



LNG: An Alternative Fuel for British Columbia Coastal Ferry Services

May 2013

Coastal Ferry Service

- 25 routes
- 47 terminals
- 35 vessels
- 500 sailings per day



Coastal Ferry Service

- Largest vessels
 - 2100 passengers
 - 470 vehicles
- Smallest vessel
 - 133 passengers
 - 16 vehicles
- Oldest
 - 50 years
- Newest
 - 5 years



Fuel for the Fleet

- Operating differences
- ULSD cost and advantages
- Reliability
- Easy delivery & bunkering
- Easily stored, processed and burned on board...



Environmental Science

CLIMATE CHANGE (GHG)

OZONE DEPLETION

AEROSOL LOADING

FRESH WATER USE

LAND USE (HABITAT STRESS)

BIODIVERSITY LOSS

NITROGEN/PHOSPHORUS

CHEMICAL DISPERSION

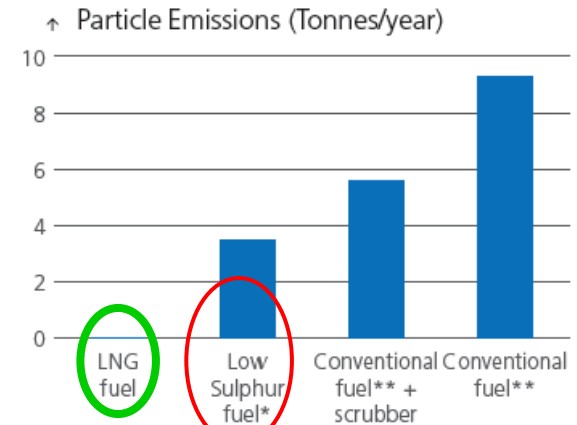
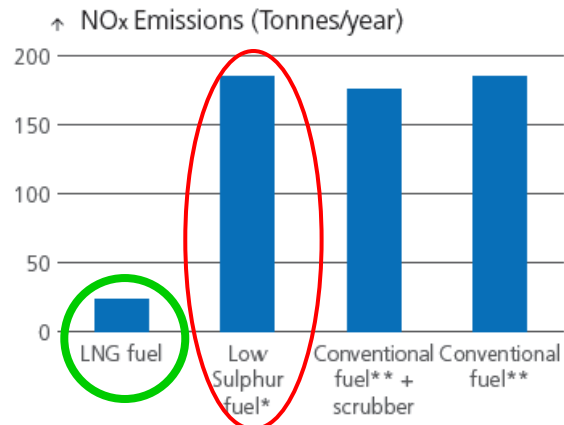
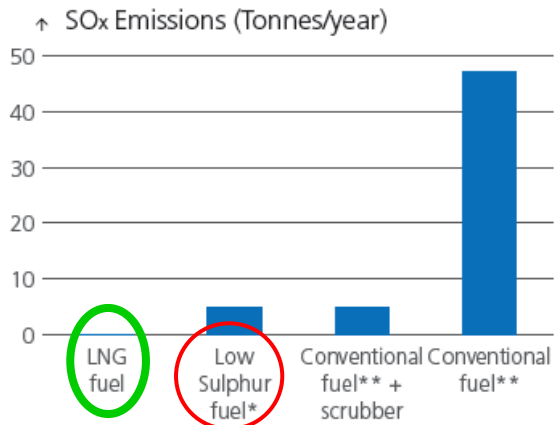
OCEAN ACIDIFICATION



Aerosol Loading



Environmental emissions for alternative concepts for a typical general cargo ship



* Low sulphur fuel contains maximum 0.10% sulphur

**Conventional fuel as per 1 July 2010, containing maximum 1.0% sulphur

LNG Promise and Opportunities



ENVIRONMENT

\$\$ FUEL COST REDUCTION

VESSEL CONVERSIONS

- Select vessels for conversion
- Establish a master schedule for conversions
- Determine the LNG technology solutions:
 - Bunkering methodology
 - Engine types
 - Propulsion drive options (electric and mechanical)
- Build the Safety Case for each vessel and operating site
- Convert vessel

