Vaasan yliopisto
UNIVERSITY OF VAASA

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VAASA GAS EXCHANGE

Maritime Sector Update March 2019

Mark Bell

Why gas as a marine fuel ?

What are the issues?

Regulation & Rules

Ship Types

Performance

Safety

Competition

New Build or Retrofit?

Technology

ENVIRONMENT

Availability

Price

Public Perception

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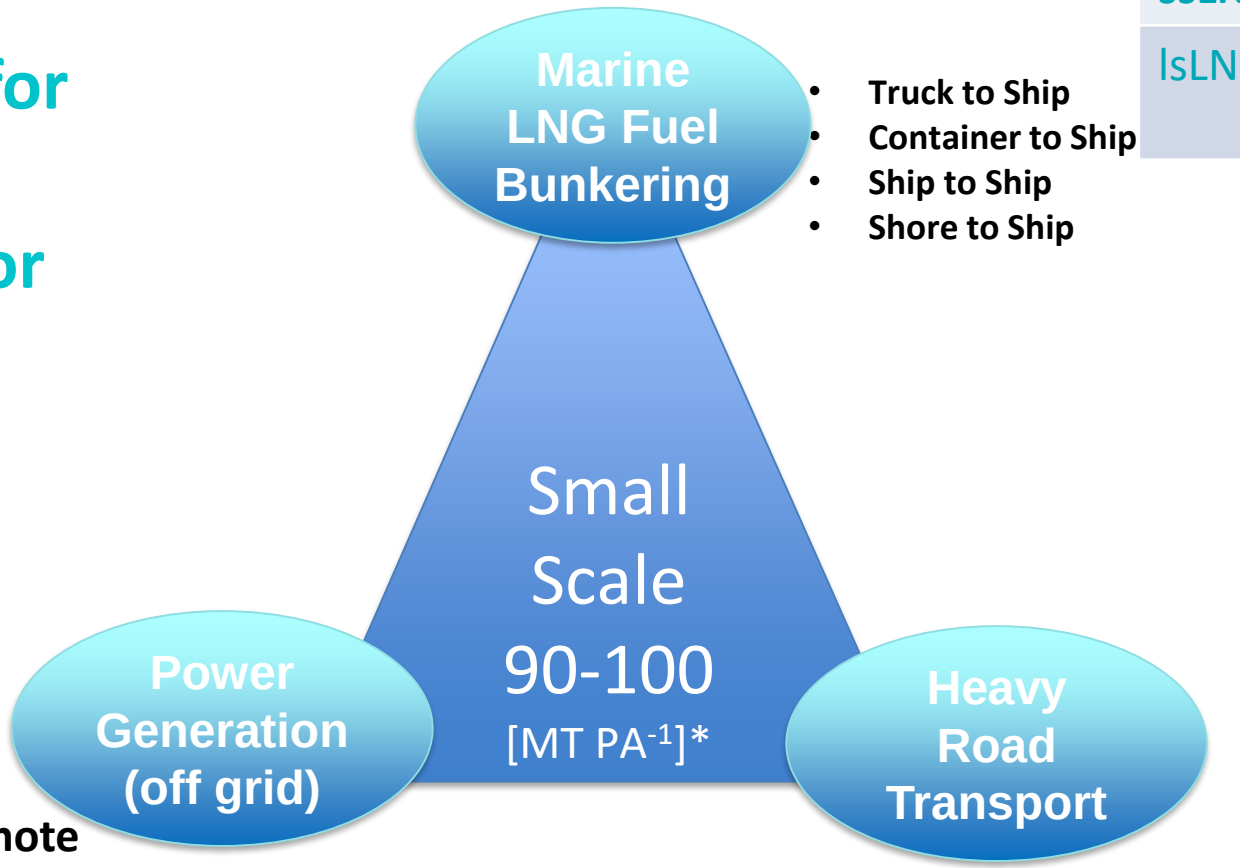
AVAILABILITY

ssLNG SUPPLY = (small scale)

Designation	Size [MT PA^{-1}]	Typical
msLNG	<0.5	Bio, 1-offs, Peak shaver
ssLNG	**0.5**	**Smallest Viable**
lsLNG	>0.5	Major Plant – Gorgon 16

1/3 for each sector



- **Truck to Ship**
- **Container to Ship**
- **Ship to Ship**
- **Shore to Ship**

- LNG or CNG

Island or remote Communities

Eg Malta, Mauritius, Gibraltar, Northern Canada, Jamaica

Images courtesy of Wartsila,Iveco,BC Ferries, Fortis, TernTank

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AVAILABILITY

- Was everywhere and nowhere - terminals
- Terminal and Port initiatives are key
  Small Scale and Terminals
- 'Gas Factor' is a 4 to 7 times higher infrastructure cost than Oil Fuel
- Europe as a whole cluster example
  <u>70 projects</u>
  28 operational
  16 decided
  26 proposed
- Not happening overnight but is gaining momentum
- Mostly by truck but
  At least six new vessels to deliver in 2019
  180 to 37,000 [m^{-3}]capacity increase in 2018

