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EU Refining Competitiveness and impact of planned legislation

EU Refining Forum

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Items

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

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

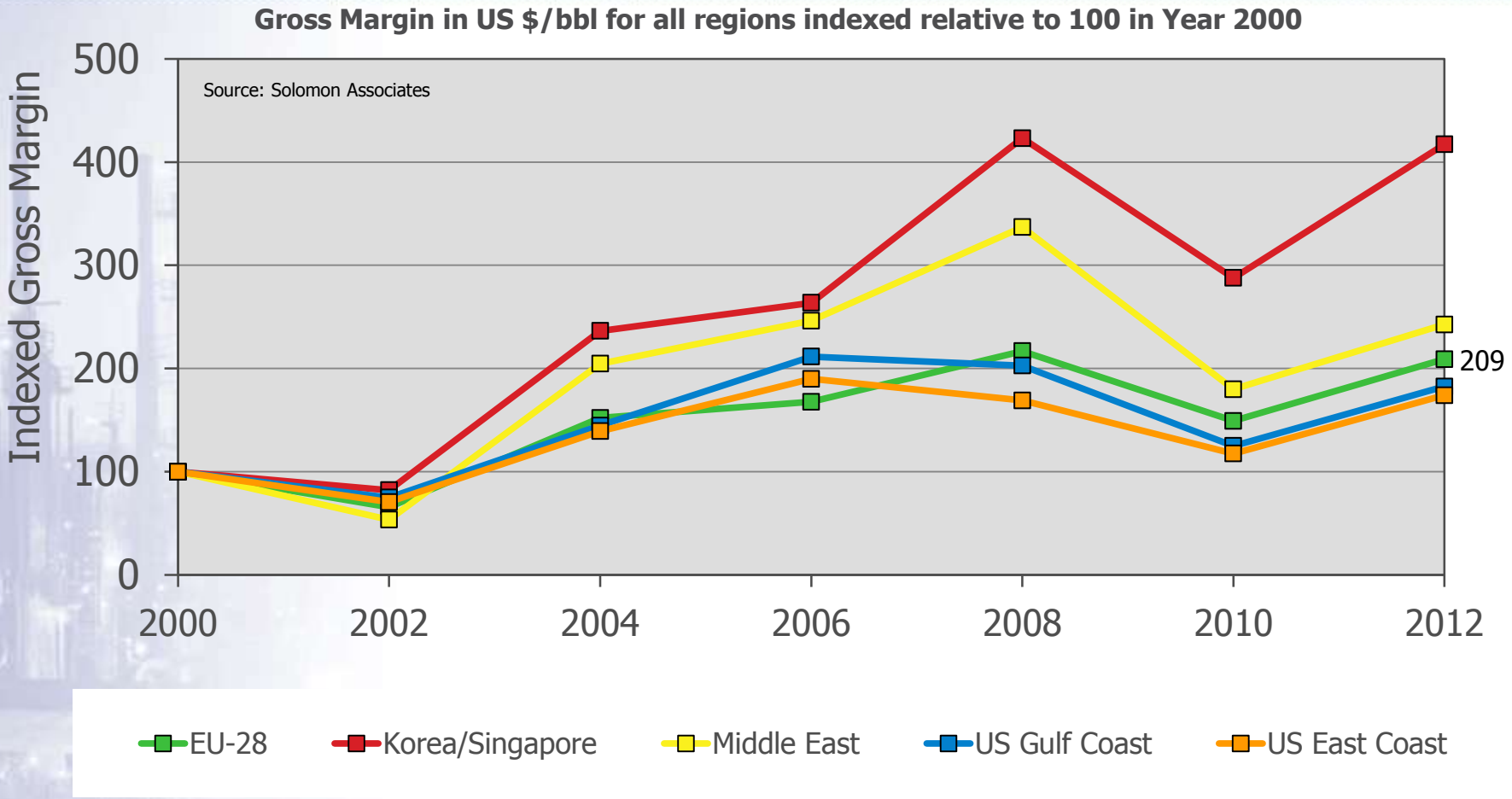
Comparative study of EU refining vs peers

- 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 Comparative study of EU refining vs peers

