



An economically feasible approach toward a sustainable future

Stefano Cantarut
Segment Manager Cruise & Ferry

THIS IS WÄRTSILÄ

A global leader in smart technologies
and complete lifecycle solutions for
the marine and energy markets





CLEAN ENVIRONMENT

A future without emissions or pollution



MARKET SHAPING & INNOVATION

A union of new technology and business models

ENERGY INTELLIGENCE

An optimised way of producing and using energy



WÄRTSILÄ'S PURPOSE

is to enable sustainable societies with smart technology.

Just two examples

2009



Viking Lady
330kW fuel cell – 18'500rhs
500kWh ESS

<https://www.youtube.com/watch?v=BmCPYotVBbM>

2018



Victoria of Wight
408kWh ESS

<https://www.youtube.com/watch?v=18k5XIABt-w>

Not only engine's maker but also System integrator

You are here



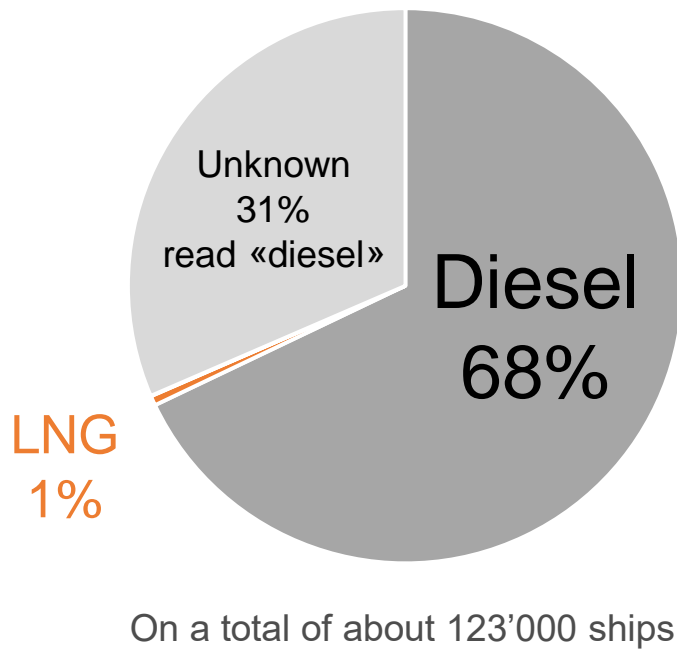
1. Assess the actual situation
2. Set the path

