Interreg
EUROPEAN UNION
Danube Transnational Programme
GRENDEL

This fact sheet offers information on drop-in fuels that can be used as a replacement for conventional diesel without major engine conversions, information on economics and environmental sustainability as well as references to deployed examples.

FACT SHEET N° 6

DROP-IN FUELS

In cooperation with
INDanube Centre for Innovation Transfer
EIBIP | European Inland Barging Innovation Platform

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FACT SHEET
DROP-IN FUELS

REGULATIONS

EN 15940:2016 for paraffinic diesel fuels includes HVO, GTL, BTL and CTL as well as diesel. EN 14214 is for biodiesel (FAME).

DROP-IN FUELS FACTS

Drop-in fuels are a synthetic and completely interchangeable substitute for conventional petroleum-derived hydrocarbons (gasoline, jet fuel, and diesel), meaning it does not require adaptation of the engine or the fuel system. It can be used “as it is” in currently available engines, either blended with conventional fuels, or even in pure form. However, engine OEMs should be contacted regarding warranty, risk of losing type approval and recommendations for adapted lubricants. In many cases the emission profile can be improved with optimisation of engine control parameters.

TECHNICAL DETAILS

X to Liquid (XTL)

XTL fuels (also known as Fischer-Tropsch fuels) are various synthetic fuels that convert a solid or gaseous energy carrier into a carbonaceous fuel, which is liquid at normal temperature and pressure levels. The "X" is a variable and is replaced by an abbreviation of the original energy carrier, while "TL" stands for "to Liquid". The abbreviations GTL (Gas-to-Liquid) for the use of natural gas or biogas, BTL (Biomass-to-Liquid) for the use of biomass and CTL (Coal-to-Liquid) for the use of coal as a source of energy are currently used.

Hydrotreated Vegetable Oil (HVO)

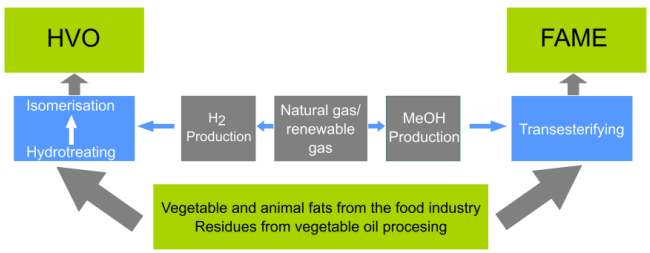
HVO is a mixture of straight-chain and branched paraffins, the simplest form of hydrocarbon molecules under the aspect of clean and complete combustion. Typical carbon numbers are C15 ... C18. In addition to paraffins, fossil diesel fuels contain also significant amounts of aromatics and naphthenes. Aromatics impair a clean combustion. HVO, on the contrary, does not contain aromatics, and its composition is similar to that of GTL and BTL diesel fuels, which can be produced by the Fischer-Tropsch synthesis from natural gas and gasified biomass.

Biodiesel

Biodiesel, chemically fatty acid methyl ester (FAME), is a fuel that is equivalent in use to mineral diesel fuel. The chemical industry produces biodiesel by transesterifying vegetable or animal fats and oils with monohydric alcohols such as methanol or ethanol. Biodiesel mixes with conventional diesel in any ratio. Many countries therefore use biodiesel as a blending component for conventional diesel fuel.

	Conventional diesel	**GTL**	**HVO**	**Biodiesel**
Cetane number	>51	70	>70	54–56
Density [kg/m^3]	820	820	780	875
Energy density [MJ/kg]	42.9	44.0	44.1	37.2
Volumetric energy density [MJ/l]	35.2	36.1	34.4	32.6
Toxicological evaluation				
Water hazard class*	2	1	1	1
Carcinogenic	Yes	No	No	No

*Water hazard classes: 1: slightly hazardous to water, 2: hazardous to water



As it can be seen within the graphic illustration, the process of HVO production differs from the production process for biodiesel (FAME), as it is a catalytic process with hydrogen (hydrogenation); compared to the esterification process used for FAME production.

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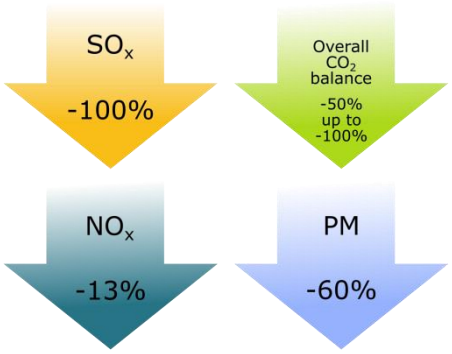
BUNKERING & ECONOMICS AND ENVIRONMENTAL SUSTAINABILITY

The drop-in fuels are bunkered nowadays mostly via truck. Some bunkering companies offer them also from their bunker vessels. The pure drop-in fuels GTL and HVO are about 5 % more expensive than conventional diesel fuel.



The use of HVO or GTL can reduce the NO_X emissions by up to 13 % and the PM emissions by up to 60 % if used pure. Blended the reduction of these emissions is proportional to the ratio of HVO or GTL. The amount of SO_X emissions drops by 100 %, when pure HVO or GTL is used.

When considering the overall balance of the CO2 cycle, emissions can be reduced between 50% and 90% for renewable feedstock compared to conventional diesel. Energy consumption during harvesting and transport of the raw materials is included in this calculation. If the starting material of the drop in fuels is waste and residues, a 100% reduction can be assumed when observing the overall CO2 balance.

CONSIDERATIONS FOR DEPLOYMENT

The following aspects may be of interest for deployment:

- Engine parameters can be optimized in some cases,
- Very interesting especially for cabin vessels, as unpleasant emissions for passengers are significantly reduced

DEPLOYMENT EXAMPLES

MS JENNY / MS WISSENSCHAFT

Owner: Albrecht Scheubner
Location: Rhine-Main-Danube
Organisers:
In operation: Since 1987 / since 2016 on GTL
ⓘ www.scheubner.de

Vessel type: Container Vessel / Event Vessel
ENI: 04503240
Vessel size: 102 × 9.50 m (L × W), Draught (max): 2.86 m

Propulsion: Mitsubishi Typ S12A2-Z3MPTAW-3, 701 kW; Verhaar Omega Jet, 261 kW
Specifics: GTL as fuel, SCR

MS FOR-EVER

Location: Alpherium-Rotterdam/Antwerp
Organisers: HEINEKEN
In operation: since 2012 / since 2019 on Bio-fuel Oil MR1-100 (GoodFuels)

Vessel type: Container Vessel
ENI: 02334650
Vessel size: 90 × 10,50 m (L × W), Draught (max): 3 m
Propulsion: 2 × Scania DI-16, 386kW; 2 × DAF –

Specifics: HVO as fuel

MS ALPHENAAR

Location: Alpherium-Rotterdam/Antwerp
Organisers: HEINEKEN
In Operation: since 2019

Vessel type: Container Vessel
ENI: 02338177
Vessel size: 90 × 10,50 m (L × W), Draught (max): 3,8 m
Propulsion: 2 × Veth L-drive VL-400 with PM engine 400 kW: VSG 1300L bow thruster, 2.4 MWh Battery and Mitsubishi gen sets S6R (600 kW) and 6024 (200 kW)
Specifics: HVO as fuel, up to 5 hours zero emission on batteries

Contact

For further information or suggestions how to improve this fact sheet please do not hesitate to contact:

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