

Cost and benefits of using alternative fuels

Joint study of DNV GL and MAN Diesel & Turbo

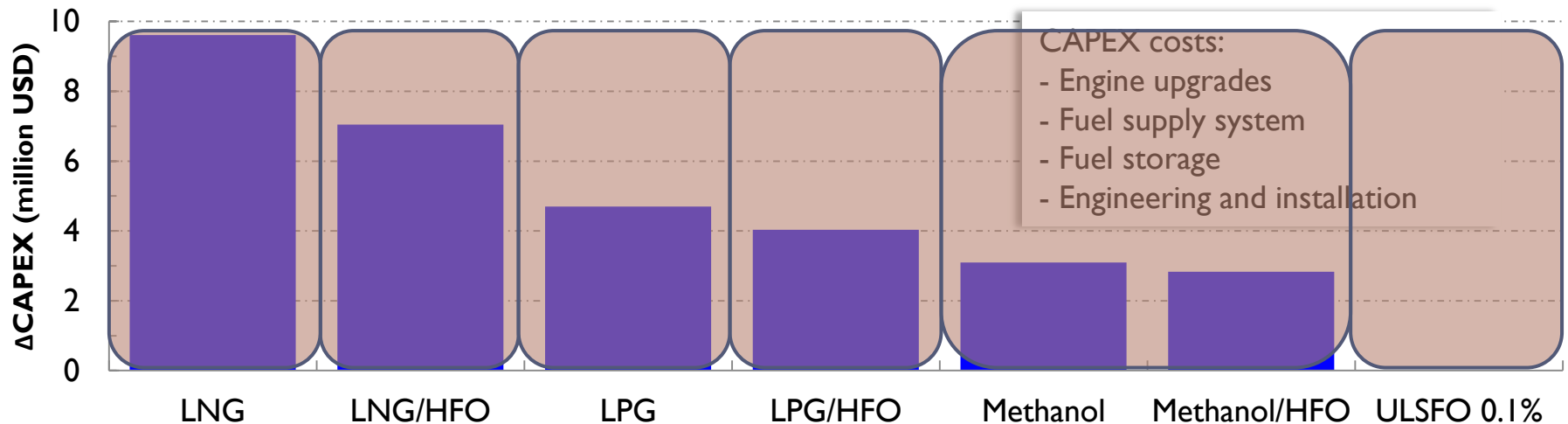
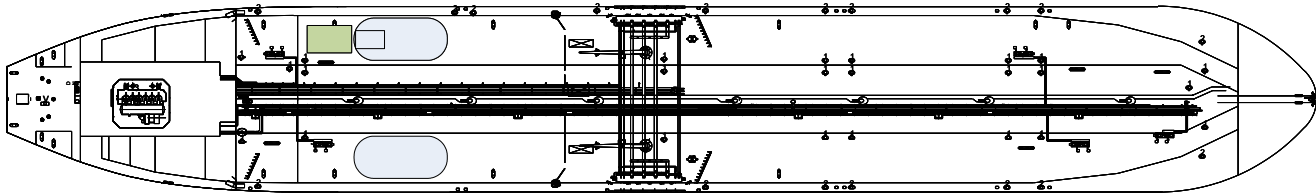
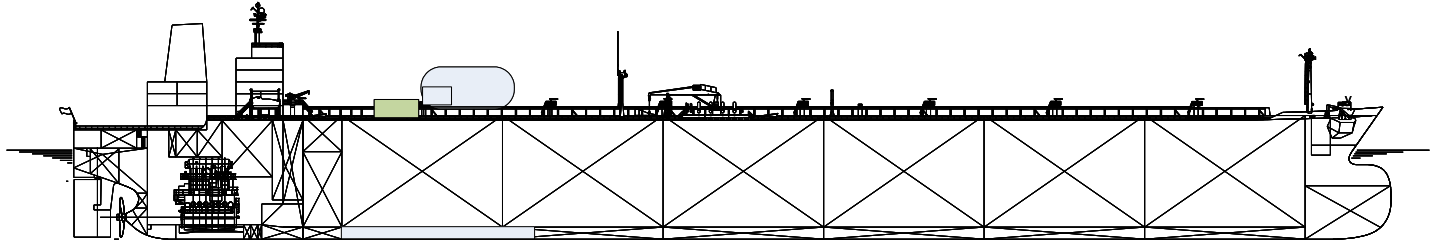
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Pierre Sames, Niels B. Clausen, Christos Chryssakis, Per R. Kristensen



