

LCA as a decision-supporting tool in production of biodiesel from Waste Edible Oils (WEO): an industrial perspective

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ABSTRACT

A project of producing biodiesel from Waste Edible Oils (WEO) is currently being carried out by VEOLIA ENVIRONNEMENT. Life Cycle Assessment (LCA) is being used to back up the project, in the aim of supporting the stakeholder discussion and decision making during the planning phase of the new technology installation. More precisely, LCA takes place as a decision-supporting tool in order to optimize the biofuel from collection and production to final use (transportation phases, transformation process of oils and use scenarios), and to produce an alternative and competitive fuel compared to fossil diesel and biodiesel from dedicated fuel crops (rapeseed or sunflower).

CONTEXT

The perspective of climate change, the high energy prices and the oil supplies have driven a strong interest in alternative transportation fuels. Biofuels have become a hot topic and a large number of environmental studies have been published on the subject. A lot of these studies follow the methodology of the LCA, probably the most appropriate method to evaluate the global impact of a biofuel on the environment, from well to wheel.

But if biofuels present advantages in terms of energy use and emissions of greenhouse gases compared to fossil fuels, one can wonder if additional pressure won't be created on agriculture, biodiversity, water and soil resources with a strong development of the fuel crops.

In order to optimize the management of waste together with the production of energy, waste edible oils (WEO) can be used for the production of biodiesel. This biodiesel could then be used in transportation services, like the buses for passengers.

R&D PROJECT: PRODUCTION OF BIODIESEL FROM WEO AND APPLIED LCA

A LCA study constitutes the environmental part of the project of production of biodiesel carried out by VEOLIA ENVIRONNEMENT and aims to optimize the life cycle of the fuel. The goal of the study is also to conduct a comparative LCA between biodiesel made from WEO and others fuels like fossil diesel and diesel from dedicated fuel crops (rapeseed or sunflower).

The life cycle of the system studied begins with the collection of WEO because the base product for biodiesel is waste oils here (see Figure 1). Oils come from edible oils used by restaurants in France.

Organization of the project

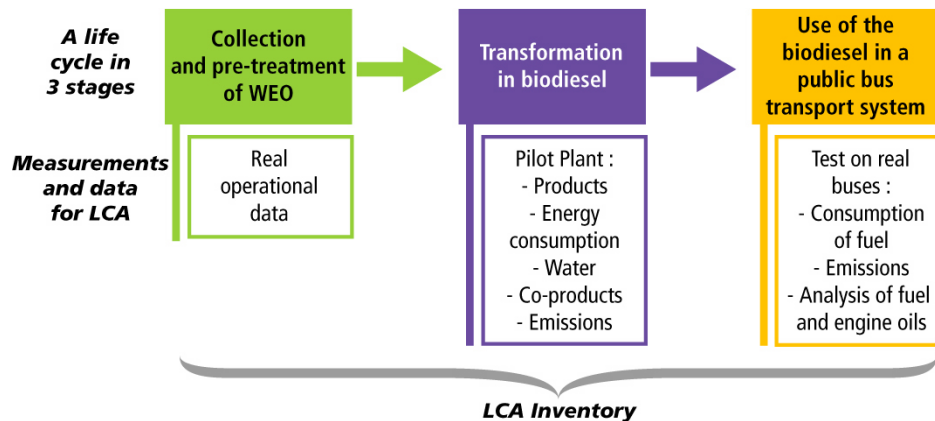


Figure 1: Organization of the project and LCA Inventory

LCA FOR BIOFUELS: CHALLENGES FOR THE LCA METHODOLOGY

A literature review has constituted the first phase of the project: 22 LCA studies on biofuels and other environmental studies (non LCA) have been analysed. They are mostly European and concern bioethanol and biodiesel from dedicated crops and WEO.

The main conclusions of these LCA are:

- Impacts on energetic resources (fossil fuel consumption) and climate change are well known and show benefits of biofuels compared to fossil fuel.
- Biodiesel from WEO seems to have less impact than diesel and biodiesel from dedicated crops (no impacts from the production step of biomass).

However, a little number of LCA studies has been carried out on biodiesel from WEO and assessment for other impacts is incomplete (impacts on ecosystem and human health in particular).

The key parameters influencing results of the studies are:

- Boundaries of the system: if the life cycle begins with the production of biomass in the case of the dedicated energy crops, it starts from the collection of WEO in case of biodiesel produced with WEO because they are considered like a waste.
- Quality of data: Are they operational data, or do they come from literature, databases? Is the system for production of biofuel a pilot plant or an industrial installation?
- Co-products and allocation procedures (see Figure 2): different methods exist and have some influence on results. The method of allocation with mass or energy content of the co-products for example is opposed with the method of substitution (system extension or avoided impacts), which seems to be more realistic.
- Considered categories of impacts: impacts on energy and global warming have to be evaluated but the studies have to analyse impacts on eutrophication, acidification, toxicity, etc., too. These impacts are in general less known but show disadvantages for biofuels compared to fossil fuels.

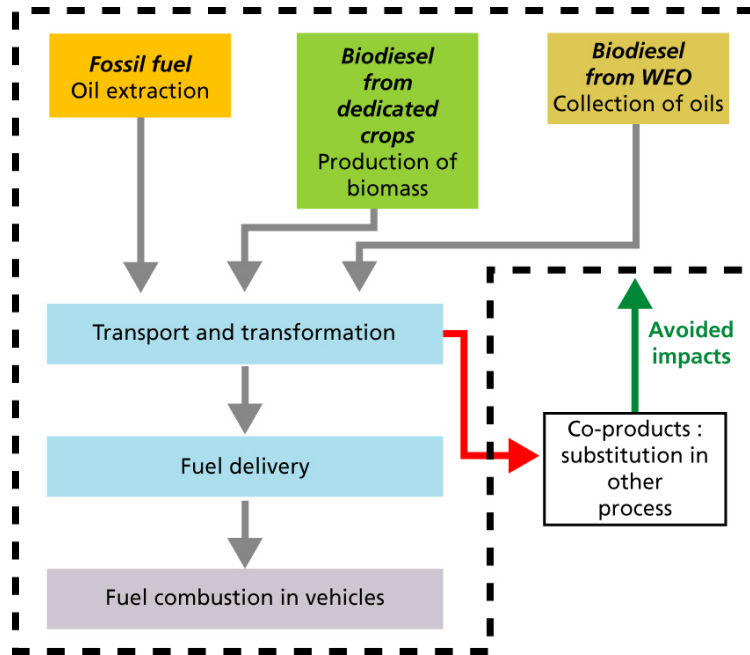


Figure 2: Allocation procedures and impacts on environmental results

CONCLUSIONS AND FUTURE DEVELOPMENTS

Some conclusions can be done for the LCA methodology to apply in the case of a study:

- give the priority for operational data for LCA;
- choose the most appropriate allocation procedure for co-products, have some knowledge on substitution processes for them;
- carry out sensitivity analysis.

The perspectives of this kind of research are the followings:

- Produce biodiesel from WEO seems to be a good answer in terms of environmental impacts compared to others fuels and it allows energy recovery of a waste.
- LCA takes place as a decision-supporting tool to optimize the biofuel from collection and production to final use.