From individual LCA towards a more holistic approach

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

(International Transport Forum Workshop)

Virtual – 13 April 2021

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Concawe – Environmental Science for European Refining

Concawe Membership

Concawe represents 41 Member Companies ≈ 100% of EU Refining

Open to companies owning refining capacity in the EU

Concawe mission

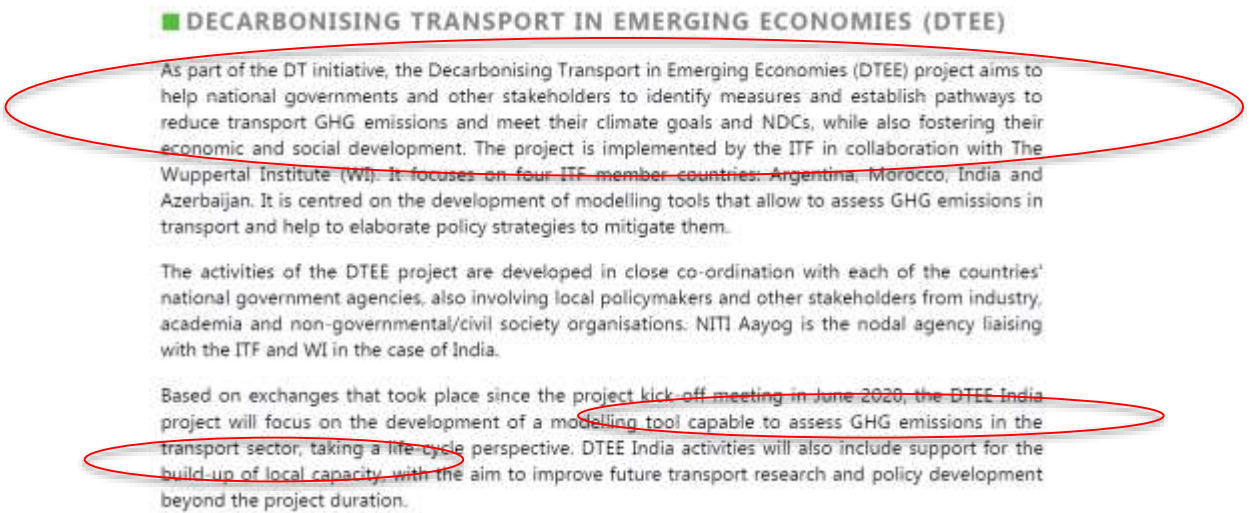
To conduct research to provide **impartial scientific information**, in order to:

- 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



DECARBONISING TRANSPORT IN EMERGING ECONOMIES (DTEE)

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.

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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