 Sustainable future

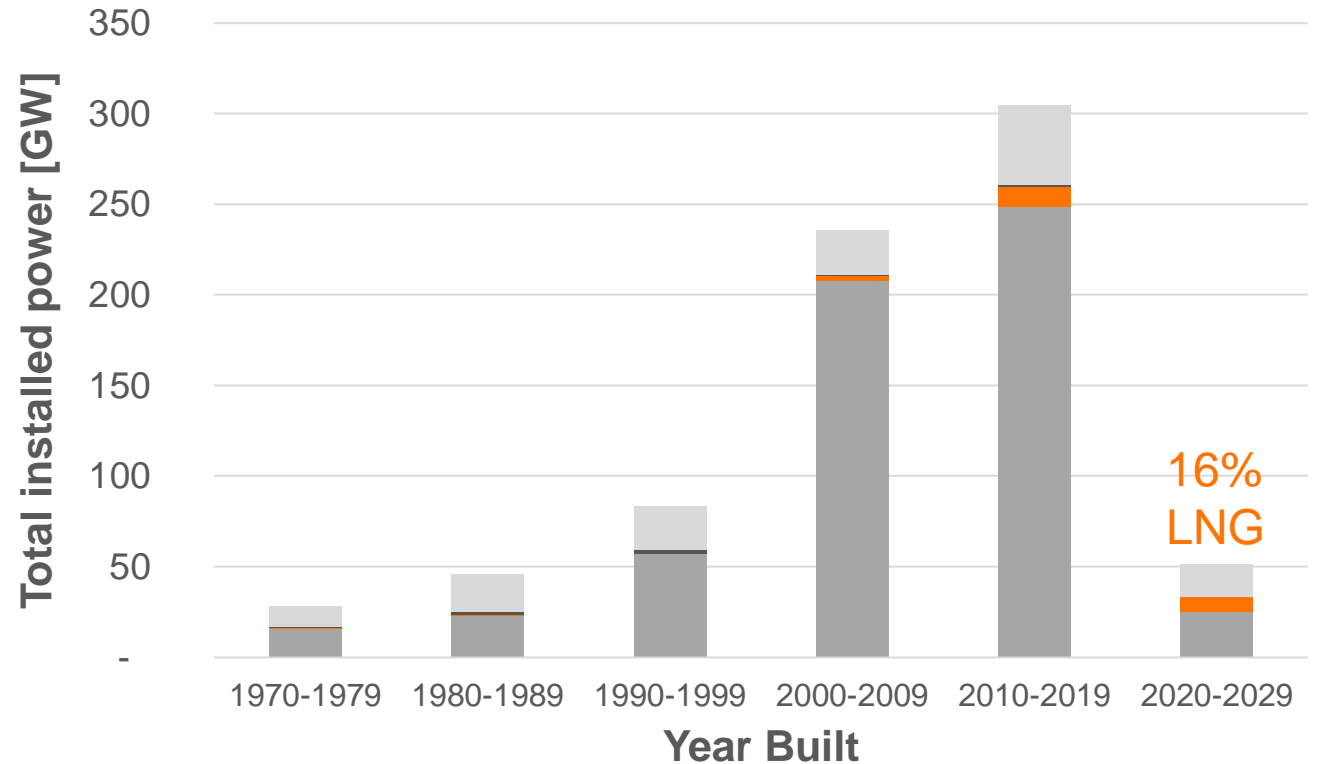


It's a «diesel» world that is slowly changing toward LNG

Today world fleet fuel spread
(source Clarksons)



Today world fleet fuel spread – power
(source Clarksons)



TCO – Total Cost of Ownership

The key parameter for decision making into the financial world
20y window for the marine business



Initial investment (CapEx)



Machinery costs
included



Balance of plant
NOT INCLUDED



Operating costs (OpEx)