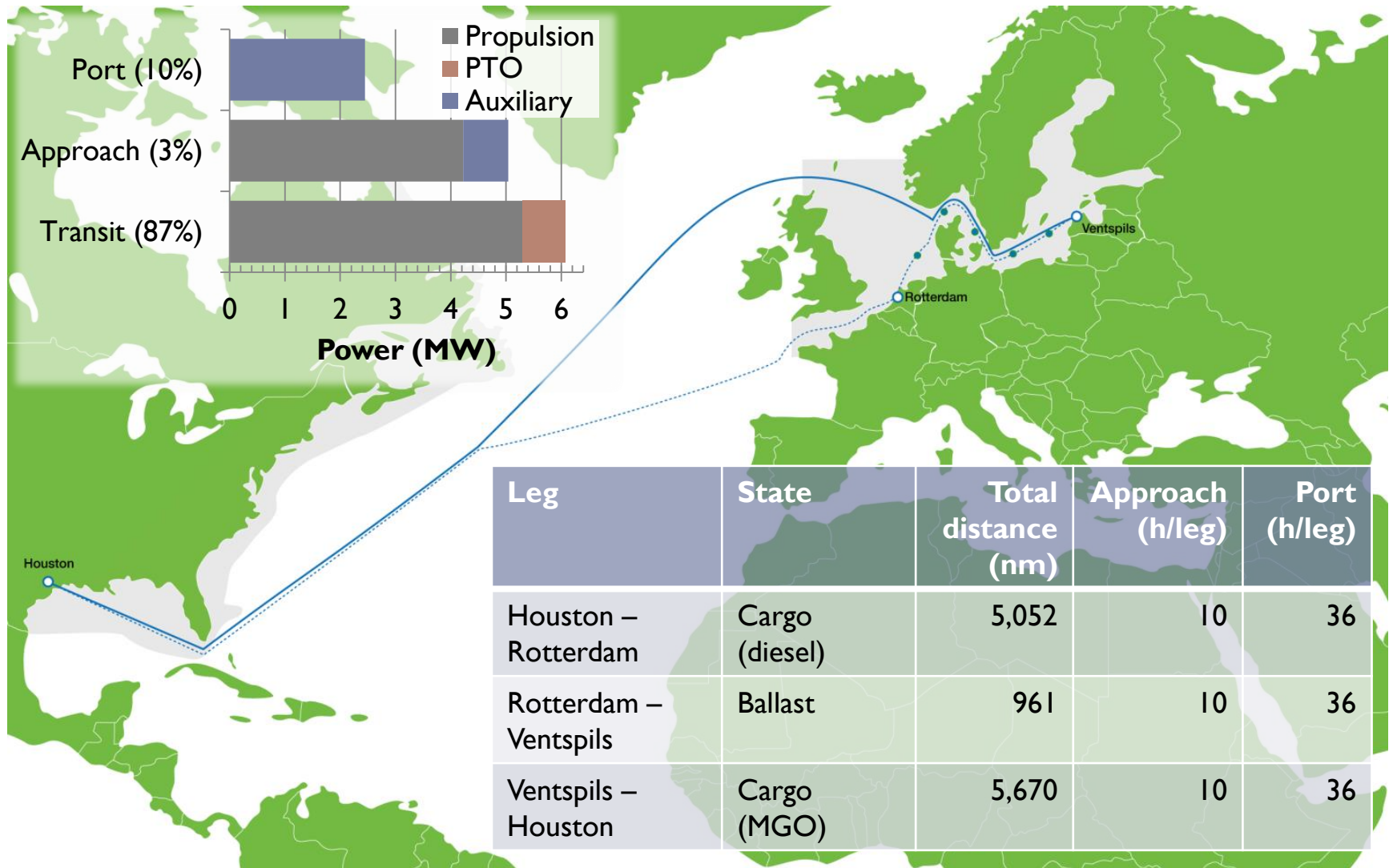
Introduction

Variant	ECA fuel	Non-ECA, 2018-2019	Non-ECA, 2020 -
Base	MGO	HFO	LSFO 0.5%
LNG	LNG	LNG	LNG
LPG	LPG	LPG	LPG
Methanol	Methanol	Methanol	Methanol
LNG/HFO	LNG	HFO	LSFO 0.5%
LPG/HFO	LPG	HFO	LSFO 0.5%
Methanol/HFO	Methanol	HFO	LSFO 0.5%
ULSFO 0.1%	ULSFO 0.1%	ULSFO 0.1%	ULSFO 0.1%