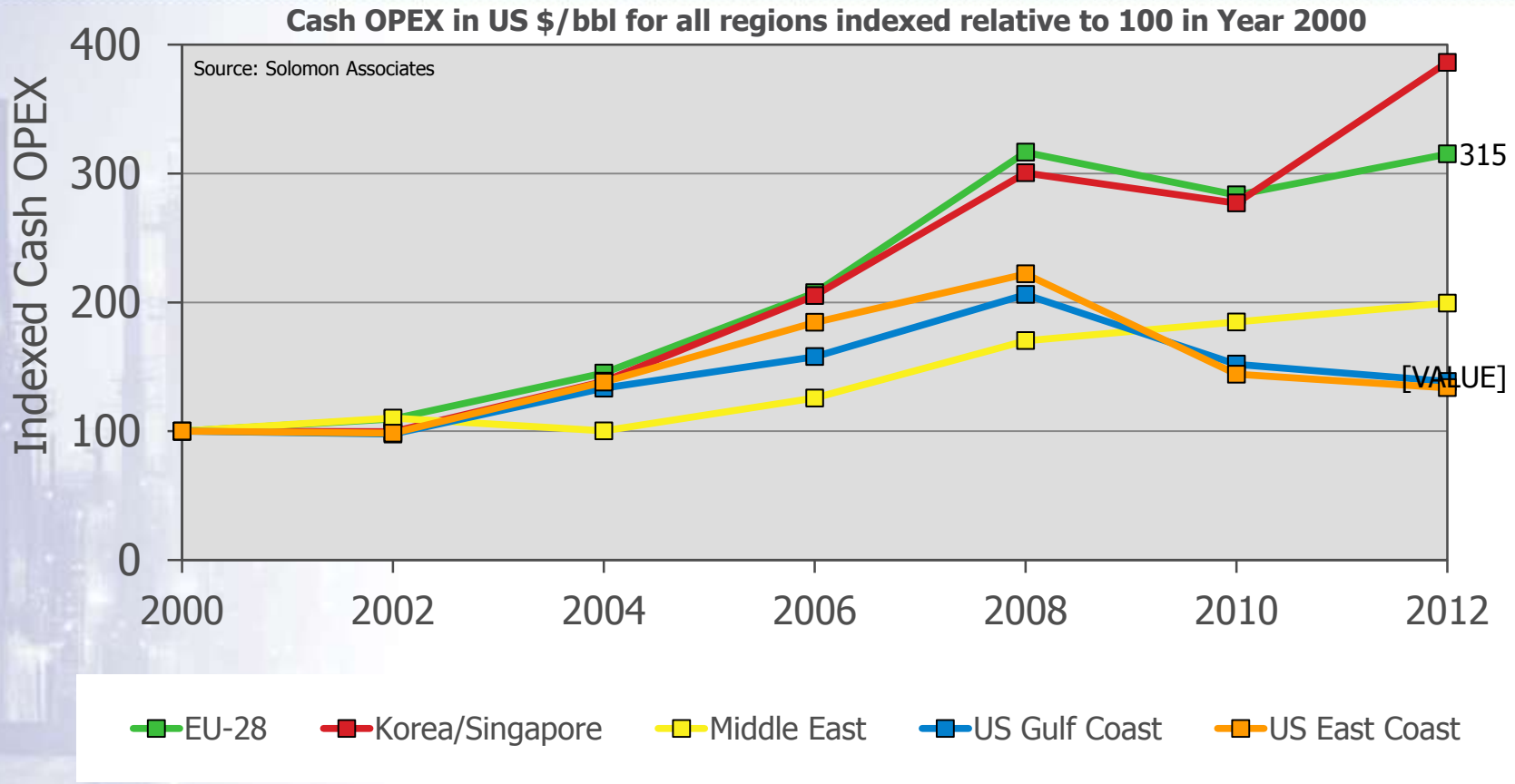
- **CONCAWE requested Solomon to supply historic data showing the relative position of EU average refineries against other competing world regions**
- **Performance Indicators:**
  - Gross Refining Margin
  - Cash Operating Costs
    - Energy costs
    - Personnel costs
    - Other cash costs
  - Net Cash Margin
- **Regions:**
    - EU-28
    - US
    - Middle East
    - Russia
    - Korea/Singapore
    - India

Gross Margin (GM)



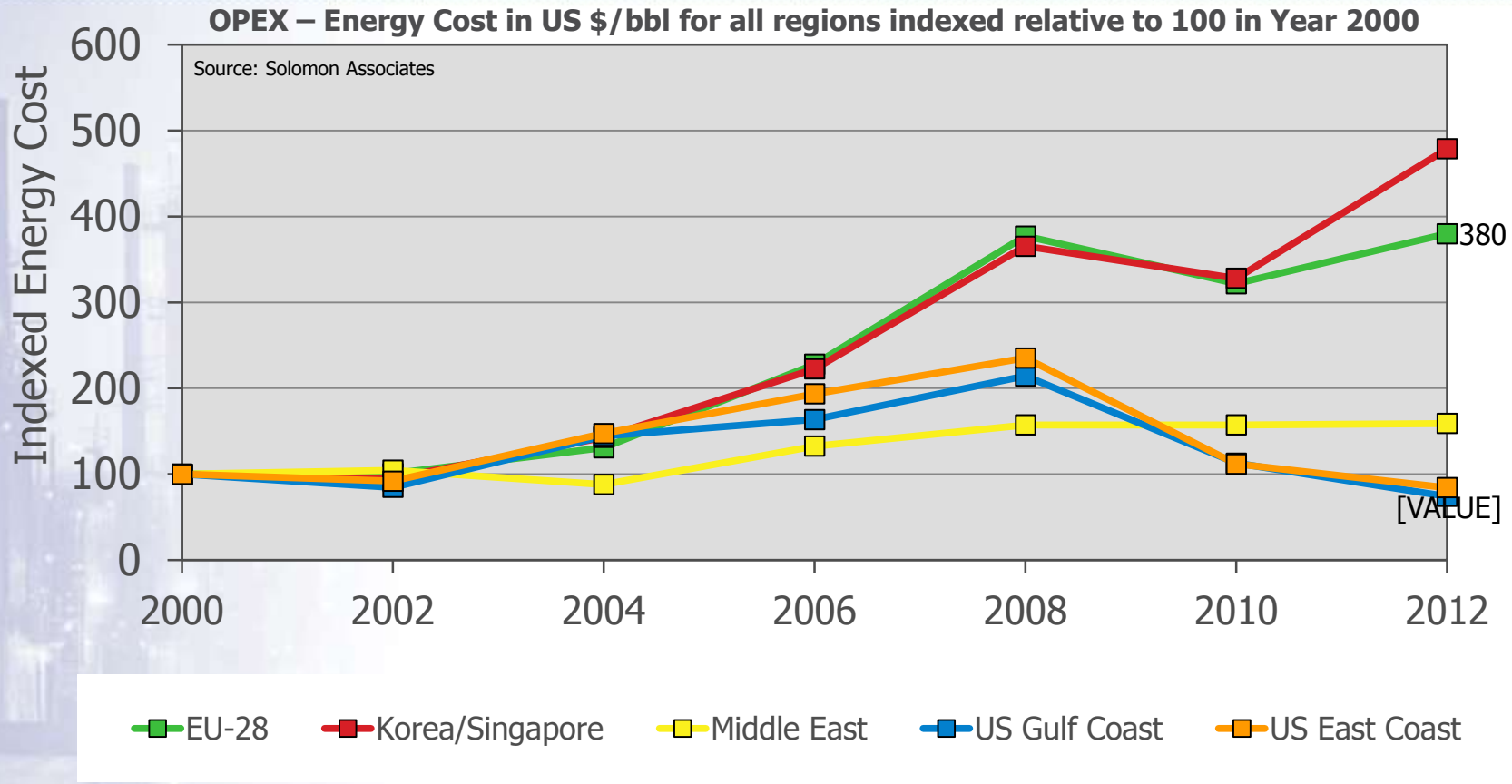
- Growing demand (esp. China) improves GM until Financial Crisis in 2008.