Maintenance costs
included



Fuel costs
included

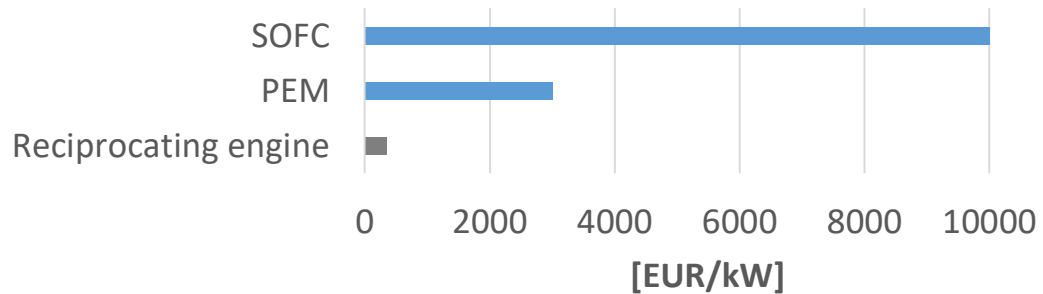


Fuel supply costs
NOT INCLUDED

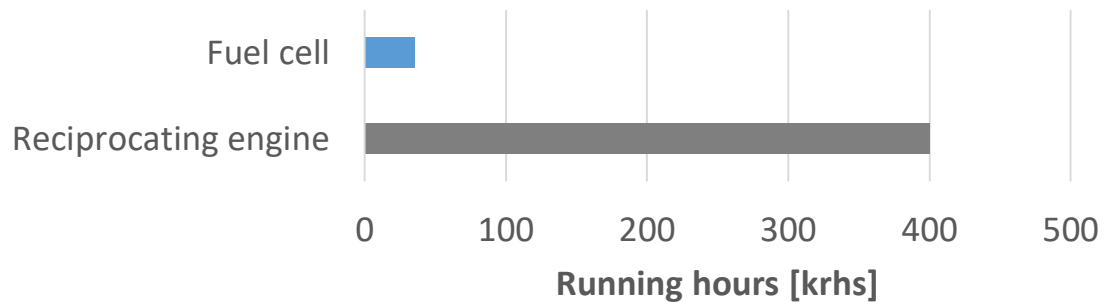


20'000 kW
5000 r/h/y

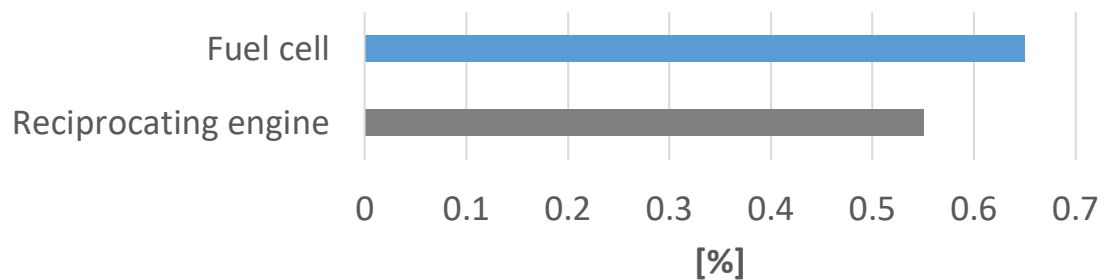
CapEx - energy producer only*