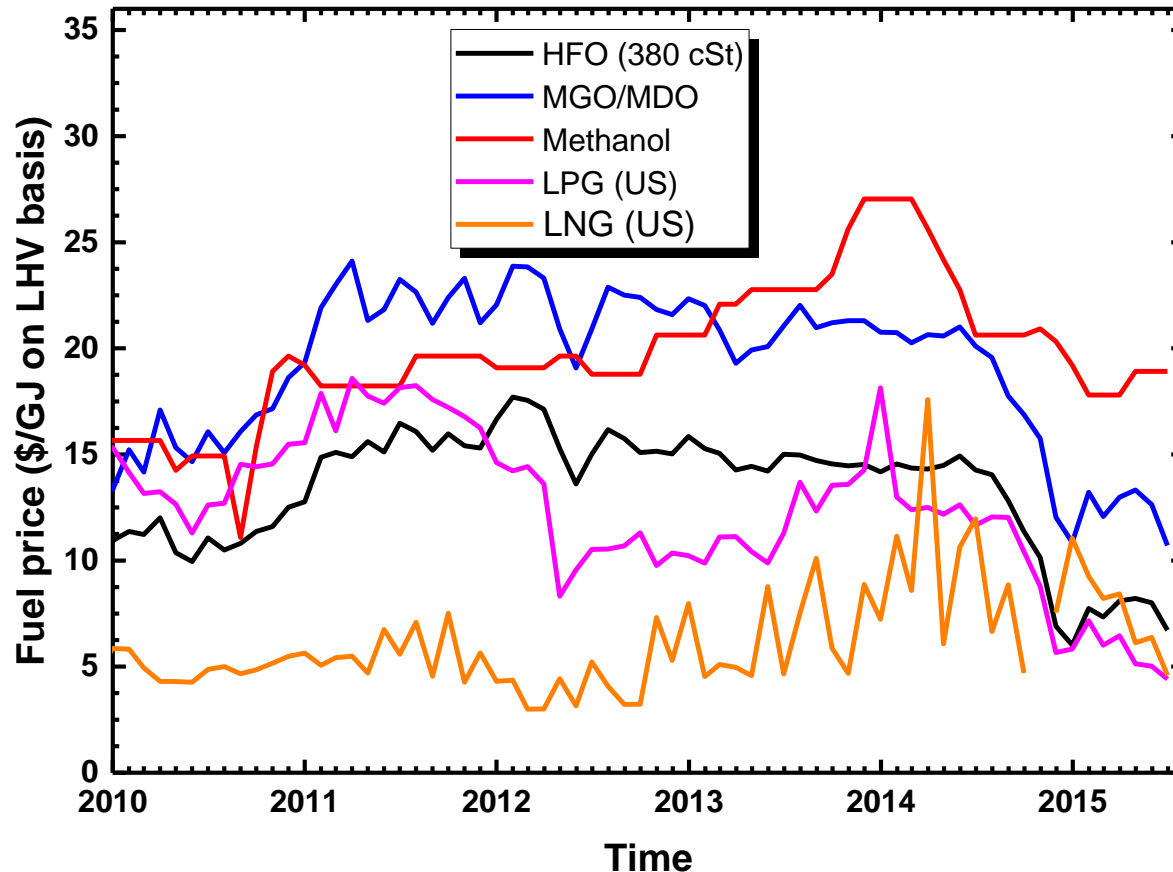
Application – LR1 tanker (75,000 d.w.t.)



Application – trading route



Fuel prices – historic data

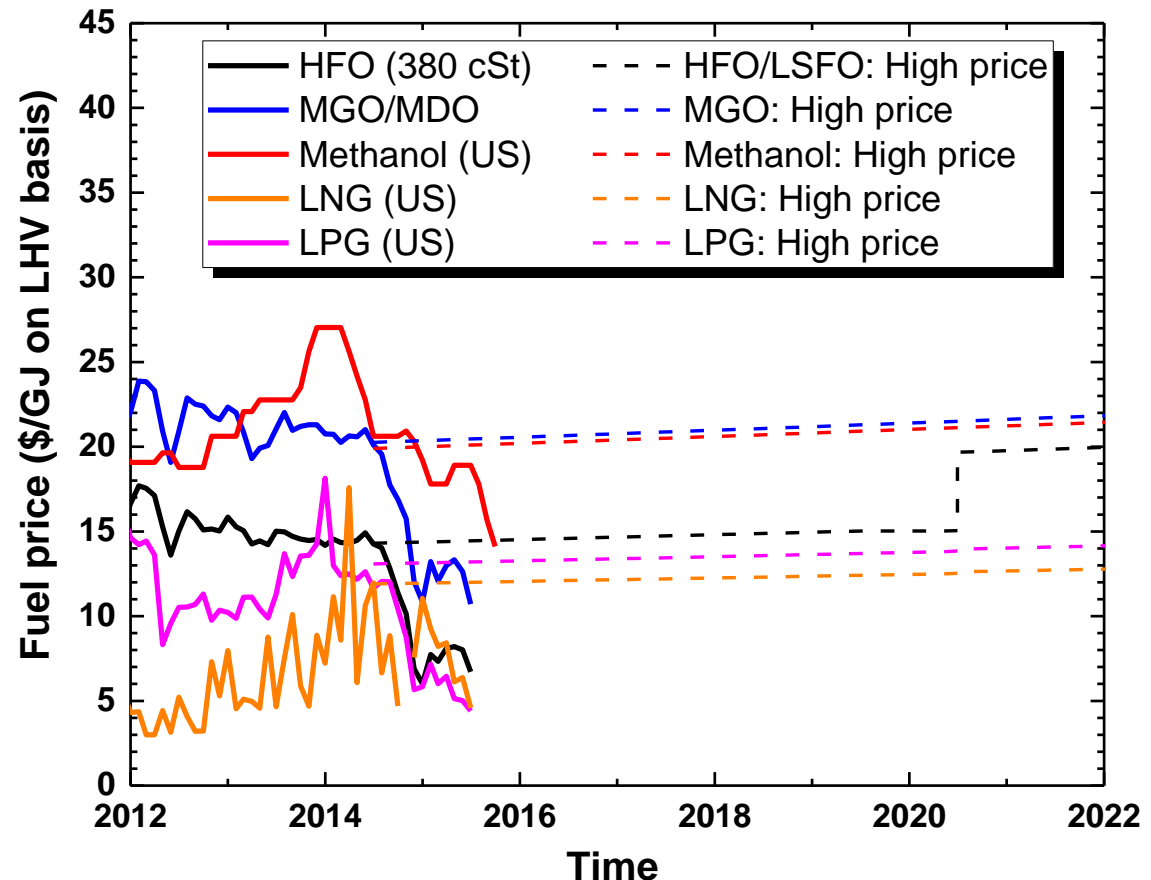


Europe vs. USA

- ▶ HFO and Methanol: same price
- ▶ LNG and LPG cheaper in USA
- ▶ MGO slightly cheaper in Europe