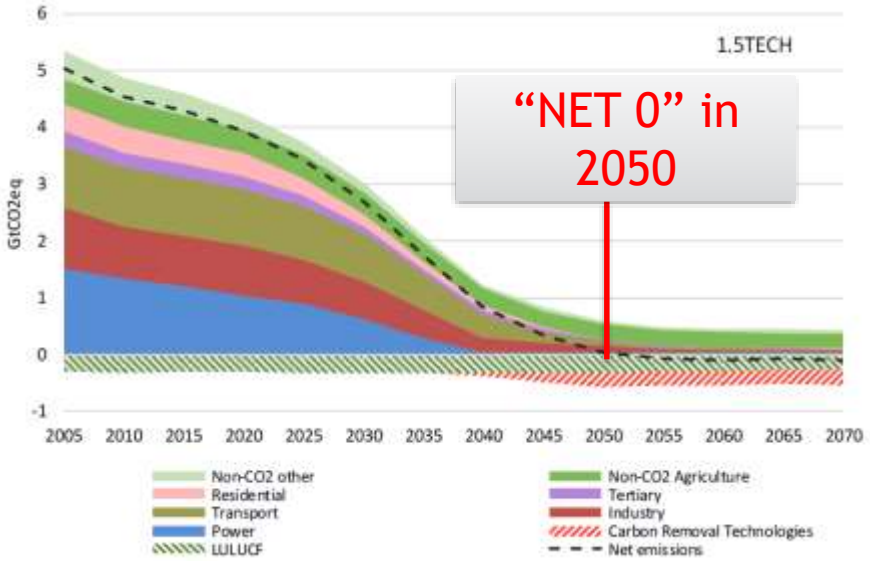
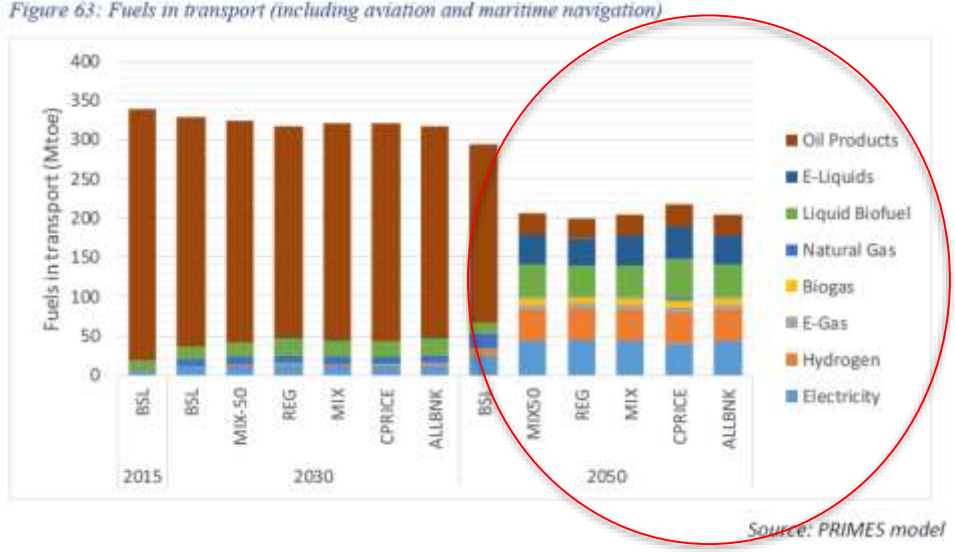


Figure 63: Fuels in transport (including aviation and maritime navigation)



Source: PRIMES model

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

* 2030 Impact Assessment, Nov 2020

01

Life-Cycle Analysis – Individual fuel / powertrain combinations

JEC Well-To-Wheels Analysis v5

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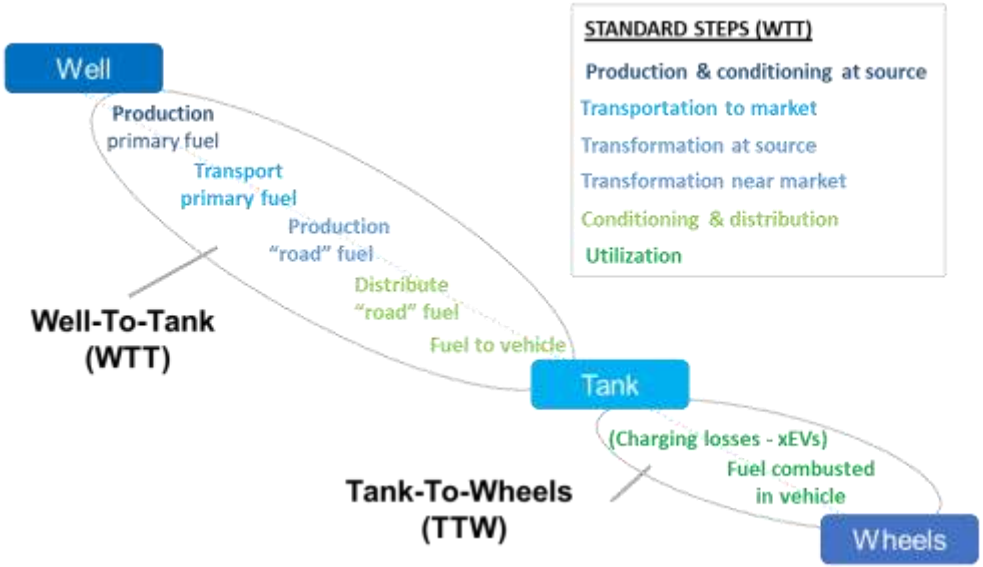
JEC WTW

