

# A life cycle cost analysis of using alternative technologies on short sea shipping vessels in ECAs

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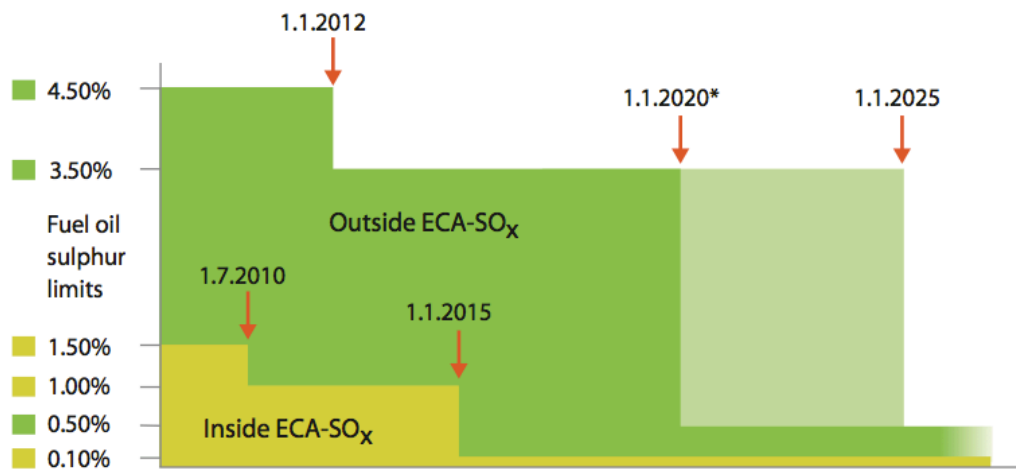
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## MARPOL Annex VI

### SO<sub>x</sub> emission regulation



\*Depending on the outcome of a review of fuel oil availability, to be completed 2018, the 2020 date could be deferred to 2025

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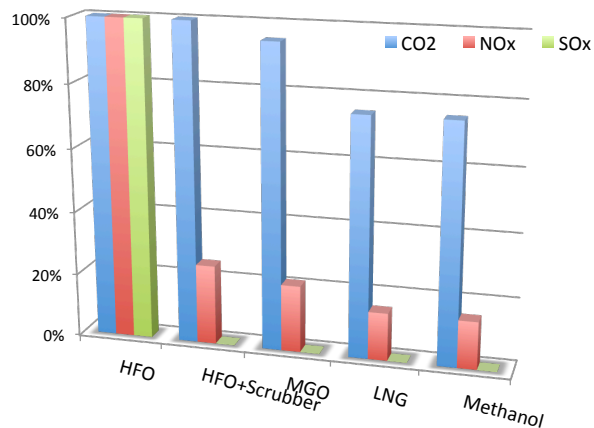
## Emission Control Area (ECAs)

- Baltic Sea, North Sea, North America & Caribbean(2014)



## What can we do?

- Marine Gas Oil (MGO)
- Liquefied Natural Gas (LNG)
- Scrubber System
- Methanol (MeOH)

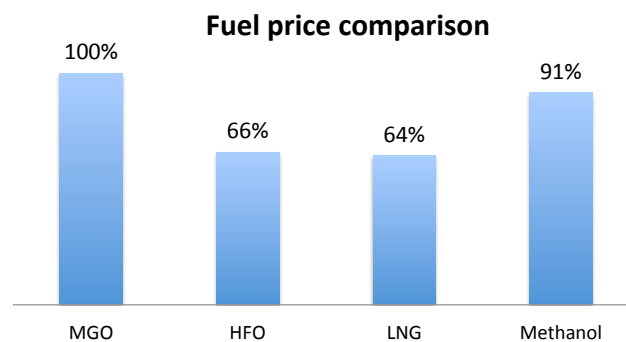


## Impacts of alternatives

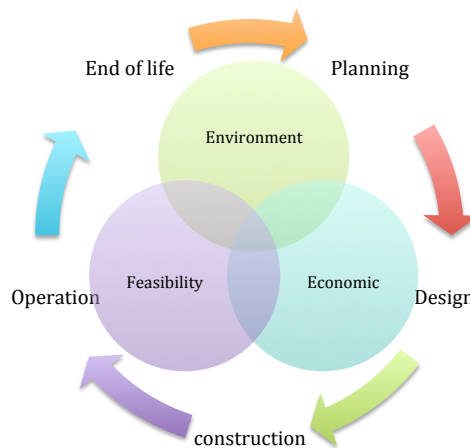
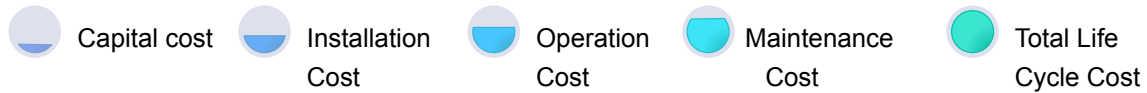
- LNG / Methanol
  - Infrastructure
  - Storage
- Scrubber
  - Chemical usage
  - Wash water and sludge discharge
- MGO
  - Price