Cash OPEX



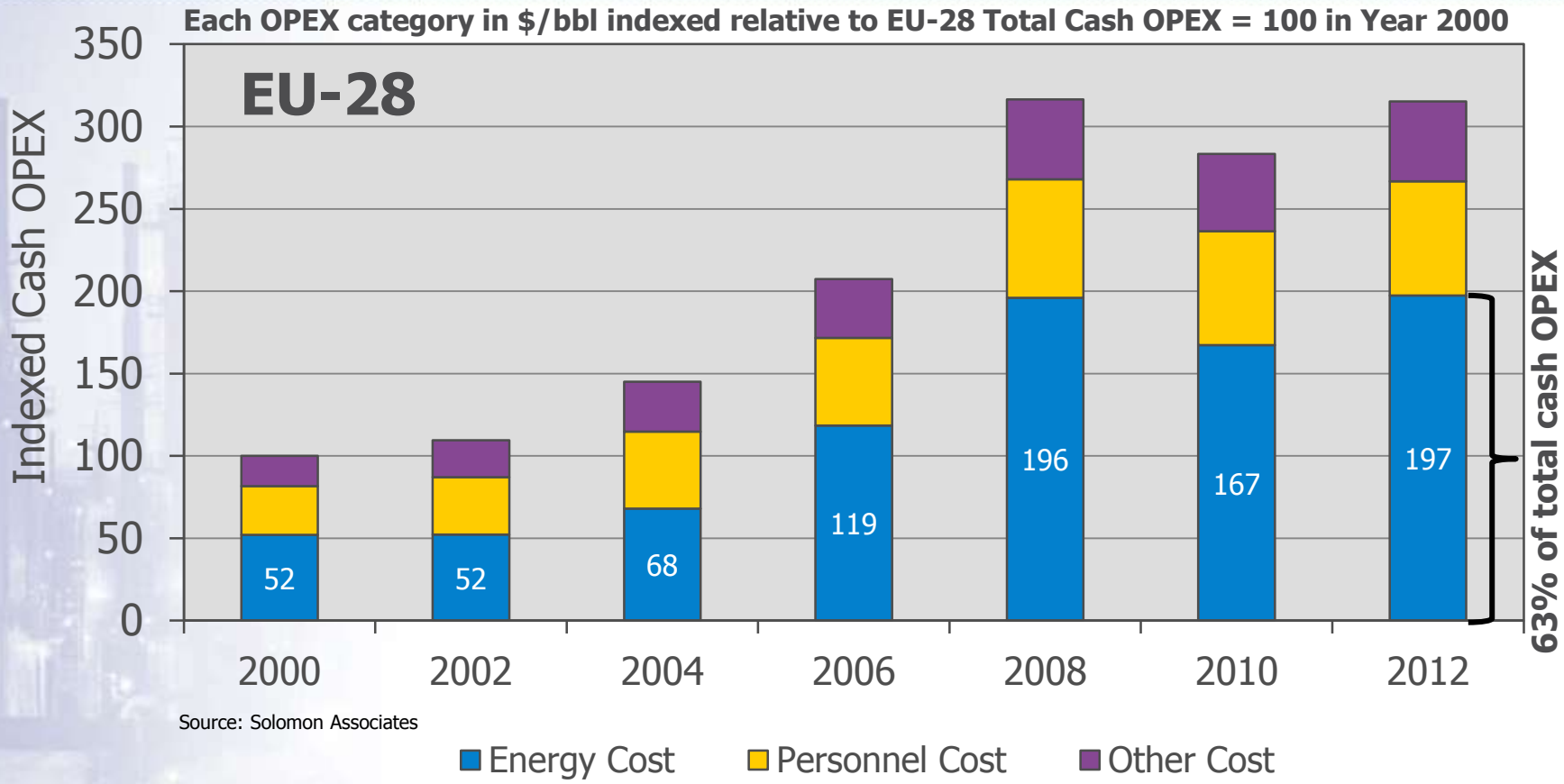
- From 2008, operating costs in the US fall relative to other regions
- EU-28 costs increase by a factor of 3 over the period, while US costs increase by only 1/3