Scope - Goals

Feedstock/Resource → Conversion Technology → Final fuel → Use in powertrain



Establish

in a **transparent** and **objective** manner a consensual **Well-to-Wheels assessment** of:

- **energy use**

and

- **GHG emissions**

for a **wide range** of **automotive fuels** and **powertrains**, relevant to Europe in 2025+

Analysis updated as technologies evolve
Common methodology and data-set

The JEC use a **consequential approach** as it aims to guide judgements on the potential benefits of substituting conventional fuels/vehicles by alternatives and/or 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

WTT
fuel
gCO2 / MJ

> 250 Resource to fuel pathways

TTW
Powertrain efficiency
MJ / km

> 1500 possible combinations!

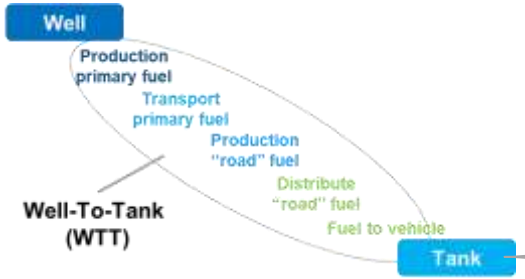
FLEET

>60 powertrains combinations

Penetration
of alternative powertrains

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

- Scope



Major updated versus JEC WTT v4

For each WTT pathway indication of Technology & Commercial readiness levels **(TRL & CRL)**

JEC WTT v5 IN NUMBERS

- 252 • **Total WTT pathways**
- 78 • **New pathways**
- 54 • **Synthetic fuel** pathways investigated
- 7 • **Resource categories**

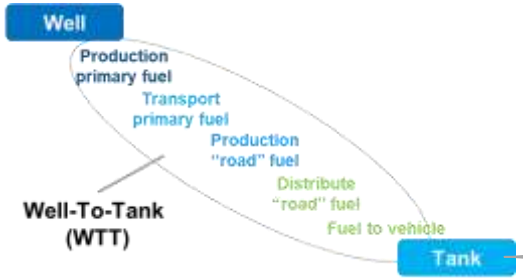
From Resource to fuel: production routes (*Pathways*)

- Crude oil
- Natural gas
- Coal
- Electricity production
- Biomass / Waste
  - ✓ Crop based
  - ✓ Waste
  - ✓ Wood
- Hydrogen
- Power-to-fuels (e-fuels)

Role of CCS

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

- Scope



Major updated versus JEC WTT v4

For each WTT pathway indication of Technology & Commercial readiness levels **(TRL & CRL)** (NEW!)

JEC WTT v5 IN NUMBERS

- 252 • **Total WTT pathways**
- 78 • **New pathways**
- 54 • **Synthetic fuel** pathways investigated
- 7 • **Resource categories**
- 10 • **Final fuels** (“families”)

