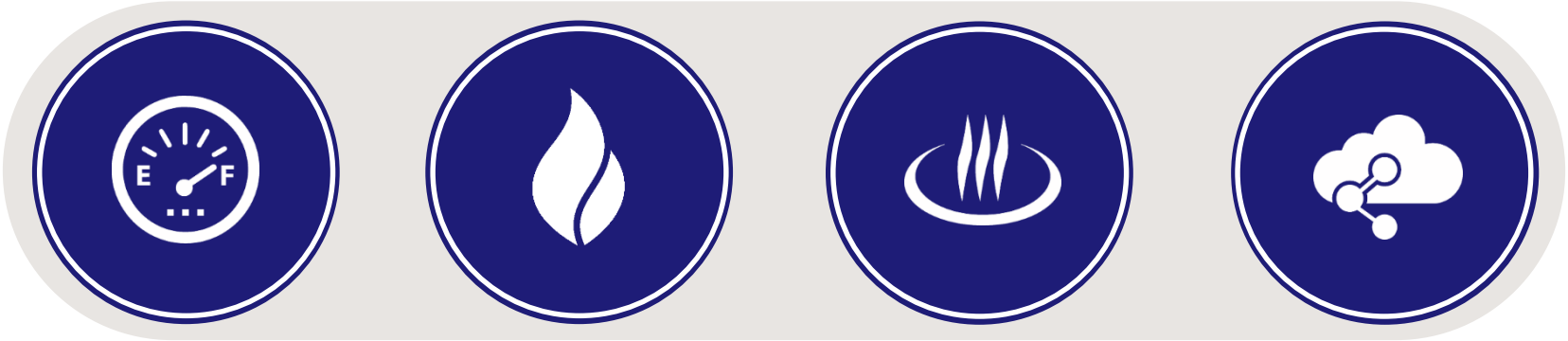
Alfa Laval

Marine 2020 & Beyond – Be a Step Ahead

Pieter Borg

Agenda



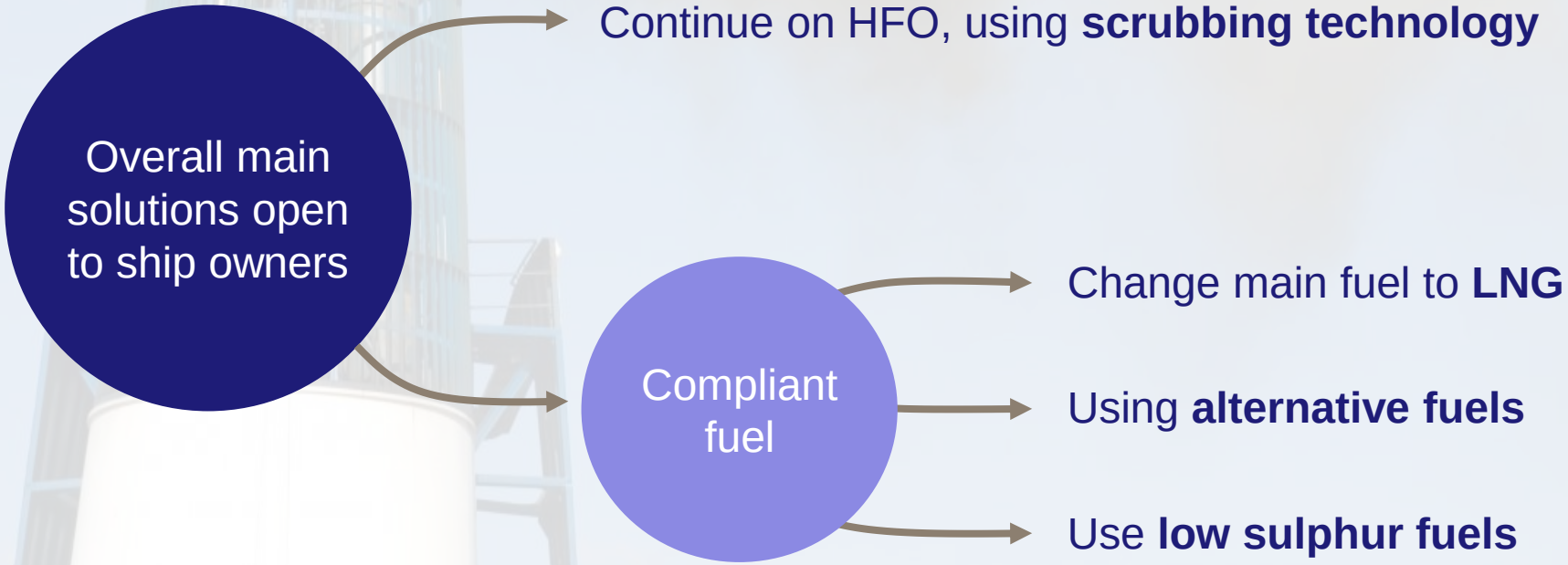
Main fuel strategies