  (Small LNG carriers as LNG Bunkering Vessels)
- Initiated by subsidy, now on its own largely
- Mixed fuels in use here, growing proportion on LNG and not just marine sector
  1) Pipeline, Truck, Industry
  2) Marine
  3) Rail

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New Bunker LNG Bunker Vessels

SHIP	Operator	IMO	Delivery	Cont	Capacity	Region
Seagas	Sirius	7382691	2013	Type C	180	Baltic
Engie Zeebrugge	Engie NYK Fluxys	9750024	2017	Type C	5000	N EU
Cardissa	Shell	9765079	2017	Type C	6500	EU
Coralius	Gasum		2017	Type C	5800	Baltic
Oizmendi		9494981	2018	Type C	600	EU
Coral Methane	Anthony Veder	9404584	2018 (Conv)	Type C	7500	Carib
Kairos	BSM	9819882	2019	Type C	7500	EU
Clean Jacksonville	TOTE	IWV	2018	Membrane	2200	USA
FlexFueler 1	Titan LNG	IWV	2018	Type C	760	EU
8 In operation					37,040	
9 on order					+66,600	

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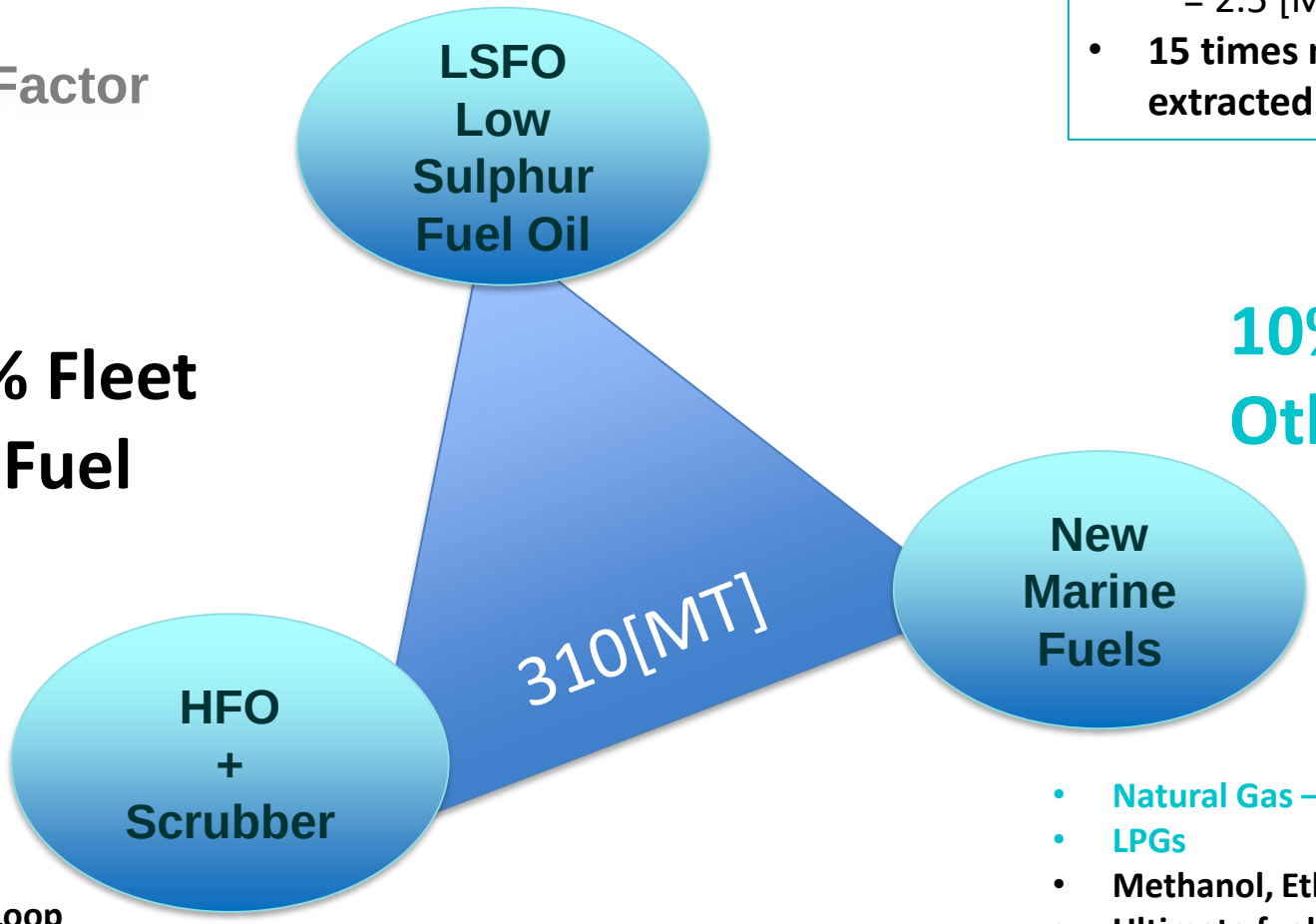
ENVIRONMENT - REGULATION

