



## D2.1 – Fuel Matrix for future HD engines

Innovation Action

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## Publishable summary

The first deliverable of the Longrun project is a report on the most promising fuels for future HD applications. One of the project objectives is to develop a robust ICE engine technology for future fuels while achieving a major well-to-wheel CO<sub>2</sub> reduction. This objective shall be reached by provision of pathways how highly efficient renewable fuels (from production and combustion side) can be used in existing fleets using also retrofit solutions.

The project partners (OEMs, engineering partners and fuel suppliers) discussed about possible sustainable fuels and combustion systems which are promising with regards to high thermal efficiency, low engine out emissions and suitability for current and modified fuel infrastructures.

The selected fuels are hydrogen, methanol and paraffinic diesel such as HVO (Hydrogenated Vegetable Oils) or synthetic diesel produced by the Fischer Tropsch synthesis. Herein, the paraffinic diesel used is “Neste My Renewable Diesel”™

Paraffinic diesel has been chosen because it is one of the few renewable fuels compatible with current vehicle fleet and fuel infrastructure, thereby allowing an immediate impact on W2W-CO<sub>2</sub> emissions. In addition, paraffinic Diesel shows a lower sooting tendency compared to fossil Diesel, thereby allowing to optimize the engine hardware and software for improved thermal efficiency, e.g. by increased compression ratio without sacrificing engine-out soot level.

Hydrogen was selected being the only fuel allowing immediate reduction of Tank-to-Wheel (T2W) CO<sub>2</sub> emissions, which is particularly important for OEMs bearing in mind the current CO<sub>2</sub>-Legislation on T2W-basis. Furthermore, H<sub>2</sub> also allows a W2W CO<sub>2</sub>-neutrality with lowest energy loss in the conversion process, both on the power-to-fuel side and the fuel-to-power side. The clear shortcoming of H<sub>2</sub> is the fuel infrastructure and fuel handling. However, being a central element in the renewable energy ecosystem and therefore strongly supported by a large number of European governments, the infrastructure for H<sub>2</sub> is assumed to improve significantly in the future.

Methanol was selected being the fuel with the best compromise in the tradeoff between fuel production and transportability. In contrast to typical spark-ignited methanol combustion, a new combustion concept was selected where methanol is burned diffusively in a compression ignition (CI) engine. To enable CI of methanol, a diesel pilot is used to preheat the combustion chamber. The resulting process allows to operate on a high compression ratio thereby achieving high thermal efficiency.

It's worth mentioning here that ethers are potential fuels for CI-engines as well but were not selected here due to different reasons. In a nutshell, DME is considered in a parallel work package and results will be transferred. OME is considered as highly potential but was not selected due to the limited availability of high-quality OME allowing extensive testing and due to the several compatibility shortcomings with standard diesel injection systems. A detailed investigation of ethers as a fuel for CI engines is suggested for future projects.

## 5 Acknowledgement

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### Project partners:

#	Partner	Partner Full Name
1	FEV	FEV EUROPE GMBH
2	DAF	DAF TRUCKS NV
3	FPT	FPT INDUSTRIAL SPA
4	FORD	FORD OTOMOTIV SANAYI ANONIM SIRKETI
5	IRIZAR	IRIZAR S COOP
6	IVECO	IVECO S.p.A.
7	VOLVO	VOLVO TECHNOLOGY AB
8	VDL	VDL ENABLING TRANSPORT SOLUTIONS BV
9	ABEE	AVESTA BATTERY & ENERGY ENGINEERING
10	AVL	AVL LIST GMBH
11	EATON	EATON ELEKTROTECHNIKA SRO
12	GARR	GARRETT MOTION CZECH REPUBLIC SRO
13	IDIADA	IDIADA AUTOMOTIVE TECHNOLOGY SA
14	IFP	IFP Energies Nouvelles
15	AVL	AVL MTC MOTORTTESTCENTER AB
16	NESTE	NESTE
17	PRIMA	PRIMAFRIO SL
18	SHELL	SHELL GLOBAL SOLUTIONS (DEUTSCHLAND) GMBH
19	SIE	SIEMENS INDUSTRY SOFTWARE SAS
20	TECHNA	FUNDACION TECHNIALIA RESEARCH & INNOVATION
21	TOTAL	TOTAL MARKETING SERVICES
22	UMIC	UMICORE AG & CO KG
23	UNR	UNIRESEARCH BH
24	JRC	JRC -JOINT RESEARCH CENTRE – EUROPEAN COMMISSION
25	CHALM	CHALMERS TEKNISKA HOEGSKOLA AB
26	RWTH	RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN
27	TU/e	TECHNISCHE UNIVERSITEI EINDHOVEN
28	TUG	TECHNISCHE UNIVERSITAET GRAZ
29	UNIAQ	UNIVERSITA DEGLI STUDI DELL'AQUILA
30	VUB	VRIJE UNIVERSITEIT BRUSSEL

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