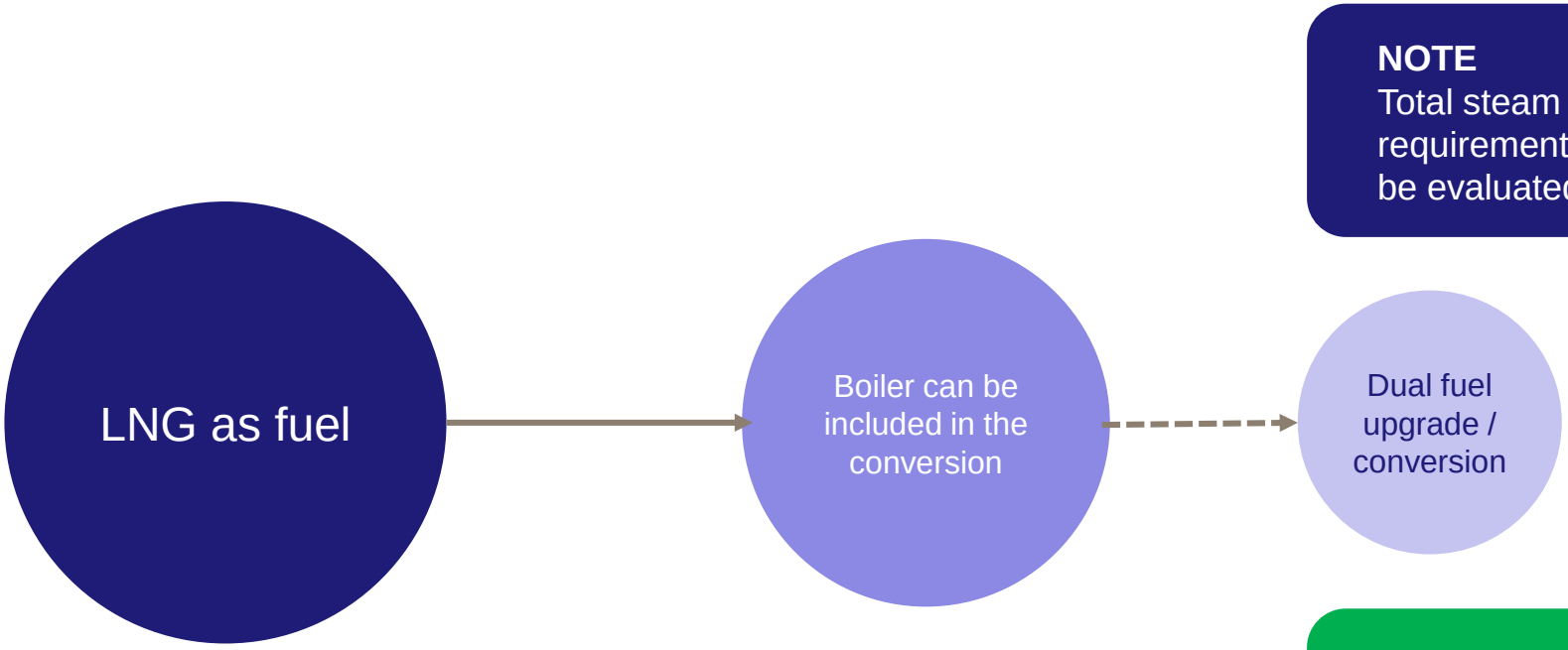
Dual fuel

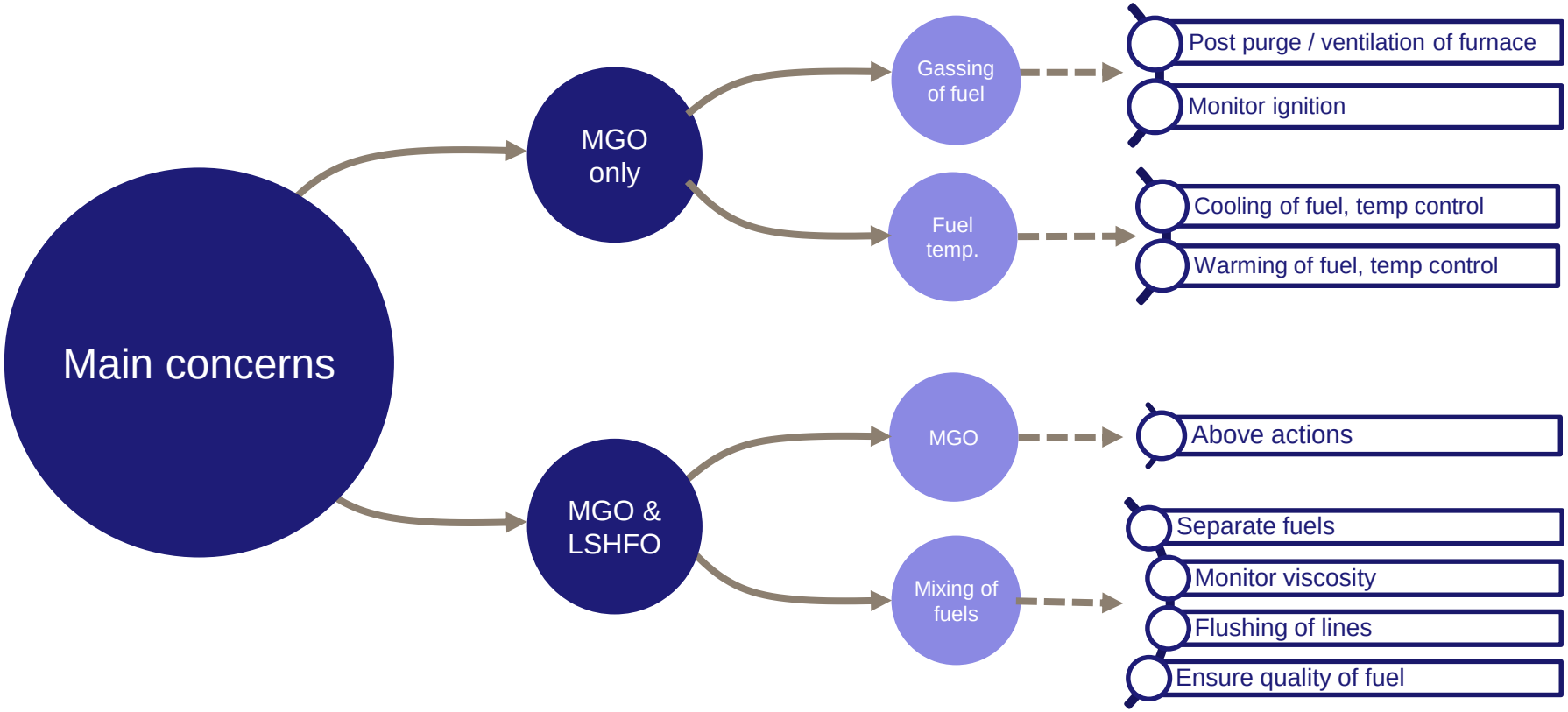
Utilizing all energy resources

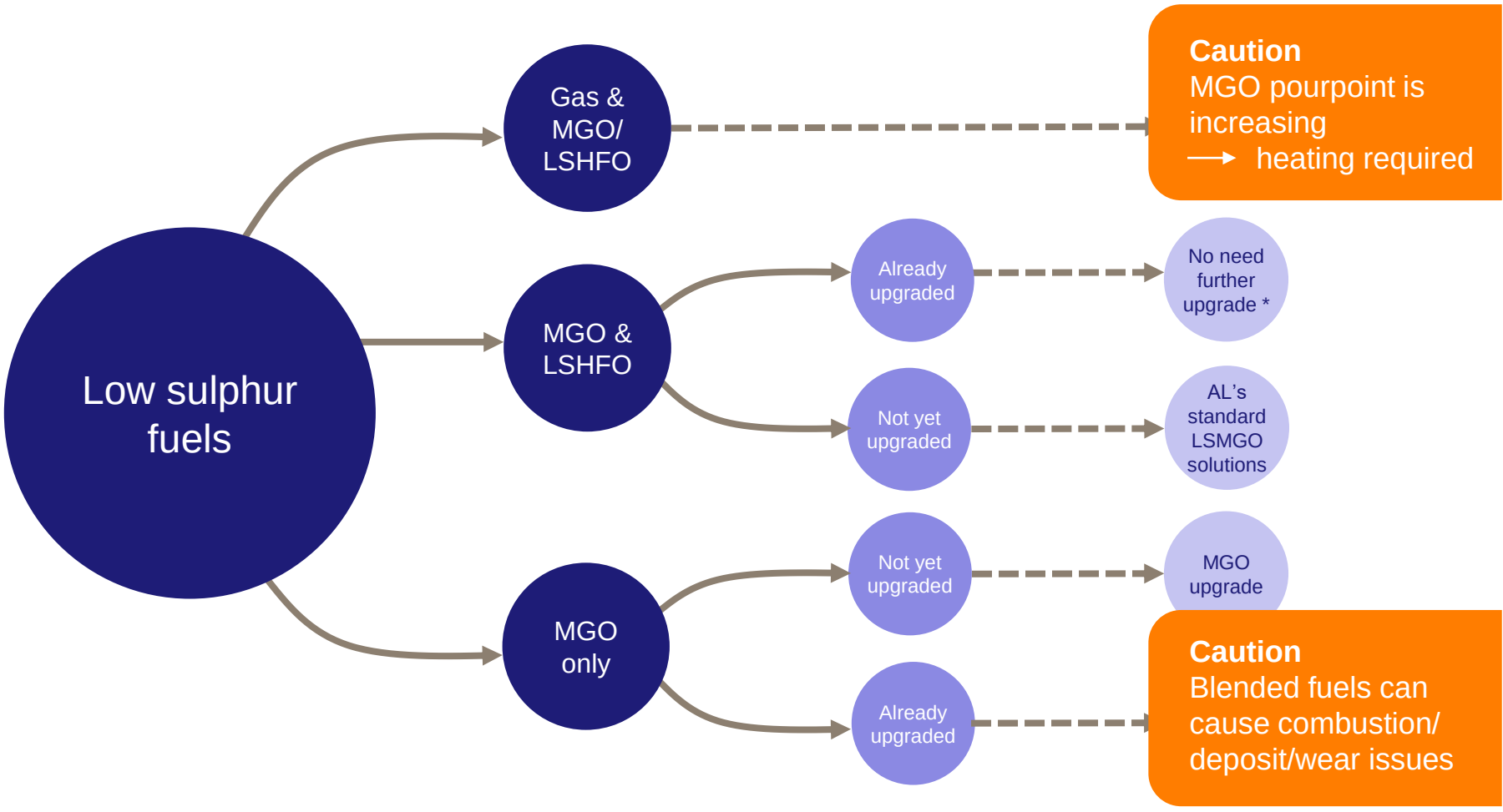
Connectivity

Main fuel strategies




LNG as fuel
Boiler can be included in the conversion
Dual fuel upgrade / conversion
NOTE
Total steam requirement to be evaluated
NOTE
Possible to operate boiler at free flow and as GCU


