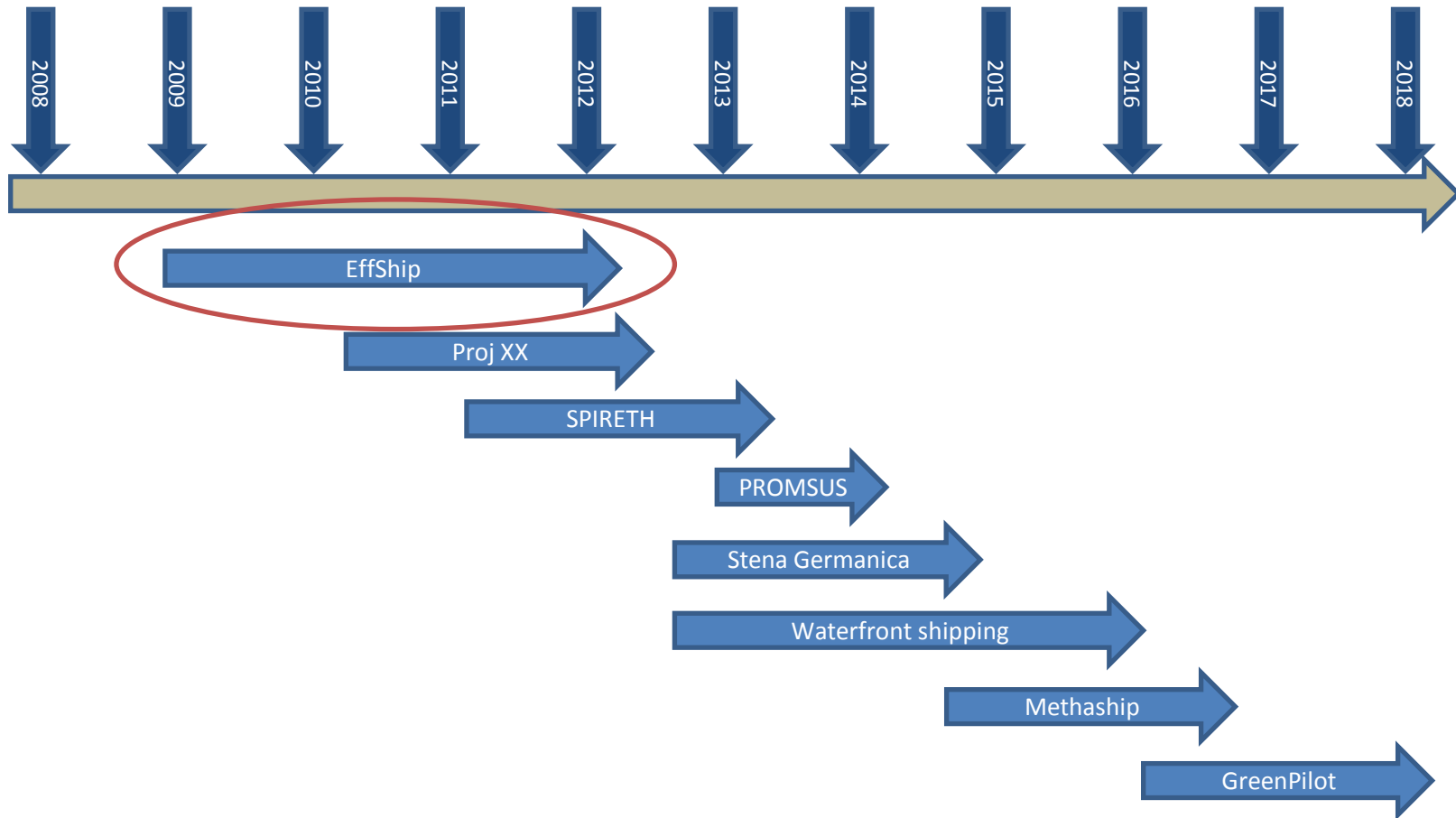


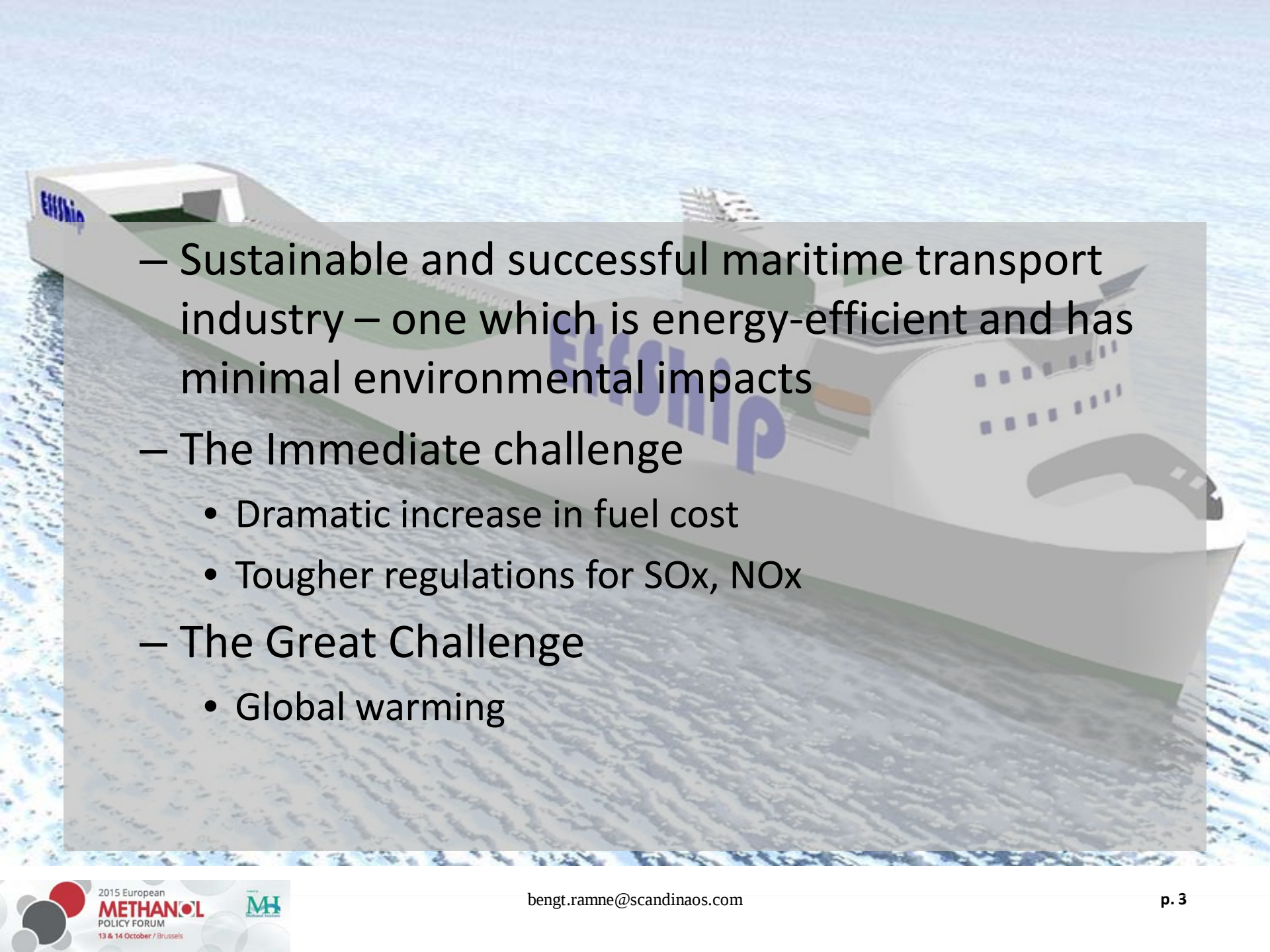
Previous R&D

Bengt Ramne

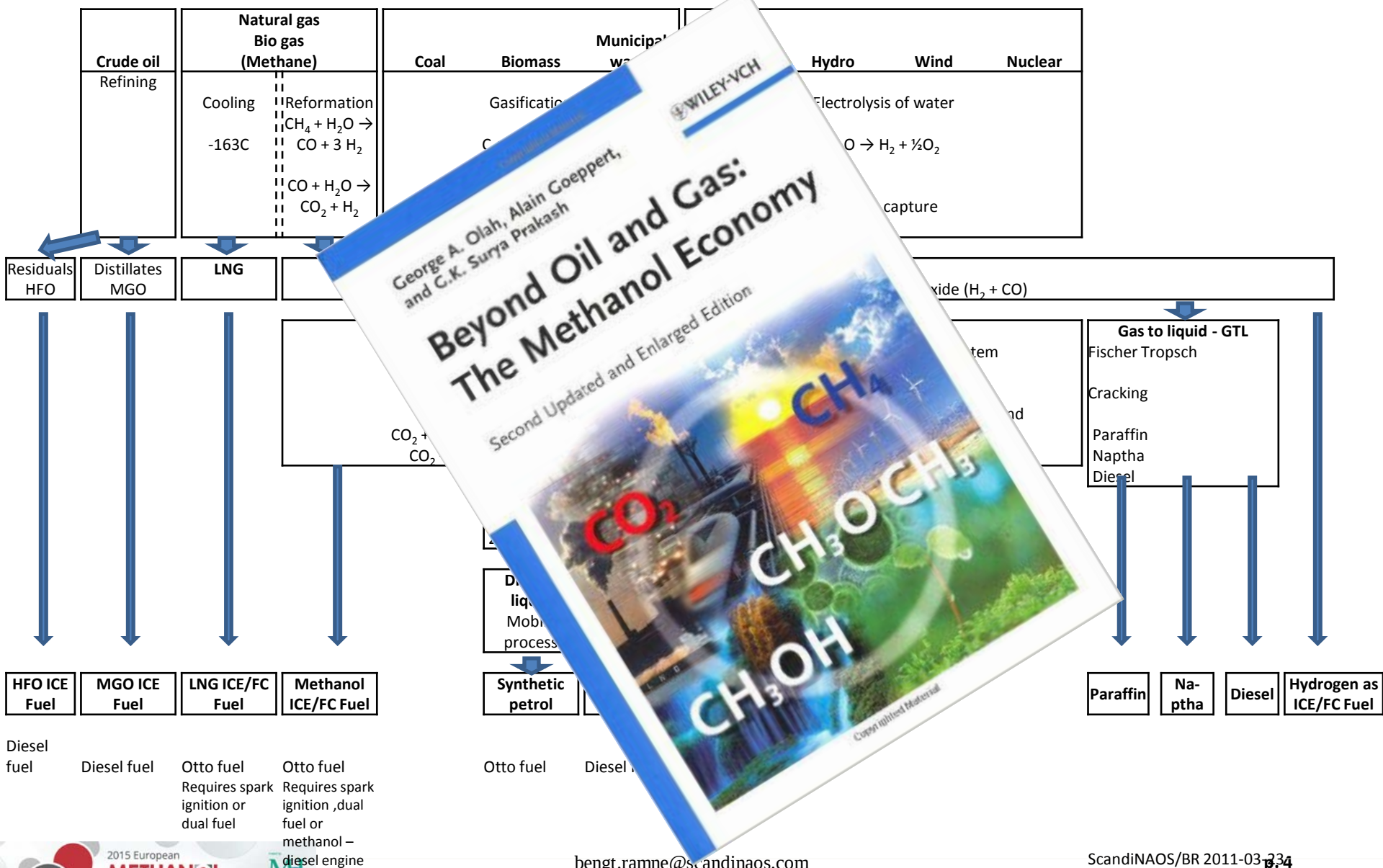
Naval Architect, Managing Director - ScandiNAOS AB
Professor of the Practice - Chalmers University of Technology

Significant projects



- 
- Sustainable and successful maritime transport industry – one which is energy-efficient and has minimal environmental impacts
 - The Immediate challenge