Decision is made……
Current choices with 2020 approaching –
Determinant Factor

- ECA requirement 16 [MT]1.00% to 0.10%
  = 0.15 [MT] sulphur extracted
- Global Cap means 120 [MT] 2.6% to 0.50%
  = 2.5 [MT] sulphur extracted
- **15 times more sulphur to be extracted and dealt with for 2020**



90% Fleet
Oil Fuel

10% Fleet
Other Fuels (LFPt)

- **Open Loop**
- **Closed Loop**
- **Uncertain regulation**
- **High Capex & BW clash**

- **Natural Gas – LNG LXG (Bio)**
- **LPGs**
- **Methanol, Ethanol, Hybrid, Ammonia**
- **Ultimate fuels – Hydrogen, Fusion**

DELFT Study for HFO availability 2020
Gas quantity by energy equivalent

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SHIP TYPES AND SEGMENTS

- World Fleet : 55000+ ships >500GRT
- Current Gas Fueled Fleet: 0.14%
  1500 ships – 7 years – 2.75% of world fleet
- Most are represented – Shortsea, Deepsea, Pax, Cruise, Container, Dry, Tanker, Offshore…
- -150 Gas Fueled Ships in Operation
- -150 Gas Fueled Ships on Order
- Cruise Sector – Container Sector
- MIXED FUEL FLEET for many years to come

0.2 – 2.0 – 20 %

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Container Sector developments

- 9 x 22K TEU Containerships
- 64 Mw installed power (WinGD 12X92DF)
- 20K [M^3] membrane tank
- Waigaoqiao & Hudong Build
- Delivery during 2020 / 21
- **Global Emissions**
  17% CO_2 , 85% NO_2, Negligible SO_x
- **Local Emissions**
  99% Pts, Zero SO_x, 85% NO_2

- One vessel = Total current Gas fueled fleet (Volumes)

CMA CGM

The choice to power its 22,000 TEUs ships with #LNG will allow the #CMACGM Group to go beyond current and future regulations.

"We have made the bold decision to equip our future 22,000 TEUs vessels with a technology firmly focused on the protection of the environment. By choosing LNG, CMA CGM confirms its ambition to be the a leading force in the industry in environmental protection by being a pioneer in innovative and eco-responsible technologies."