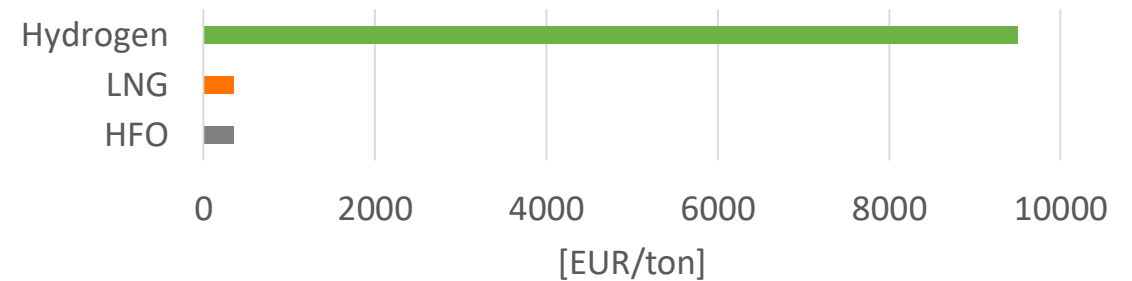
Expected lifetime



Efficiency



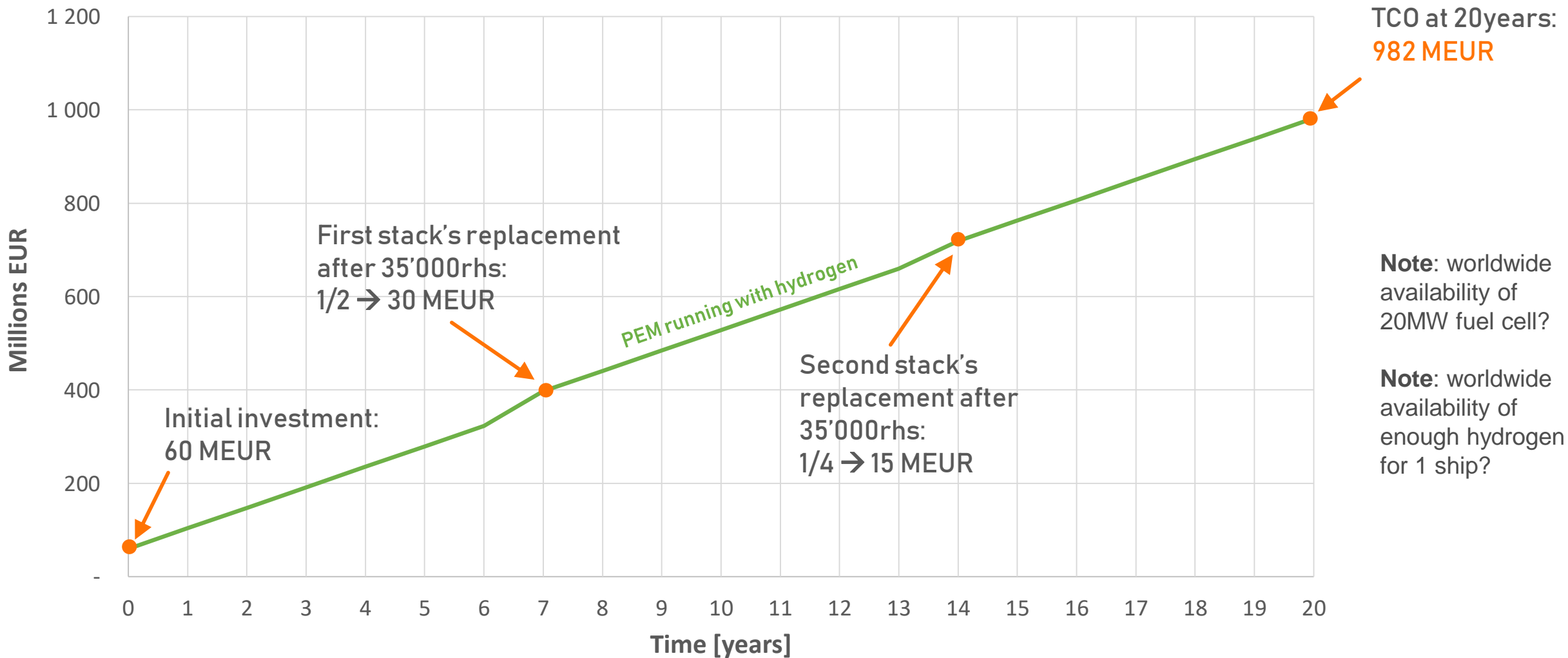
Fuel prices



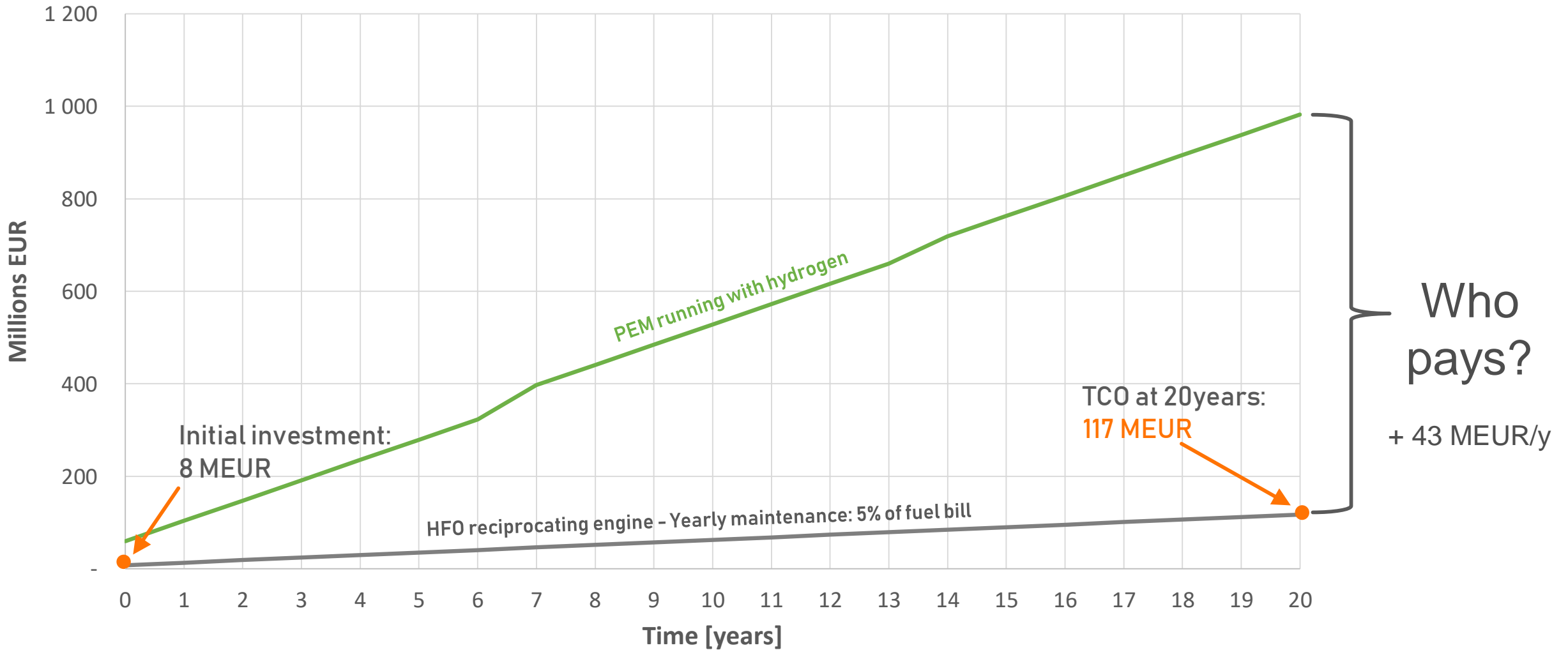
Fuel cells are 10 – 30 times more expensive, with an expected life time that is less than 1/10