 - Dramatic increase in fuel cost
 - Tougher regulations for SO_x, NO_x
 - The Great Challenge
 - Global warming

Alternative Marine Fuel - Feedstock and products

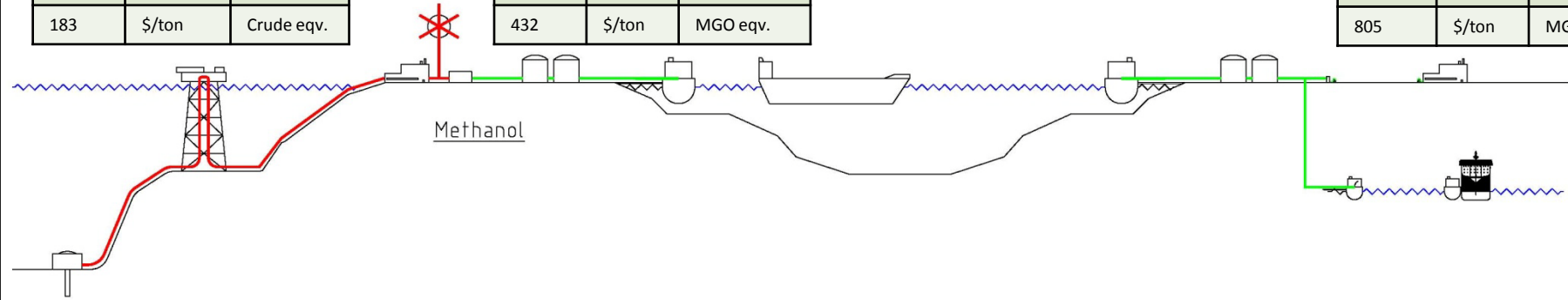


Natural gas well head price		
0.010	€/kWh	
183	\$/ton	Crude eqv.

Methanol cost ex works		
0.025	€/kWh	
432	\$/ton	MGO eqv.

Methanol produced from forest products		
0.072	€/kWh	
1244	\$/ton	MGO eqv.

Methanol along side Göteborg		
0.044	€/kWh	
805	\$/ton	MGO eqv.

