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ENVIRONMENTAL SCIENCE FOR THE EUROPEAN REFINING INDUSTRY

Refining Fitness Check Looking ahead:

Concawe's estimate of the forward cost of EU legislation

Concawe Symposium

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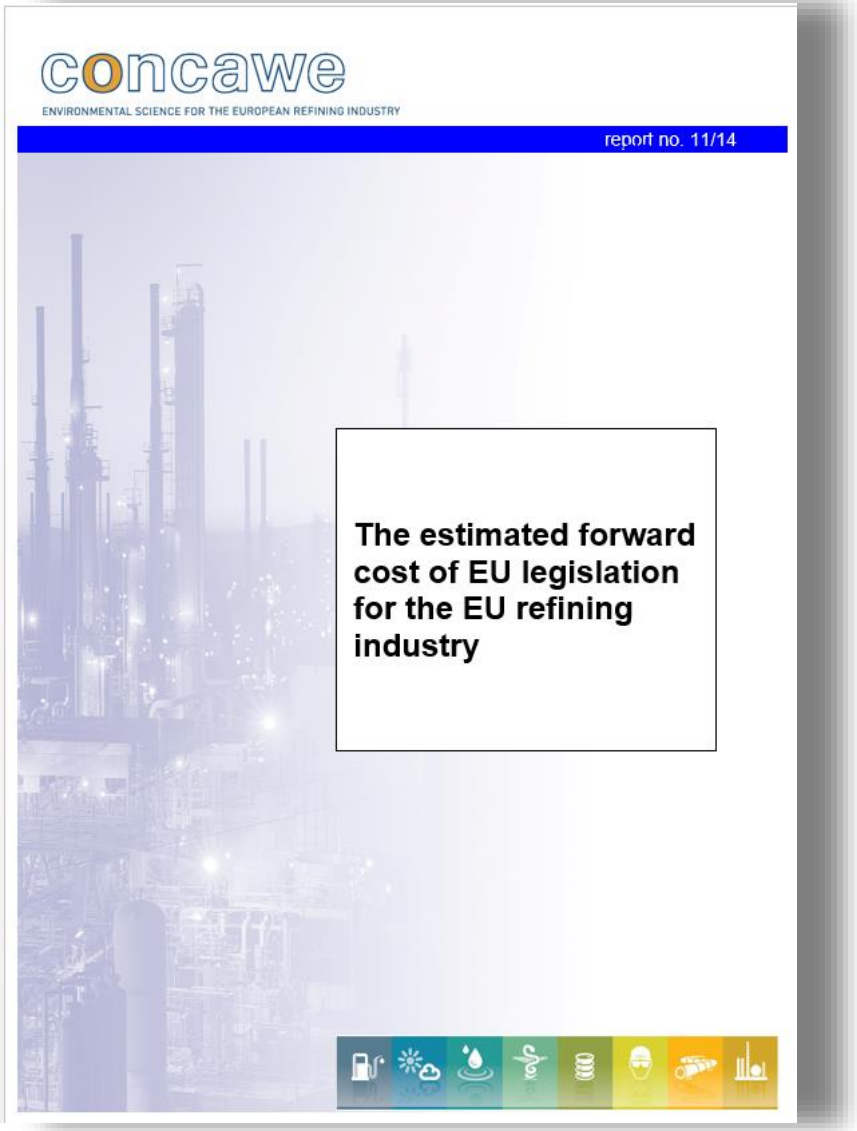
Legislative challenges post-2012

- **ETS** (Emissions Trading System): Phase III free allowances significantly reduced by refining benchmark and cross-sectoral correction factor
- **IED** (Industrial Emissions Directive): More stringent air and water emission limit values -> Compliance by 2018
- **REACH**: Administrative burden and license fees
- **RED** (Renewable Energy Directive): Loss of demand and refining throughput, replaced by biofuels
- **SLFD** (Sulphur in Liquid Fuels Directive): Marine Fuels sulphur reduction requires major capital investment and increased operating costs

What is the combined impact on costs?

Concawe report no. 11/14, Dec. 2014



EU Emissions Trading Scheme (EU ETS) costs

- EU ETS Phase III runs from 2013 to 2020
- Emission allowances are distributed by auction in this period
- Refining is among the sectors qualifying for free allowances, based on a sectoral benchmark
- Cross-sectoral correction factor (CSCF) cuts the total free allocation over 2013-2020 period by 11.6% (about 95 Mt CO_2)
- Free allowances for EU refining in 2013 were estimated at 67% of refining emissions*, reducing to 58% in 2020 (instead of a constant 71% without the CSCF)
- About 60 Mt allowances to be purchased by EU refineries in 2020