Rodolphe SAADE

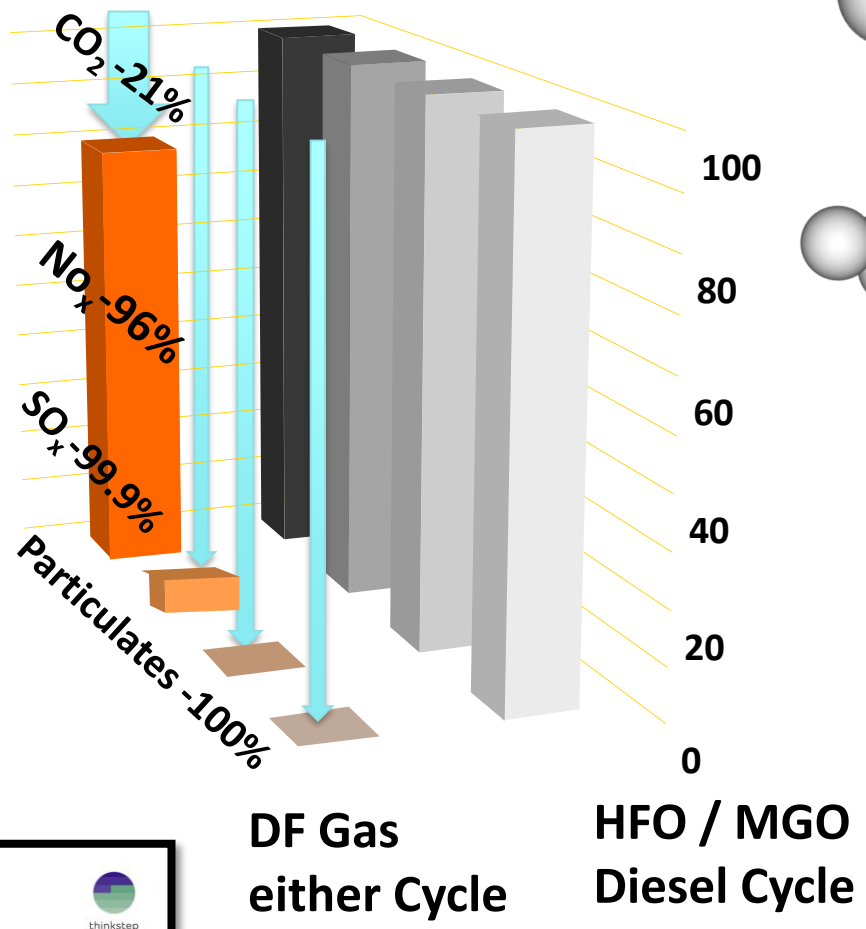
Environment – CH_4 Facts

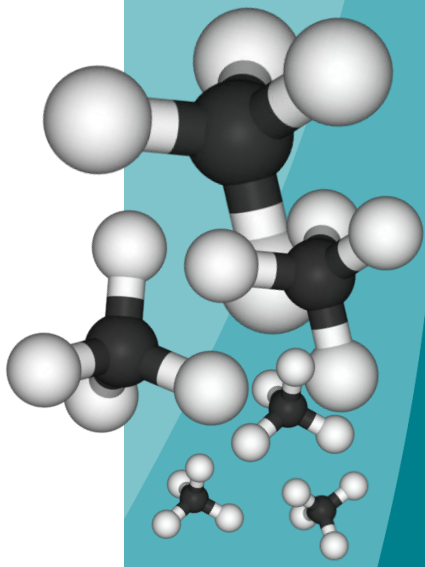
Lots of stats and comparisons available

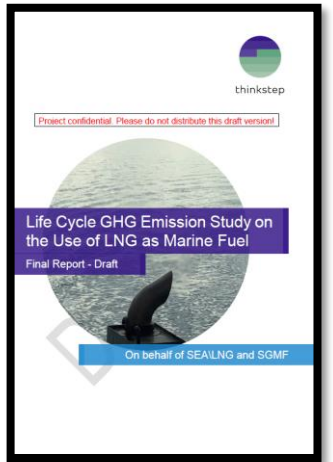
- Maritime is just getting around to solving the Sulphur problem – MEPC70/1/2/3/4
- Yet Carbon is the big issue, Shipping focus at COP22 23 24 etc?
- 2050 Carbon Target or Carbon Cap
- Use of Gas improves Carbon reduction but **does not solve it** (maximum is 21% reduction)

Meanwhile…….

- Population Increase = Shipping growth
- Public wants cheaper goods everywhere all the time in the shortest time
- **Just what is the Impact of shipping on Climate Change?**
- **A lot of effort measuring emissions yet we do know how much fuel is used!**
- **Burning Methane is significantly cleaner provided you do not spill, leak or slip it**
- **TOTAL FLEET AVERAGE 15% carbon reduction MEPC statement Spring 2019**







sgmf environmental committee

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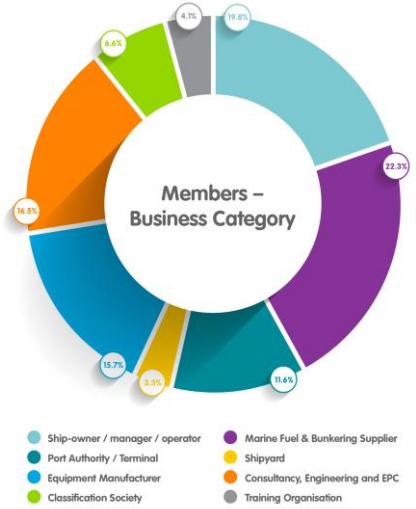
SGMF at a glance….

Industry leading NGO representing best practice from the Gas fuelled shipping supply Chain

- Formed in 2013 now with over 135 members across the sector
  Including Suppliers / Owners / Operators / Class / OEMs / Shipyards / Port Authorities
  (Open to all – not for profit)
- Provides Regulators with key guidelines as key input for National and International Standards
- Works with Industry at all Levels
  IMO – EU – USCG – MPA and other NGOs
- Analyses and solves issues with regard to Safe Operations, Technical, Quality and Quantity, Training and Competence and Environmental matters
- Regular meetings and Forums across all Geographies for members interaction
- SGMF Portal is key resource for Industry data and member interaction
- IGF Code Vessels



