

A COMPARATIVE ASSESSMENT OF CURRENT AND FUTURE FUELS FOR THE TRANSPORT SECTOR

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INTRODUCTION

To facilitate the transition to a sustainable and less fossil dependent transport sector in the short to medium term, the current fuel mix needs to be enriched with renewable fuel alternatives. Advanced biomass based fuels offer improved engine performance characteristics, high blending potential and sustainable production pathways. This work provides a preliminary assessment and ranking of such novel fuels and compares their performance to currently available biofuel options. Promising fuels for the transport sector are identified.

METHOD AND MATERIALS

Four advanced biomass based fuels and three existing biofuel options were considered in the assessment. The focus is on fuels that can be used in compression ignition engines, fulfilling the diesel EN590 standard. Fuels were assessed as neat fuels or blends focusing on their properties and performance.

Table 1. List of fuels considered in the assessment

Fuel group	Fuel	Feedstock	Assessed as
Alcohols	2-Ethyl hexanol (2-EH)	Forest residues	blend with 50% HVO and 7% RME
	n-Butanol	Forest residues	blend with 40% HVO and fossil 40% diesel
Ethers	Poly-oxymethylene dimethyl ether (OME ₁)	Forest residues	blend with 65% fossil diesel
	Poly-oxymethylene dimethyl ether (OME ₃₋₅)	Forest residues	neat fuel
	Dimethyl-ether (DME)	Forest residues	neat fuel
Vegetable oils	Hydrotreated vegetable oil (HVO)	Tall oil	neat fuel
	Rapeseed methyl-ester (RME)	Rapeseed	neat fuel

The assessment is based on technical, environmental and economic criteria (Figure 1). The Analytic Hierarchy Process (AHP) is used to compare and rank the selected fuels.