		Low	High
CO2 price in 2020	€/t	16.5	30.0
Estimated cost to EU refiners (purchase of CO2 allowances)	G€/a	0.99	1.80
	$/bbl	**0.31**	**0.57**

* EU refining emissions were assumed to remain constant at 144 Mt/a CO_2

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Industrial Emissions Directive (IED) costs

- The IED sets emission limit values on the effluents of industrial installations to air and water
- Compliance with the range of Associated Emission Levels (AELs) achievable with the Best Available Techniques (hence BAT-AELs) is required by October 2018
- Many refineries will need to invest: Electrostatic precipitators, Wet gas scrubbers, Super Claus, Selective Catalytic Reduction, ….
- Water Framework Directive may lead to additional water effluent treatment measures, over and above the IED requirements.

Cost scenario in 2020		**Low**	**High**
Emissions to air (SO2, NOX and dust only) Estimated cost (capital and operating cost)	G€/a $/bbl	1.35 0.43	4.5 1.43
Emissions to water Estimated cost (capital and operating cost)	M€/a $/bbl	25 0.01	not estimated
Total estimated cost to EU refiners	G€/a	1.37	4.5
	$/bbl	**0.44**	**1.43**

REACH* legislation costs

- Significant additional burden on product suppliers into the EU market
  - Development of methodologies required for the assessment of UVCBs * and in the preparation of the registration dossiers
  - Registration fees
- Total of these costs incurred for all EU refineries estimated at 130 M€
- Potential costs for additional testing estimated at 50 M€
- On-going costs of about 50 M€/a for additional admin personnel.

Cumulative once-off costs 2010-2020 Capital charge	M€ M€/a	180 27
On-going cost	M€/a	50
Total estimated cost to EU refiners	M€/a	77
	$/bbl	**0.02**

* **REACH**: **R**egistration, **E**valuation, **A**uthorisation and restriction of **Ch**emicals

** **UVCB**: Substance of **U**nknown or **V**ariable composition, **C**omplex reaction products or **B**iological materials

Renewable Energy Directive (RED) costs

- RED forces the introduction of biofuels and renewables into transport fuels
- Ethanol displaces refined gasoline from the demand pool
- Gasoline export market is assumed to be saturated
- A reduced production of refined gasoline would require a reduction in crude throughput: by about 18 Mt/a in 2010, increasing to 45 Mt/a in 2020
- Cost impact on refining can be estimated as a loss of margin due to reduced throughput
- Calculation uses notional average EU refining net margin of 3 $/bbl (**NOT** to be taken as representative of current or historic margins)