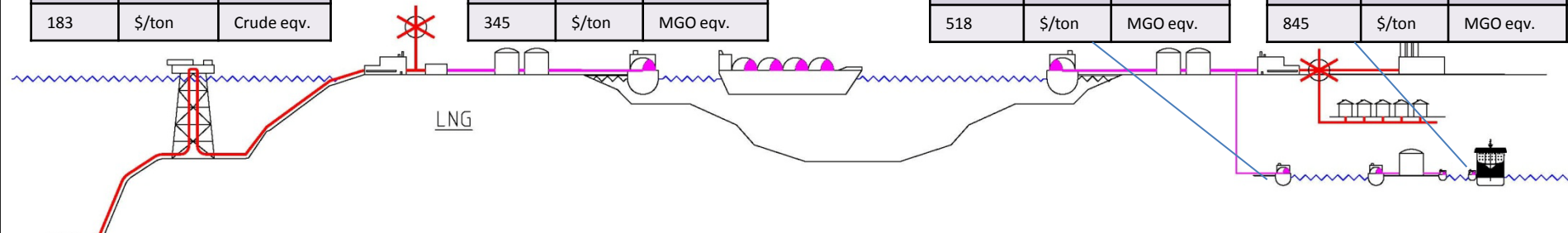


Natural gas well head price		
0.010	€/kWh	
183	\$/ton	Crude eqv.

LNG cost ex works		
0.02	€/kWh	
345	\$/ton	MGO eqv.

LNG FOB Zeebrugge		
0.03	€/kWh	
518	\$/ton	MGO eqv.

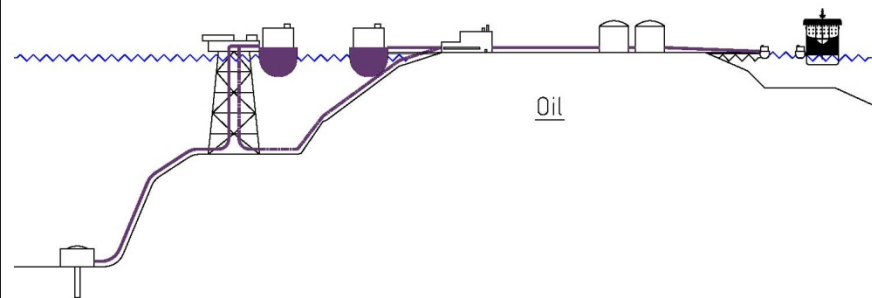
LNG along side Göteborg		
0.046	€/kWh	
845	\$/ton	MGO eqv.



Crude oil well head price		
115	\$/bbl	
843	\$/ton	

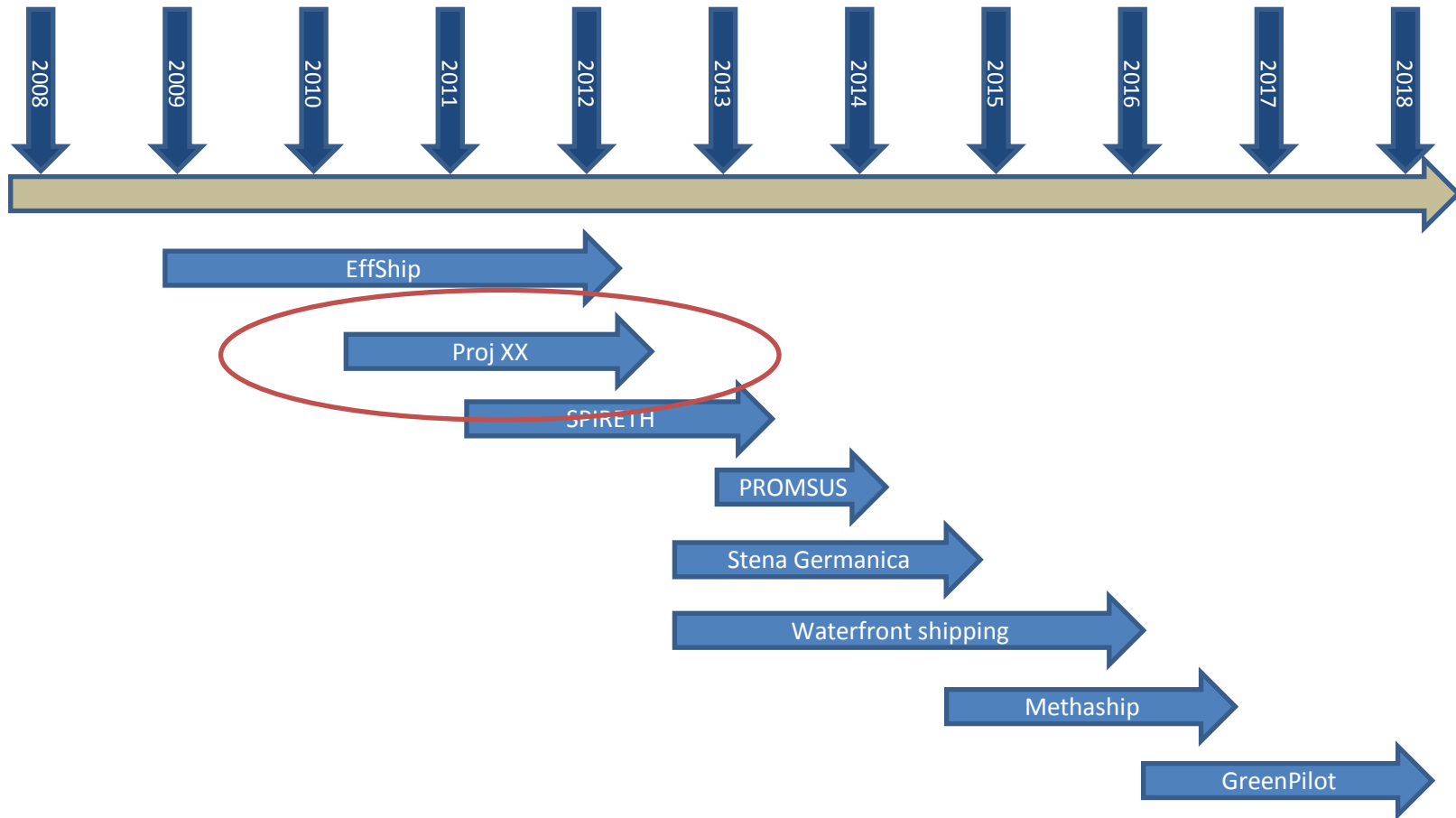
Crude landed (WTI/Brent approx)		
119	\$/bbl	
0.051	€/kWh	
872	\$/ton	