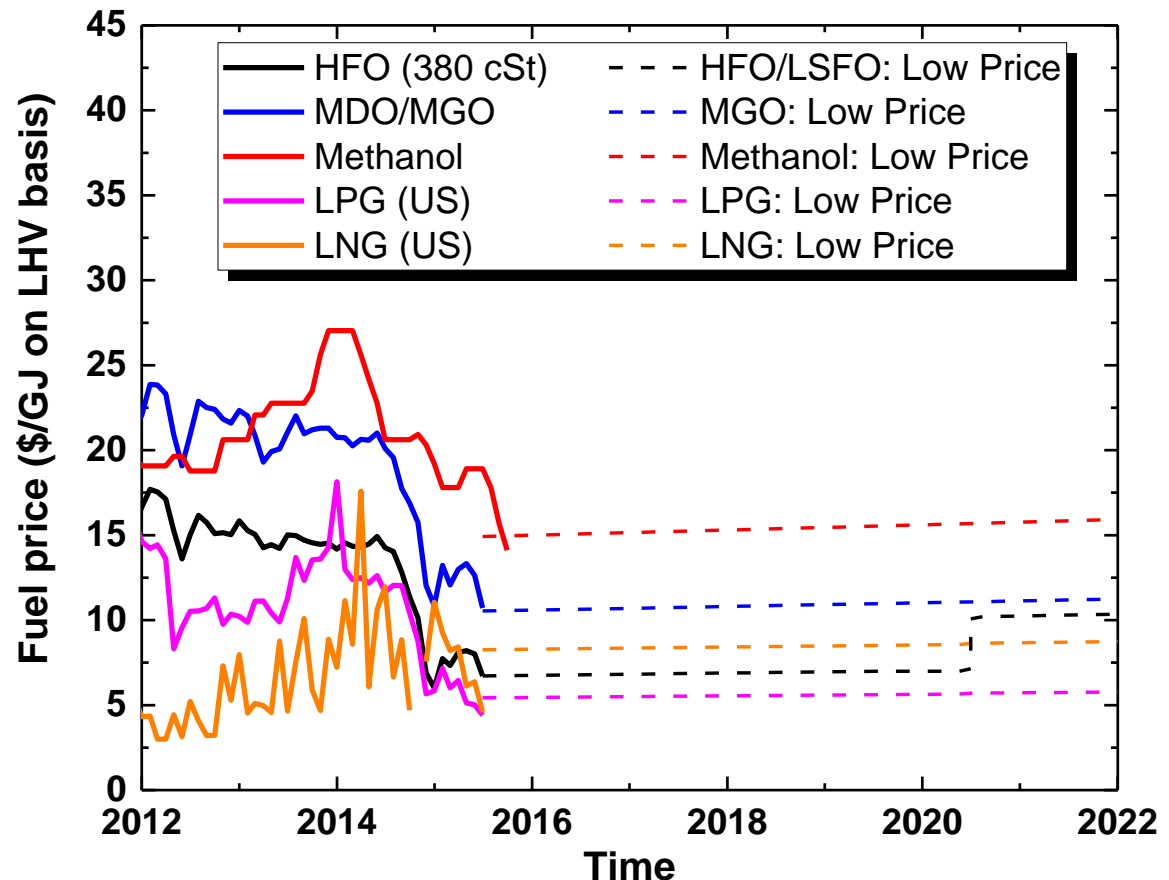
Fuel price scenarios

- ▶ High price scenario based on mid 2014 prices
- ▶ For LNG and LPG distribution costs are added



