Low sulphur marine fuel options: Technical, environmental & economic aspects

Maritime Stakeholder Event
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CONservation of
Clean
Air and
Water in
Europe

The Oil Companies’ European association for health, safety and environment in refining and distribution (founded in 1963)
### CONCAWE Membership

- Open to companies owning refining capacity in the EU
- Currently 41 Member Companies:
  - ALMA
  - API
  - APC
  - BP
  - CEPSA
  - Chevron
  - ConocoPhillips
  - ENI
  - ERG
  - ExxonMobil
  - Hansen & Rosenthal
  - Hellenic Petroleum
  - I PLOM
  - Koch
  - KPI
  - Lotos
  - Lukoil
  - LyondellBasell
  - Murco
  - MOL
  - Motor Hellas
  - Neste Oil
  - Nynas
  - OMV
  - Petrogal
  - Petroplus
  - Petroplus
  - PKN Orlen
  - Preem
  - Repsol
  - RHG
  - Rompetrol
  - Sara
  - SARAS
  - Shell
  - SRD
  - ST-1 AB
  - Statoil
  - Tamoil
  - Total

- Represents nearly 100% of European refining capacity
- Not for profit association, funded by Member Companies

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Road fuel demand continuing steady shift from gasoline to diesel
Jet/kero demand expected to increase
Ratio of on-road diesel to gasoline continuing to grow

Source: IEA/Wood Mackenzie 2010
The Refinery’s Challenge

Crude oil: typically much “heavier” than product demand

- Use available crudes:
  - Adapt to quality variations
  - Adapt to different crudes on a day-to-day basis

- Produce desired products:
  - All products must be “on-spec”
  - All must be produced at the same time
  - Nothing can be thrown away!

- And …minimise energy, CO₂, environmental impacts, and costs
Refineries turn crude into multiple fit-for-purpose products

- Achieving this requires complex process technology and hydrogen
  - “Reforming” to obtain the desired molecules and distribution
  - Residue conversion to “crack” larger molecules into smaller ones
  - Hydrotreating to obtain the desired product quality (e.g. S removal)
- More refinery complexity means that more energy and more hydrogen are needed - and typically more CO$_2$ emissions
### IMO proposed path to low sulphur marine fuels

**Proposed implementation schedule has four steps**

Ratified at the October 2008 IMO MEPC meeting

- **Global cap 4.5%**
  - Baltic and North Sea
  - SO\textsubscript{X} ECA 1.5%

1. **2008**
   - All ECA 1.0% S (July)

2. **2009**
   - Global cap 3.5% S (January)

3. **2011**
   - All ECA 0.1% S (January)

4. **2012**
   - Global cap 0.5% S (January)

- **Review**

- **Global cap 0.5% S**
  - (January)

- **2024**
  - (January)
EU refineries CO₂ emissions pathway to 2020

These figures assume constant energy efficiency frozen at the 2005 level

Source: CONCAWE report 8/08
Refinery CO₂ emissions are linked to refining activity, reflecting market demand for fossil fuels and the processing intensity required to meet specifications.

Full implementation of IMO bunker specifications in 2020 results in an increase in EU refining emissions of about 12 Mt compared to a core case without IMO.

Declining market demand results in reducing emissions to 2030 but the incremental IMO bunker emissions remain unchanged.
The six major units shown here make up 85% of the total investment in 2030.

Hydrocracker Units (HCU) form the biggest single unit investment type, amounting to 9 G$, in response to increasing demand for automotive diesel fuel.

In the IMO case, the model assumes additional investment is mainly in residue desulphurisation units. These units need additional hydrogen production capacity for POX Hydrogen units, contributing 4 G$ to the total 16 G$ cost of switching to IMO bunkers.
Mainly distillate fuel or distillate / residual fuel mix

Major conversion capacity addition: cokers, hydrocrackers, hydrodesulfurisation

Unprecedented volume transition on a global scale

Unknowns: development of emission abatement technology, demand evolution other fuels, ETS, …

Supply & investment decisions by individual refiners

EU-27 Fuel Product Demand Changes

Source: Purvin & Gertz, June 2009
Conclusions

• 2010 and 2012 changes to S content of marine fuels:
  - crude slate optimisation and blending / segregation
• Longer term (2015 - 2025):
  - unprecedented step changes & major investments needed
  - refiners unlikely to be able to supply market in the same way
• Not currently possible to predict how the market will react
• Much depends on factors such as:
  - the rate of ECA growth
  - the application of abatement technology, etc.
• Switching marine fuels to distillate will increase the total supply chain CO₂ emissions
• GHG / warming impact of marine fuel S reduction is significant
Our technical reports are available at no cost to all interested parties

CONCAWE Website:

www.concawe.org