## Current fuel prices

- MGO 0.1% sulphur 686.5 Euro/MT  
(Price of port Rotterdam from Bunkerworld on August 19, 2013)



## Life cycle cost analysis



## Selected Models

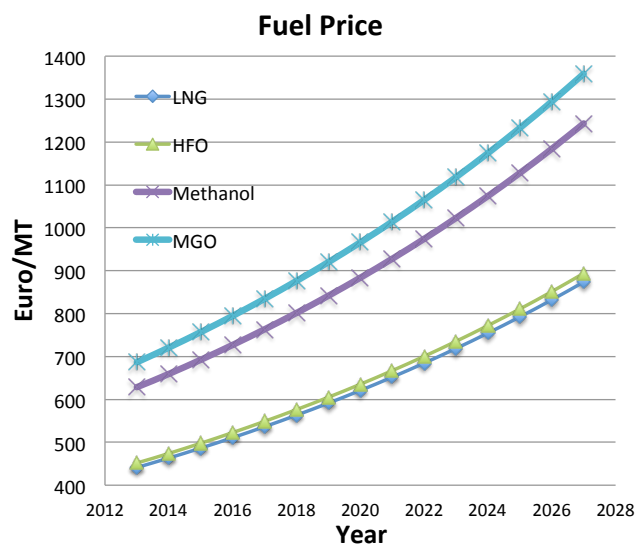
- Ro-Pax (1300 passengers and 300 cars)
- Cruise Vessel (3080 passengers)
- Container Feeder (1700 TEU)
- Small Ferry (600 passengers and 160 cars)

## Data collection

- Initial Cost
  - Engine, Equipment cost
  - Installation cost
- Operation Cost
  - Ship fuel consumption rate
  - Route, operation working condition, average load
  - Future fuel price

