LNG as a Marine Fuel
Benefits & Challenges

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Society for Gas as a Marine Fuel

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Who are SGMF?

- **The Society for Gas as a Marine Fuel is**
  - A non-governmental, non-profit making, industry membership based organization
    - London based
    - 101 members
  - Objective is to establish and encourage the safe and responsible operation of gas fuelled vessels and their fuelling infrastructure
  - SGMF is developing and delivering best practice and guidance on most aspects of the marine gas fuelled industry avoiding duplication and where it matters most
- **As for regulations……**
  - Gas as Fuel = SGMF + IGF code
  - Gas as Cargo = SIGTTO + IGC code

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Five Key Areas of Activity

ENVIRONMENT
- Emission levels
- ECAs
- Scrubbing
- Alternative fuels

TECHNICAL
- Worldwide infrastructure
- Ship fleet projections
- Ship fuel systems
- **Bunkering systems and procedures**

SAFETY
- Handling Cryogenic fluids
- **Safety distances**
- Designing in safety
- Risk assessment
- Simultaneous Operations
- Emergency procedures
- **Salvage of LNG**

CONTRACTUAL
- Commercial agreements
- **Quantity, sampling & quality calculation**

TRAINING & COMPETENCE
- **Training & Competence**

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Drivers for clean fuel

Price

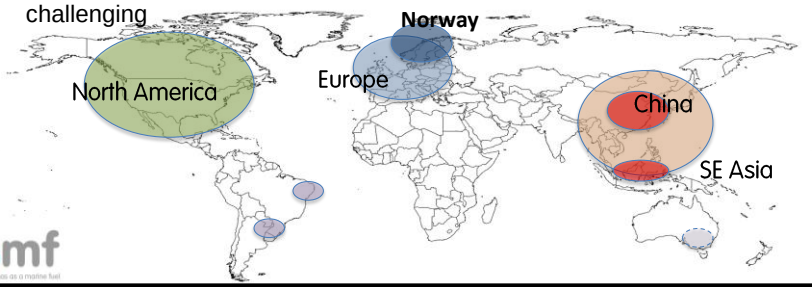
"I can make money changing to a cleaner, cheaper fuel"

- North America: gas prices depressed by excess shale gas remain below reduced oil
- Europe: marginal at best, now detrimental against current oil
- Far East: economics were always challenging

Regulation

"Because I have to"

- North America: yes but price drives harder
- Europe: the main driver
- Far East: enforced in China and potentially in Hong Kong and Singapore



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LNG as a marine fuel

Benefits

- Meets all SECA requirements (SOx)
- Reduces Greenhouse gas emissions (CO2)
- Reduces NOx (meets most NOx ECA requirements)
- Widely available in bulk (via road tanker)
- Acceptable energy density (22 MJ/litre vs oils at 35-38 MJ/litre)
- Becoming widely used as a fuel for other transport applications

Challenges

- LNG is not “cold fuel oil” – hazard issues
- Expense of cryogenic equipment for fuel storage
- Larger fuel tanks leading to loss of cargo space

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Other “clean” marine fuels

Evolution of old fuels

- Distillate
  - Meets SECA requirements
  - Bulk but limited markets
  - Expensive
- Clean diesels
  - Clean HFO
  - Niche fuel (so far)
  - Very limited refinery capacity (now)
- Scrubbers
  - Cleaning dirty fuel
  - Environmental impact
  - Costs of disposing of scrubber waste

Revolution to New fuels

- Compressed Natural Gas (CNG)
  - Lacks energy density (9 MJ/litre) – short haul only – few ships
- Ethane
  - More hazardous than LNG
  - Many similar technologies and costs to LNG
- Methanol
  - Toxicity and hazards
  - Low energy density (15 MJ/litre)
  - Low retrofit costs
- Hydrogen
  - Availability
  - Storage hazards

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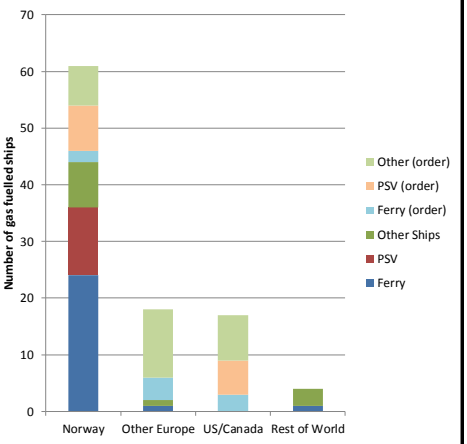
Status report: ships

- 54 gas fuelled ships in service
- 59 vessels under construction

- Short Sea and Regional ferries currently make up the majority of the LNG fuelled fleet 26 (48%) in operation and 15 (25%) on order.
- Offshore support vessels make up the second largest contingent at 29% and 18% respectively
- Most types of ship now represented by a gas fuelled variant
- 15% of deep sea fleet (LR)
- 1500 Ships (DNV-GL)



- **70,000 ships** - world fleet
- 250 – 2500 in next 5-7 years
- 9000 fold increase in transactions!

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An uncertain future

Now

- Shipping rates low
  - Too much shipping for global trade
  - EU recession, reducing growth in China
- How strong/effective is enforcement?

- Investment difficult
  - Extend ship life by burning distillate
  - Retrofit scrubbers for mid term compliance
  - Build gas fuelled ships for fleet replacement

Future

- IMO step change in fuel sulphur levels in 2020 or 2025
- Worldwide shipping impacted

- New ships required
- What fuel at what price?

- Scrubbers become common place?
- LNG preferred fuel in ECAs?

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Thank you for your attention
we sea change, do you?
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