EU Refining Competitiveness and impact of planned legislation

EU Refining Forum
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1. Introduction

2. Solomon study on EU refining competitive position vs regional peer groups 2000-2012

3. Summary of CONCAWE report 1/13R

4. Trends & impact of legislation on future competitiveness
Established as a European association for research on health, safety, and environmental (HSE) issues of importance to the European oil refining industry

Objectives:
- Acquire adequate scientific, economic, technical, and legal information on HSE issues
- Improve the understanding of these issues by the industry, authorities, and consumers

Operating principles:
- Sound science
- Cost-effectiveness of options
- Transparency of results

Our research reports are available at [www.concawe.org](http://www.concawe.org)
CONCAWE Membership

- Not for profit association, funded by Member Companies
- Open to companies owning refining capacity in the EU
- 43 members, representing ~100% of European refining capacity
Solomon Associates is a US-based consultant to the global refining industry, specialising in performance benchmarking.

Refiners all over the world participate in the Solomon survey every two years.

- Each refinery completes a questionnaire providing an extensive set of operating data.
- Each participating company is presented with the confidential results showing:
  - Relative position of its own refineries compared to anonymised aggregates of refineries in the region, and in other world regions.
  - Many different performance indicators (margins, energy efficiency, personnel costs, maintenance costs, etc.)
CONCAWE requested Solomon to supply historic data showing the relative position of EU average refineries against other competing world regions.

Performance Indicators:
- Gross Refining Margin
- Cash Operating Costs
  - Energy costs
  - Personnel costs
  - Other cash costs
- Net Cash Margin

Regions:
- EU-28
- US
- Middle East
- Russia
- Korea/Singapore
- India

Source: Solomon Associates
From 2008, operating costs in the US fall relative to other regions.

EU-28 costs increase by a factor of 3 over the period, while US costs increase by only 1/3.

Source: Solomon Associates
- US energy costs fall by 26% due to shale gas whilst EU-28 energy costs increase by a factor of 3.8 over the same period.
- Korea/Singapore energy costs increase over 2010-2012 period, probably due to higher fuel oil prices after the 2011 Japanese tsunami.
EU-28 energy costs grow from 52% of total cash operating costs in 2000 to 63% in 2012
Cash OPEX Breakdown

Each OPEX category in $/bbl indexed relative to EU-28 Total Cash OPEX = 100 in Year 2000

US Gulf Coast

- US Gulf Coast energy costs shrink from 52% of total cash operating costs in 2000 to only 28% in 2012

Source: Solomon Associates
EU-28 refining is trailing the pack in terms of improvement in Net Cash Margin

US refining has gained a significant competitive advantage, with Net Cash Margin improving by a factor of 2.22 over the period
Refined product demand loss 2005-2030 is estimated at 166 Mt

- Equivalent to combined capacity of the 9 biggest (or the 40 smallest) refineries out of the 90 currently active EU mainstream refineries

- Share of light products in the demand basket changes from 75% in 2005 to 83% in 2030, requiring more conversion processes, energy, CO₂ emissions
Announced refining investments and closures 2009-15

- 14 EU refineries closed in 2008-13 resulting in *Capacity Reductions* in crude distillation (CDU, VDU) & units that boost gasoline production (FCC, REF)
- Publicly announced investments to *increase conversion* capacity in units to:
  - Distillate Hydrocracking capacity increased by 28% Residue hydrocracking & Coking by 37%). Reduced residue and increased diesel & jet fuel production.
  - 49% more hydrogen production capacity, needed for cracking and sulphur removal reactions

Guide to terms used:
- **CDU** - Crude Distillation Unit
- **VDU** - Vacuum Distillation Unit
- **REF** - Reforming unit
- **DHC** - Distillate Hydrocracking unit
- **RHC** - Residue Hydrocracking unit
- **FCC** - Fluid Catalytic Cracking unit
- **COK** - Coking unit
- **VIS** - Visbreaking unit
- **HDS** - Distillate Hydrodesulphurisation unit
- **H2U** - Hydrogen production unit
EU refined products demand declined by 100 Mt over 2005-2010 period

€21 billion\textsubscript{2011} investments in publicly announced projects for the period 2009-2015:
- Hydrodesulphurisation & conversion capacity to produce more diesel and meet fuels specifications for EU automotive & IMO 0.1% Emission Control Areas (ECAs)
- Supply/demand imbalances remain due to declining demand for gasoline & high sulphur fuel oil
- Increased operating costs have significantly degraded the competitive position of EU-28 refineries
In Emission Control Areas, S content of marine fuel oil reduced from 1.5% to 1.0% by 2010, then from 1.0% to 0.1% by 2015.

Global S cap equivalent to reducing Heavy Fuel Oil S content from 3.5% to 0.5% by 2020 (or 2025).