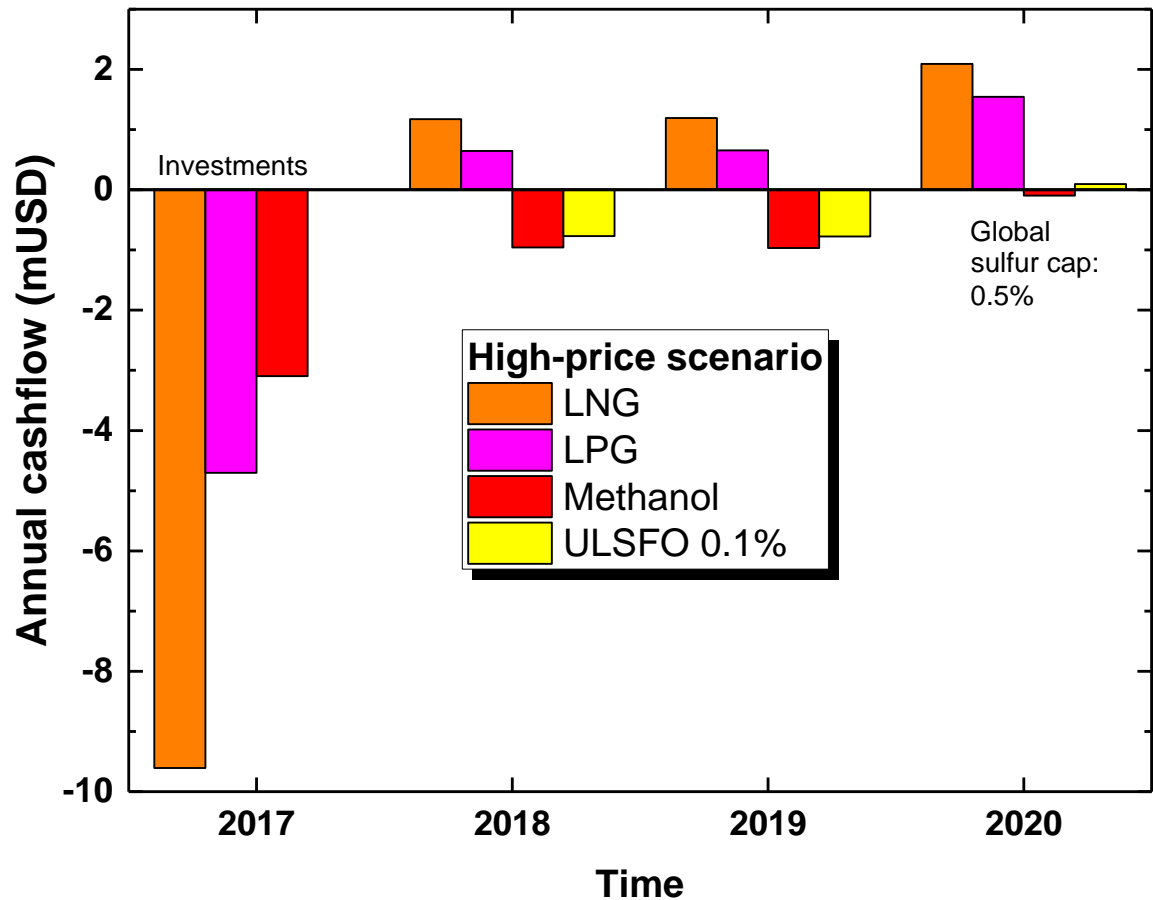
Fuel price scenarios

- ▶ High price scenario based on mid 2014 prices
- ▶ For LNG and LPG distribution costs are added
- ▶ Low price scenario based on mid 2015 prices
- ▶ Less price reduction for methanol and LNG



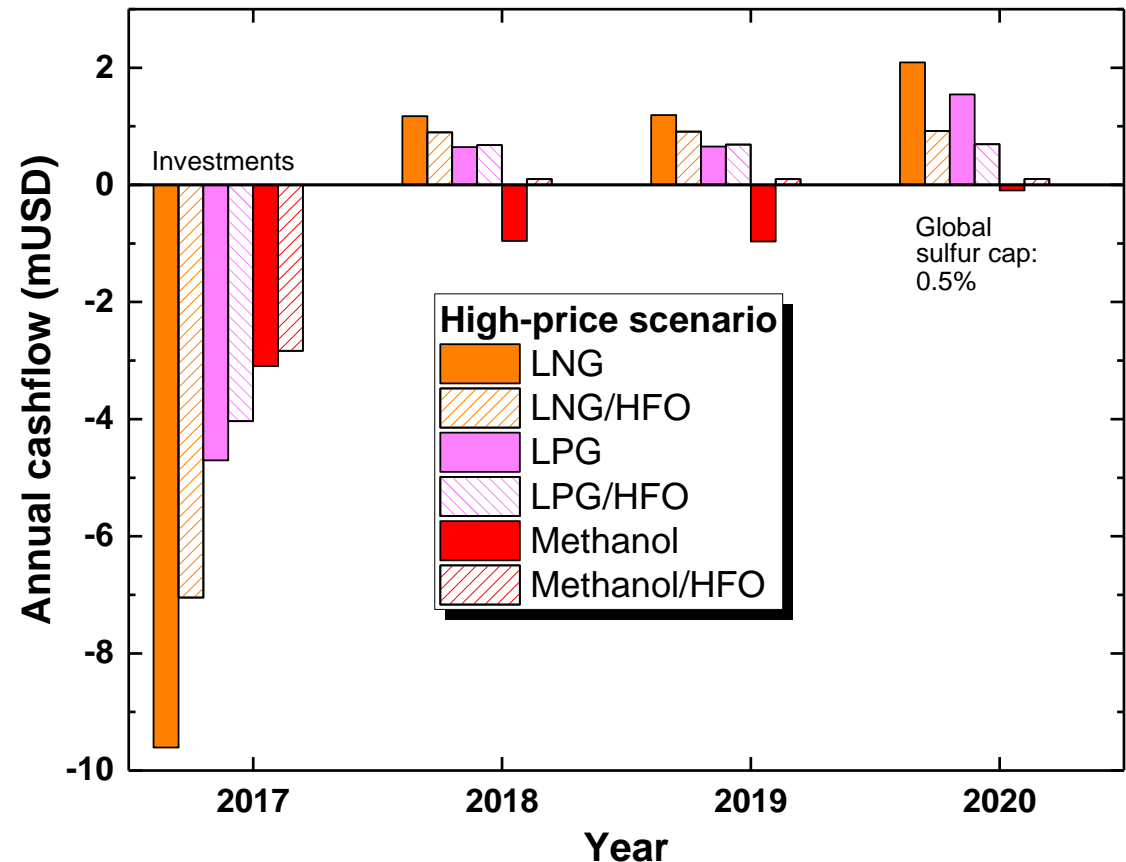
Annual cashflow for single-fuel variants