Main concerns
MGO only
MGO & LSHFO
Gassing of fuel
Fuel temp.
MGO
Mixing of fuels
Post purge / ventilation of furnace
Monitor ignition
Cooling of fuel, temp control
Warming of fuel, temp control
Above actions
Separate fuels
Monitor viscosity
Flushing of lines
Ensure quality of fuel


Low sulphur fuels
Gas & MGO/ LSHFO
MGO & LSHFO
MGO only
Already upgraded
Not yet upgraded
Not yet upgraded
Already upgraded
No need further upgrade *
AL's standard LSMGO solutions
MGO upgrade
Caution
MGO pourpoint is increasing
→ heating required
Caution
Blended fuels can cause combustion/ deposit/wear issues

Conclusion

- The fuel strategy is your choice
- Almost all strategies will affect the boiler operation
- Alfa Laval is ready to assist, but the earlier the better

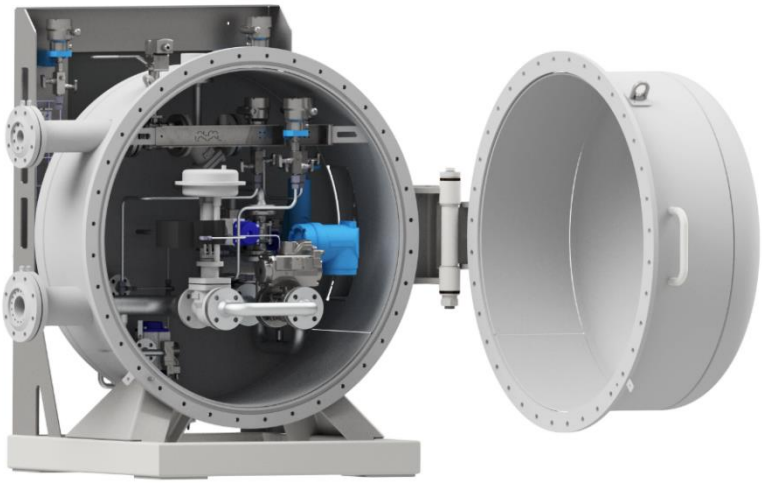
Dual fuel boilers

Combustion

Burner type	Boiler type: Aalborg OS-TCI	Aalborg OC-TCI	Aalborg OL	Aalborg D
Pressure atomizing burner Aalborg Multiflame KBM	●	●		
Steam atomizing burners Aalborg MPF, Aalborg Multiflame KBSD			●	●

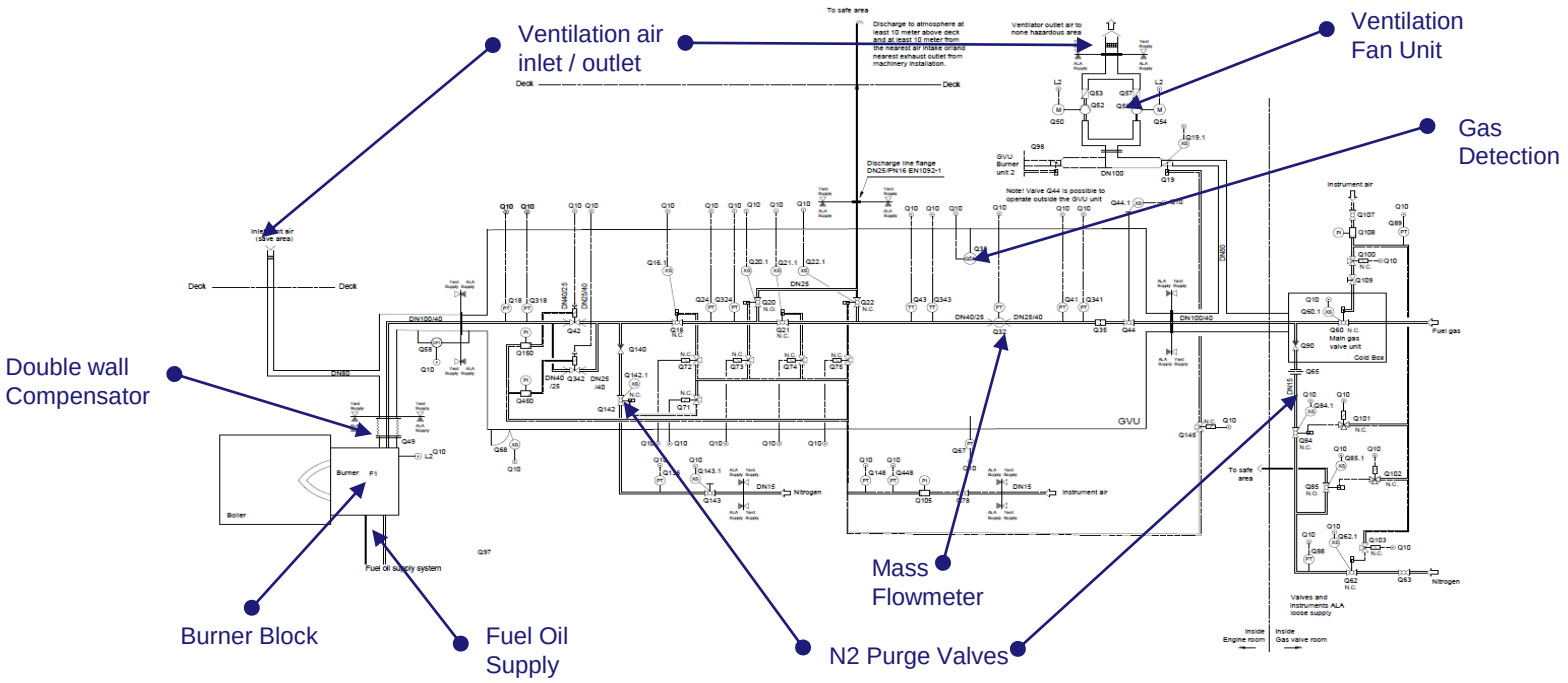
GVU (Gas Valve Unit)