*Indicative market prices

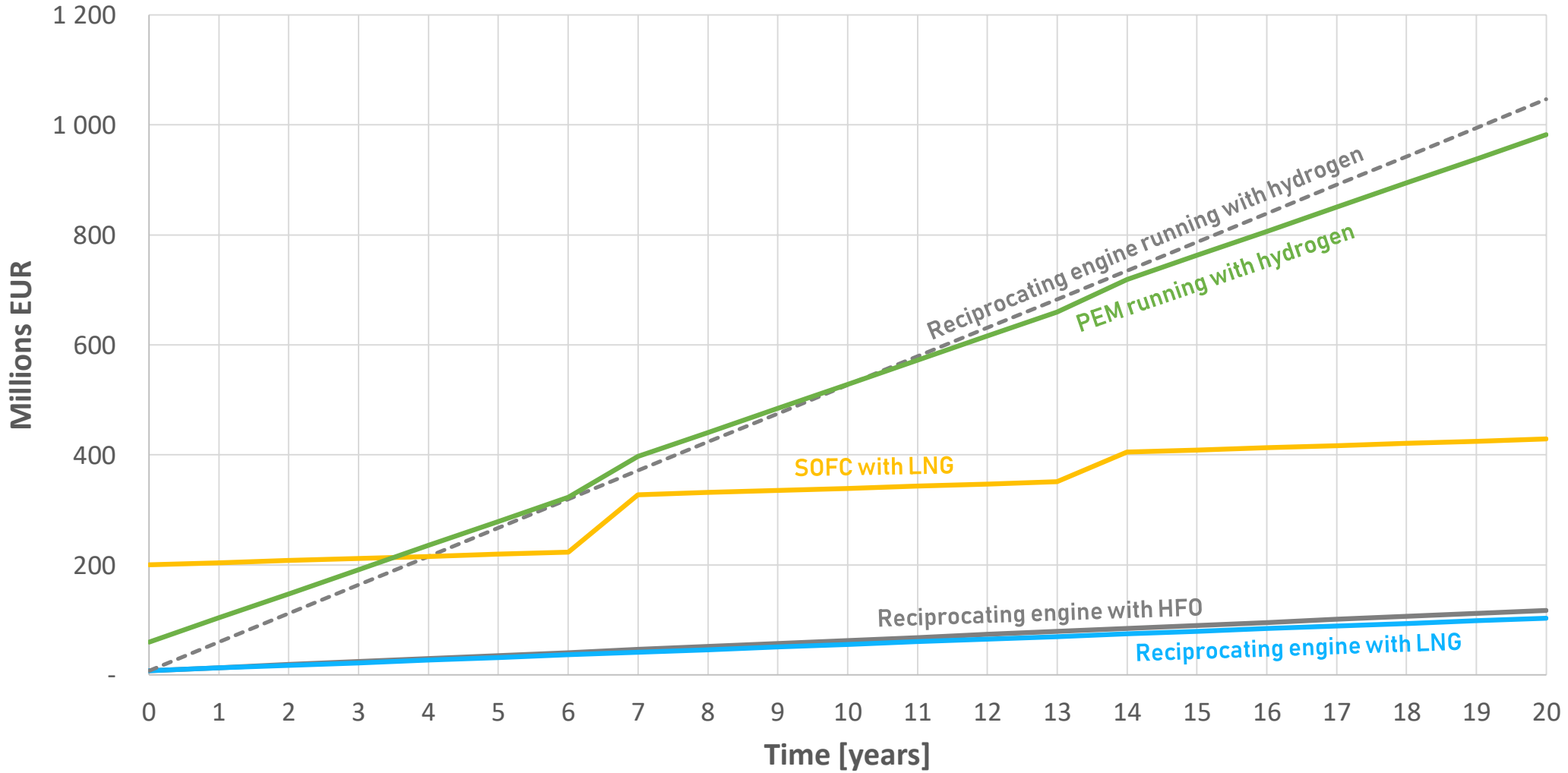
Total cost of ownership - 20'000 kW installation - 5000 rhs/y
 (initial CapEx + maintenance + fuel)



Total cost of ownership - 20'000 kW installation - 5000 rhs/y
 (initial CapEx + maintenance + fuel)

