LNG as a Marine Fuel
Market Developments

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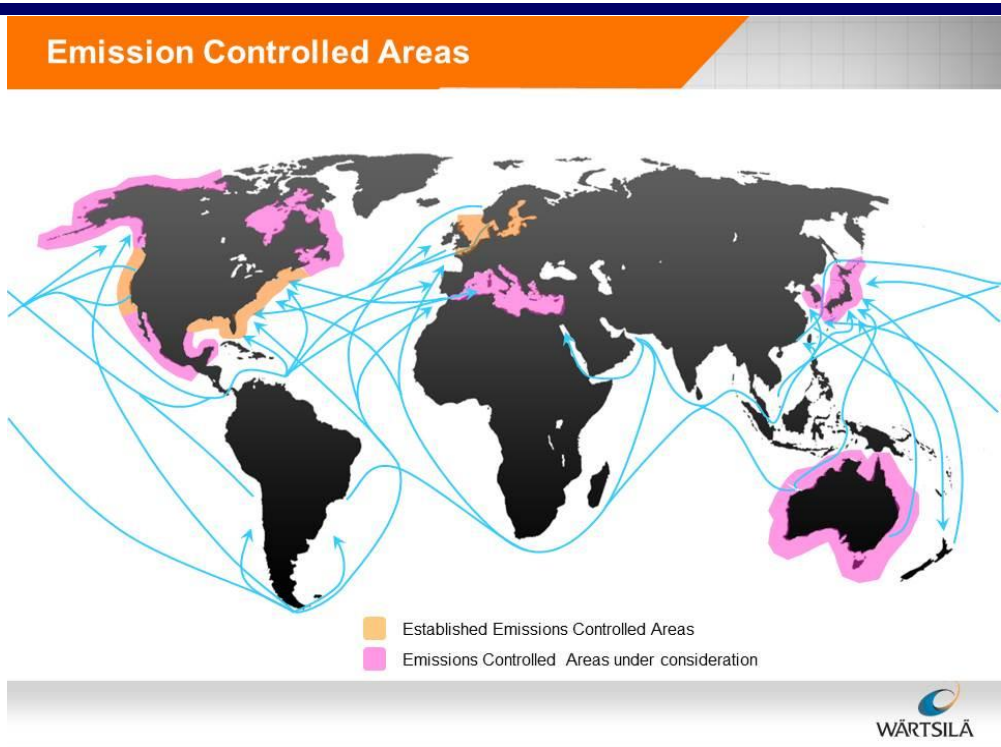
Washington DC
29 October 2014

Outline

- Projects
- Equipment
- Bunkering
- Summary

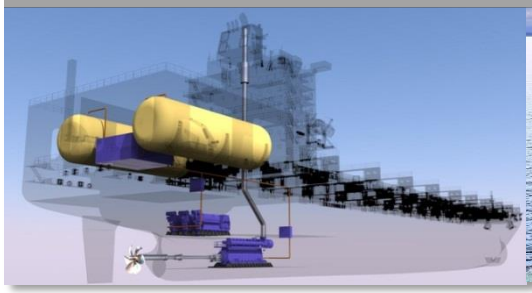


Projects

TOTE Orca Class Trailer Vessel Conversion

- Wartsila LNGPac – 4 x 50DF main engines plus gens
- Diesel/Gas - Electric
- 2 x 1100 m^3 tanks on upper deck weather

MAN Diesel 2-stroke ME-GI engine – First order for 3100TEU Container Carrier



Existing LNG regulations leveraged for application to non-LNGC ship-board gas-fuel systems