- Enclosure type GVU
- 10 bar(g) design pressure
- Ventilation fan unit (2 fans)
- Double wall pipe from burner tc GVU with double wall compensator.
- In-house engineering and production
- Free flow option available

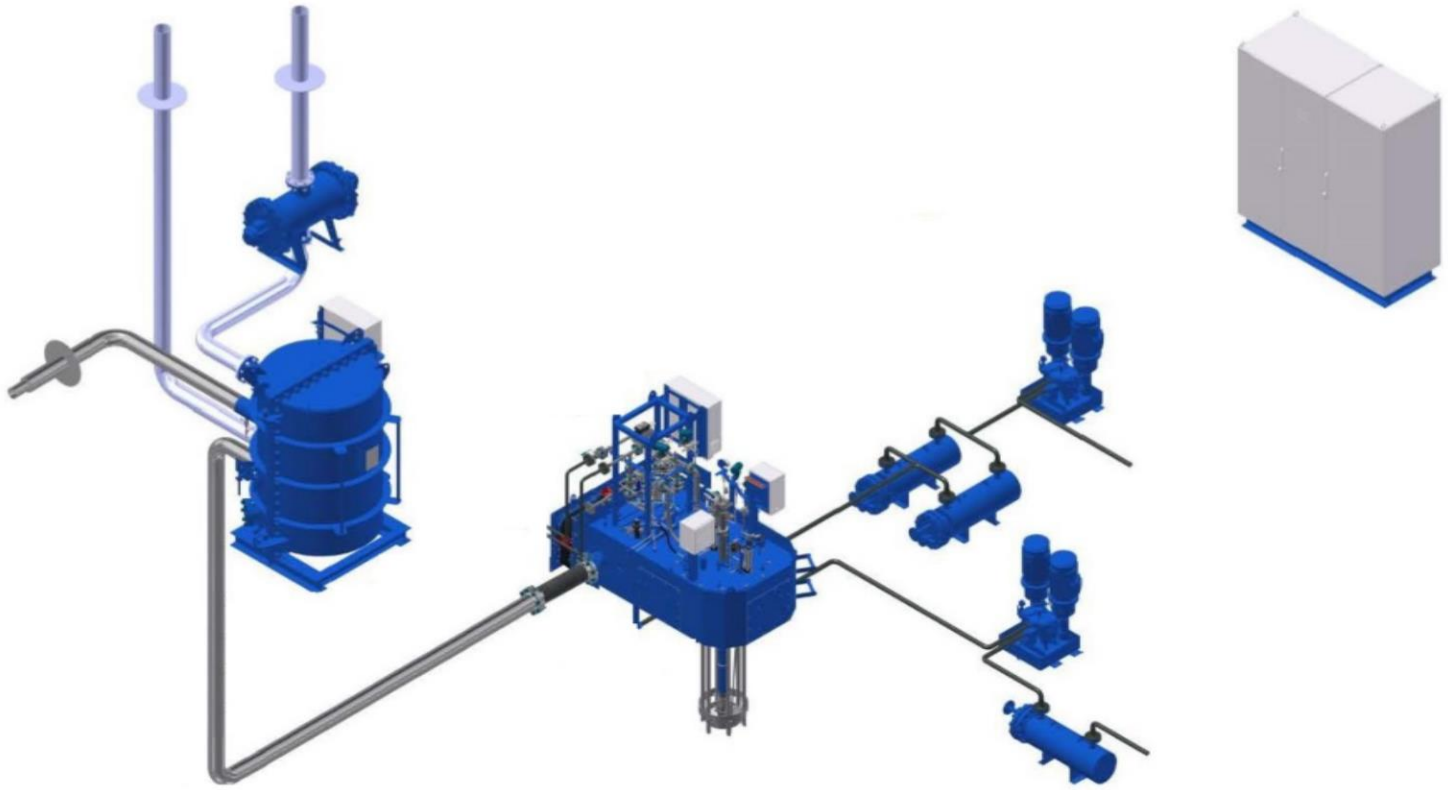


GVU and ventilation fan unit

Gas supply arrangement



Typical layout of the system



IGF Rules: Control of tank pressure

6.9.1 Control of tank pressure and temperature

6.9.1.1 With the exception of liquefied gas fuel tanks designed to withstand the full gauge vapour pressure of the fuel under conditions of the upper ambient design temperature, liquefied gas fuel tanks' pressure and temperature shall be maintained at all times within their design range by means acceptable to the Administration, e.g. by one of the following methods:

.1 reliquefaction of vapours;

.2 thermal oxidation of vapours;

.3 pressure accumulation; or

.4 liquefied gas fuel cooling.

