sources. In addition, at a time of concern in relation to security of energy supply and high fuel prices, serious consideration must be given to the depletion of natural resources and, in this respect, the value of waste oil should not simply be measured on the basis of its calorific value.

- Responding to market demand the European regeneration industry has in recent years made significant technological advances in terms of the quality of regenerated products, production efficiency and environmental impact, putting them on an equal footing with virgin base oils and providing an important economic alternative.

- However, in order to encourage investment in regeneration, realise the economic and environmental potential of this technology and secure a future for the re-refining industry in Europe, regeneration must remain an EU waste management priority.

Waste Oils Regeneration: Background Information



Glossary:

Regeneration: any process whereby base oils can be produced by refining waste oils, in particular by removing the contaminants, oxidation products and additives contained in such oils (*Art. 1 of Council Directive 87/101/EEC*)

Waste Oil: any mineral-based lubrication or industrial oil which have become unfit for the use for which they were originally intended (*Art. 1 of Council Directive 87/101/EEC*)

Base oil: a liquid product totally or partially consisting of mineral oil or synthetic fluid used as primary component for various type of marketed lubricants including engine oils, automotive transmission fluids, hydraulic fluids, gear oils, metalworking oils, medicinal white oils and greases.

Lubricant: a liquid product totally or partially consisting of mineral or synthetic oil that works to prevent metal-to-metal contact, removes contaminants, cools machine surfaces, removes wear debris and transfers power. Lubricating oils are composed of base oils and additives.

Nutrification: is a process by which a body of water acquires a high concentration of plant nutrients, especially nitrates or phosphates. Then nutrification promotes algae growth and can lead to a depletion of dissolved oxygen. Although nutrification is a natural process human activities can greatly accelerate nutrification.

Acidification: The problem of acidification is caused by acid depositions, which originate from antropogenic emissions. The reference substance for the measurement of the acidification potential is SO_2. Acid depositions e.g in the form of "acid rain" have a negative impact on water, forest, and soil.

PAO's (Polyalphaolefins): synthetic base fluids for high-performance lubricants. PAO's are impurity-free and contain only well-defined hydrocarbon molecules. They offer excellent performance over a wide range of lubricating properties. PAO's are manufactured by a two-step reaction sequence from linear α-olefins, which are derived from ethylene.