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Refinery emissions from a competitive perspective

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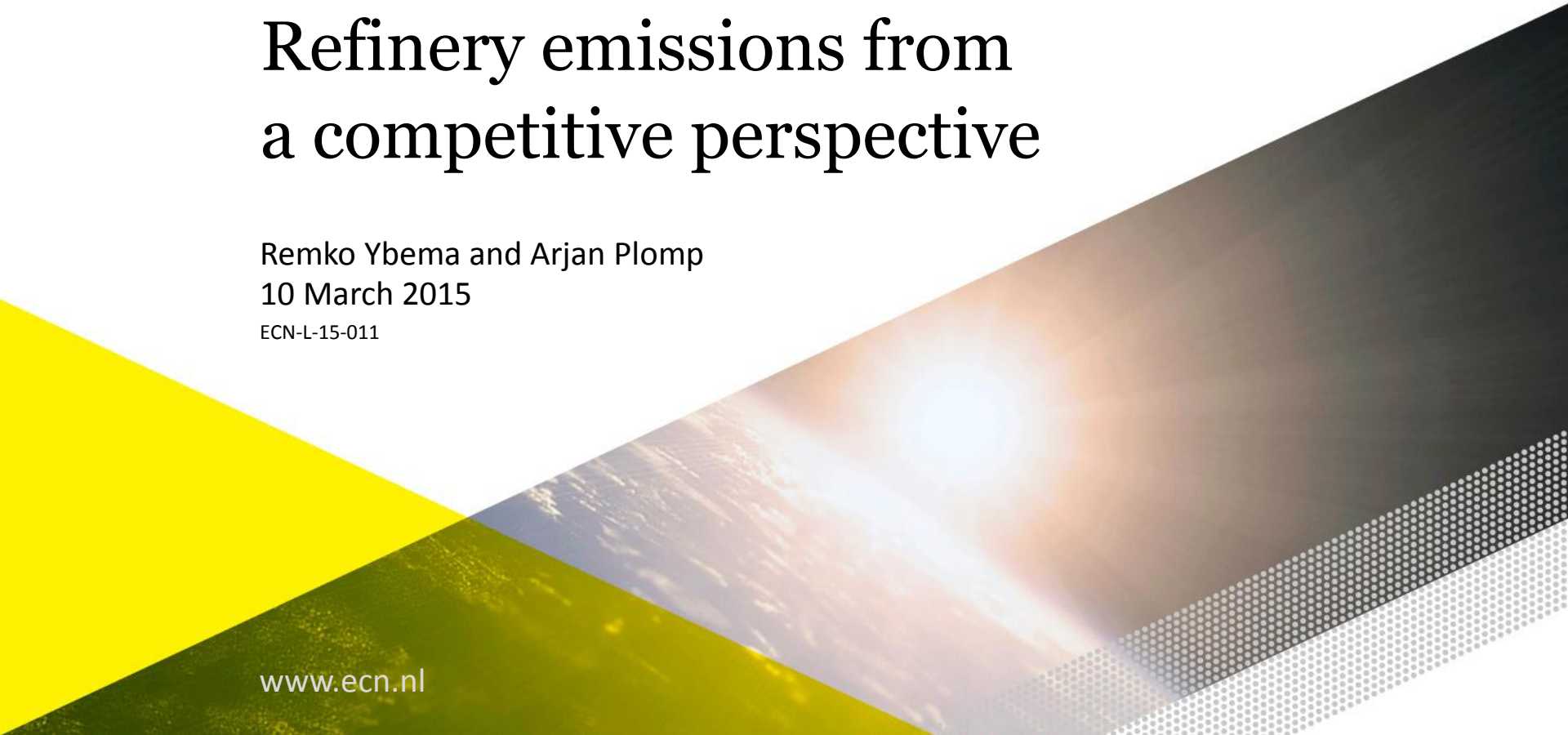