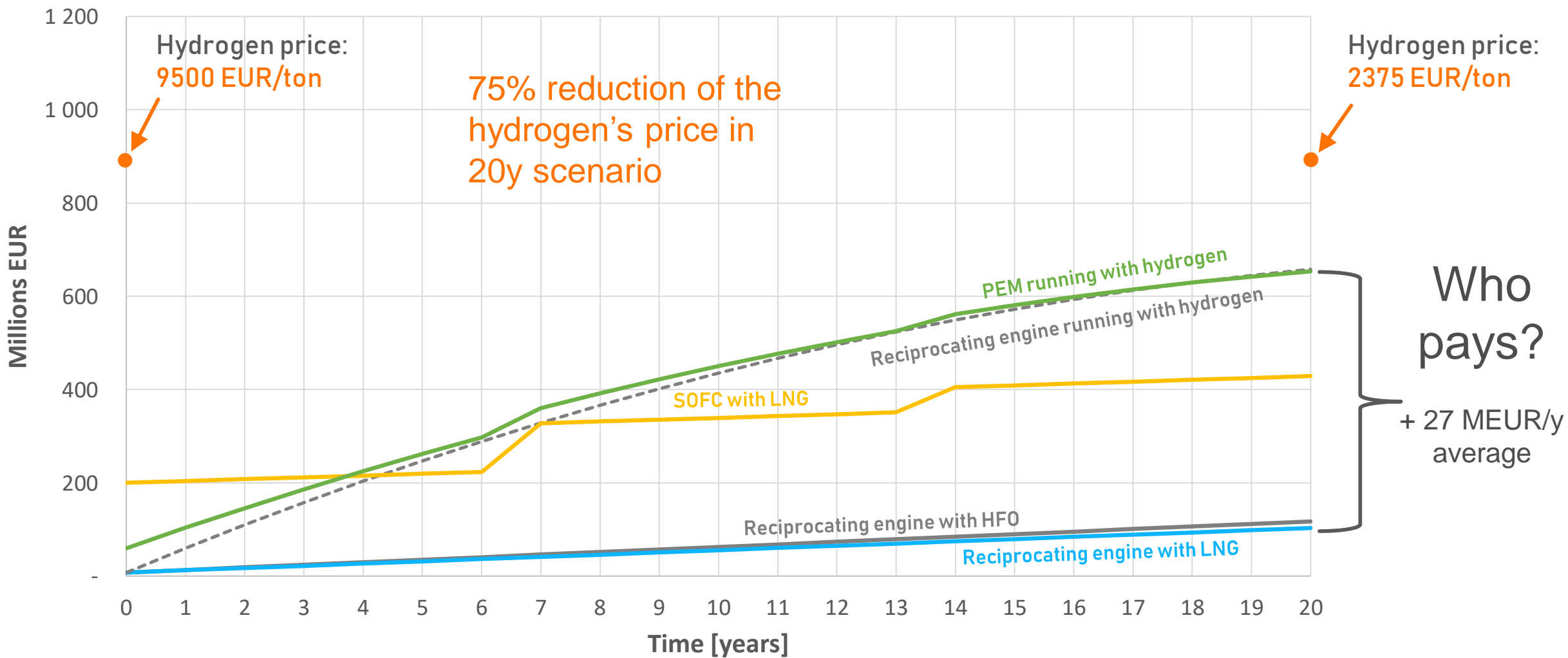


Total cost of ownership - 20'000 kW installation - 5000 rhs/y
 (initial CapEx + maintenance + fuel)



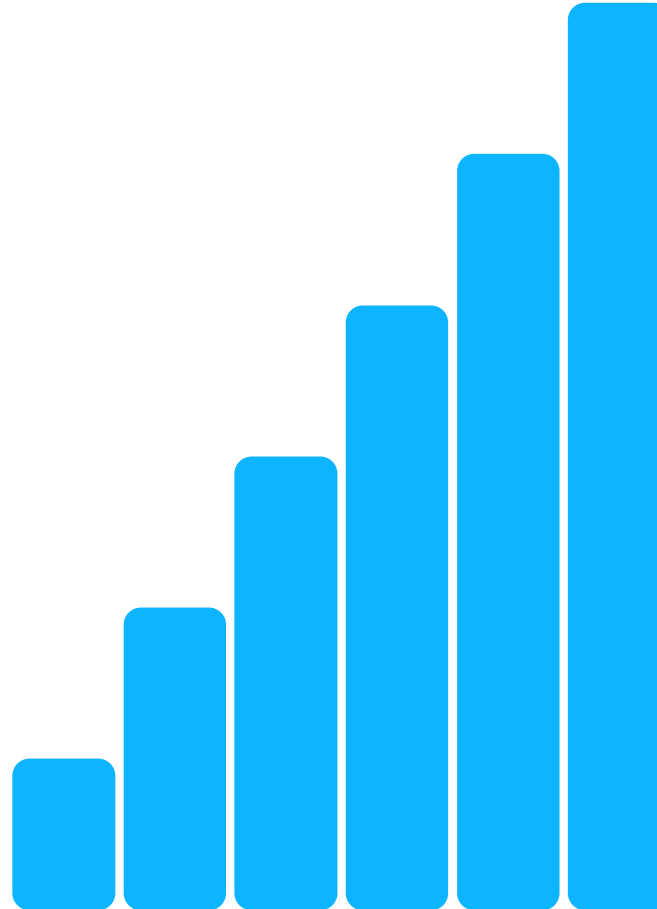
Note: LNG reciprocating engine emits 30% less CO2 emissions than Diesel

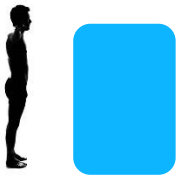
Total cost of ownership - 20'000 kW installation - 5000 rhs/y
 (initial CapEx + maintenance + fuel)



How to make
a sustainable
future
**economically
accessible?**

Not in one
jump, we
need
**middle
steps!**





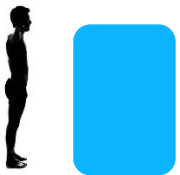
Reciprocating engine running with hydrogen

- ✓ Reduced initial investment while fuel cell market would develop
- ✓ Possibility to run multiple fuels in order to reduce OpEx and operate worldwide while the hydrogen's supply chain would develop

CapEx



OpEx



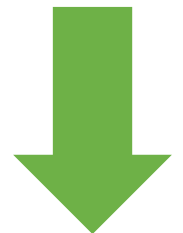
Fuel Cells fueled with LNG

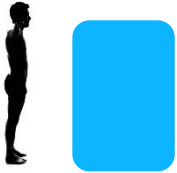
- ✓ Possibility to run with available fuels worldwide
- ✓ Lower TCO at 20y than hydrogen