OPEX – Energy Cost



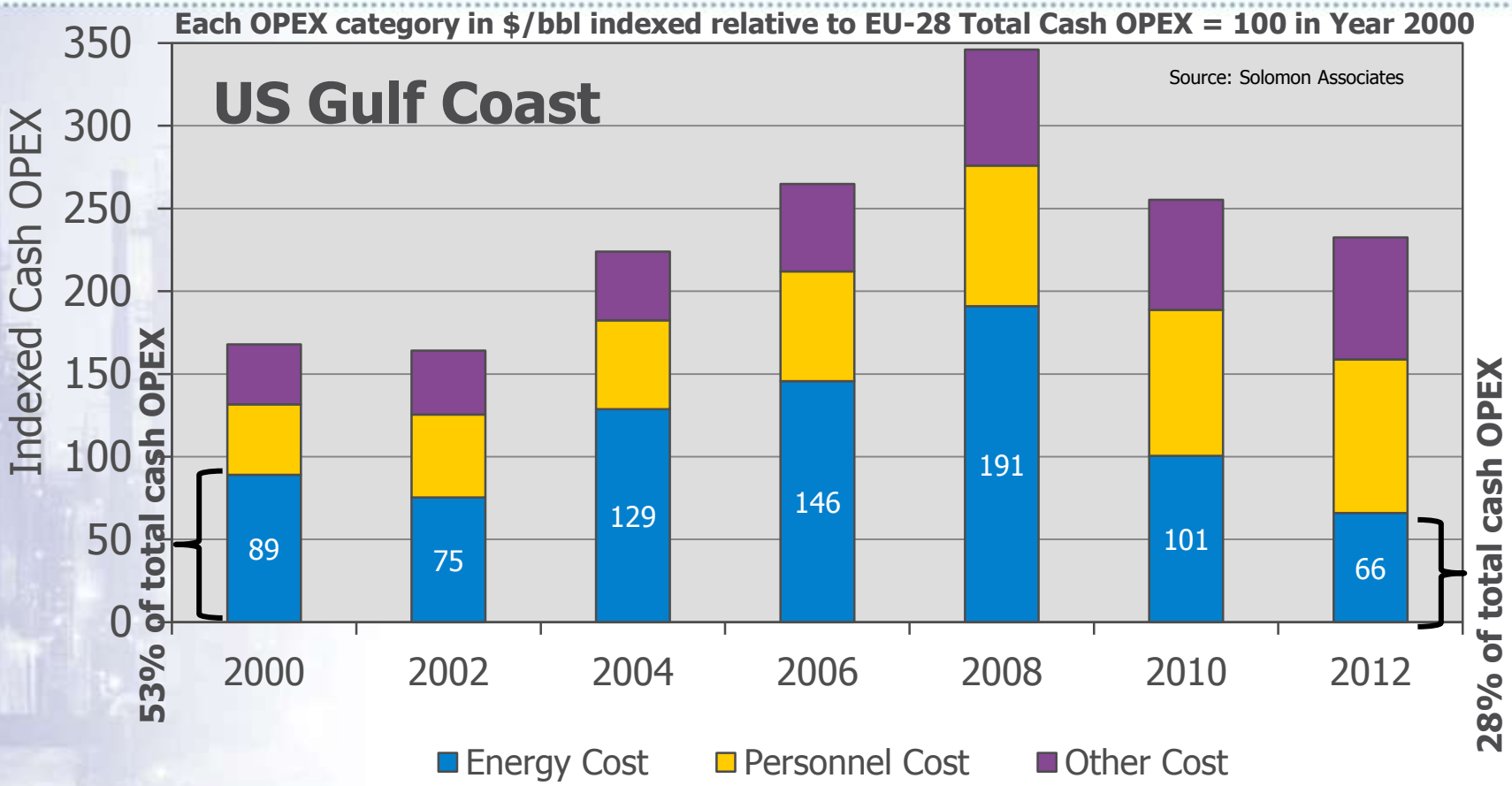
- US energy costs fall by 26% due to shale gas whilst EU-28 energy costs increase by a factor of 3.8 over the same period
- Korea/Singapore energy costs increase over 2010-2012 period, probably due to higher fuel oil prices after the 2011 Japanese tsunami