MGO port price		
0.062	€/kWh	
1070	\$/ton	



HFO port price		
0.041	€/kWh	
698	\$/ton	

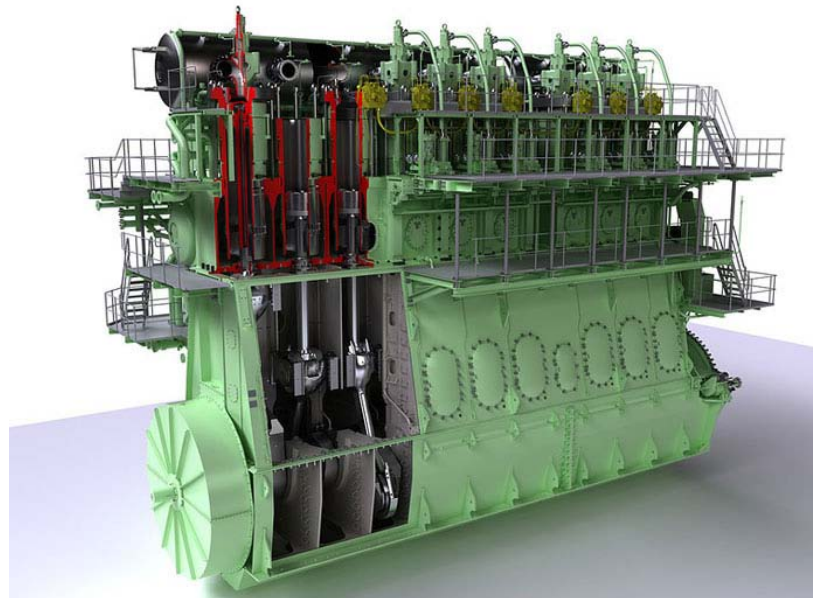
Significant projects



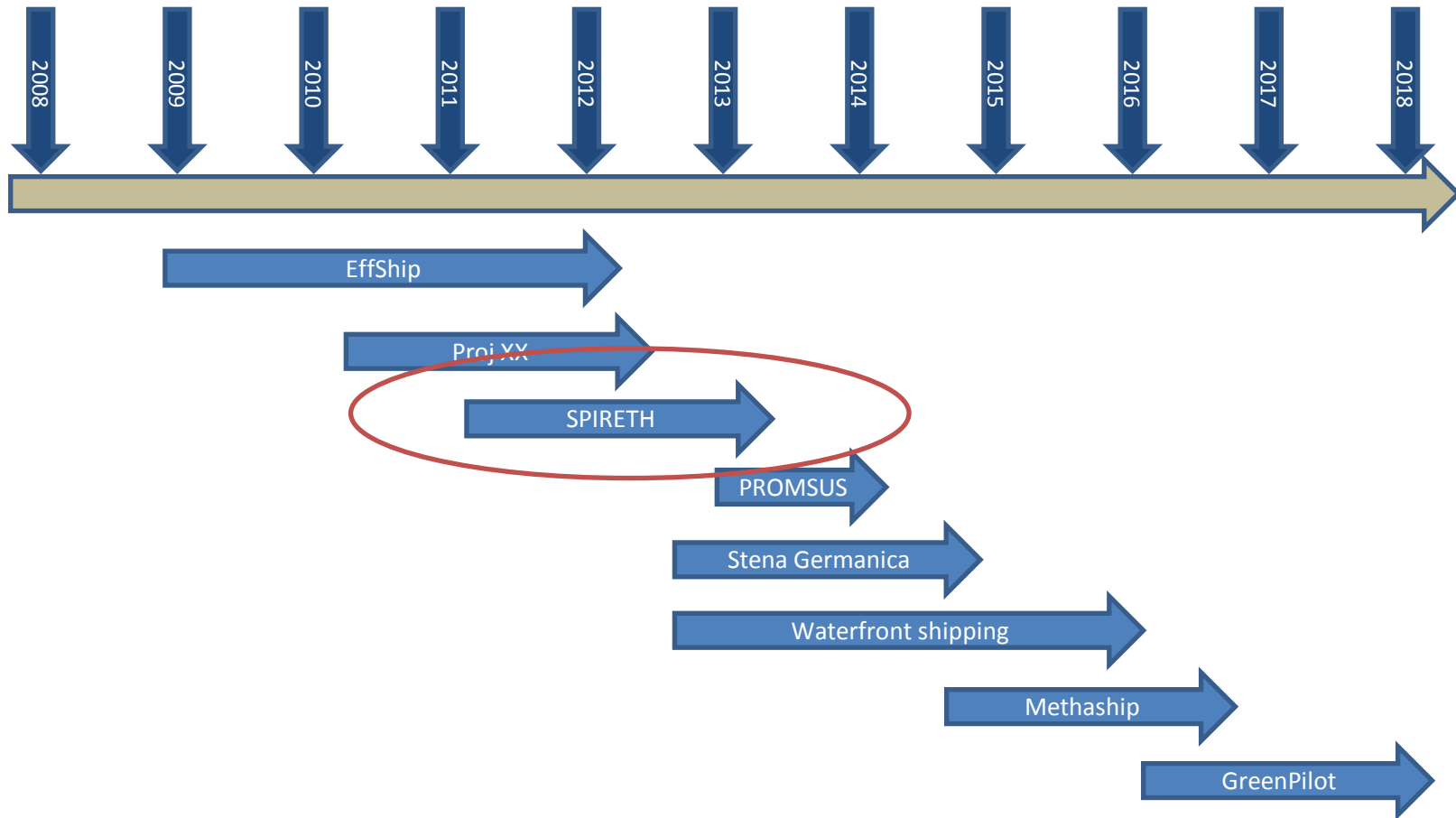
Project XX

MAN S50ME-B9.3-LGI

Two stroke high pressure gas (methanol) engine

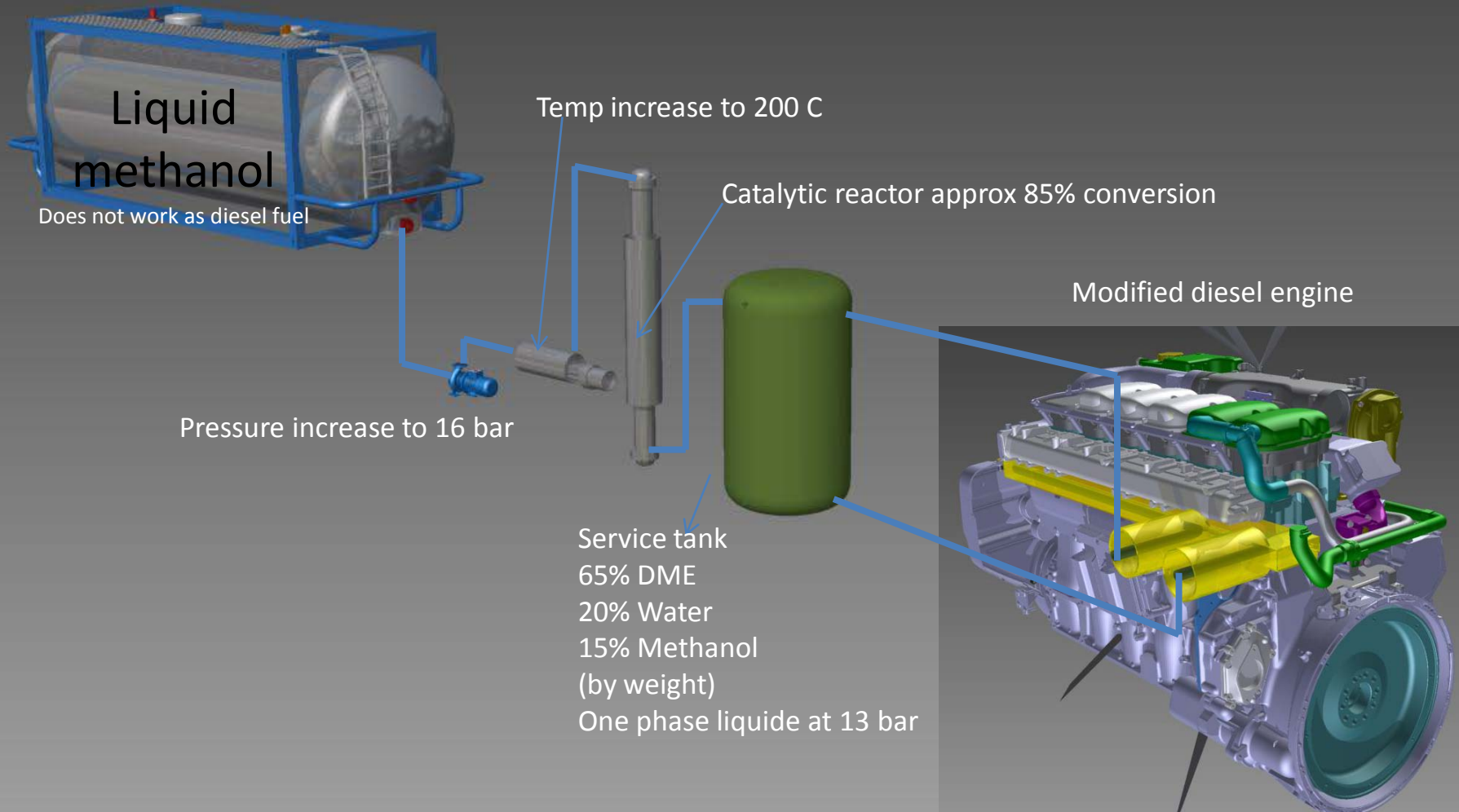


Significant projects



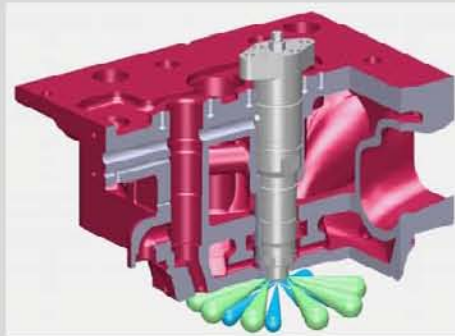
SPIRETH - Stena Scanrail





Wärtsilä Dual Fuel Concept for Methanol

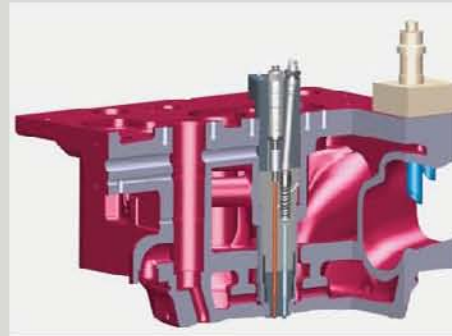
Methanol or Gas - Diesel