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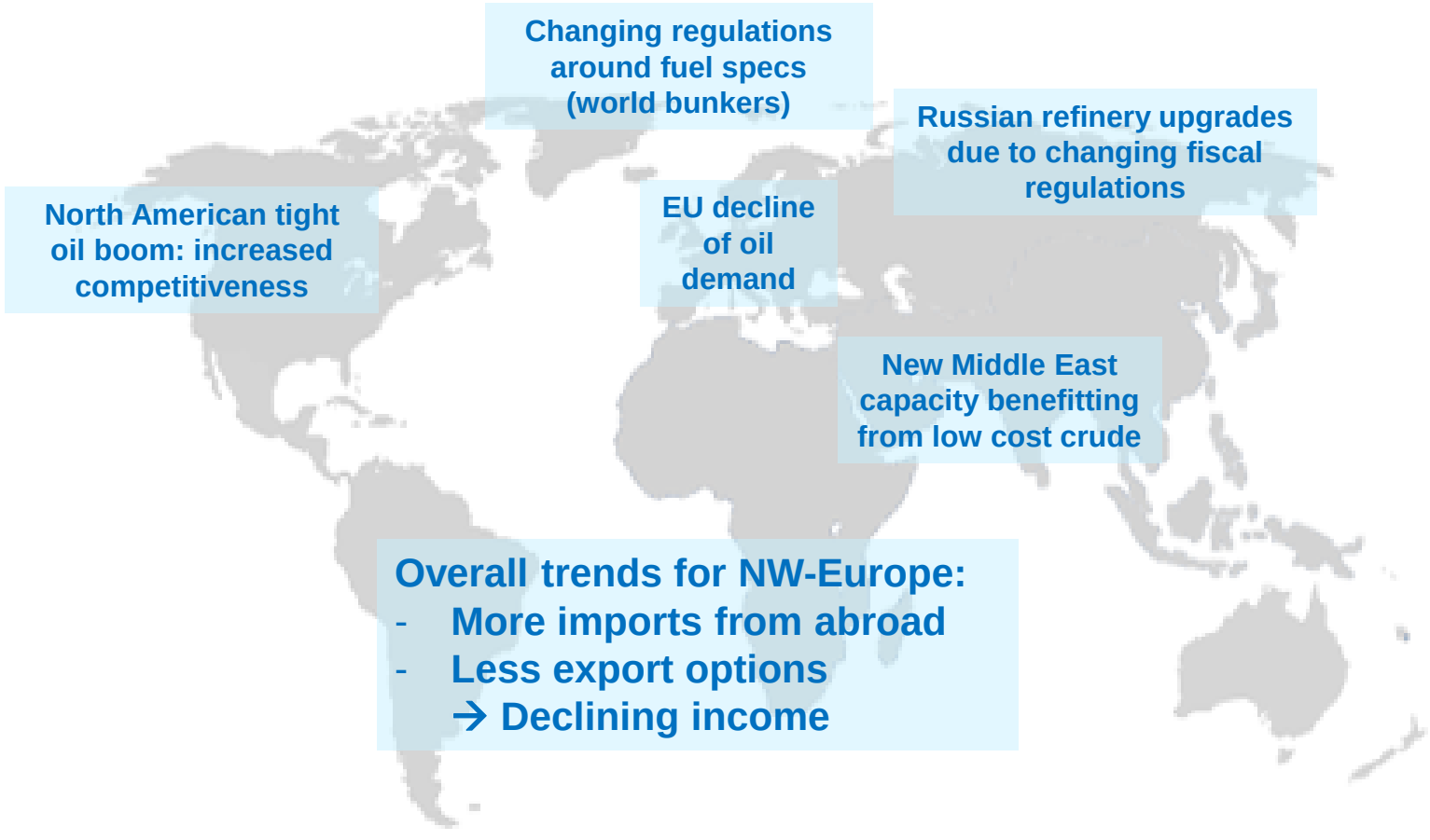
Research question

How would future emissions legislation affect the economics and competitive position of the Dutch refining industry?