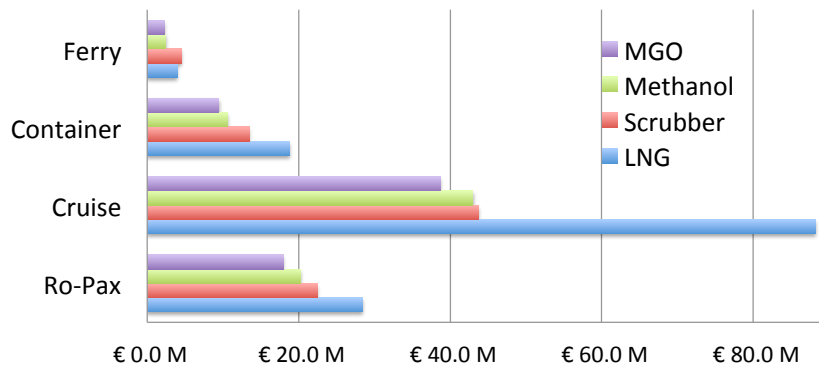
## Fuel price estimation

- Escalation Rate 5%
- MGO-LNG/HFO  
abt. € 450 difference  
after 15 years



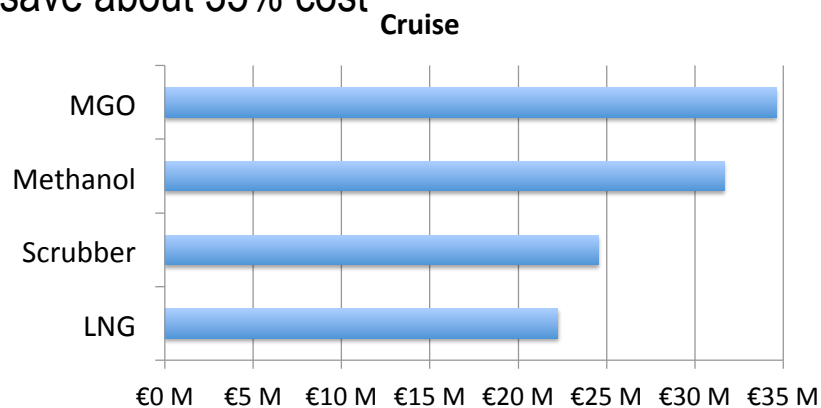
## Initial Cost

- Total power
- Required continuous operation time



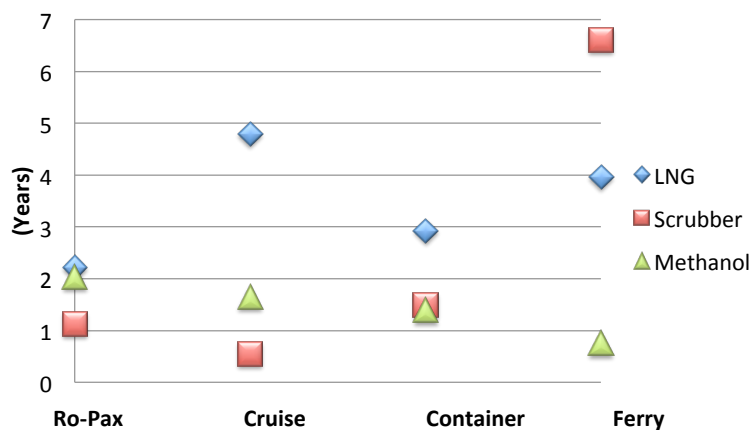
## Annual Cost

- LNG/Scrubber save more than **€10 Million / year**
- LNG save about 35% cost



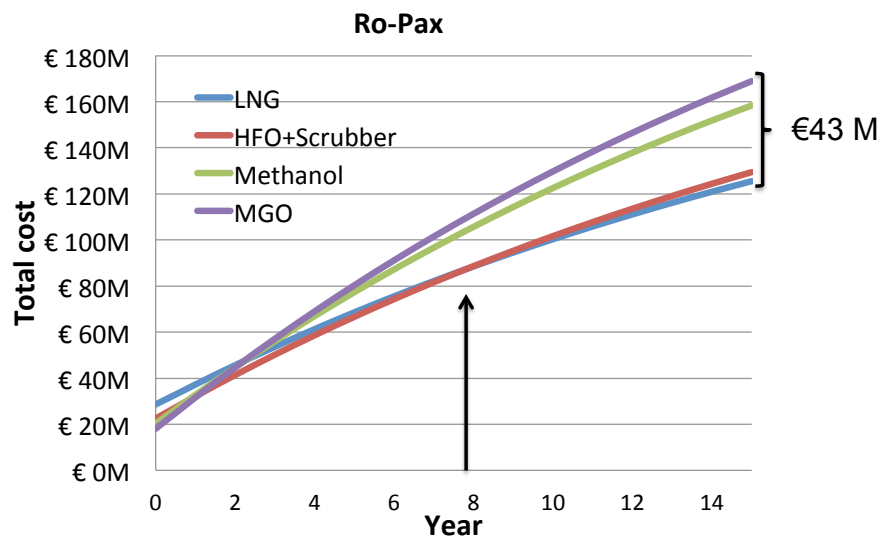
## Time to get initial investment payback

- Baseline - MGO



## Total life cycle cost (15 years)

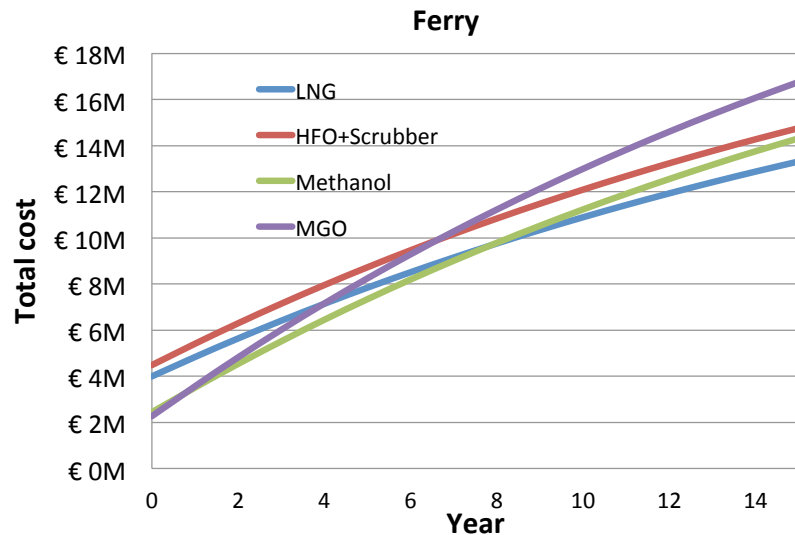
Scrubber or LNG ?



## Total life cycle cost (15 years)

Methanol might be a good solution

Short life  
→ Retrofit



## Conclusions

- Fuel price has significant impact
- ECA operation profile
  - time in ECA
  - continuous operation days
- LNG & Scrubber – long life cycle
- Methanol – short life cycle, low initial investment