Diesel Combustion
(Diffusion Combustion)

- + Not knock sensitive,
→ fuel MN not an issue
- + Low THC, CO
- + High load acceptance

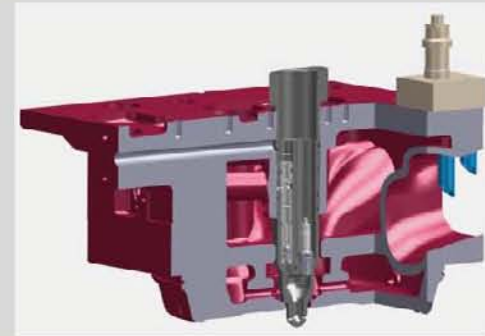
Duel-Fuel



Otto Combustion
(Premixed Combustion)

- + Tier III (NOx) solution
- + Higher ignition energy
than spark plug
- + High efficiency (*in gas mode*)

Spark-Ignited



Otto Combustion
(Premixed Combustion)

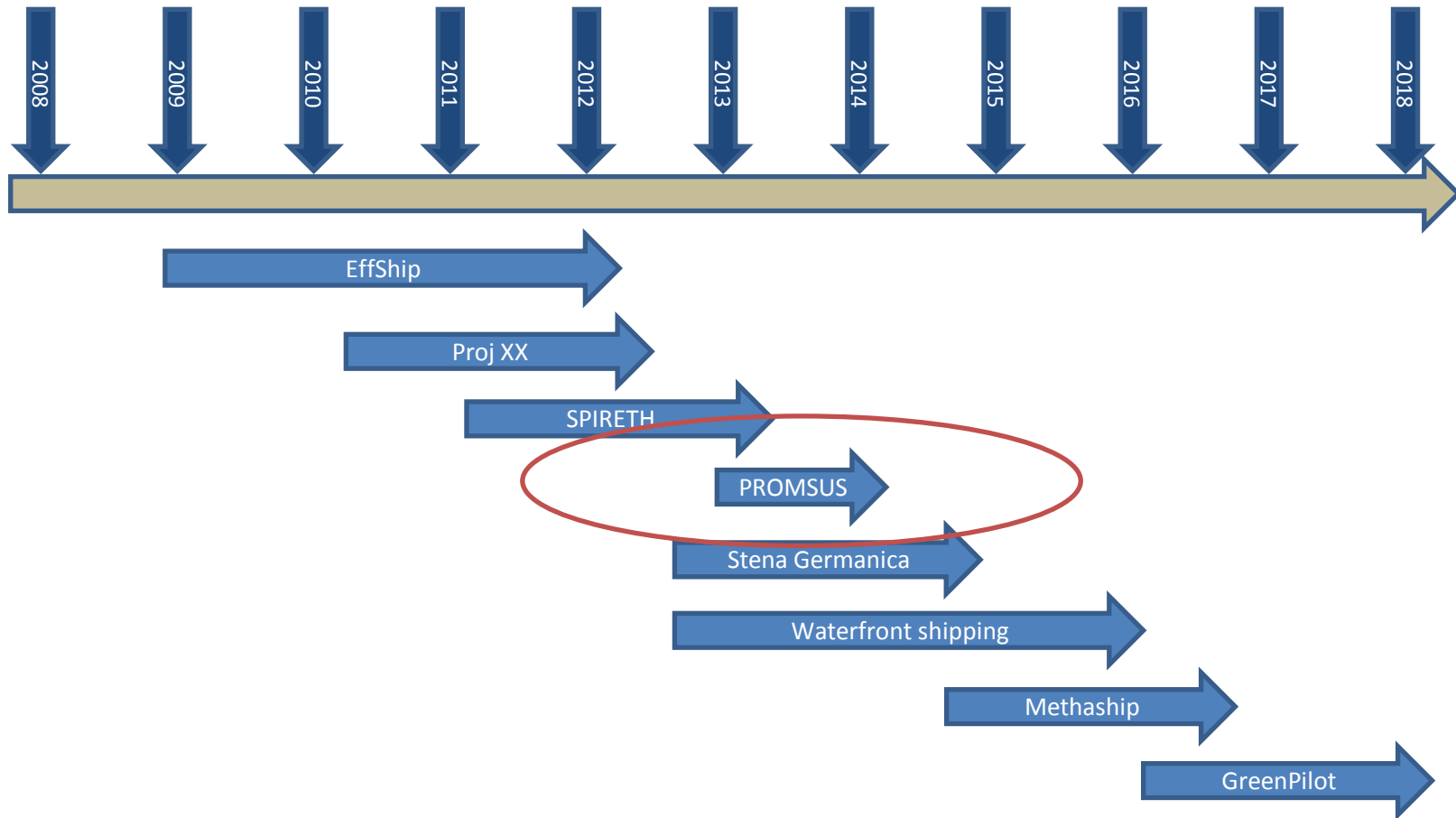
- + Tier III (NOx) solution
- + No additional fuel
beside gas
- + High efficiency