NEW VESSEL CONSTRUCTION

- Consideration for all new vessels

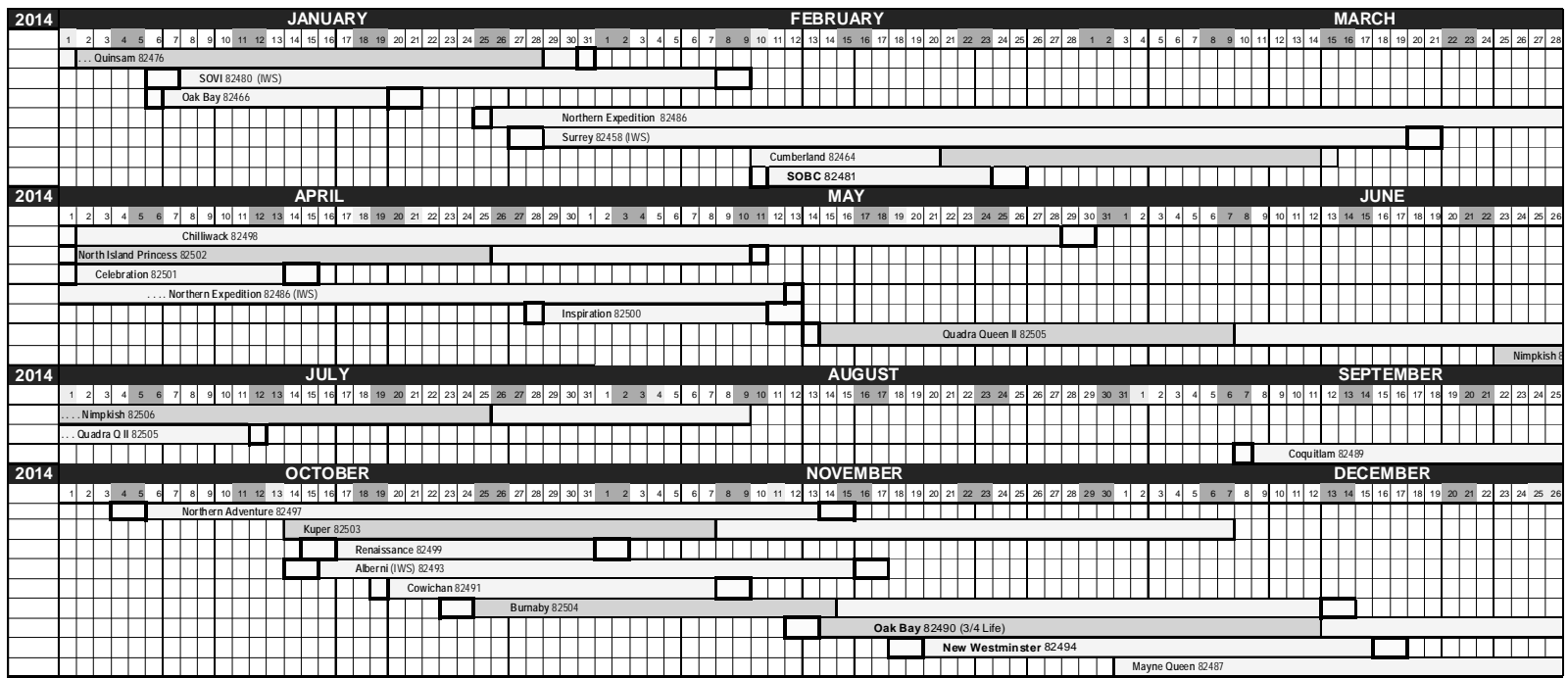
Suitability Criteria

1. Technically practicable conversion with proven technology;
2. LNG can be supplied cost effectively to the vessel;



Suitability Criteria

3. Vessel can be removed from service for the conversion work;
4. Cost-efficient vessel relief available for the project duration;
5. Sufficient lead time to prepare and procure for the project;



Suitability Criteria

6. Conversion is deemed affordable in preliminary assessment.



LNG Availability



- BC South Coast has two liquifaction facilities:
 - Tilbury, Delta, and
 - Mount Hayes near Ladysmith on Vancouver Island
- LNG can be transported by truck from a liquifaction plant to the vessel location

Safety Goals

- Embed formal risk assessment methodology in all operations



Safety Case Development

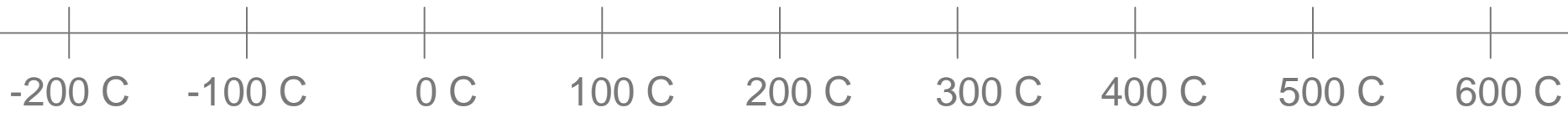
(5%-15% gas to air ratio)

-188 C Flash Point

Auto-Ignition 537 C

Minimum Ignition Energy = 0.27 mJ *barely visible spark*

Natural Gas



Diesel

60 C Flash Point

Auto-Ignition 210 C

Minimum Ignition Energy = 20 mJ



Safety Case Development



Task Analysis Example: Bunkering

- access lanes for a tanker truck
- preparing / securing the vessel
- maneuvering the truck onto the vessel
- position of the truck for transfer
- LNG transfer operation
- contingency measures and plans

Coastal Ferry Service for the Future