- ▶ LNG and LPG generate a positive cashflow after the investment
- ▶ Methanol and ULSFO not financially attractive



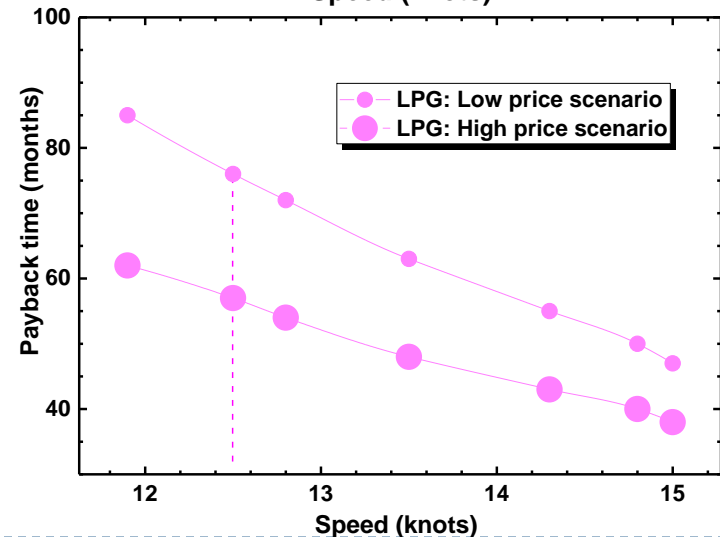
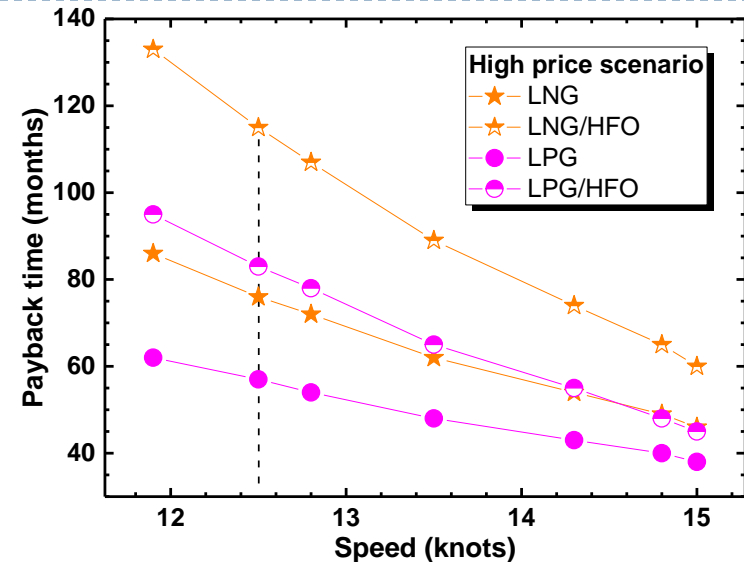
Annual cashflow for combined variants

- ▶ Combined variants are not affected by global sulfur cap
- ▶ A global sulfur cap favours the single-fuel variants



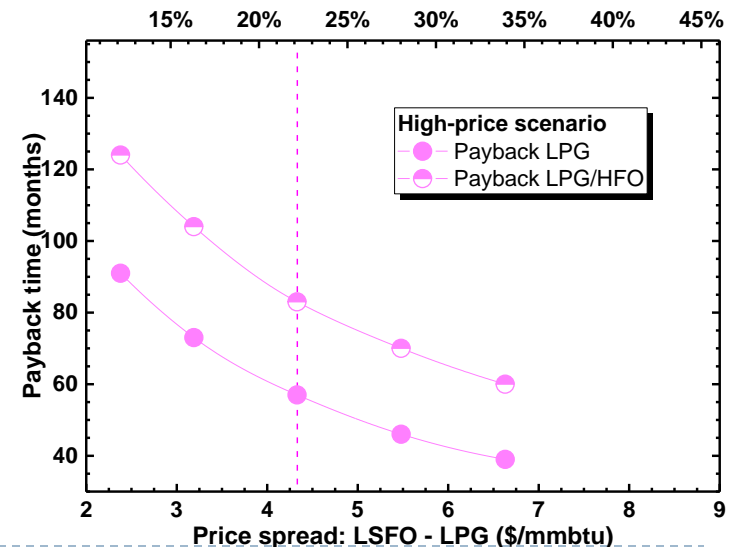
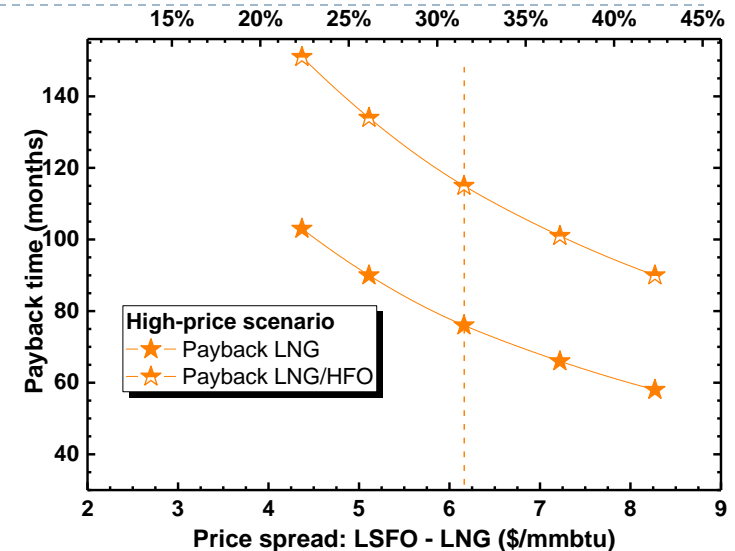
Payback time for LNG and LPG