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

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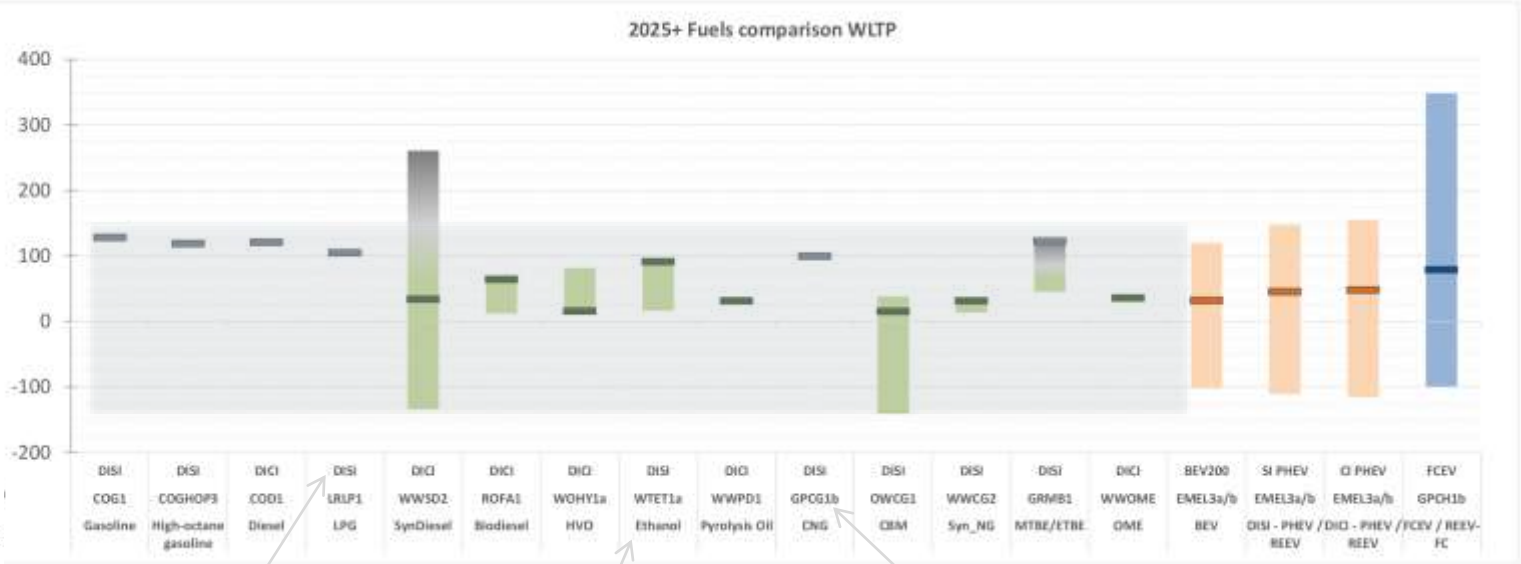
Not just one single solution

Multiple solutions: feedstock / technology / powertrains towards low GHG



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

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02

Expanding LCA (individual combinations) towards holistic constrained scenarios

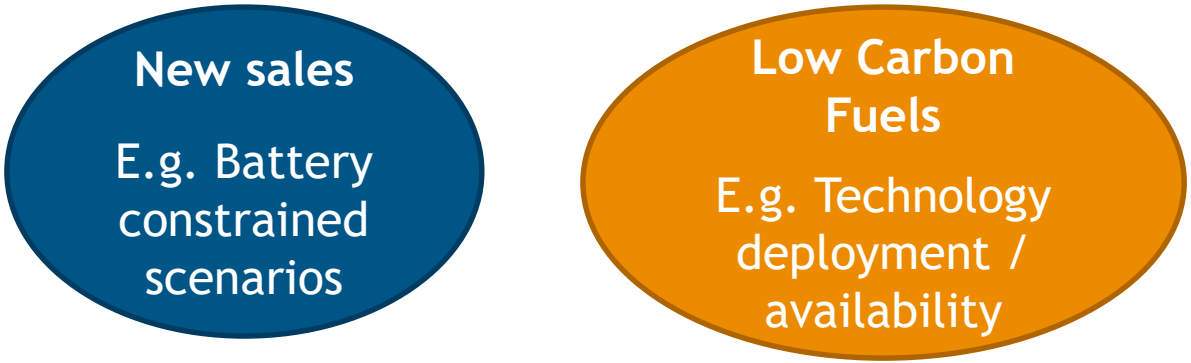
Concawe reports (about-to-be-published)

Expanding the scope of LCA

Real world constrains

- 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.