Cash OPEX Breakdown



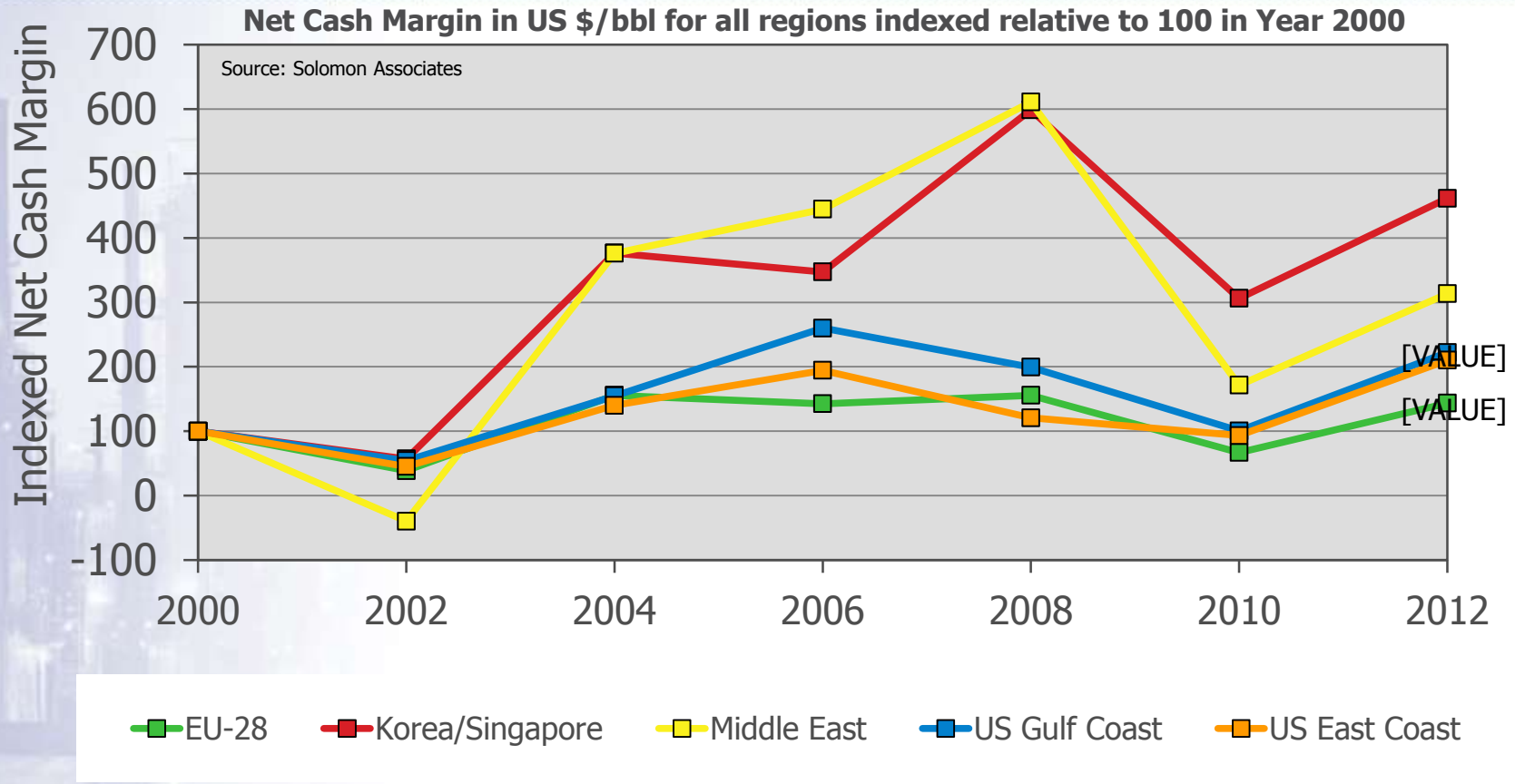
- EU-28 energy costs grow from 52% of total cash operating costs in 2000 to 63% in 2012