The method chosen shall be capable of maintaining tank pressure below the set pressure of the tank pressure relief valves for a period of 15 days assuming full tank at normal service pressure and the ship in idle condition, i.e. only power for domestic load is generated.

IGC Rules: Control of tank pressure

7.1 Methods of control

7.1.1 With the exception of tanks designed to withstand full gauge vapour pressure of the cargo under conditions of the upper ambient design temperatures, cargo tanks' pressure and temperature shall be maintained at all times within their design range by either one, or a combination of, the following methods:

.1 reliquefaction of cargo vapours;

.2 thermal oxidation of vapours;

.3 pressure accumulation; and

.4 liquid cargo cooling.

7.1.3 Venting of the cargo to maintain cargo tank pressure and temperature shall not be acceptable except in emergency situations. The Administration may permit certain cargoes to be controlled by venting cargo vapours to the atmosphere at sea. This may also be permitted in port with the authorization of the port Administration.

IGF Rules: System Definition and Sizing of the Heat Exchanger

6.9.6 Availability of Systems

6.9.6.1 The availability of the system and its supporting auxiliary services shall be such that in case of a single failure (of mechanical non-static component or a component of the control systems) the fuel tank pressure and temperature can be maintained by another service/system.

6.9.6.2 Heat exchangers that are solely necessary for maintaining the pressure and temperature of the gas fuel tanks within their design ranges shall have a standby heat exchanger unless they have a capacity in excess of 25% of the largest required capacity for pressure control and they can be repaired on board without external sources.

IGF Rules: System Definition and Sizing of the Heat Exchanger

7.8 Availability

The availability of the system and its supporting auxiliary services shall be such that:

.1 in case of a single failure of a mechanical non-static component or a component of the control systems, the cargo tanks' pressure and temperature can be maintained within their design range without affecting other essential services;

.2 redundant piping systems are not required;

.3 heat exchangers that are solely necessary for maintaining the pressure and temperature of the cargo tanks within their design ranges shall have a standby heat exchanger, unless they have a capacity in excess of 25% of the largest required capacity for pressure control and they can be repaired on board without external resources. Where an additional and separate method of cargo tank pressure and temperature control is fitted that is not reliant on the sole heat exchanger, then a standby heat exchanger is not required; and

Boiler ”GCU function”

- IGF rules clause 6.9.6.1. – Redundancies
  - Mechanical non-static components or component of the control system

- Redundancies in GCU Function:
  - Double FD fans
  - Double fuel gas control valves
  - Double high tension igniters
  - Double PLCs
  - Steam and water systems:
    - 2 x feedwater control valves, steam dump valves, dp-transmitters, temperature transmitters.

- Steam dump 125% sizing

Boiler ”GCU function”