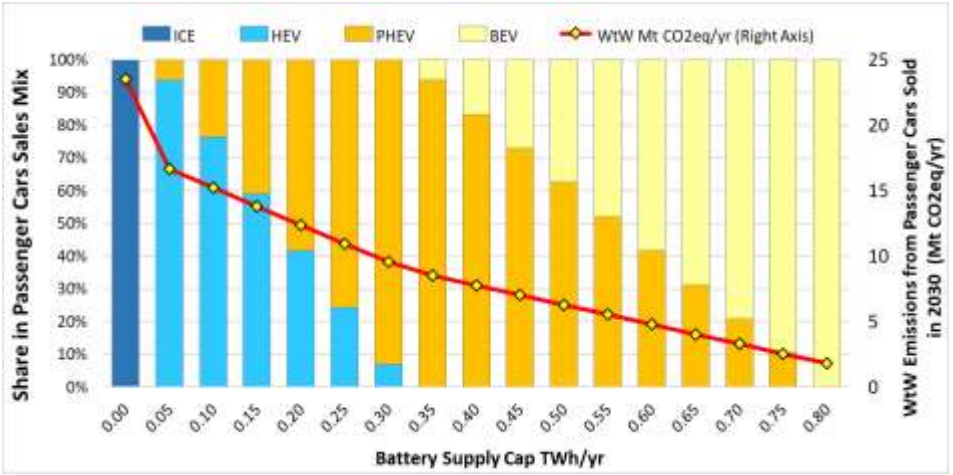
Selected example of studies about-to-be-published in Concawe:



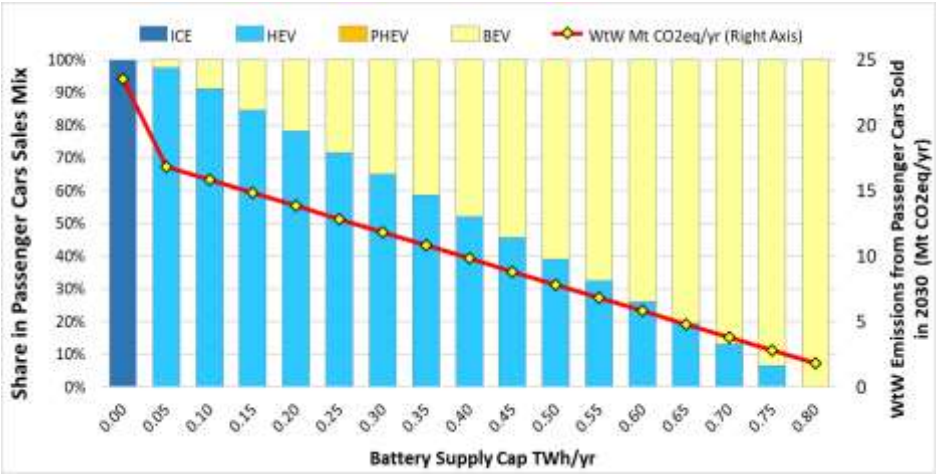
2.1. Battery constrained scenario (2030)

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.**



(Utility factor PHEVs > 45%)



(Utility factor PHEVs < 45%)

2.2. LCF - Time to deployment / scale-up

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

Accelerating
the pace
towards
1st-of-a-kind
in parallel to
supply chain
+ market creation!

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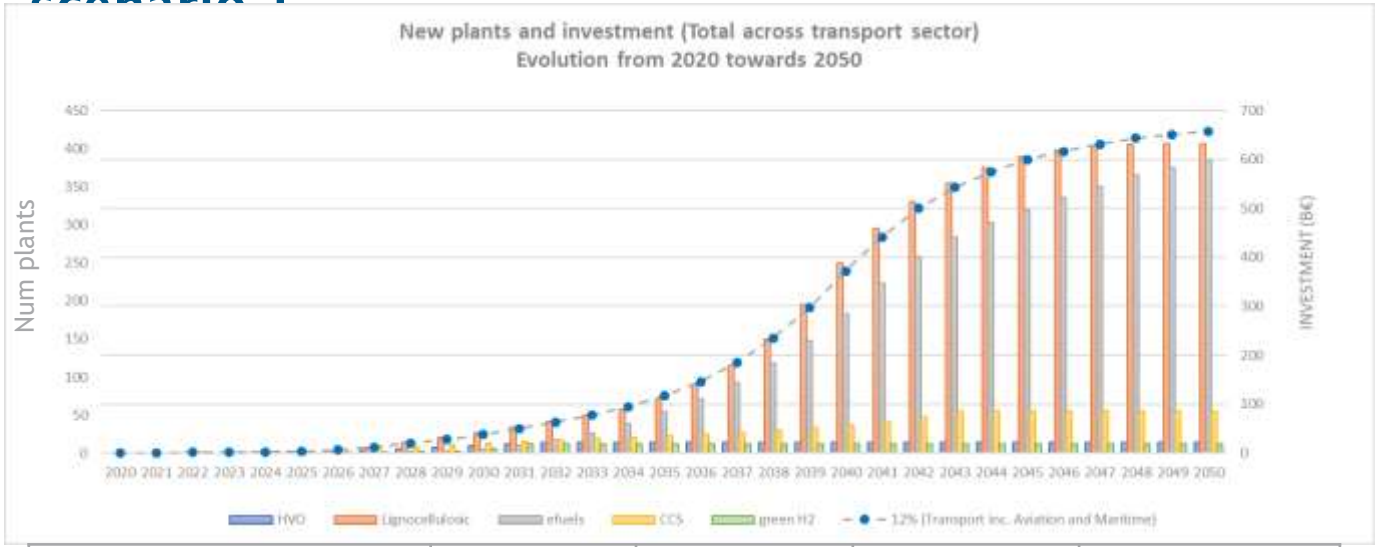
2.2. LCF - Time to deployment / scale-up