CONCAWE modelling assumes demand fully met by 0.5% S Marine Fuel Oil in 2020.
Global Sulphur cap reduction to 0.5% would require significant additional investment in EU-28 refineries, estimated at €15 billion\textsuperscript{2011}.

BUT - Uncertainty on how the Global Sulphur Cap will be achieved.

1. Installation of flue gas scrubbers on ships?
2. Hydrodesulphurisation (HDS) of High Sulphur Fuel Oil?
3. Conversion of ships to LNG or dual fuel LNG / diesel engines? LNG cost competitive with marine low S diesel.

As Global S cap comes into effect, some combination of the above 3 alternatives will emerge.
Summary 2015-2020

- Operating costs are not expected to improve through to 2020
- Energy costs are not expected to benefit from the US shale gas boom until US LNG gas exports are allowed and terminals are operational
- EU legislation will impact EU-28 refineries
  - Investment costs for new equipment
  - Increased Operating costs - process energy, hydrogen, additional treatment chemicals and catalysts
CONCAWE estimates are based on CONCAWE refinery model run results or on anonymized data from refineries in Europe. This data is then used as the basis for simple calculations and assumptions to develop the cost impact scenarios. These should not be regarded as forecasts.

**Note:** This is an initial release of work in progress

- First tier: Estimates already released by CONCAWE
  - Marine Fuels Directive (MFD)
  - IED REF BREF Air and Water emissions compliance
- Second tier: CONCAWE estimates based on simple calculations, reasonable assumptions and relevant backup data, EU ETS
  - RED
  - REACH
- Third tier: Estimates based on consultant studies (Wood Mckenzie)
  - FQD article 7a (crude differentiation impact)
    - Legislation is not yet finalized
    - Estimates in this tier have a high level of uncertainty
Additional costs imposed by EU Legislation in 2020 (expressed in $2012 per barrel of crude) are estimated to be in the range 2.5-4.5 $/bbl.

This excludes the possible cost impact of crude shuffling resulting from FQD art.7a, estimated by Wood Mackenzie at 1.5-7 $/bbl.

This compares with the range of EU refining Net Cash Margin of 1-6 $/bbl over 2000-2012.
Our technical reports are available at no cost to all interested parties

CONCAWE Website:

www.concawe.org
Definitions of
- Gross Margin,
- Opex
- Net Margin
Gross Margin – in US $ per Net Raw Material Input Barrel

\[
\text{Gross Margin} = \frac{(\text{Gross Product Value} - \text{Raw Material Cost})}{\text{Net Raw Material Input}}
\]

- **Gross Product Value**: Sum of net product quantity multiplying product price, plus net value of lube refinery & chemical plant transfers, and refinery-produced fuel, minus third-party product terminalling.

- **Raw Material Cost**: Sum of crude quantity multiplying crude price, plus costs for other net raw materials, plus third-party raw material terminalling.

- *The actual Gross Margin values calculated in $/bbl are the intellectual property of Solomon Associates and may not be divulged.*

- The graphs show the indexed $/bbl Gross Margin values relative to a fixed value in the year 2000, without any adjustment for inflation.
Cash OPEX – in US $ per Net Raw Material Input Barrel

\[
\text{Cash OPEX} = \frac{(\text{Personnel Cost} + \text{Energy Cost} + \text{Other Cost})}{\text{Net Raw Material Input Barrels}}
\]

- **Personnel Cost**: Includes salaries, wages, and benefits of company employees, contract maintenance labor, other contract services, 55% of annualized turnaround expenses, and General & Administrative personnel cost (G&A; typically provided by parent company at headquarters location)

- **Energy Cost**: On a net consumption basis, includes purchased fuel, electricity, and steam, plus refinery-produced fuel at regional average price

- **Other Cost**: All other volume-related or non-volume-related cash operating expenses excluding personnel and energy costs

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- The graphs show the indexed \$/bbl Cash OPEX values relative to a fixed value in the year 2000, without any adjustment for inflation
Net Cash Margin – in US $ per Net Raw Material Input Barrel

\[
\text{Net Cash Margin} = \frac{\text{Gross Product Value} - \text{Raw Material Cost} + \text{Other Revenue} - \text{Cash OPEX}}{\text{Net Raw Material Input Barrels}}
\]

- **Other Revenue**: Revenue from other sales or services such as gaseous and liquid CO\(_2\) sales, insurance payments (if premium reported under OPEX), and reimbursement for services provided to third parties (such as laboratory use, maintenance, environmental, and water treating, excluding toll processing fees)

- **Cash OPEX**: Sum of personnel cost, energy cost, and other cost

\[\text{The actual Net Cash Margin values calculated in $/bbl are the intellectual property of Solomon Associates and may not be divulged}\]

- The graphs show the indexed $/bbl Net Cash Margin values relative to a fixed value in the year 2000, without any adjustment for inflation