IMO Res. MSC285(86) Interim guidelines for natural gas fueled engines

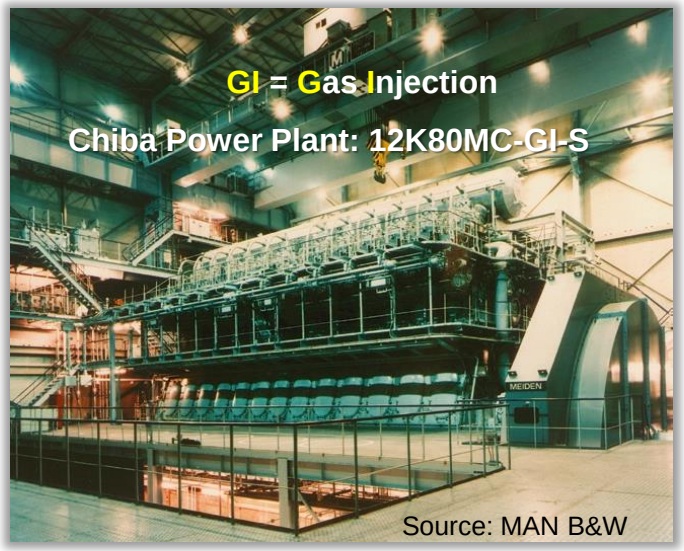
Under Development

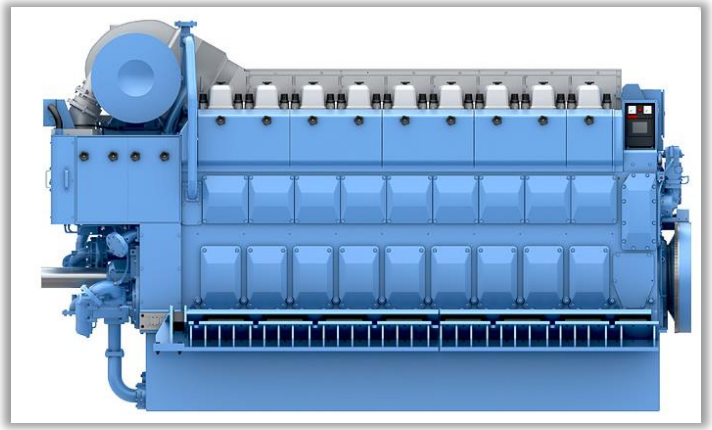
IMO International Code for Safety for Ships Using Gases or Other Low Flashpoint Fuels (IGF Code)

Current Fleet Statistics

- Ships with dedicated tanks installed for LNG to be used as propulsion fuel
  - Excludes:
    - Vessels using LNG for other purposes (e.g. FPSO power)
    - Ships using boil off from cargo (LNG carriers)
    - Barges using LNG for other purposes (power or bunkering)
- Approximately 149 ships with total 2,389,548 GT
  - 60 ships (341,730 GT) in service
  - 89 ships (2,047,818 GT) under construction/conversion
    - Of which 14 vessels are conversions (280,967 GT)
    - 16 vessels are LNG-ready (605,402 GT)