Cash OPEX Breakdown



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

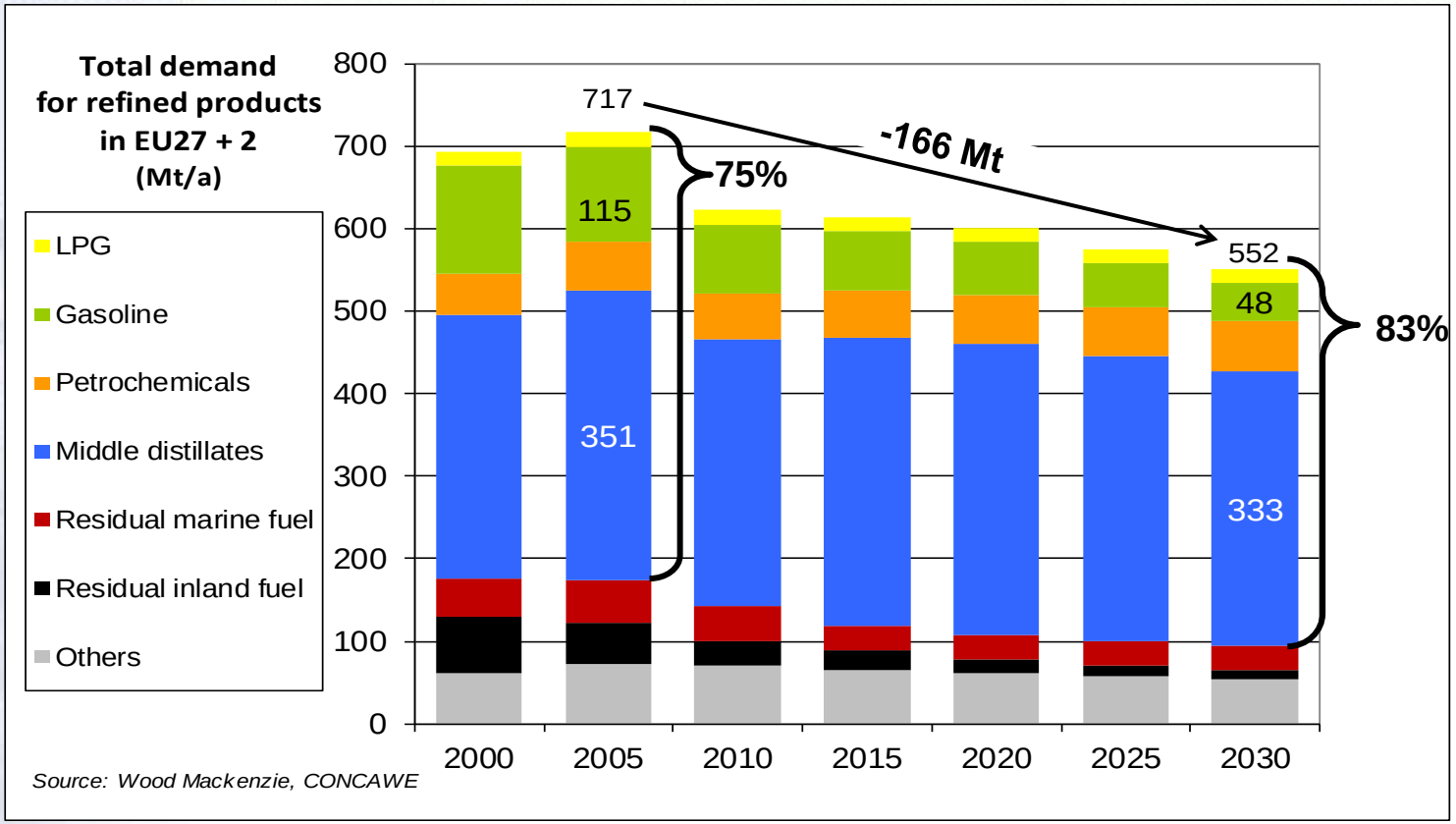
Net Cash Margin



- 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

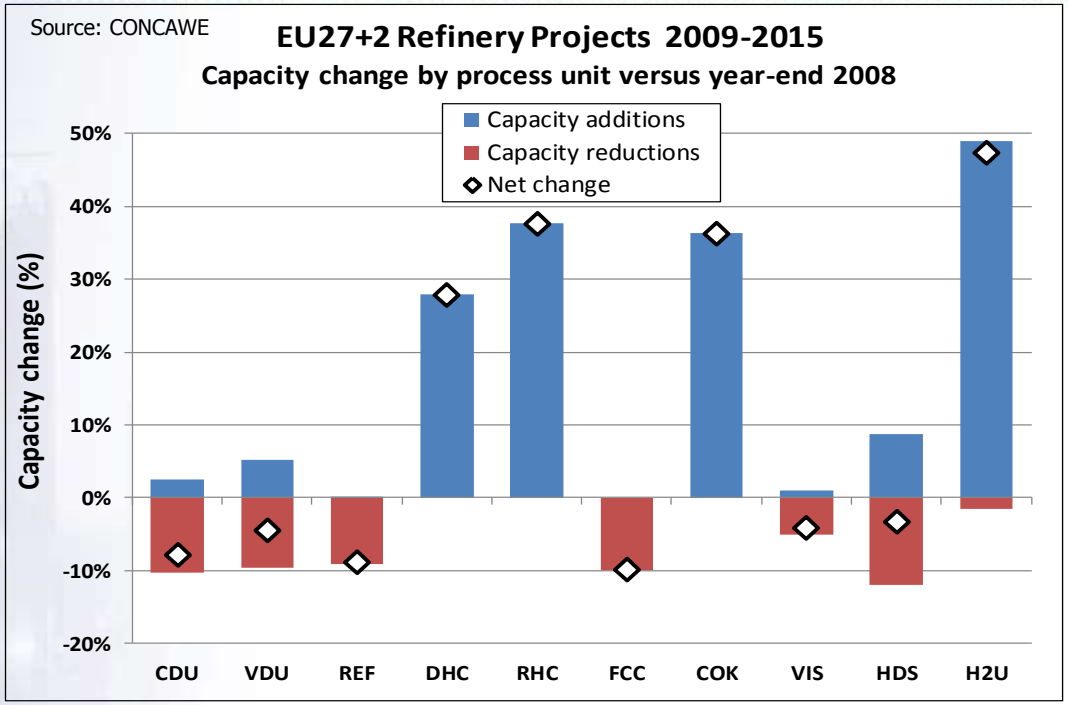
Highlights of CONCAWE report no. 1/13R

Product demand and quality trends



- 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, CO_2 emissions

Announced refining investments and closures 2009-15



Guide to terms used:

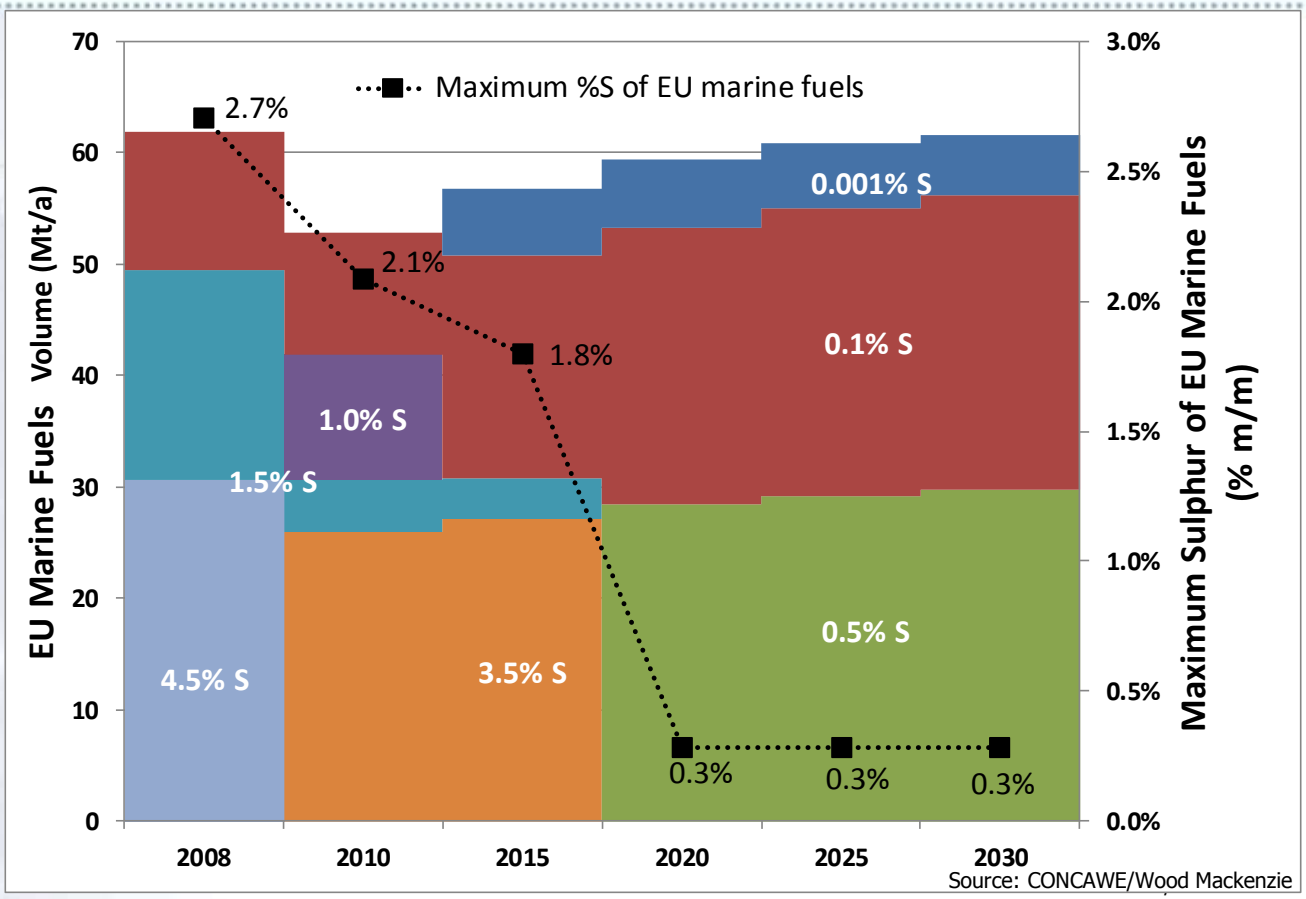
- **CDU** - Crude Distillation Unit
- **VDU** - Vacuum Distillation Unit
- **REF** - Reforming unit
- **DHC** - Distillate Hydrocracking unit
- **RHC** - Residue Hydrocracking unit
- **FCC** - Fluid Catalytic Cracking unit
- **COK** - Coking unit
- **VIS** - Visbreaking unit
- **HDS** - Distillate Hydrodesulphurisation unit
- **H2U** - Hydrogen production unit

- 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

Summary 2000-2015

- **EU refined products demand declined by 100 Mt over 2005-2010 period**
- **€21 billion$_{2011}$ 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**

Marine fuel Sulphur reduction



- 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……

Marine fuel Sulphur reduction

Global Sulphur cap reduction to 0.5% would require significant additional investment in EU-28 refineries, estimated at €15 billion$_{2011}$.

