Climate, environment and circular economy | Life cycle analysis (LCA)

LIFE CYCLE ANALYSIS (LCA)
OUR SOLUTIONS

FROM ATTRIBUTIONAL LCA TO CONSEQUENTIAL LCA

*«Our economic engineers work on methods enabling us to assess the performance of the **energy and transport sectors**. Areas tackled recently include the analysis of the environmental challenges of mobility, biofuels and biobased products, as well as energy storage solutions. The quality of our studies stems from the systemic approach employed:*

- *an **attributional LCA** refers to an environmental assessment conducted at a given point in time "t": it incorporates a description of physical flows but it does not make it possible, when used alone, to predict the impact on a sector of the creation of a new industrial process;*
- *we therefore propose combining these traditional LCAs with **economic and energy scenarios**, capable of quantifying the environmental consequences of political and industrial decisions on a **large scale**. This new approach, known as **consequential LCA**, takes into account one or more economic sectors, the energy and transport sectors, or the entire economy. It is based on **energy system scenario models**. For example, we used it to study the impact of the emergence of BtL (Biomass to Liquid) biofuel production technology in France by 2030 (in French). »*

Jérôme Sabathier, head Economics & Environmental Evaluation department, IFPEN

A STRONG LINK WITH FORECASTING TOOL

*«We have already published several studies and analyses concerning **prospective LCAs**. These include :*

- *a state of the art on prospective energy and resource analyses as well as prospective LCAs, within the framework of the SCORELCA network,*
- *a thesis on the theme Regionalization in life cycle analysis: consequential analysis of alternative sectors for transport in France, defended by Laure Patouillard in May 2018. »*

Anne Bouter and Daphné Lorne, IFPEN engineers

AVAILABLE ANALYSES AND STUDIES

Economic, energy and environmental study for French road transport technologies(E4T)

«In July 2018, we published a final report concerning the study conducted in partnership with the ADEME (French Environment and Energy Management Agency), giving a cross-functional assessment of the impact of electrification by segment in France. This document offers an analysis of the major trends concerning electrification technologies currently being introduced or developed.

Globally, this summary report highlights the fact that :

- *with the exception of the long-haul heavy truck segment, **the conventional powertrain (gasoline or diesel) will be facing stiff competition in 2030**, be it from the point of view of total cost of ownership (TCO) or its environmental impact (Greenhouse Gas [GG] and pollutant emissions). These powertrains will thus be in*

considerably less widespread use by 2030,

- ***48V Mild Hybrid*** *(MHEV 48V) architecture, pushed to maximum performance, may be a promising solution to compete with current power-split Full Hybrid (HEV) solutions,*
- ***plug-in electric vehicles*** *(PHEV) seem to be the most appropriate solutions from the point of view of the impact on GG emissions, thanks to their reduced-sized battery, perfectly suited to most vehicle use. However, in the absence of* ***help-to-buy initiatives****, their economic profitability remains a barrier to their roll-out,*
- ***electric vehicles (BEV) are effective solutions for reducing local pollution and GG emissions,*** *especially if they are widely used (buses for example) so as to absorb the impact of manufacturing the battery. Nevertheless, the economic profitability of these solutions remains limited currently (although they are supported by help-to-buy initiatives) but should improve by 2030 thanks to the probable reduction in the cost of the batteries,*
- *the current trend towards* ***bigger battery sizes in order to increase the range of electric vehicles*** *has a detrimental impact on GG emissions generated by the electric vehicle sector. Further research is likely to be conducted in this area in the future.»*

Cyprien Ternel and Anne Bouter, LCA engineers, and Fabrice Le Berr, head of the Electric Systems department, IFPEN

Report for downloading:
E4T Project - Cross-functional assessment of the impact of electrification by segment - April 2018

> ADEME-IFPEN press release of 5 July 2018

Techno-economic and Life Cycle Assessment of methane production via biogas upgrading and power-to-gas technology study

«The increasing use of renewable energies, which by their very nature are variable, means that surplus electricity produced during periods of over-production has to be converted into a form that can be stored. Converting electricity into gas is one way to solve this problem, because the method enables the surplus electricity to be stored for later use. The technology behind the solution is ***power-to-gas****, which consists in:*

- *using electricity to convert water into hydrogen via* ***electrolysis****,*
- *synthesizing methane from carbon dioxide and hydrogen.*

We conducted a ***technical and economic and LCA analysis*** *of methane production via a combination of anaerobic digestion and power-to-gas technology applied to the conversion of treatment plant sludge.*

Several conclusions emerge from our study :

- *the more expensive electricity is, the longer the operation time of the methanization process must be in order to be competitive with the injection of methane from biogas,*
- *reducing the electricity consumption of the electrolysis step reduces production costs,*
- *from an environmental point of view, continuous power-to-gas generates more greenhouse gases than direct injection, but intermittent operations with renewable electricity can reduce emissions considerably,*
- *the impact of continuous power-to-gas is greater than biogas conversion, but lower than fossil energy,*
- *the future development of low electricity consumption associated with the electrolysis process and the integration of renewable credits from CO_2 conversion could increase the competitiveness of this technology.»*

Anne Bouter, LCA engineer, IFPEN

>> **All our environmental studies**

CONTACT

Jérôme Sabathier
Head Economics & Environmental Evaluation Department
jerome.sabathier@ifpen.fr

Life cycle analysis: Our solutions

Link to the web page :