- ▶ Payback time is faster for single-fuel variants
- ▶ Payback time is faster by increased speed
- ▶ Payback time is faster in the high price scenarios
- ▶ LPG is at least comparable to LNG
 - ▶ Shorter payback
 - ▶ Less sensitive to price scenario
 - ▶ Less investments



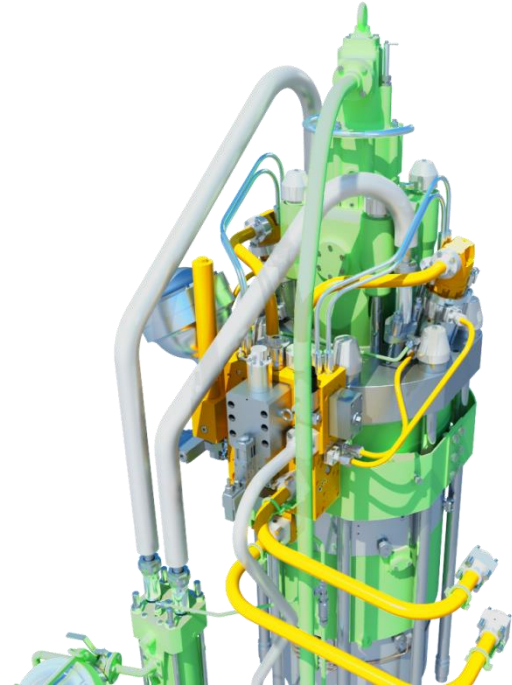
Payback time as a function of fuel-price spread

- ▶ For most of the period 0.5% S fuel (LSFO) is the relevant comparison
- ▶ LNG requires a larger discount than LPG
- ▶ Single fuel variants (LNG or LPG) are better than to use the alternative fuel only in the ECA
- ▶ Methanol: Requires ~18% discount on MGO to be comparable to LNG

