WASTE2ROAD

Biofuels from WASTE TO ROAD transport

LC-SC3-RES-21-2018 (818120)

Deliverable Report

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Description of the deliverable content and purpose

The Workshop on Life Cycle Costing (LCC) is a public workshop on the topic of LCC, organized together with partners. Due to the COVID-19 restrictions that were in place when the workshop was organized, it was held online on 22 September 2021 from 09:00 to 12:00 noon. This had a benefit in that expert speakers could join more easily. It is linked to task 7.4. on External Communication.

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1 Introduction

The workshop on Life Cycle Costing was organized by PDC and SINTEF. Since it was online, it followed the structure of a webinar. The webinar was advertised using a flyer designed by SINTEF with content from PDC, shown in Figures 1 to 3. This was available on the project website, along with the link where participants could register. The flyer was shared internally within the companies of the WASTE2ROAD partners and shared on the WASTE2ROAD LinkedIn Page together with the registration link. The webinar was free to join for anyone interested.

The webinar stared with an introduction of WASTE2ROAD and WP5 (the work package on value chain integration and optimization, life cycle costing, techno-economic assessment). Thereafter, four expert speakers shared their knowledge on Environmental Life Cycle Analysis, Techno-economic analysis and Life Cycle Costing (Figure 2), respectively. The workshop ended with a panel discussion on LCC. This gave valuable insights into the challenges faced when doing a LCC.

Figure 1: Flyer page 1

Life cycle costing

In the movie "Back to the future" by Steven Spielberg and Robert Zemeckis, the futuristic DeLorean car was fuelled by a banana skin and other waste/refuse. This futuristic vision can be a reality through the WASTE2ROAD project – where a new generation of biofuels are developed from a carefully selected range of low cost and abundant biogenic residues and waste fractions. These waste fractions are processed by two key technologies, fast pyrolysis and hydrothermal liquefaction, followed by upgrading and co-processing steps.

The WASTE2ROAD project investigates and is busy demonstrating (at TRL 5) the whole value chain from i) biogenic residues and wastes to high quality biofuels, having started from the waste feedstocks, ii) the optimization and upgrading of primary conversion and secondary refining processes, and iii) the analysis of various business cases for a successful exploitation in the EU markets. This is done using Life Cycle Costing (LCC), where the technical, economic and environmental aspects are taken into consideration.

For more information:

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Life cycle costing Webinar, 22nd September 2021

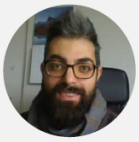
SPEAKERS

During this workshop industry experts will share their knowledge and experience on Life cycle costing and LCC elements of techno-economic assessment and life cycle assessment for value chains in the biobased industry. The workshop will end with a panel discussion on life cycle costing.

Matthias Stratmann
Head of sustainability
Nova- Institut

Marcos Latorre
Innovation Project Manager
PERSEO Biotechnology SL

Hank Vleeming
Chief Technology Officer
Process Design Center (PDC)



Fabio de Menna
Researcher
University of Bologna

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Figure 2: Flyer page 2 - Speakers

Life cycle costing Webinar, 22nd September 2021

PROGRAM

09:00 Introductions and overview of Waste2Road

09:00 Welcome and introductions, *Mieke Nieder-Heitmann, Chair and WP5 leader, Process Design Center*

09:05 Overview of Waste2Road, *Jana Chladek, Waste2Road Project Manager, SINTEF*

09:20 Workshop Presentations

09:20 Bio-based value chains in LCA, *Matthias Stratmann, Head of sustainability, Nova- Institut*

09:45 Techno-economic analysis – essential guide in sustainable process development, *Hank Vleeming, Chief Technology Officer, Process Design Center*

10:10 WASTE2BIO project: Valorization of urban wastes to new generation of bioethanol, *Marcos Latorre, Innovation Project Manager, Perseo Technology*

10:35 *Coffee break*

10:55 Integrating Life Cycle Costing and LCA: a focus on food waste prevention and valorization, *Fabio de Menna, Researcher, University of Bologna*

11:20 Panel discussion

11:20 Life Cycle Costing, *Raf Roelant, Process Design Center*

11:55 Concluding remarks

12:00 End of Workshop

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Figure 3: Flyer page 3 - Program

2 Interesting points of discussion

The presentations from the speakers are available on the WASTE2ROAD project website. Some interesting points of discussion are summarized below.