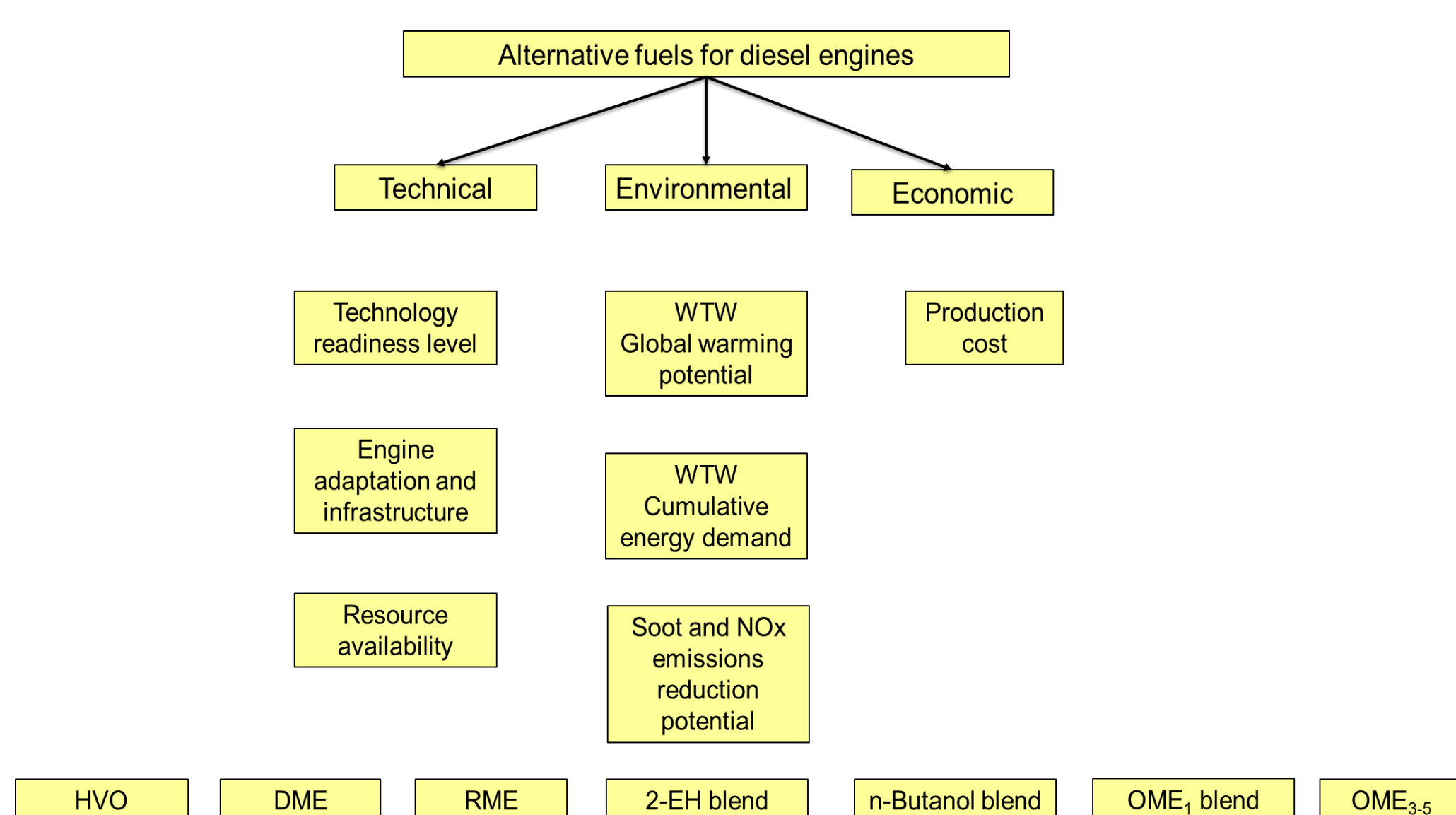


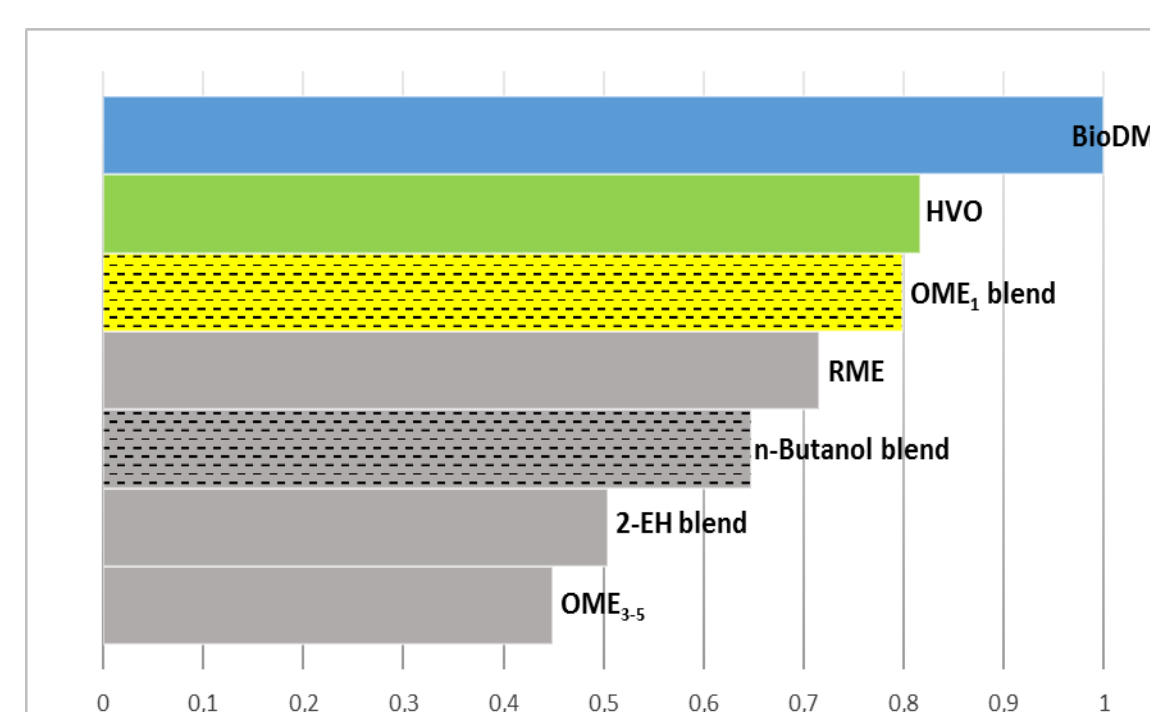
Figure 1. The different criteria, sub-criteria and fuels considered in this assessment which aims to identify the preferable transport fuels alternatives for diesel engines

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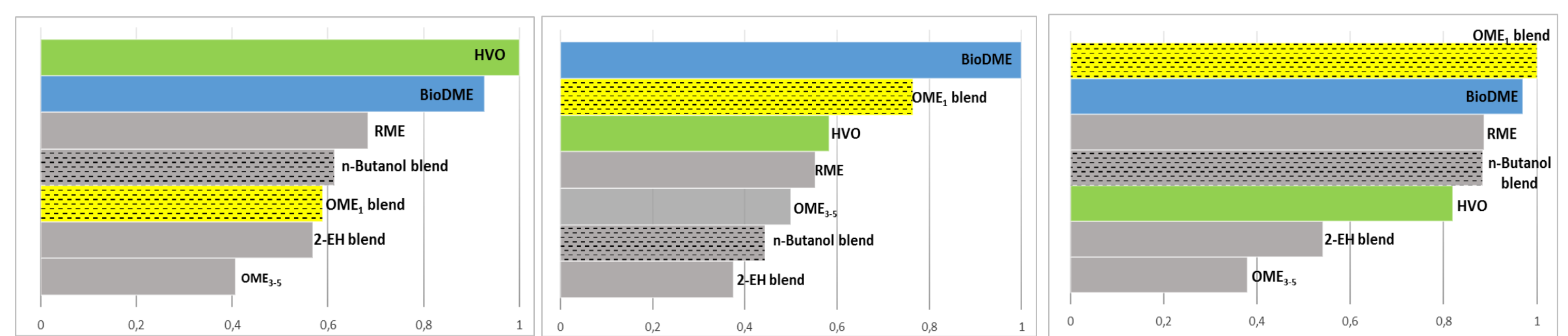
RESULTS

The ranking order obtained for the studied fuels under different weighting scenarios is illustrated below:



S1: Assessment criteria obtained equal weights

- DME, HVO and OME₁ are among the most preferable fuels in the baseline scenario (S1).
- Although DME would require engine and fuel storage modifications (reflected by the lower score in S2), it offers a competitive advantage in terms of clean and efficient combustion at a modest production cost.



S2: Focus on technical criteria

S3: Focus on environmental criteria

S4: Focus on economic criteria

- The more advanced fuels such as 2-EH or OME₃₋₅ require less engine modifications, and lead to lower GHG emissions from a life cycle perspective. Their overall score is lower due to higher primary energy demand and production cost.
- Resource availability is a constraint for all fuels and especially for vegetable oils.

CONCLUDING REMARKS

- Diesel-like fuel alternatives were assessed and ranked with the aim to identify promising low emitting, resource and cost efficient fuels for the transport sector.
- The more mature options were promoted given the current conditions and for the short to medium term.
- With stricter climate regulations, 100% renewable fuels are expected to outperform fossil diesel containing blends.
- The ranking order depends on the selected criteria and assigned weights. By engaging transport related stakeholders in the decision making process insights on the relevance and ease of adoption of renewable fuels can be obtained.