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

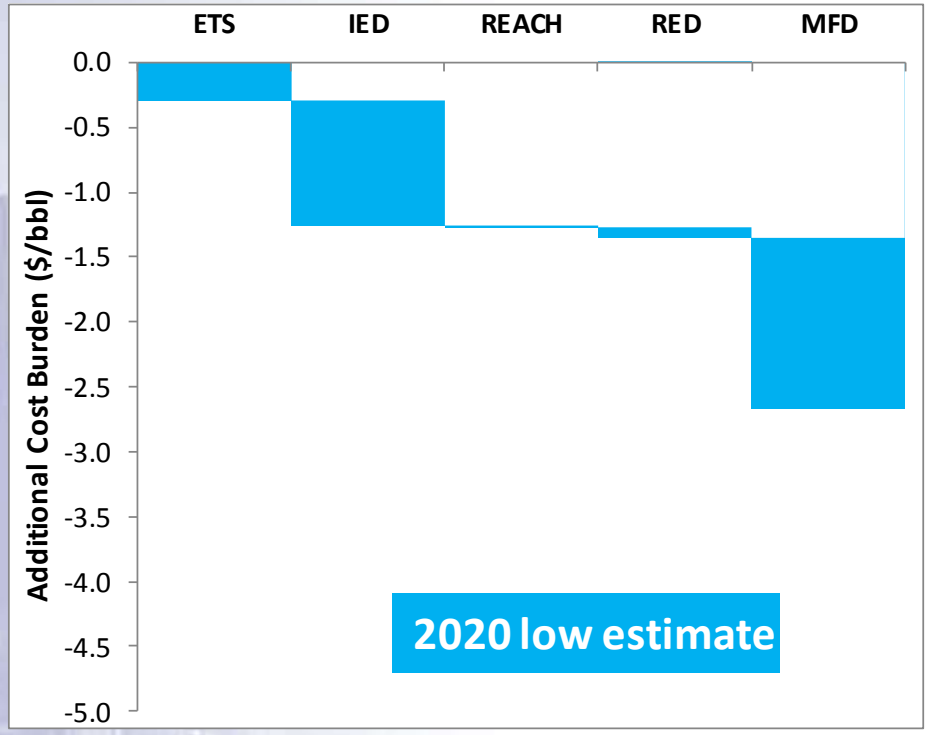
- Operating costs are not expected to improve through to 2020
- Energy costs are not expected to benefit from the US shale gas boom until US LNG gas exports are allowed and terminals are operational
- EU legislation will impact EU-28 refineries
  - Investment costs for new equipment
  - Increased Operating costs - process energy, hydrogen, additional treatment chemicals and catalysts

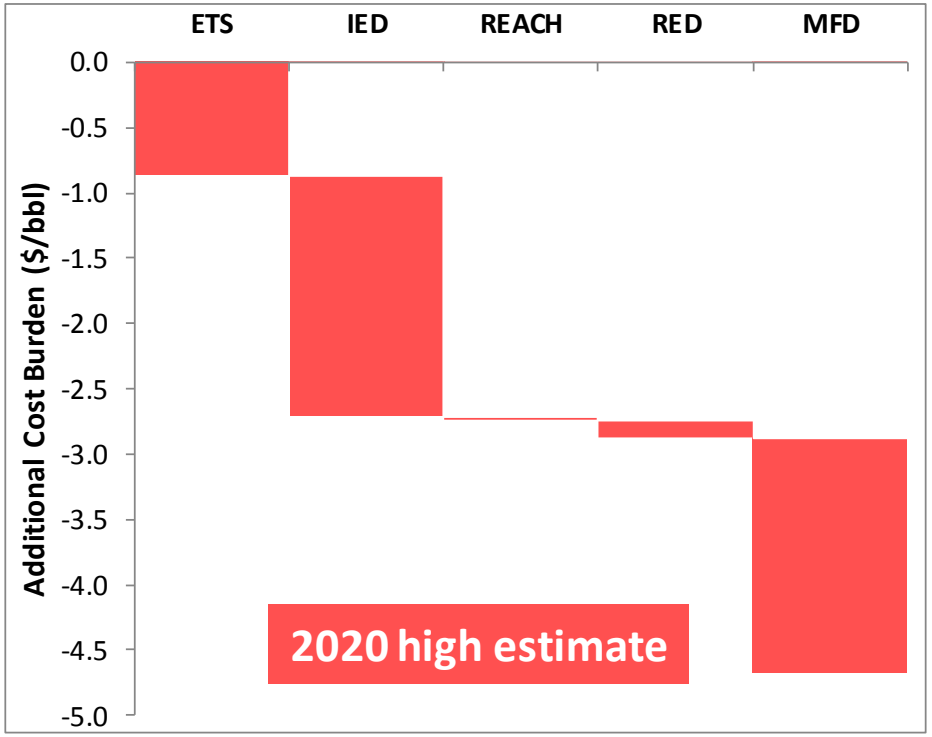
Cost Impact Scenarios

- **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.**
- **<u>Note:</u> 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

Initial estimates of cost of legislation





- 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

For More Information

Our technical reports are available at no cost to all interested parties

CONCAWE Website:

www.concawe.org

Picture: ExxonMobil

Backup

- Definitions of
  - Gross Margin,
  - Opex
  - Net Margin

Solomon - Gross 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

Solomon-Opex

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
- *The actual Cash OPEX values calculated in $/bbl are the intellectual property of Solomon Associates and may not be divulged*
- The graphs show the indexed $/bbl Cash OPEX values relative to a fixed value in the year 2000, without any adjustment for inflation

Solomon – Net cash margin

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
- *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