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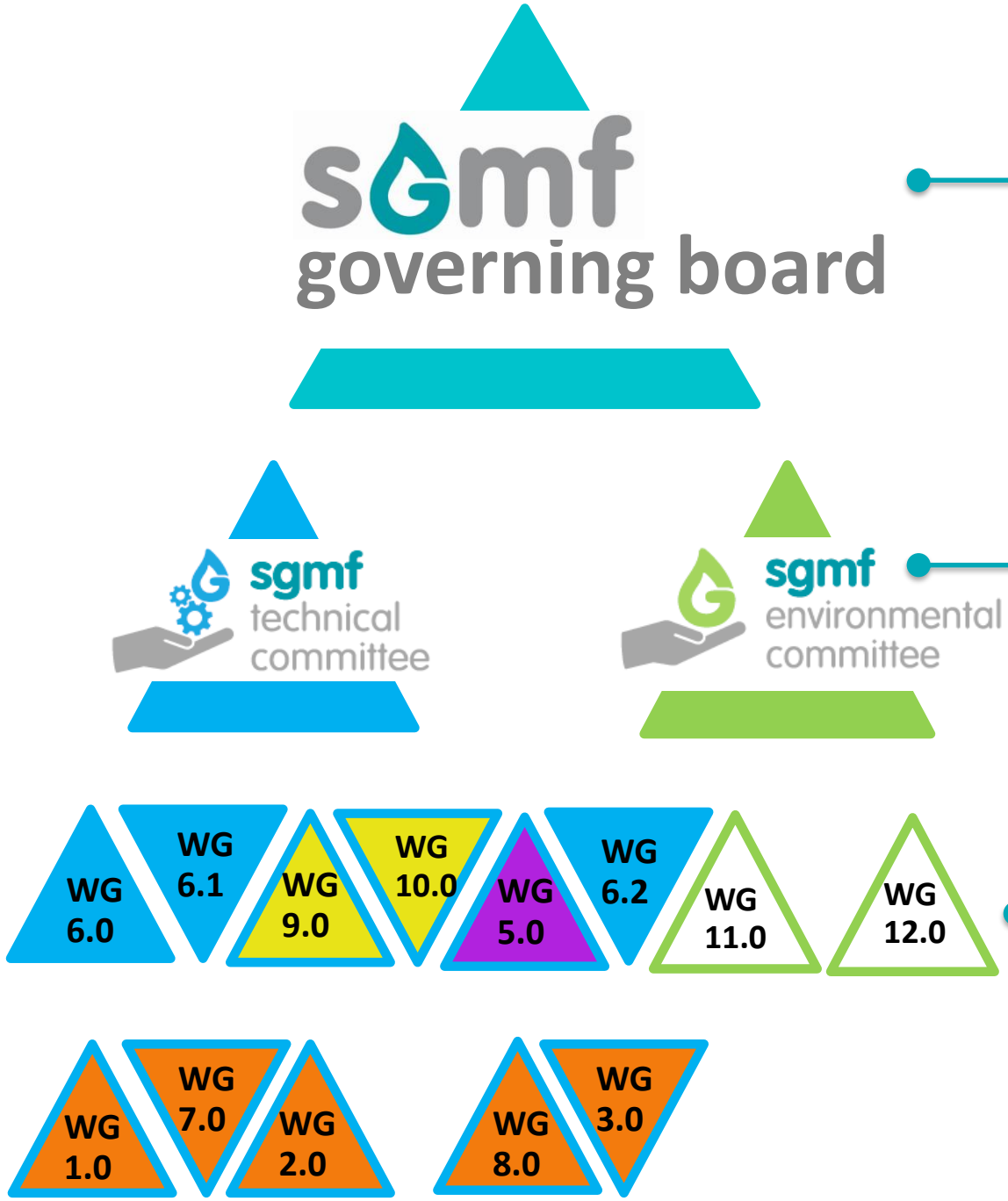

22 Individuals representing all Sectors and Geographies

2x15 Individuals representing all Sectors

Currently 7 live work groups ~ 12 individuals in each, often specialists both from members and academia

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Aberdeen Harbour
ABS
AFFINITY
Anthony Veder
ARDENT
ARISTA
ARTA More than stainless steel.
BCFerries
BP Shipping
BRAEMAR ENGINEERING
Brittany Ferries
BRUGG
BSM Bernhard Schulte Shipmanagement
Bureau Veritas
Canaveral Port Authority
Carnival Corporation & PLC
CAT
CCS China Classification Society 中国船级社
Chantier Naval de Marseille
ClassNK
CMA CGM
Containerships
Crowley 125 Years
DNV·GL
DSME
Dunlop Oil & Marine ContiTech Division of Continental AG
dusup
Eagle LNG Partners
Eastport Marine
ECM Training Services An ECM Group Company
elengy Operator of LNG terminals since 1965
Enestas Energy & Gas
engie
ENN 新奥
Evergas carried by experience
excelerate energy
ExxonMobil
Falck
Foreship
Fortis BC Energy at work
Gas to Heat
GASLOG
Gasum
Gate terminal Gas Access To Europe
Gibraltar Port Authority
GTT Expert in LNG
GTT Training
Gutteling Composite Hoses
Harley Marine A Full Service Maritime Company
Harvey Gulf International Marine
Marine Contractors
Houlder Engineering & Innovation · Design & Analysis · Project Expertise
JAXLNG
Whitaker
Kawasaki Powering your potential
K"Line Kawasaki Kisen Kaisha, Ltd.
Keppel Gas Technology Development
KLAW LNG
Knutsen OAS Shipping
Kogas
KR Korean Register
babcock
Le Havre port Haropa
Lloyd's Register
LNG Japan Corporation
LNG STS
Disney Cruise Line
MAN
Maersk
mampaey Offshore Industries
Mann Tek®
Marseille Fos The euromediterranean port
MS
MIB
Mitsubishi Shipbuilding
MOL
moran
MPA Singapore
MSC Cruises
Nakilat ناقلات
nationalgrid
Naturgy
nauticor Clean shipping powered by Linde
Nexans Brings energy to life
NiCHe
NYK Line Nippon Yusen Kaisha
Novatek
OSM
Pavilion Gas
Per Groeneveld maritime gas expert advice and consultancy
Petronas
Pilbara Ports Authority
Port of Amsterdam
Port of Gothenburg The Port of Scandinavia
Port of Rotterdam
Port of Vancouver
probunkers
Qatar Petroleum قطر للبترول
Q-LNG Transport Quality Liquefied Natural Gas Transport
Resolve Marine Group
Revine Marine Revolutionary LNG
RINA Services
Rolls-Royce
RoyalCaribbean International
Royal HaskoningDHV Enhancing Society Together
SCF Safety Comes First
seaspan Ferries
Shell
Smit Lamnalco
SMIT
SMT Stream Marine Training
STC-Group
Stolt-Nielsen
Maritime College State University of New York
TechnipFMC
Terntank www.terntank.com
TGE Marine Gas Engineering
TitanLNG
Tokyo Gas
Total
TOTE Services Leading Edge Ship Management Solutions
Trelleborg
SeaTechnik
UECC
Van Oord
Victrol
Wärtsilä
WinGD Winterthur Gas & Diesel
WMT Marine
woodside
WorleyParsons resources & energy
YKIP
Zaitoun Green Shipping Trust · Safe · Green