CapEx



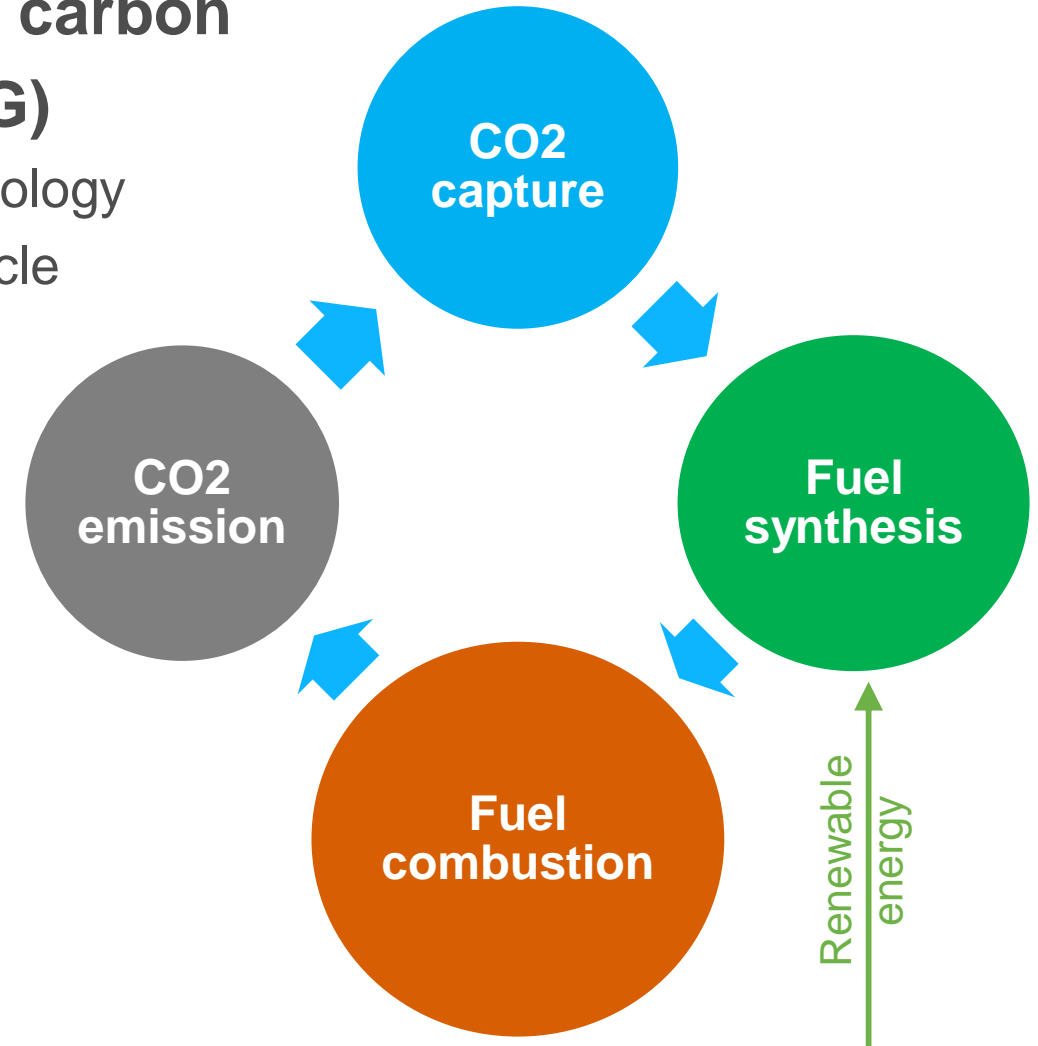
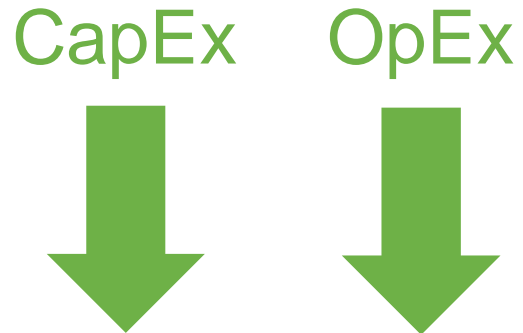
OpEx