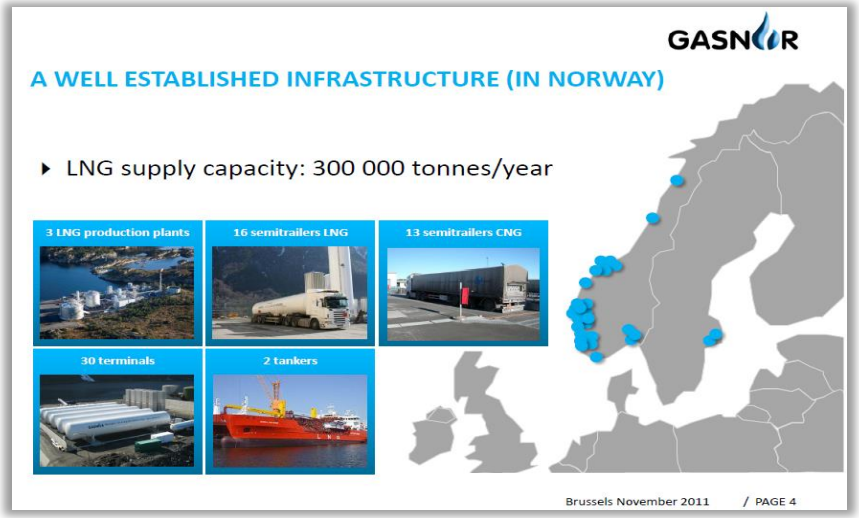
Equipment





Rolls Royce Bergen C26:33,
Source: Rolls Royce

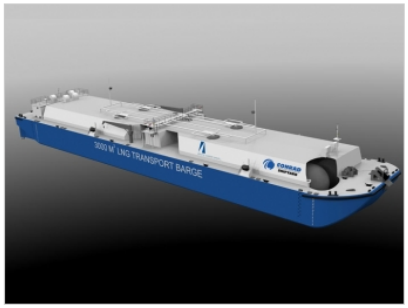
LNG Bunkering Operations



LNG as a Fuel Infrastructure

August 23, 2014

ABS approves new LNG coastal barge design



AUGUST 22, 2014—ABS recently awarded an Approval in Principle (AIP) to a new 3,000 m^3 capacity Liquefied Natural Gas (LNG) tank barge design.

The new LNG transport barge designed was developed by Bristol Harbor Group, Inc. (BHGI), Bristol, RI, for Conrad Shipyard, LLC, Morgan City, LA. The design builds on the previous experience of a Bristol Harbor Group proven hull design built by Conrad.

BHGI has a decade long relationship with Conrad Shipyard, LLC that has traditionally focused on coastal liquid cargo barges from 26,000 to 80,000 bbl. It is the 300-foot-long version of these successful double-hull oil barges that serves as the basis for this LNG transport barge.

May 22, 2014

ABS to class LNG America bunker barges

MAY 22, 2014 — Houston based LNG America has selected ABS as the classification society for North America's first LNG bunker barges, currently being designed by Jensen Maritime.

ABS will assist LNG America in working with shipbuilders and regulators in developing the first-of-their-kind barges that meet or exceed all technical and regulatory requirements.

"We are pleased to be working with ABS on this important domestic initiative. ABS has watched ship propulsion move from wind to coal, from coal to oil, and now from oil to natural gas. They are well situated to help us usher in a new era of clean domestic fuel," said Keith Meyer, President and CEO of LNG America.

ABS was the first provider of classification services for the gas sector and 34 percent of LNG tankers under construction around the world are set for ABS class. The society is also providing services to the largest and most advanced LNG fueled ships in the world.

March 11, 2014

Elliott Bay Design Group gets AIP for LNG bunker barge

MARCH 11, 2014 — Seattle-based naval architecture and marine engineering firm Elliott Bay Design Group (EBDG) has obtained approval in principle from ABS for the design of a 2,000 cubic meter liquefied natural gas (LNG) combination bunkering barge.

"At ABS our goal is to help designers, shipyards, and operators bring new and novel concepts to the marketplace in a safe and effective manner," said ABS Director of Global Gas Solutions Roy Bleiberg. "The EBDG combination bunkering barge takes an innovative approach to meeting the challenges of LNG bunkering, a hurdle that must be crossed for LNG fueled operations to become truly effective in the United States."

Waller LNG ATB gets ABS approval in principle

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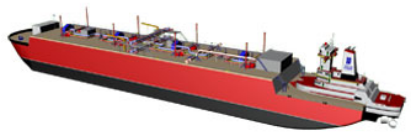


OCTOBER 9, 2012 — Classification society ABS has granted approval in principle (AIP) to a new liquefied natural gas (LNG) and regasification articulated tug barge concept introduced by Waller Marine Inc., Houston.

The vessel has the ability to load LNG from existing LNG terminals, liquefaction facilities, or traditional LNG carriers and transport the LNG to existing tanks, traditional LNG carriers, trucks, or marine vessels using LNG as a fuel. The barge also is equipped for regasification of LNG directly to a pipeline or to a power plant. An additional feature will be the use of natural gas as a fuel in the dual fuel engines of the tug to drive the tug-barge unit.