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Who we work with……

OCIMF

GASNAM
ASOCIACIÓN IBÉRICA DE GAS NATURAL PARA LA MOVILIDAD

IACS International Association of Classification Societies

EMSA

IAPH International Association of Ports and Harbors

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Six Key Areas of Activity

ENVIRONMENT

- Emission facts
- LCA Analysis
- Alternative fuels
- Ship performance
- Dual Fuel Engine Performance
- Methane Slip

INFORMATION

- Port Listing: LNG Bunkering
- Ships in operation
- Ships under construction
- Project Listing
- Incident recording

TECHNICAL

- **LNG Bunkering : Essential Functional Requirements (All Components)**
- **Leak detection**
- **Tank Location on Gas Fuelled Ships**
- **QCDCs, Hoses, ESD, Control**

SAFETY

- **LNG Bunkering : Systems and procedures guidelines**
- **Safe Working Distances**
- **Salvage principles**
- Risk assessment application
- Simultaneous Operations
- Commissioning of Gas Fuelled ships

Training & Competence

- **Competency Standards**
- **Courses – Gas as Fuel**
  LNG Bunkering
- **Establishment Accreditation**
- **Experience recording**

CONTRACTUAL

- **Quality and Quantity Guidelines**
- **Measurement**
- **Standard Contracting**
- **LNG Fuel Standard (content)**

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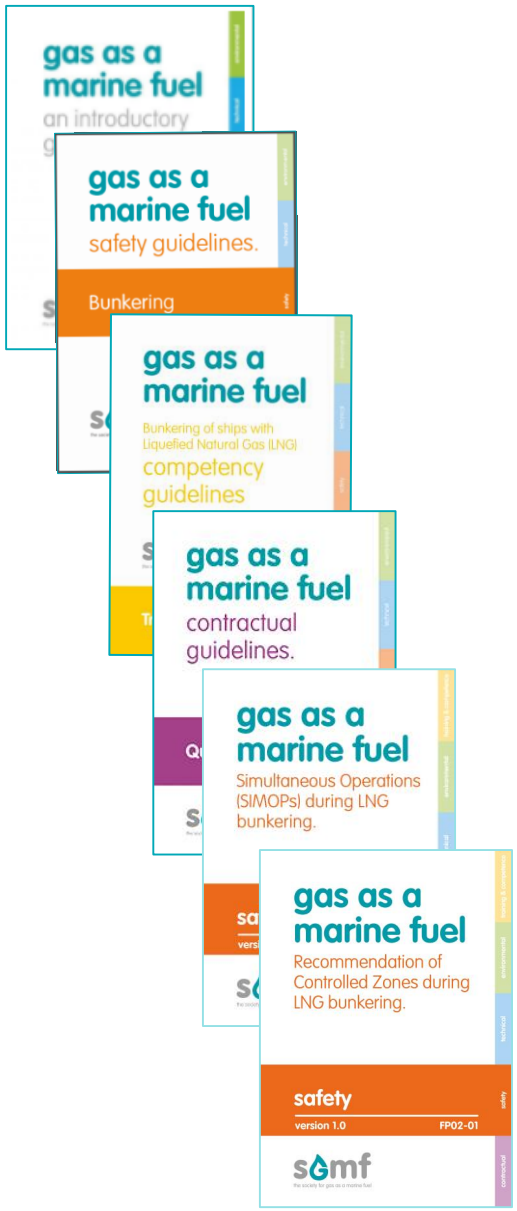
Gas Fueled Value Chain
Regulatory Framework – SGMF Guidelines