- No Tier III (NOx)

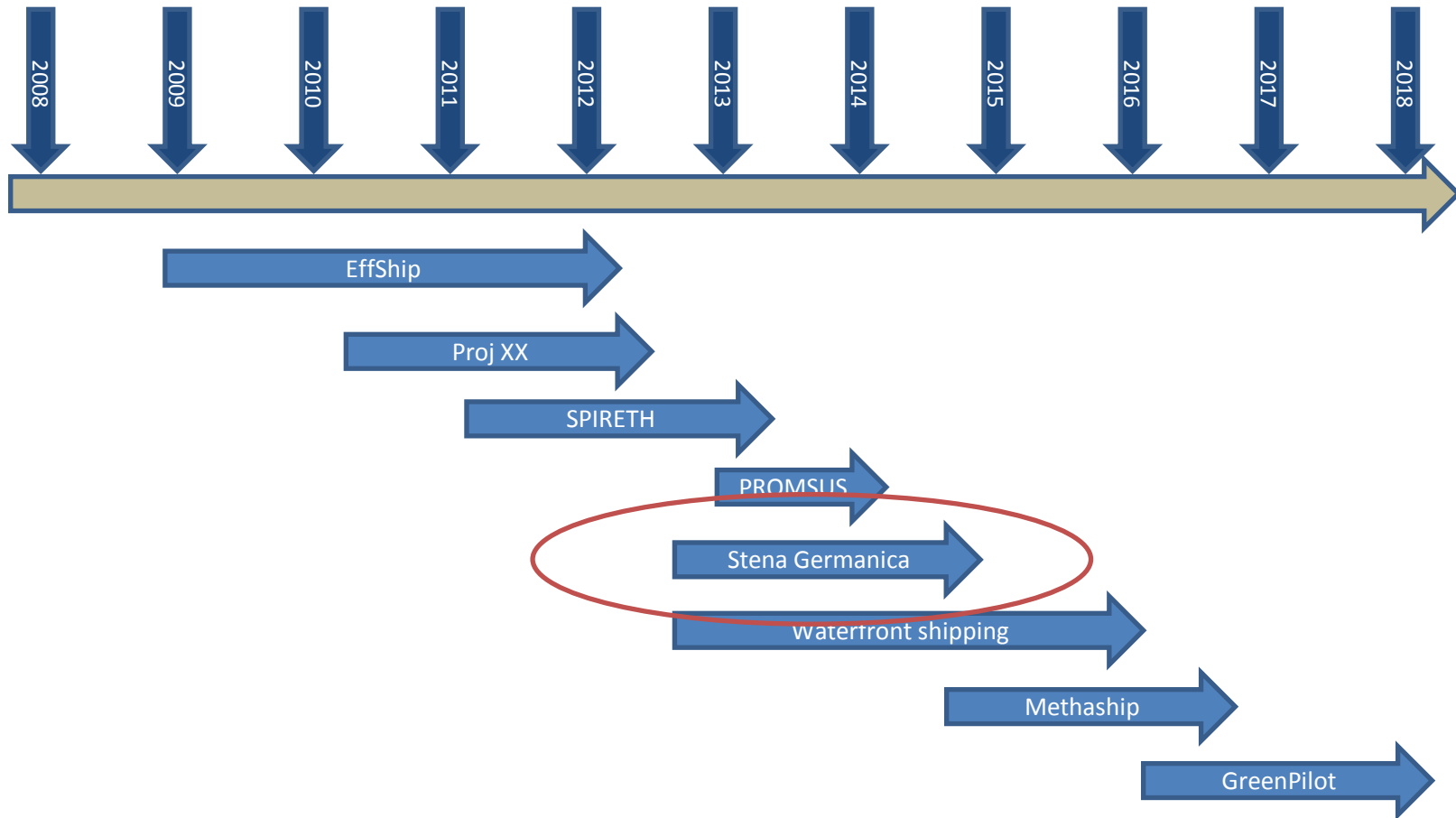
- Fuel sensitive (knocking),

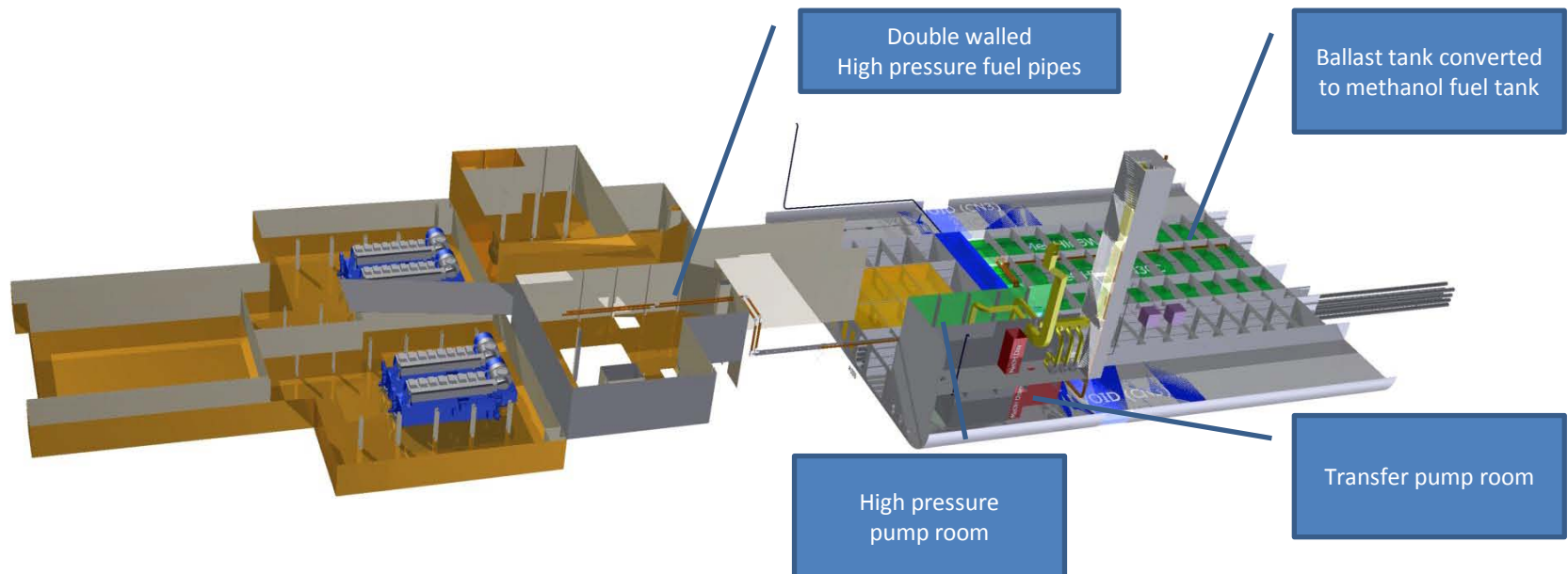
- Fuel sensitive (knocking),

Significant projects

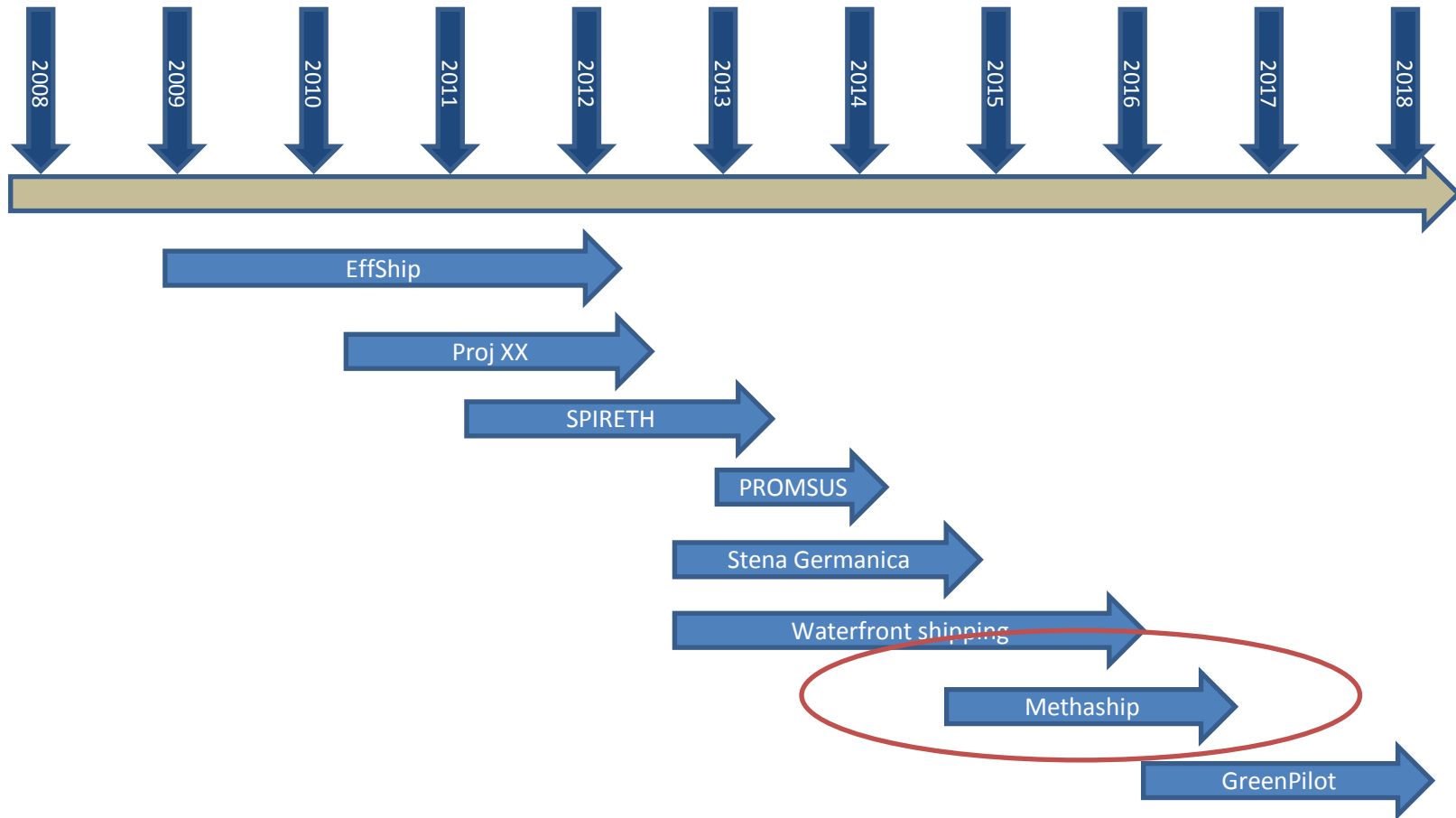


Significant projects

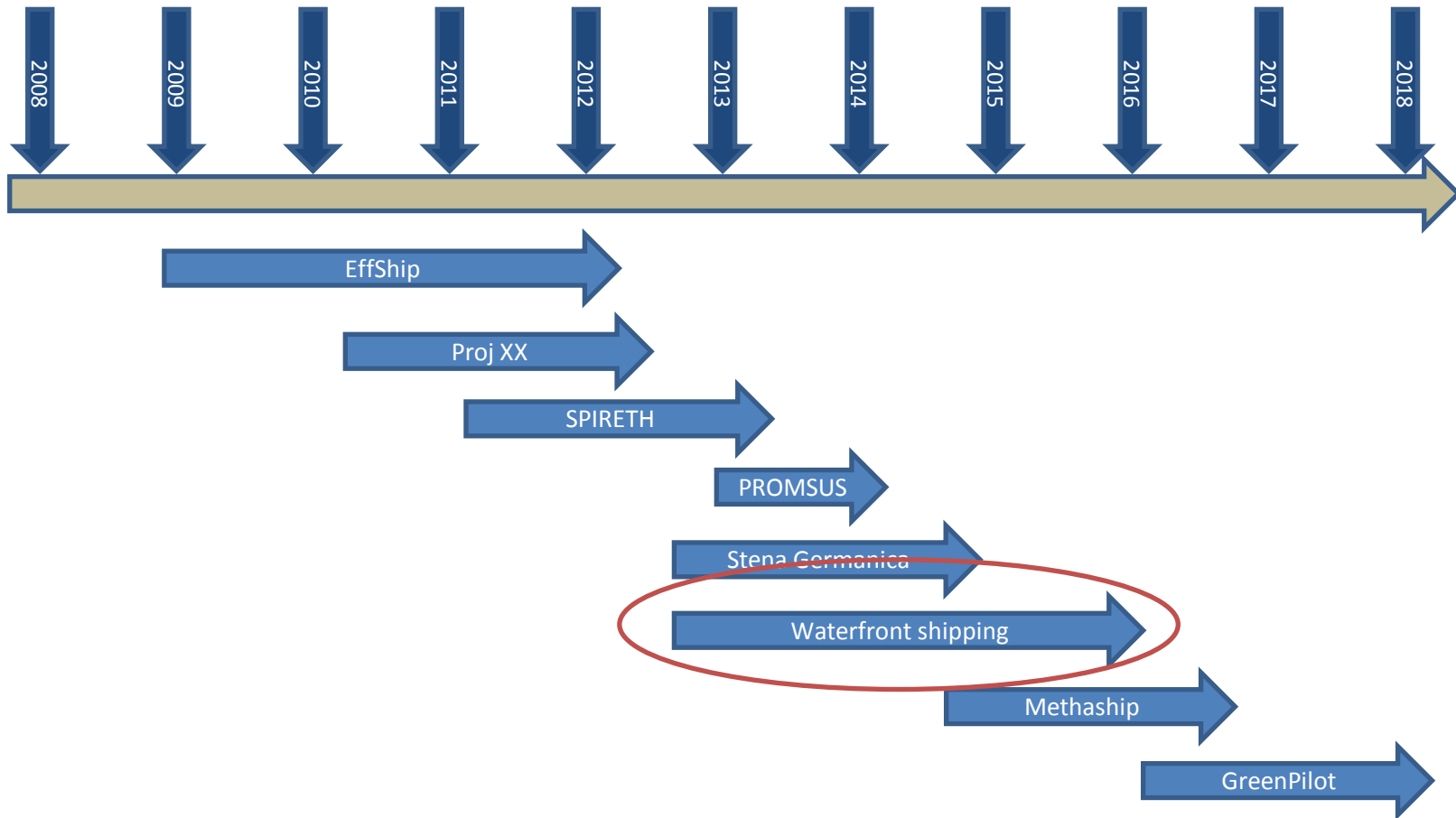




Significant projects



Significant projects

