From individual LCA towards a more holistic approach

Life cycle assessment methods to support India’s efforts to decarbonise transport

(International Transport Forum Workshop)

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To conduct research to provide impartial scientific information, in order to:

- scientific understanding
- Assist the development of technically feasible and cost effective policies and legislation
- Allow informed decision making and cost effective legislative compliance by Association members.
Agenda

01  Life-Cycle Analysis - Individual fuel / powertrain combinations (JEC WTW v5)

02  Expanding LCA (individual combinations) towards holistic constrained scenarios

As part of the DT initiative, the Decarbonising Transport in Emerging Economies (DTEE) project aims to help national governments and other stakeholders to identify measures and establish pathways to reduce transport GHG emissions and meet their climate goals and NDCs, while also fostering their economic and social development. The project is implemented by the ITF in collaboration with The Wuppertal Institute (WI). It focuses on four ITF member countries: Argentina, Morocco, India and Azerbaijan. It is centred on the development of modelling tools that allow to assess GHG emissions in transport and help to elaborate policy strategies to mitigate them.

The activities of the DTEE project are developed in close co-ordination with each of the countries’ national government agencies, also involving local policymakers and other stakeholders from industry, academia and non-governmental/civil society organisations. NITI Aayog is the nodal agency liaising with the ITF and WI in the case of India.

Based on exchanges that took place since the project kick-off meeting in June 2020, the DTEE India project will focus on the development of a modelling tool capable to assess GHG emissions in the transport sector, taking a life cycle perspective. DTEE India activities will also include support for the build-up of local capacity, with the aim to improve future transport research and policy development beyond the project duration.
The Commission strategy for 2050

1.5C Tech scenario of “Clean Planet for All” / 2030 Impact Assessment

Towards energy efficiency and a more diversified low GHG transport sector

“NET 0” in 2050

* »Clean Planet for All - A strategic vision«: European Commission, November 2018

* 2030 Impact Assessment, Nov 2020

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Life-Cycle Analysis - Individual fuel / powertrain combinations

JEC Well-To-Wheels Analysis v5
The JEC use a consequential approach as it aims to guide judgements on the potential benefits of substituting conventional fuels/vehicles by alternatives and for future fuels, to understand where the additional energy resource would come from (if demand for a new fuel were to increase). We invite JEC readers and LCA practitioner not to directly apply JEC results without taking into consideration the methodological approach chosen.
Not just one single solution

JEC Well-To-Wheels (WTW) v5

> 250 Resource to fuel pathways

> > 1500 possible combinations!

> 60 powertrains combinations

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JEC WTT v5 - Role of fuels (not a single solution)

- **Scope**

  - **JEC WTT v5 IN NUMBERS**
    - Total WTT pathways: 252
    - New pathways: 78
    - Synthetic fuel pathways investigated: 54
    - Resource categories: 7

  - **From Resource to fuel: production routes (Pathways)**
    - Crude oil
    - Natural gas
    - Coal
    - Electricity production
    - Biomass / Waste
      - Crop based
      - Waste
      - Wood
    - Hydrogen
    - Power-to-fuels (e-fuels)

Role of CCS

For each WTT pathway indication of Technology & Commercial readiness levels (TRL & CRL)
JEC WTT v5 - Role of fuels (not a single solution)

• Scope

**JEC WTT v5 in Numbers**

- Total WTT pathways: 252
- New pathways: 78
- Synthetic fuel pathways investigated: 54
- Resource categories: 7
- Final fuels ("families"): 10

**Final fuels ("families") (Pathways)**

- Gasoline/diesel fuels (& ED95 & AdBlue components)
- Synthetic Fischer-Tropsch diesel (GLT, BTL, CTL, PtD)
- Pyrolysis / HTL diesel/gasoline
- CNG/LNG, CBM/LBM, SNG/LNG, LPG
- Ethanol
- FAME, FAEE and HVO
- Methanol
- Ethers (MTBE, ETBE/ DME, OME)
- Electricity
- Hydrogen

For each WTT pathway indication of Technology & Commercial readiness levels (TRL & CRL) (NEW!)
Not just one single solution

Multiple solutions: feedstock / technology / powertrains towards low GHG future

Alternative fuels and powertrain combinations offer similar GHG reduction as BEVs depending on the electricity source used. Moving to low carbon fuels (biofuels and e-fuels) offer compelling options / multiple routes to achieve low GHG intensity WTW.
Expanding LCA (individual combinations) towards holistic constrained scenarios

Concawe reports (about-to-be-published)
Expanding the scope of LCA

Real world constraints

- LCA of individual fuel/powertrain options is the first step to help identify future measures and find pathways regarding how to reduce emissions in transport.
- However, a more holistic view should be taken integrating these results in wider analysis considering actual constrains.