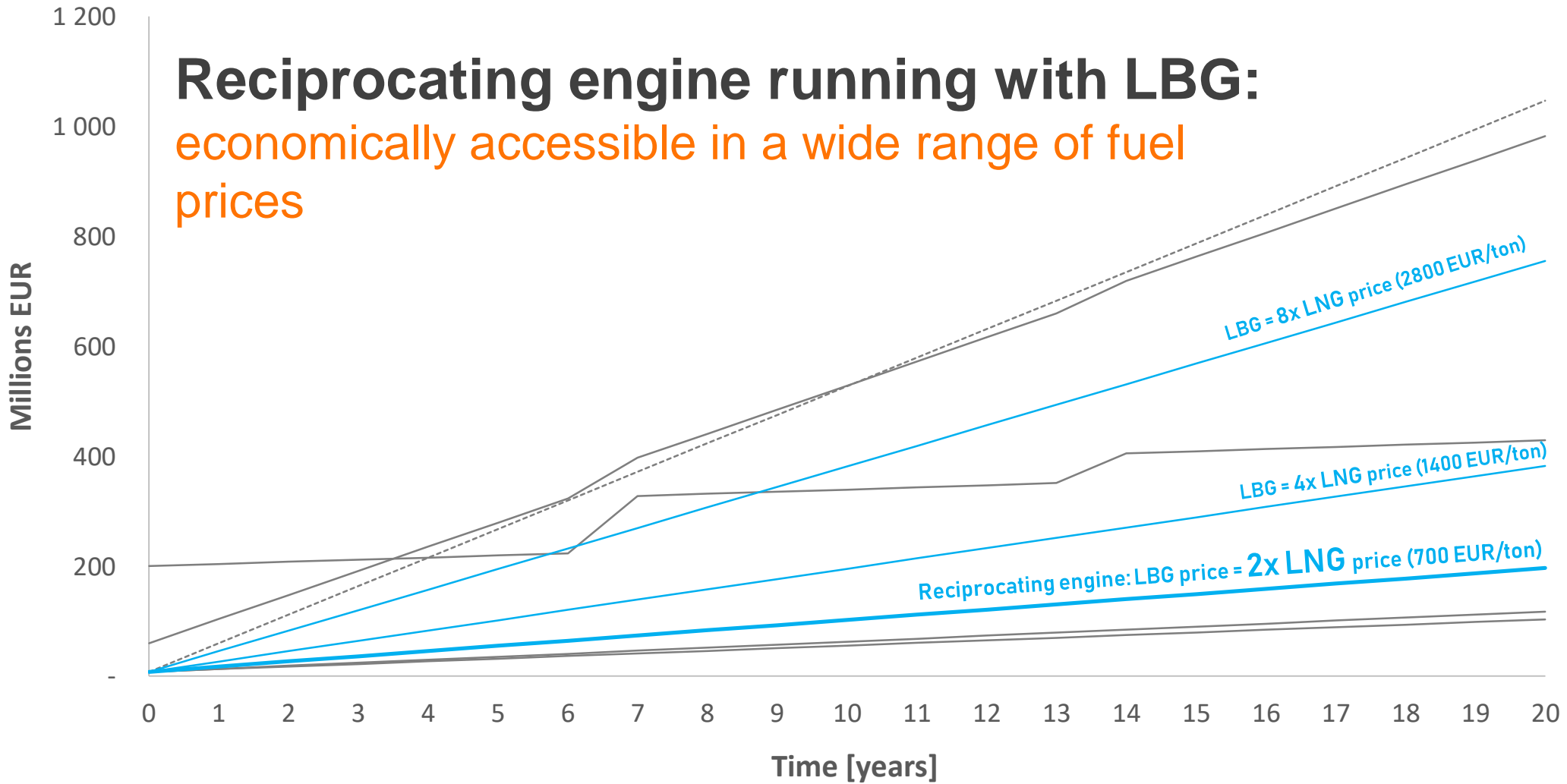
Reciprocating engines running with carbon neutral fuels (Liquid Bio Gas – LBG)

- ✓ Possibility to run with actual engine technology
- ✓ Almost Zero CO2 emission on the fuel cycle
- ✓ Low fuel costs



Total cost of ownership - 20'000 kW installation - 5000 rhs/y
(initial CapEx + maintenance + fuel)

Reciprocating engine running with LBG: economically accessible in a wide range of fuel prices

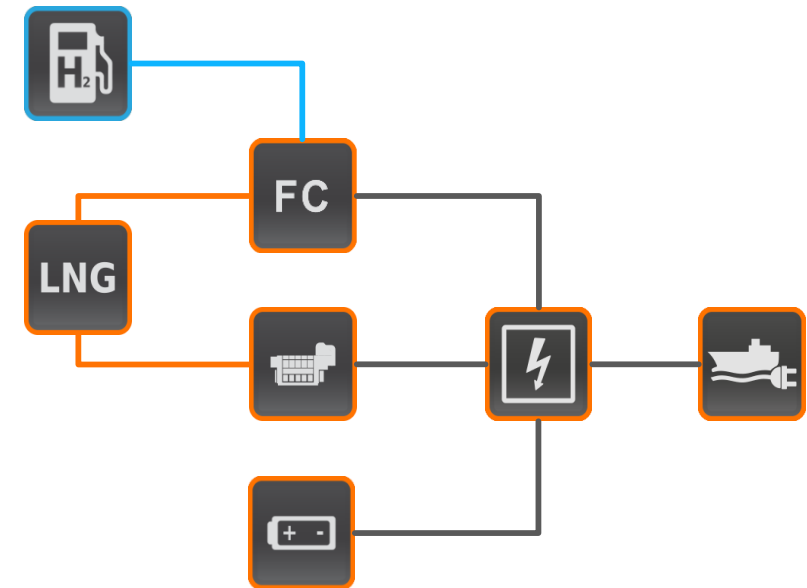


Note
Used prices:
LNG: 350 EUR/ton
HFO: 350 EUR/ton
H2: 9500 EUR/ton



Flexible system architecture

Multi fuel & multi
technology **optimized**
integrated system





WÄRTSILÄ

Stefano Cantarut

Segment Manager Cruise & Ferry

stefano.cantarut@wartsila.com

Mob: +39 366 6800475