Agenda

- Introduction
- Residual Demand & Quality
- Refinery Supply
- Pricing
Purvin & Gertz, Inc.

Technical, strategic and commercial advisory services for the global energy industry

Core Competencies

- Energy Market Analysis
- Refinery Valuations
- Technology Evaluations
- Crude Oil Valuations
- Project Finance Assistance
- Independent Engineer
- Conferences/Training
Purvin & Gertz - Background

- Founded in 1947
- Independent firm owned by active consultants
- Consulting staff of Engineers/MBAs
  - Join with 10-15 years of industry experience
  - Technical, commercial and financial experience with an average of 23 years firm-wide
Ongoing Detailed Analysis of Energy Markets

➢ Global Petroleum Market Outlook
  ▪ Two modules
    • Balances updated in March
    • Price & Margin forecasts updated quarterly
  ▪ Widely used in oil industry for strategic planning

➢ Short-term Crude Oil and Refining Outlook
  ▪ Separate market reports for tactical planning

➢ Other Market Publications
  ▪ LPG studies
  ▪ North American Natural Gas
  ▪ Global LNG
  ▪ Petrochemical Feedstocks

➢ Special Topic Studies
  ▪ Residual Fuel
  ▪ Canadian Oil Sands
  ▪ China’s Rapid Growth
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World marine bunker demand has been increasing as total residual fuel demand remains stable.

Includes all stationary, domestic and international bunker and refinery residual feedstocks.
Residual fuel oil demand for power generation has been falling in most, but not all regions.

Many large consumers have switched fuels but certain countries will continue to use and even grow oil-fired power generation.
Global waterborne trade for most categories has grown faster than overall world GDP.

Percent Growth in Tonne-Miles vs. GDP, %

S = Relatively strong global economic growth
W = Relatively weak global economic growth
Global bunker demand expected to decline this year. Long-term growth projected at ~2.5%/yr.

By our estimates, bunker has been growing at nearly 4%/yr on average since 1995.
The globalization of product manufacturing will drive driven bunker demand in all regions.
IMO sulfur regulation timeline

Study in 2018 determines availability of LS fuel and start date for 0.5% S limit

- **Global**
- **ECA**

% Sulfur, max

- 5.0
- 4.0
- 3.0
- 2.0
- 1.0
- 0.0

- 2005
- 2010
- 2015
- 2020
- 2025
- 2030
Most immediate regulations relate to ECAs

- Current (S)ECAs established in the North Sea and Baltic Sea
- U.S. EPA has submitted a ECA request to the IMO in conjunction with Canada
- California has issued a Marine Notice that only distillate fuels can be used within 24 n.m. from July 2009
- ECAs likely to be adopted in other areas
  - Norway
  - Med?
  - Straits of Melaka?
  - South Korea?
RFO bunker consumption is concentrated in a small portion of long-haul vessels

Installing scrubbers on a few thousand of the largest bunker consuming vessels would allow a large portion of bunker to remain high sulfur

- - Use in ECA’s less likely - -
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Reduction of bunker fuel emissions is a complex inter-industry issue

**Shipping Industry**
- Requires low cost fuel – very competitive market
- Resists capital and added complexity of scrubbers
- Facing complex regulatory environment
  - Uncertain ECA and global regulation schedule
  - NOx, PM and perhaps CO₂

**Refining Industry**
- Bunker has traditionally been a low-value by-product
- Difficult to envision investing for bunker production
- Stranded investment risk if emissions technology evolves
- Concerned with magnitude of investment required
- Needs clear signal from fragmented shipping industry on fuel requirements
Our study is based on a scenario analysis to understand impact on refining industry

Scrubbing of stack gases, while not commercially available, has the potential to significantly reduce compliance cost

- Degree of scrubber adoption will have a direct effect on refiners
- The uncertainty of this variable examined through two scenarios:

  - **Scrubber Compliance** – Broad scrubbing adoption key ship types and routes which moderate need for fuel quality improvements
    - **Moderate refining industry impact**

  - **Fuels Compliance** – Stringent and disruptive case for refining, suppliers and bunker consumers
    - **Significant refining industry impact**
Refiners have a range of bunker fuel production options, each with a set of market risks.

- Diesel
- Marine Diesel (DMB/DMC)
- HDS VGO
- HDS Residue
- HS Bunker (Scrubbing)
Residue hydrotreating has been added in Asia but most upgrading capacity has been coking and cracking.

Capacity Additions 1998-2008 - Million Barrels per Day

- Other
- Europe
- U.S.
- Middle East
- Asia

Residue HDS
Coking
FCC/HCU
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Fuel Oil and Bunker Pricing Methodology

- Finished Diesel/Gasoil Price (Non-Marine)
- ECA Bunker Price (0.1%S)
  - 1. Relative LCO Hydrotreating Cost
- LS Bunker Price (0.5%S)
  - 1. Cost of Production Economics
- Low Sulfur Fuel Oil Price (1%S)
  - 1. Blending Economics (to LS Bunker)
- High Sulfur Fuel Oil Price (3-3.5%S)
  - 1. Refining Conversion Reinvestment Economics
- High Sulfur LCO Price/Value
  - 1. Relative LCO Hydrotreating Cost

Bunkerworld Business Exchange – Houston 2010
Bunker market is large enough to shift price relationships in many markets

- Currently, LSFO-HSFO spread is small compared to diesel-HSFO
- LSFO volumes are small relative to bunker
- Adding LS spec to bunker fuel will increase LSFO-HSFO spread
- LSFO might move from being a “HSFO plus” product to a “diesel minus” product
Investments to produce lower sulfur bunker will raise cost to well above HSFO380

Includes operating costs and investment return. Return set consistent with alternative fuels investment (coking to produce finished transportation products).
In summary . . .

- Primary demand driver for bunker fuel is globalization of trade and outlook is good for continued growth.
- Regional ECAs are most immediate quality change which will result in a shift to distillate-”like” fuels.
- Longer-term supply of bunkers depends on ship scrubbing developments.
- Refiners are reluctant to invest for bunker markets and have options.
- Ship owners face investment or significantly higher fuel costs.
- Our view is that main engine bunker fuels will cost significantly more but well below diesel prices.
This analysis has been prepared for the sole benefit of Sustainable shipping Conference attendees. Any third party in possession of the analysis may not rely upon its conclusions without the written consent of Purvin & Gertz. Possession of the analysis does not carry with it the right of publication.

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# Residual Fuel Market Outlook Study Outline

## Diesel/Residual Balances
- **Economy & Energy**
- **13 World Regions**
- **Diesel/gasoil**
- **Stationary Fuel Oil**
  - 3 qualities
- **Bunker Fuel**
  - 5 qualities
- **Refining Capacity**
- **Refinery Supply**
  - 5 streams

## Prices & Margins
- **Three world regions**
  - Rotterdam
  - Singapore / AG
  - USGC
- **Scrubber economics**
- **Refining LS bunker cost of production**
- **Refining margins**
- **Diesel pricing**
- **Fuel oil/bunker pricing**
  - Current and future grades
- **Crude differentials**

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Completed for two scenarios