It was mentioned that is would be difficult to include some environmental parameters into monetary terms as required when doing a LCC. This is because there are many impacts to consider (i.e. 16 different impact categories), where some are more robust than others, and some are more applicable than others. This naturally includes some subjectivity. It was also discussed whether some social and environmental aspects *should* even be included in an LCC, since it enters the philosophical and ethical realm when engineers aim to start expressing impact on human life in monetary terms, such as the DALY (Disability-adjusted life year), mentioned by Hank Vleeming. One could ask whether it might be cheaper to pay insurance claims, than to install the process equipment needed to clean waste process streams. An example of the Ford Tinto case study was given were analysts calculated that it would be cheaper to pay out insurance claims than to fix a fatal design flaw. In retrospect, the financial impact was significantly more than anticipated.

Environmental impacts will have a cost, but it is difficult to calculate. Such as the introduction of alien species into an environment (e.g. the eucalyptus tree) or the cost impact caused by the extinction of species. It is also difficult to know or estimate the cost beforehand. An example given by Matthias Stratmann is the cost impact (for the overall reconstruction) of the recent floods experienced in Germany and southern parts of the Netherlands (i.e. more than 6 billion euros).

Social impacts also differ depending on the context, and it is mentioned that there might be no causal link between a process and social impacts, and if there is, it may not be possible to measure. In the case of social sustainability, minimization of the costs (which is important from a LCC perspective for the economic feasibility) might not be favorable for social impacts. For example, job creation as measured through labor costs should be low for a good OPEX, but should be maximized for more social sustainability. Even within job creation as one social impact category, aspects such as child labor, human and labor rights, labor quality and quantity, and gender equality could be considered.

Overall, it was clear that a major challenge with sustainability (economics, social, & environmental) assessments is the different **methodologies** available and the different ways in which to implement these methodologies. The guidelines on these are also not always clear and the assumptions made between different studies/assessment could differ. Even for GHG emissions, the politically/policy motivated method of RED II (Renewable Energy Directive to 2030) could be followed, or a more objective/conventional LCA using the ISO 14040 and 14044 guidelines.

3 Learnings for WASTE2ROAD's benefit

Advice given for the WASTE2ROAD LCC is that cost distribution could be given along the value chain. Overall, it was clear that a new methodology should be developed especially for WASTE2ROAD (as is already being done) and that carbon tax is a good parameter to take into account for the GHG emissions (i.e. Climate change impact e-LCA impact category). No other e-LCA impact category was suggested that could be monetized and included. The same applies for social LCA impact categories.

Information on the EU projects REFRESH and WASTE2BIO was shared. From these, a "FORKLIFT" tool (https://eu-refresh.org/forklift.html) was developed by the REFRESH project, which could be useful as an example to WASTE2ROAD for the LCC toolbox to be developed.

4 Participant statistics

- A total of 46 people registered for the webinar, and the participants varied between 28 to 37 during the webinar.
- Of the 46, approximately 35 % are female. Of the speakers, 3 of the 8 were female (37.5 %).
- The roles of the participants were mainly R&D and Bio-resources with some in primary conversion technologies, upgrading, energy, LCA and techno-economics.
- Participants were from Austria, Belgium, Brazil, Denmark, France, Italy, Netherlands, Norway, and Spain.

From those who registered, 1 participant was from: Avantium, Avinor, CEA Liten, EC JRC, Embrapa, EU Commission, Genagricola SPA, Ghent University, ICP, IMU zt GesmbH, Novozymes, OMV, University of Tuscia, and University of South – Eastern Norway. There were 2 participants from CENER, 2 from CNRS, 11 from Process Design Center and 15 from SINTEF.