Total estimated cost to EU refiners (2020)	G€/a	0.70
	$/bbl	**0.22**

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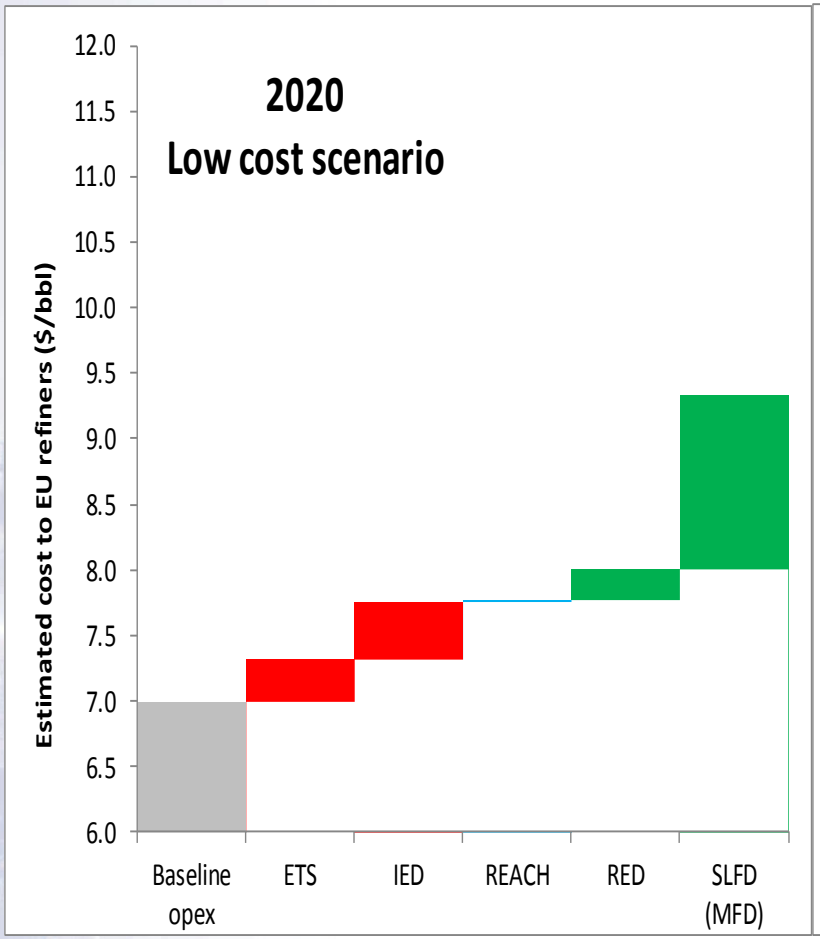
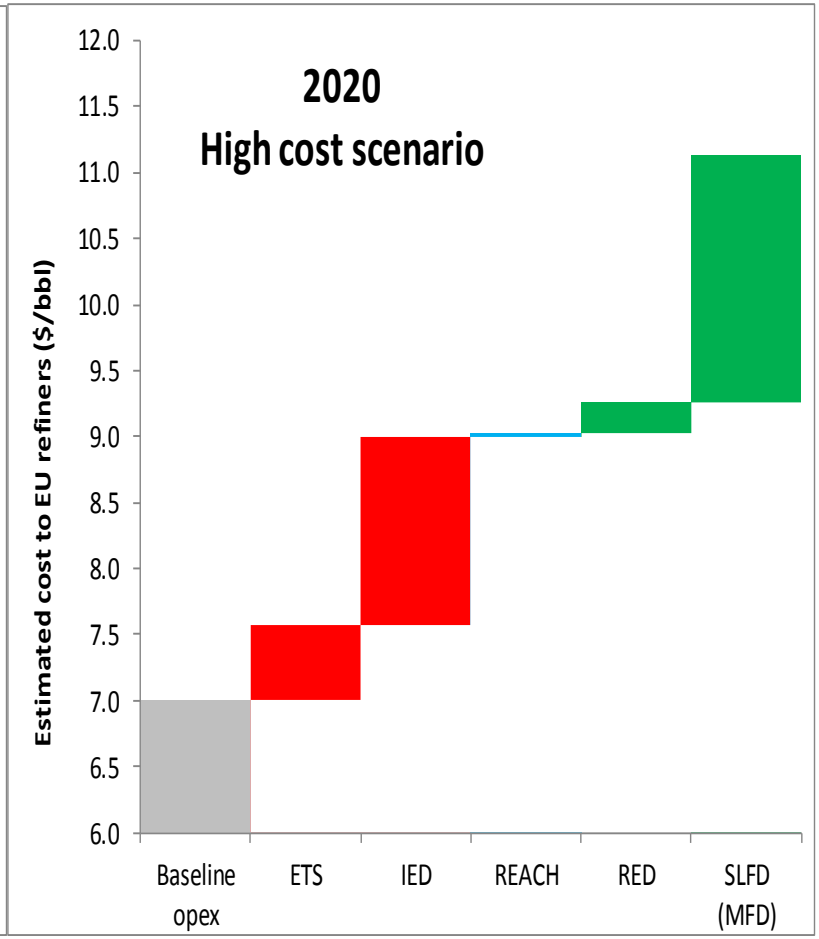
Sulphur in Liquid Fuels Directive (Marine Fuels) costs

- Concawe 2013 study estimated the costs of EU refining investments required to meet reduced Marine Fuels %S limits:
  - **10 G€** for the ECA 0.1% S limit in 2015
  - **15 G€** for the 0.5% S limit, assuming all non-ECA bunker fuel sold in the EU meets that specification in 2020
- Refiners also face a sizeable extra energy bill as well as carbon costs
- Uncertainties on timing of the IMO 0.5% global limit and alternative abatement measures for ships (scrubbers, LNG, etc.)
- Some compensating incremental revenue from higher value refined products but very difficult to predict

% of non-ECA EU bunker fuel @ 0.5% S		**Low (50%)**	**High: (100%)**
Estimated cumulative investment 2010-2020	G€	17.5	25.0
Capital charge	G€/a	2.63	3.75
Estimated additional operating costs	G€/a	1.61	2.19
Total estimated cost to EU refiners	G€/a	4.23	5.94
	$/bbl	**1.34**	**1.89**

Cumulative cost impact of EU legislation in 2020





- The cumulative cost of meeting all these legislative challenges in 2020 is in the region of **2.5 - 4 $/bbl** (including annualised investment costs)

Conclusions

- EU legislation will impact EU refineries' costs
  - Increased investment costs: new process equipment, new emissions abatement equipment
  - Increased operating costs: energy, hydrogen, additional treatment chemicals and catalysts
- Uncertainties could make it difficult to economically justify additional refining investments

⇒ **Competitiveness of EU refineries will continue to be under pressure**

For More Information

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

Concawe Website:

www.concawe.org

Thank you for your attention

Any questions?

Picture: ExxonMobil