GTT Gets ABS Nod for LNG Barge

March 31, 2014 in *LNG*, *Marine* by *Rich Piellisch* | *No Comments*

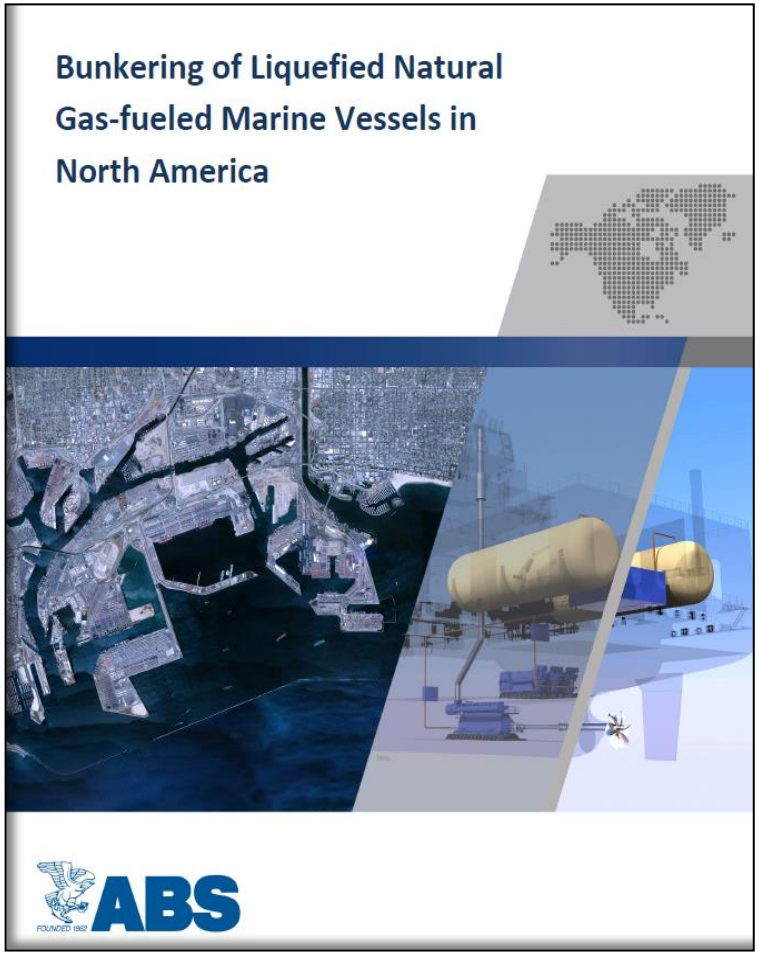
212-Foot Vessel Designed for Versatility, Ability to Handle Boil-Off, The Cryogenic Liner Is Directly Supported by the Vessel's Inner Hull

Houston-based GTT North America reports ABS approval in principle for its design of a 2,200-cubic-meter liquefied natural gas (LNG) bunker barge. The design incorporates GTT's membrane for cargo containment technology, which the company says is used in 70% of the global LNG carrier fleet and nearly 90% of LNG carrier projects on order.

Houston-based GTT North America reports approval in principle from ABS for the design of a 580,000-gallon LNG bunker barge using GTT's Mark III Flex cargo containment system.