- Gas as Fuel an introductory guide
- Bunkering Operational Guidelines
- Bunkering Competency Guidelines
- Quality & Quantity Contractual Guidelines
- Recommendations of Controlled Zone for LNG Bunkering
- Simultaneous Operations for LNG Bunkering
- Manifold Arrangements for IGF Vessels
- Quick Connect /Disconnect Couplings
- Safe Working Distances for LNG Bunkering

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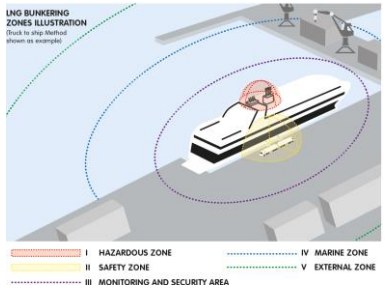
Bunkering Area Safety information LNG



Soon to come…

- ESD and Control systems
- Flexible Hose Selection and Handling
- Methane Number Considerations
- Dry Docking and Maintenance for IGF vessels
- LCA study for Gas Fuelled Shipping

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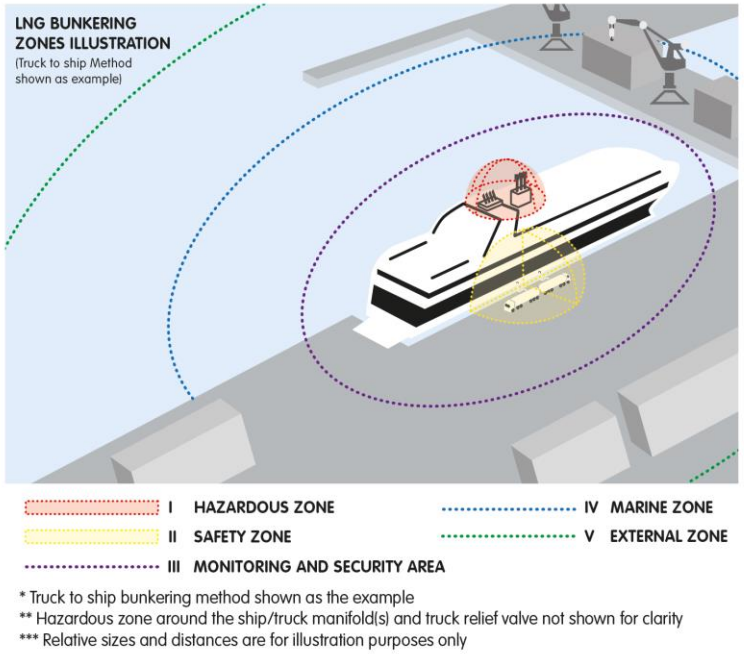
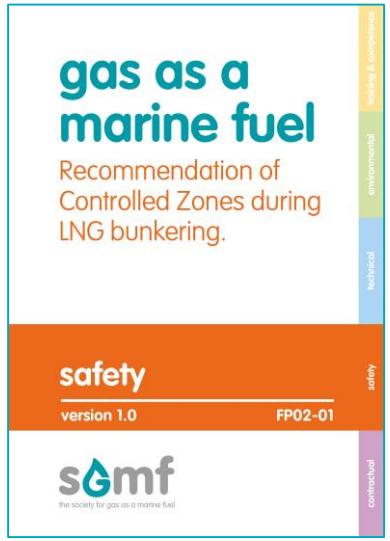
SGMF safety guidance

- SGMF's aim is to provide guidance to the industry on the setting of safety distances that are:
  - based on representative scenarios
  - mildly conservative for each scenario
  - based on best industry information
  - appropriate to different bunkering systems, eg road tankers and bunker vessels
  - cover a wide range of bunkering rates, volumes and pressures
  - practical to implement and manage
  - applicable worldwide
  - repeatable
  - inexpensive to perform