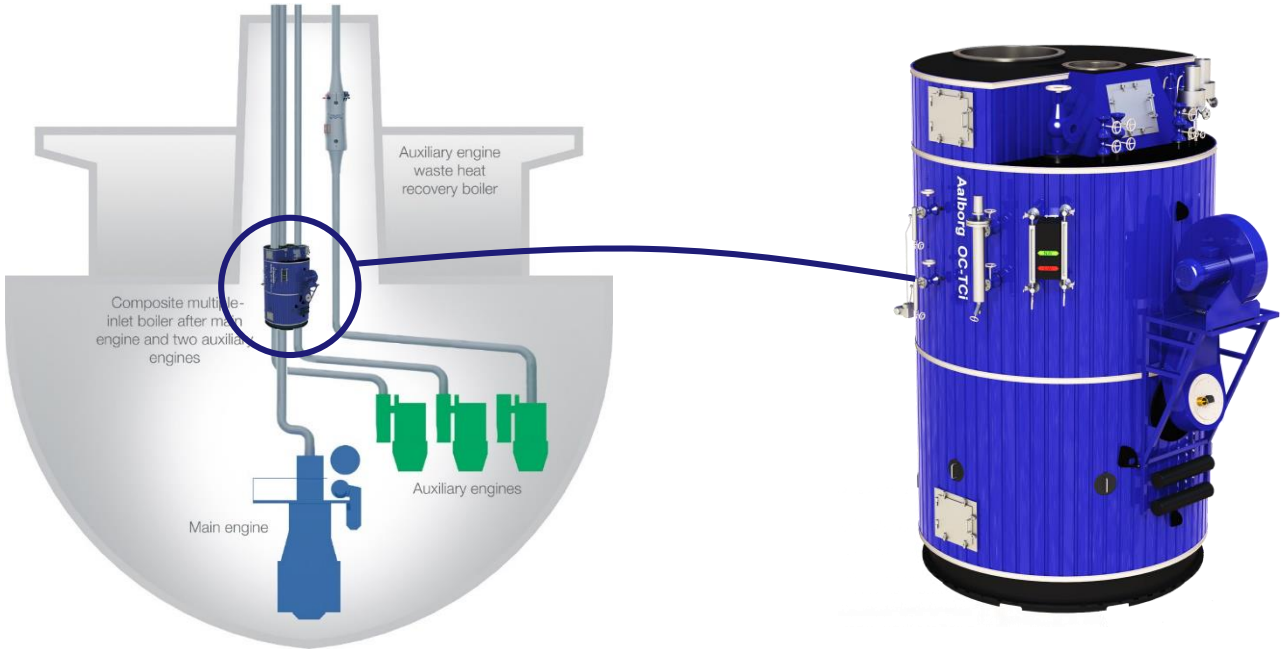
Item	Standard DF solution	DF boiler with GCU function
FD fan	Single fan, direct connection to windbox	Double fans, connected to windbox via valve arrangement (one fan active other standby)
Gas valve unit	Single valve arrangement	Redundant control valve, other equipment in arrangement as standard
Ignition	Single electric igniter	Double electric igniters
Control system	Standard control system	Internal redundancies in control system
Steam dump arrangement	N/A (if no economizer installed)	Either 2x steam dump arrangement, or 1 x steam dump arrangement with 125% sizing
Mechanical Components	1 x of each Feedwater control valves, dp-transmitter, temperature transmitter	2 x of each: Feedwater control valves, steam dump valve, dp-transmitter, temperature transmitter

Selected references for DF boilers

Office	Boiler amount	Boiler type	Boiler capacity	Vessel amount	Vessel type	Contract year	Shipyard	Ship owner	Operating area
AAL	1	Aalborg OM	35 ton/h	1	LNGRV	2006	DSME	Exmar/Excellerate	
AAL	1	Aalborg OM	30 ton/h	1	LNGRV	2007	DSME	Exmar/Excellerate	
AAL	3	Aalborg OL	50 ton/h	3	LNGRV	2008/09	DSME	Exmar/Excellerate	
AAL	1	Aalborg OL	16 ton/h	1	LNGC	2008	STX	Elcano	
AAL	2	Aalborg OL	15 ton/h	4	4xLNGC	2010/2011	STX	Sovcomflot	
AAL	2	Aalborg D-type	65 ton/h	1	LNGCFSRU	2012	HHI	Hoegh LNG	
AAL	1	Aalborg OM	7 ton/h	10	Container vessels 14.4kTEU	2013	HHI	UASC	
AAL	1	Aalborg OM	8 ton/h	7	Container vessels 19kTEU	2013	HHI	UASC	
AAL	2	Aalborg OL	35 ton/h	15	LNGC	2014/2015	DSME	Sovcomflot/TeeKay/ MOL (YAMAL)	Northern Europe / Russia
AAL	1	Aalborg OS	6.5 ton/h	2	LNGC	2014	Imabari	Elcano	
AAL	2	Aalborg OS	6.5 ton/h	1	LNGC	2016	DSME	E.ON	
RAU	2	Aalborg OH	2700 kW	1	Ro/Ro	2013	Fincantieri	STQ (Quebec)	
RAU	1	Aalborg CHB	4 ton/h	1	Ice-breaker	2014	Arctech	Finnish Transportation agency	
RAU	2	Aalborg CHB	5 ton/h	1	Ferry	2015	Meyer Turku	Tallink	
RAU	1	Aalborg CHB	1.6 ton/h	2	Bulkcarrier	2016	Qingshan Shipyard	ESL Shipping	
RTM	2	Aalborg TFO	3000 kW	1	Bitumentanker	2015	Besiktas	Transport Desgagnes	Great Lakes / St Lawrence River
RTM	2	Aalborg TFO	3000 kW	3	Chemicaltanker	2016	Besiktas	Transport Desgagnes	Great Lakes / St Lawrence River
RTM	1	Aalborg TFO	2000 kW	1	Multipurposevessel	2015	La Naval	DEME	Worldwide
AAL	2	Aalborg OL	25 ton/h	2	Crude Oil Tanker	2017	SHI	AET	North Sea
AAL	2	Aalborg OS	5 ton/h	1	FSRU	2017	HHI	SWAN	India
AAL	1	Aalborg OL	35 ton/h	2	Shuttle tanker	2017	SHI	AET	North Sea
AAL	1	Aalborg OL	14 ton/h	9	Container vessels 22k TEU	2018	Hudong	CMA-CGM	