LNG Bunkering Study

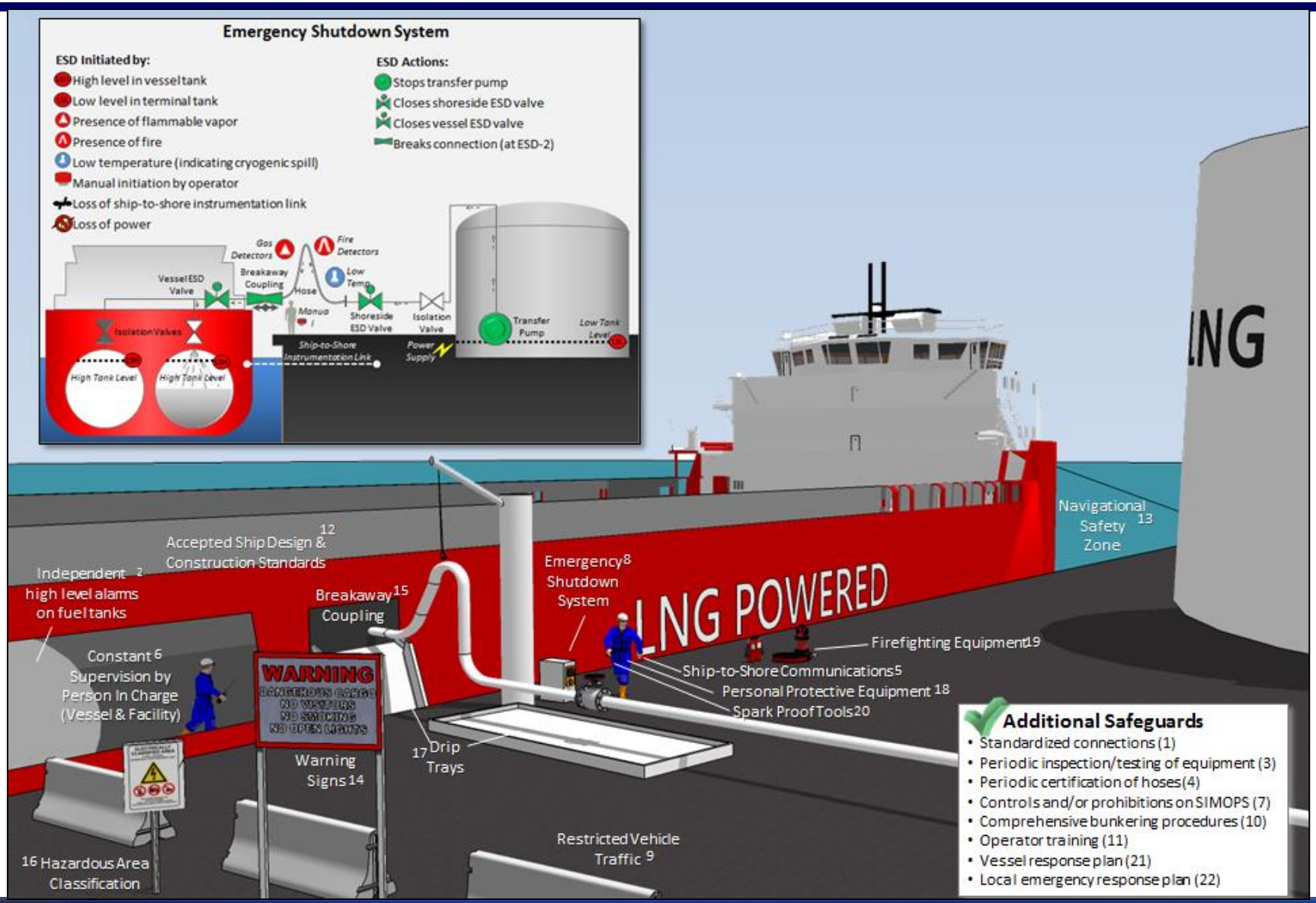
- ABS Study for Bunkering LNG in North America
  - Operations
  - Infrastructure
  - Bunkering safety
  - Training requirements
  - Regulatory framework



Examples of Other Studies

- Maritime Administration - Liquefied Natural Gas (LNG) Bunkering Study (DNV-GL)
  - Report No.: PP087423-4, Rev 3 (3 Sep 2014)
- LR LNG Bunkering Infrastructure Survey 2014
- Maritime and Port Authority of Singapore (MPA) study on the technical procedures for LNG bunkering in the Port of Singapore (LR)
- BV's Guidance on LNG Bunkering (NI 618)
- ISO "Guidelines for systems and installations for supply of LNG as a fuel to ships" (DRAFT)
  - ISO TC8/WG8 - LNG Fueled Ships

Recommended Safeguards for LNG Bunkering



Summary

- Project numbers and sizes are growing
- Equipment market adds competition and choices
- Bunkering facilities will develop

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