- Work started in 2015 and was published in 2018





BASiL
Bunkering Area Safety information LNG

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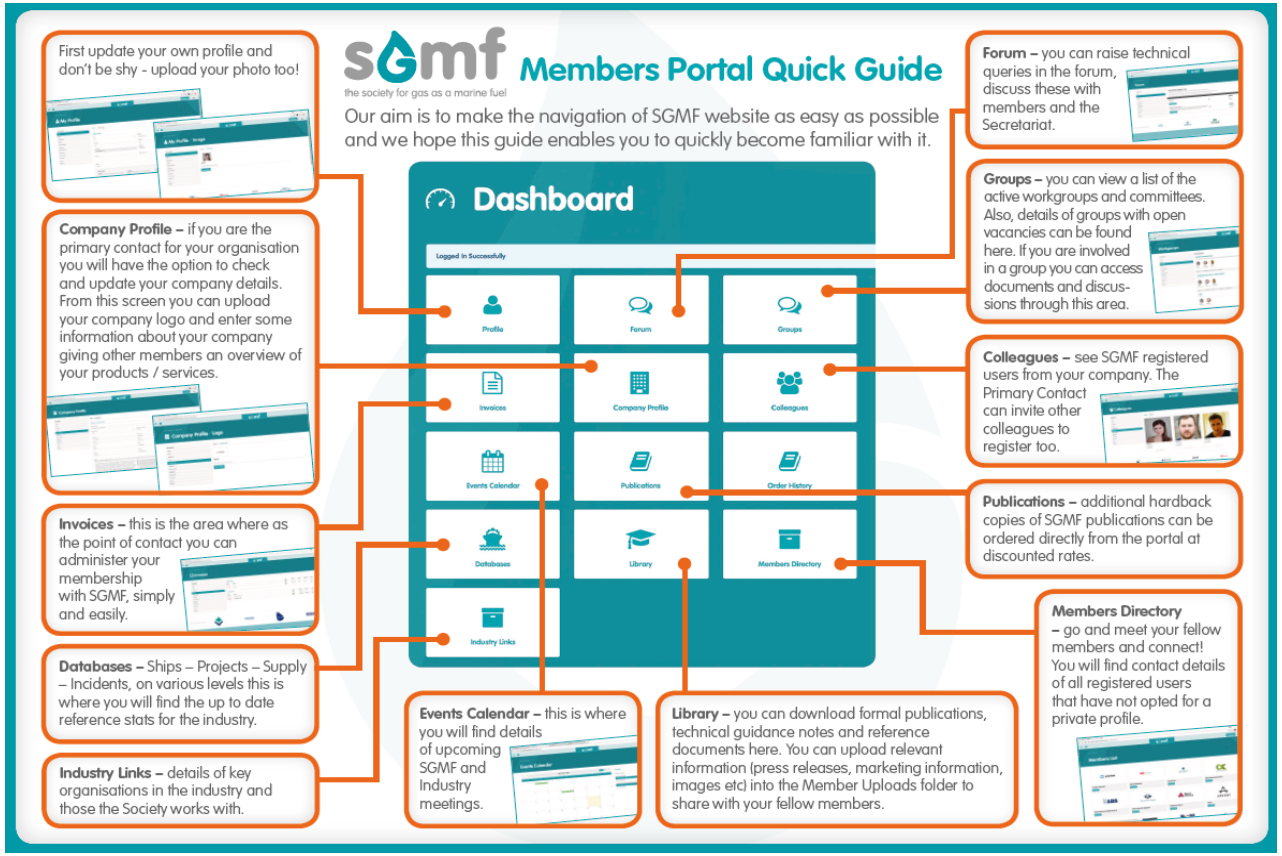

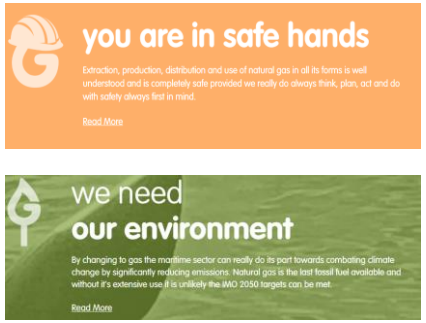

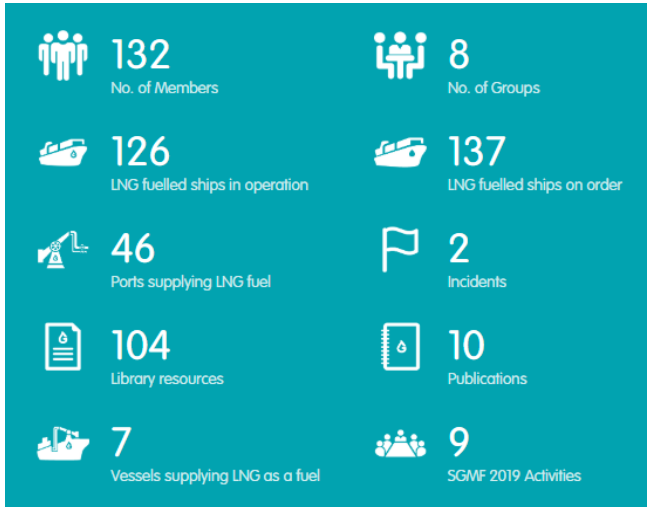

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Conclusions & Summary

- Alternative fuels are available – Natural Gas is one of them
- 2020 is here – Gas is a Fully Compliant 202O fuel with significant Environmental savings CO2 SOx NOx Pts
- Distribution and supply is taking time
- Most ship types now have a Gas Fueled variant in service or on order
- Short sea sector is largely ECA and 'Local' Regulation dependent
- Deep sea sector – Cruise and Container showing large take – up
- Currently 0.2% - Expect 2% (1500) - Won't see 20% for a long time

  LSFO's will dominate – Scrubber Regulation uncertainty
- 2019 – A year of change for maritime fuels
- Only thing certain in maritime – Regulation!

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we sea change, do you?

THANK YOU

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