Utilizing all energy resources

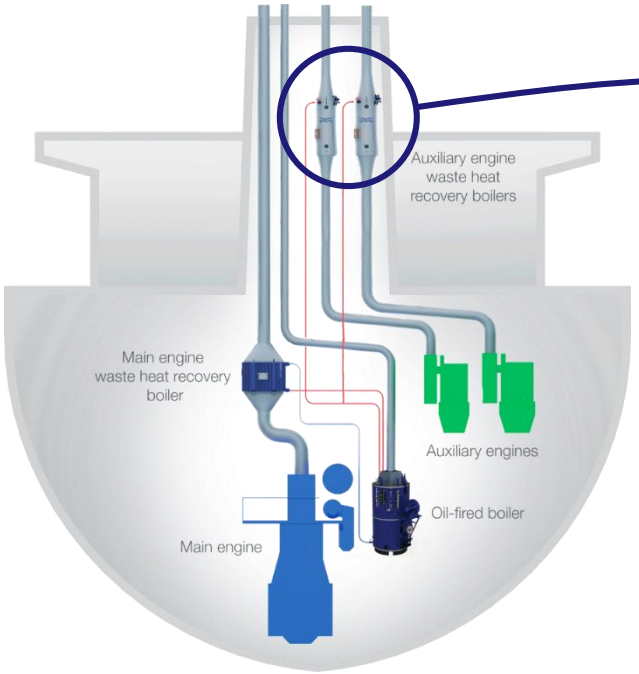
Aalborg composite boiler



Rule of thumb – approx. 300 kg/h steam per MW Engine Power

Utilizing all energy resources

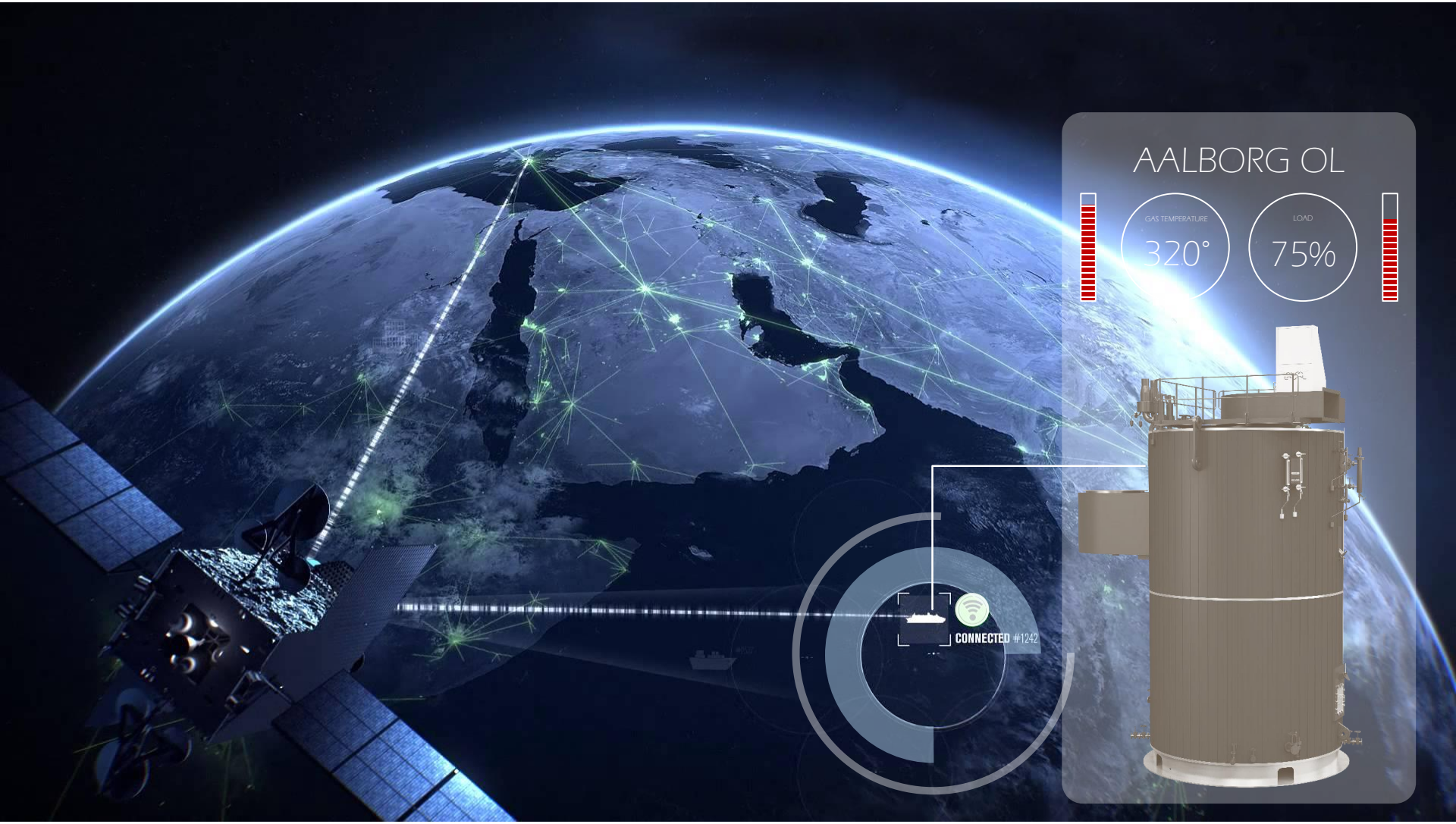
Aalborg economizer



Smoke tube type
after aux. engines

Rule of thumb – approx. 300 kg/h steam per MW Engine Power

Connectivity



Remote Service