Selected example of studies about-to-be-published in Concawe:

- New sales
  - E.g. Battery constrained scenarios

- Low Carbon Fuels
  - E.g. Technology deployment / availability
2.1. Battery constrained scenario (2030)

What’s the optimum composition of new sales?

- A new Concawe study explores the optimal passenger cars sales mix minimizing Well-to-Wheel (WtW) GHG emissions as a function of battery production capacity available in the 2030 timeframe.

- In most cases, HEV and/or PHEV play a central role for decarbonizing individual transport with the PHEV utilisation factor, Carbon intensity of the electricity grid and volume of low carbon intensity fuels available as key parameters.
2.2. LCF - Time to deployment / scale-up

Demo and Scale-up is needed for most of the Low Carbon Fuel routes!

<table>
<thead>
<tr>
<th>WHAT?</th>
<th>WHEN?</th>
<th>HOW MUCH?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio (1G)</td>
<td>2020: - 14 Mtoe,</td>
<td>2030 vs 2020: 14 Mtoe,</td>
</tr>
<tr>
<td></td>
<td>Increasing utilization rate</td>
<td>No additional plants</td>
</tr>
<tr>
<td>HVO (VegOil - Residue)</td>
<td>2021: - 5 Mtoe,</td>
<td>Total: - 10 Mtoe,</td>
</tr>
<tr>
<td></td>
<td>2022-2029: - 0 Mtoe,</td>
<td>Total: 10 New plants,</td>
</tr>
<tr>
<td></td>
<td>0.5 Mtoe/y per unit (-2 plant per year)</td>
<td>Total: -2.7 B€</td>
</tr>
<tr>
<td>Lignocellulose residues + Waste</td>
<td>2022-2029: - 0 Mtoe,</td>
<td>Total: - 4 Mtoe,</td>
</tr>
<tr>
<td></td>
<td>0.15 Mtoe/y per unit (-5 plants per year (2026-2030))</td>
<td>Total: -25 B€</td>
</tr>
<tr>
<td>EFuels</td>
<td>2022-2029: - 0 Mtoe,</td>
<td>Total: - 1 Mtoe,</td>
</tr>
<tr>
<td></td>
<td>0.2 Mtoe/y/unit (-2 plants/ year)</td>
<td>Total: -5 New plants,</td>
</tr>
<tr>
<td></td>
<td>2030 vs 2020: - 3.3 B€</td>
<td>Total: -3.3 B€</td>
</tr>
<tr>
<td>Refining + CCS -&gt; Green H₂</td>
<td>2022-2029: - 0 Mtoe,</td>
<td>Total: 13 New plants,</td>
</tr>
<tr>
<td></td>
<td>2030 vs 2020: - 6.5 B€</td>
<td>Total: -6.5 B€</td>
</tr>
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Accelerating the pace towards 1st-of-a-kind in parallel to supply chain + market creation!
2.2. LCF - Time to deployment / scale-up

Techno-economic analysis in numbers towards 2050 – Concawe scenario 1

<table>
<thead>
<tr>
<th>Cumulative (Transport)</th>
<th>2020-2030</th>
<th>2020-2035</th>
<th>2030-2040</th>
<th>2020-2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total volume LCF (Mtoe)*</td>
<td>~30</td>
<td>~40</td>
<td>~90</td>
<td>~150</td>
</tr>
<tr>
<td>Total investment, B€*</td>
<td>~30-40</td>
<td>~75-110</td>
<td>~240-350</td>
<td>~420-630</td>
</tr>
<tr>
<td>Total new plants (bio+efuels)</td>
<td>~40</td>
<td>~130</td>
<td>~420</td>
<td>~760</td>
</tr>
</tbody>
</table>

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Key takeaways to reduce GHG emissions in transport:

- Multiple combinations
- Not a single silver bullet
- LCA is a key tool to be integrated in a more holistic picture when defining best strategies forward to minimise GHG emissions