

Liquefied natural gas (LNG) as alternative energy source for mobile machines



Motivation

Due to the global warming, countries all over the world have decided on reduction objectives of anthropogenic greenhouse gas emissions (CO_2e). The finite resources of fossil fuels which will not cover the world's energy consumption on a long term and the ambitious objectives of the European Union concerning the CO_2e reduction, forces all industries to make their contribution.

Although there are currently no legitimate regulations for greenhouse gas emissions from mobile machines, the construction equipment industry has to make their contribution to reduce the total emissions and hence to counteract the global warming.

One possible approach is to use liquefied natural gas.

The preliminary study has shown that in spite of the higher emissions for the production of liquefied natural gas (well- to- tank) compare to diesel, the well- to- wheel (fuel production & fuel combustion) value is still below that of diesel.

LNG: Liquefied natural gas (-167 to -157 °C, 1 bar)

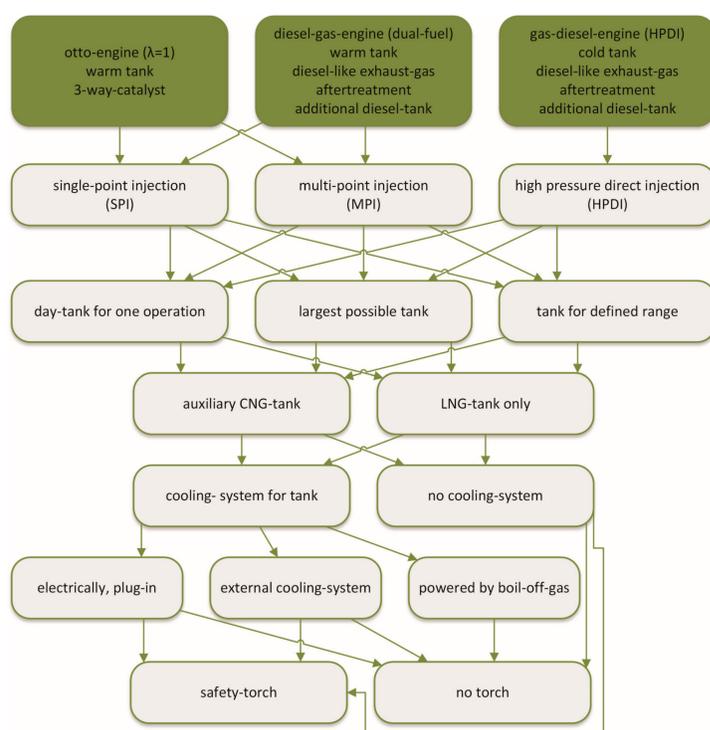
	WtT	TtW	WtW
LNG fossil	19,0	56,0	75,0
LNG from wind power-SNG	12,3	0,7 (process with fraction diesel) 0,6 (Otto process)	13,0 12,9
LBG liquid biomethane	31,3	0,7 (process with fraction diesel) 0,6 (Otto process)	32,0 31,9
Diesel	15,3	74,0	89,3

Unless otherwise indicated, all values are in [g $\text{CO}_2\text{e}/\text{MJ}$]

Technical implementation

Three processes can be distinguished for combustion of natural gas in engines:

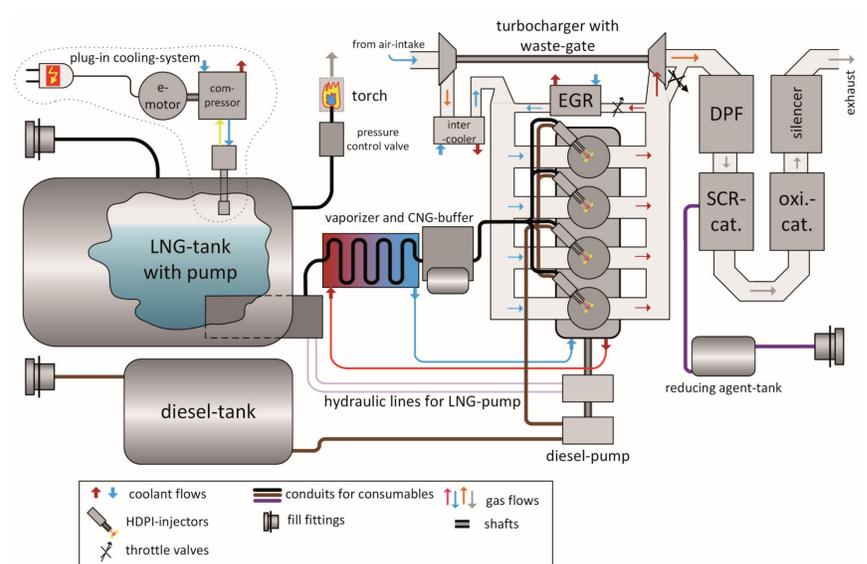
- otto- engine (natural gas without additional fuels)
- diesel- gas- engine (diesel- gas- mixture)
- gas- diesel- engine (diesel- gas- mixture)



Due to the high temperature difference between the interior of LNG tanks and their surroundings, heat inflow into the tank cannot be avoided. Consequently, constant evaporation of LNG takes place in the tanks, referred to as „boil- off- gas“.

Treatment of boil- off- gas:

- safety torch
- cooling- system



Project management

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