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



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

~150 Mtoe/y

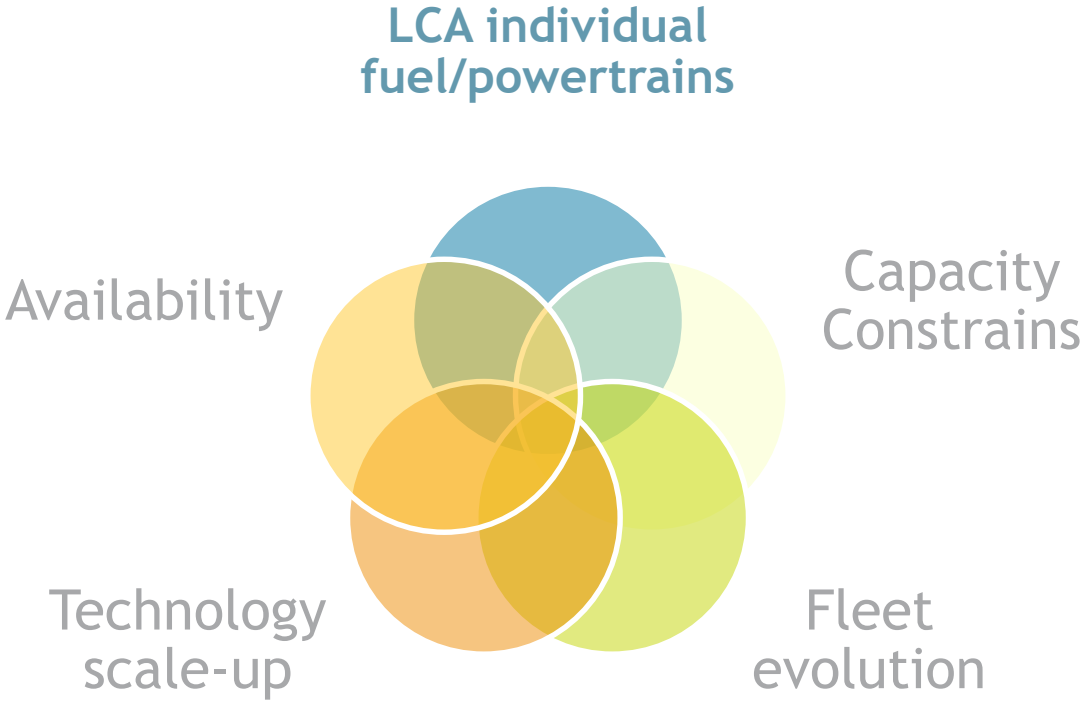
t/y Low Carbon Liquid fuels (MA)

~400-650 B€

Investment needed

~100 Mt CO2/y

GHG savings in transport by 2035 <> 50 M BEVs



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**