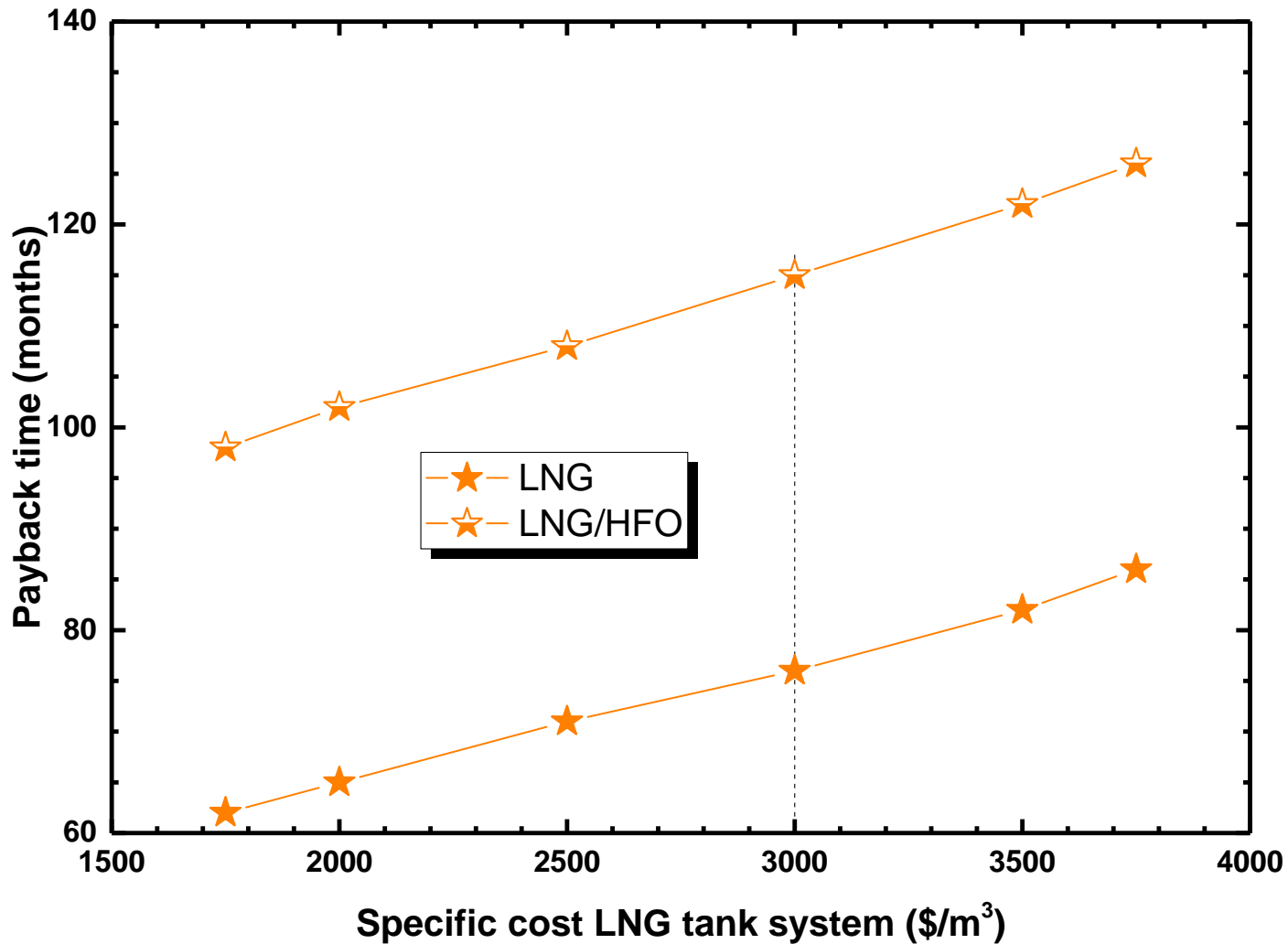


Conclusions

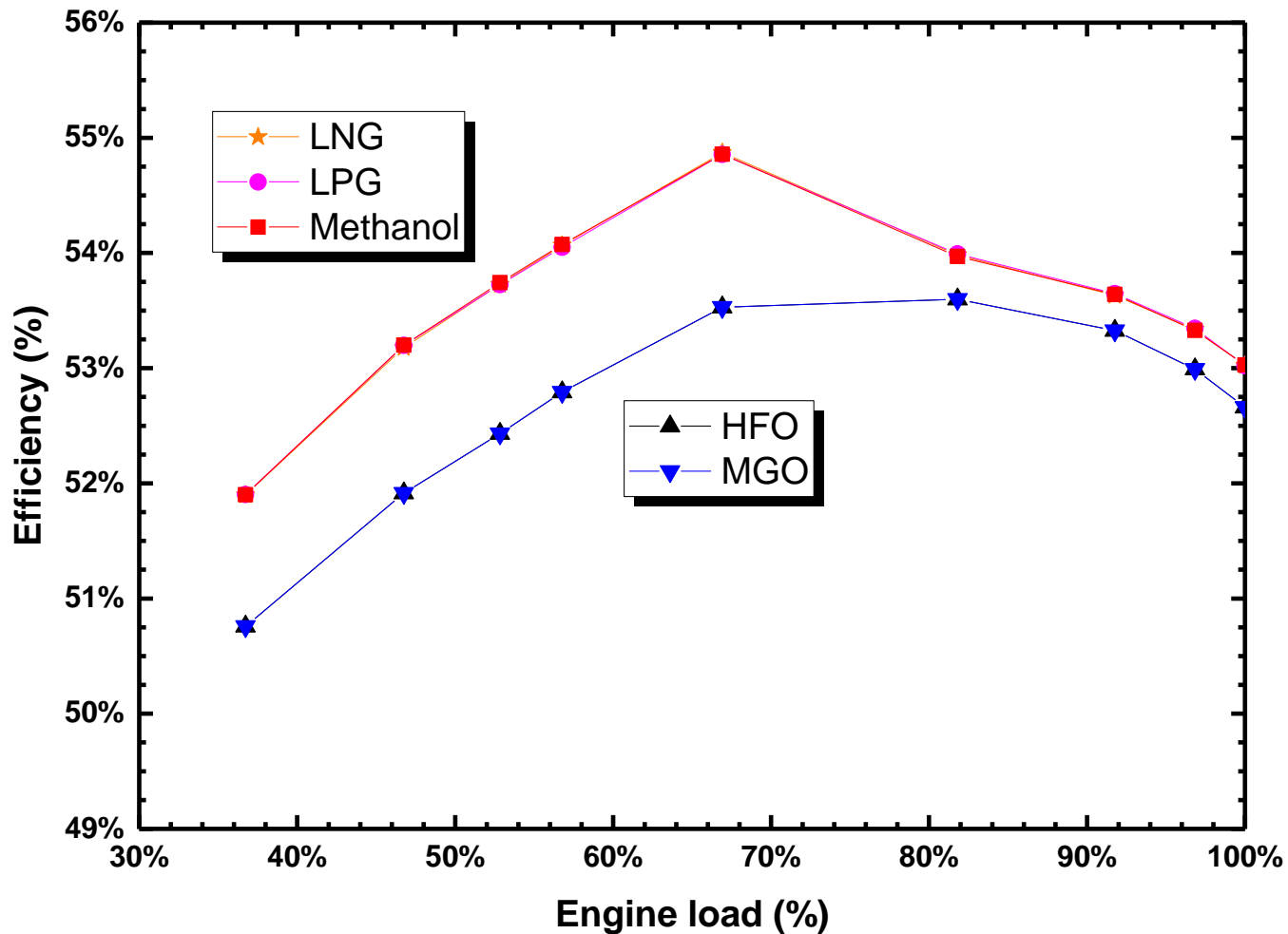
- ▶ Regulations call for alternative fuels as a means of compliance
- ▶ Costs and benefits for various fuels (LNG, LPG, methanol, ULSFO) were investigated
- ▶ LNG and LPG were found to be the most promising options
- ▶ For the most promising alternative fuels, the best option is to use the fuel both in ECAs and non-ECAs.
- ▶ Financial attractiveness is highly dependent on fuel price scenario.



Back-up slide



Back-up slide 2



Back-up slide 3