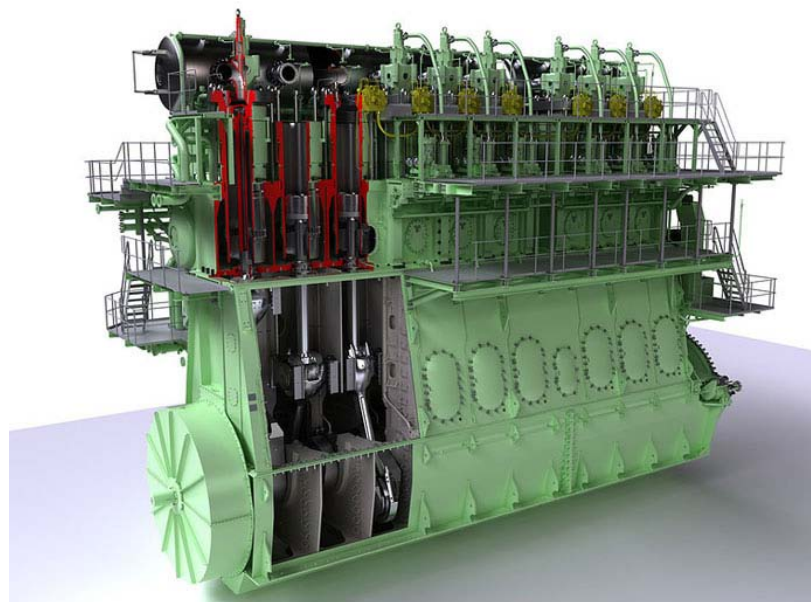


Methanol new buildings

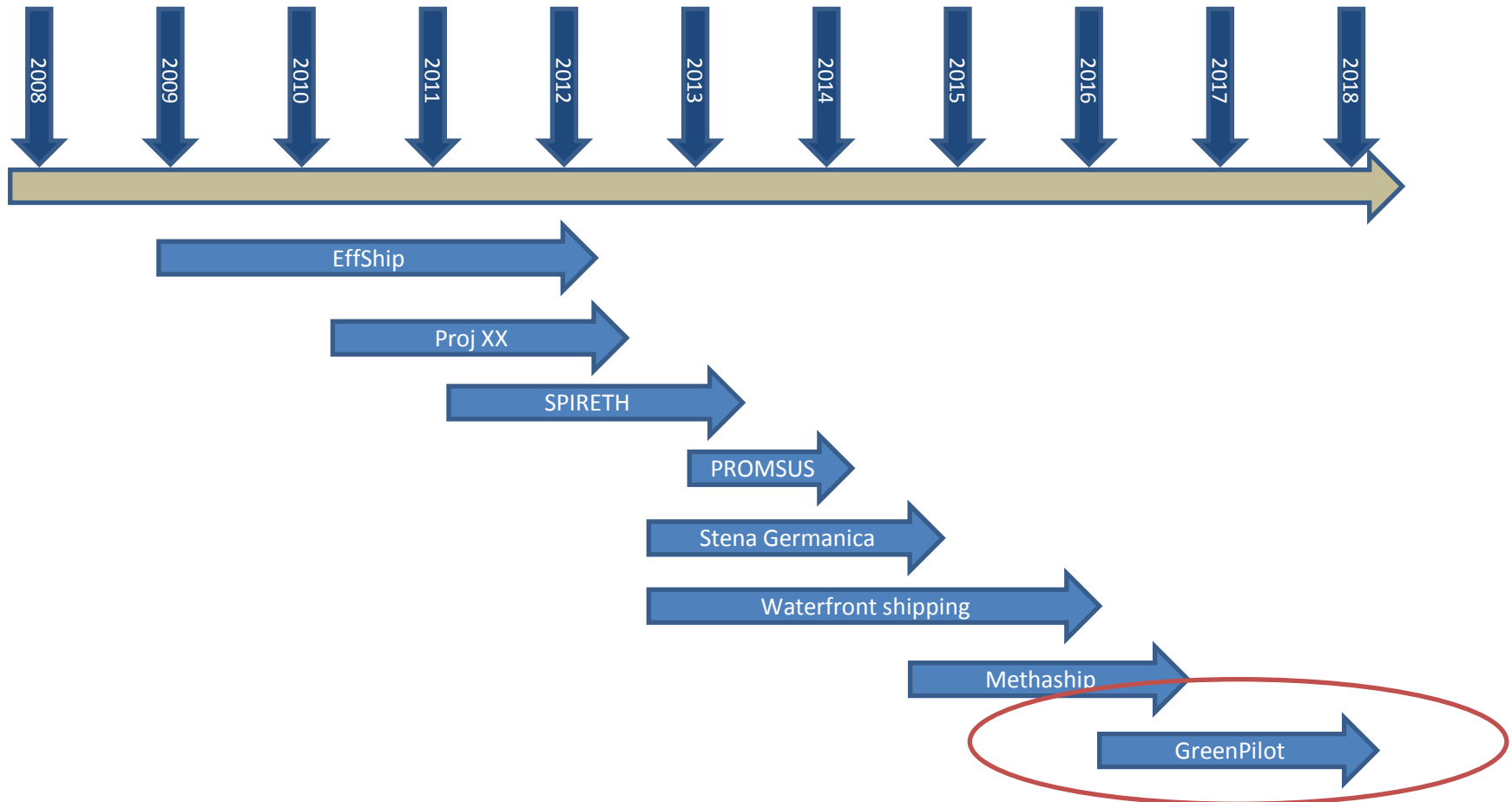
Six 50 000 dwt Chemical Tankers



MAN S50ME-B9.3-LGI
Two stroke high pressure gas (methanol) engine



Significant projects



Conversion of pilot boat



Inland waterways

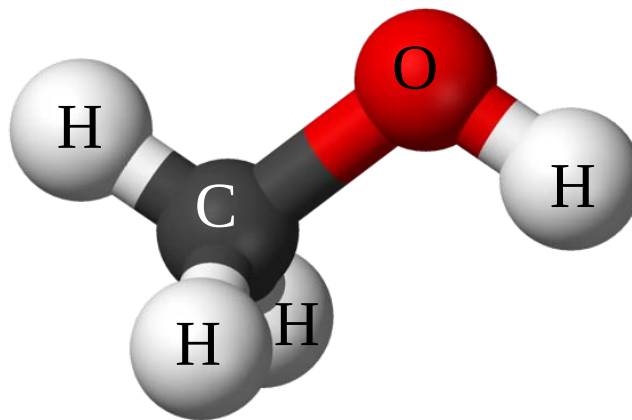


<http://www.worldcanals.com>

Western European Inland Waterway Fleet**30 000****Standard Inland Shipping Waterway vessel****L****110****B****11,4****Draft****4****Dwt****3000****TEU****200****Typical power****4 x 400 kW**

Methanol

- An efficient, universal, future-proof, energy carrier that can be sustainably produced in large quantities



Thank you for listening