Key messages

- The refining industry within northwest Europe faces major challenges and external threats
- The Dutch refining sector is a front-runner with respect to environmental performance.
- Emissions will be further reduced.
- Implementing stringent measures will likely reduce the attractiveness of operating or investing within the sector and may increase the risk of refinery closure.

Introduction – Global refining developments

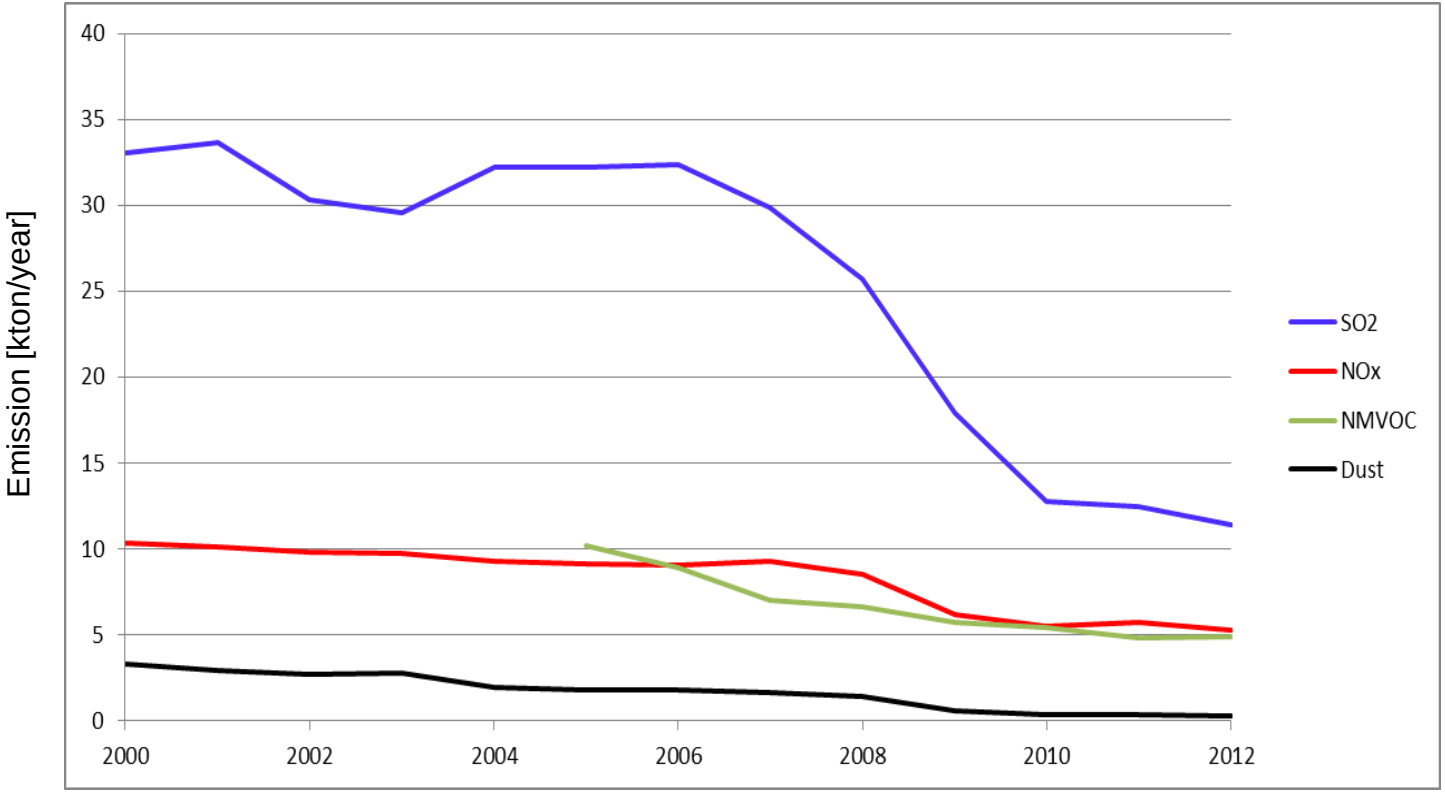


Refinery utilisation in recent years

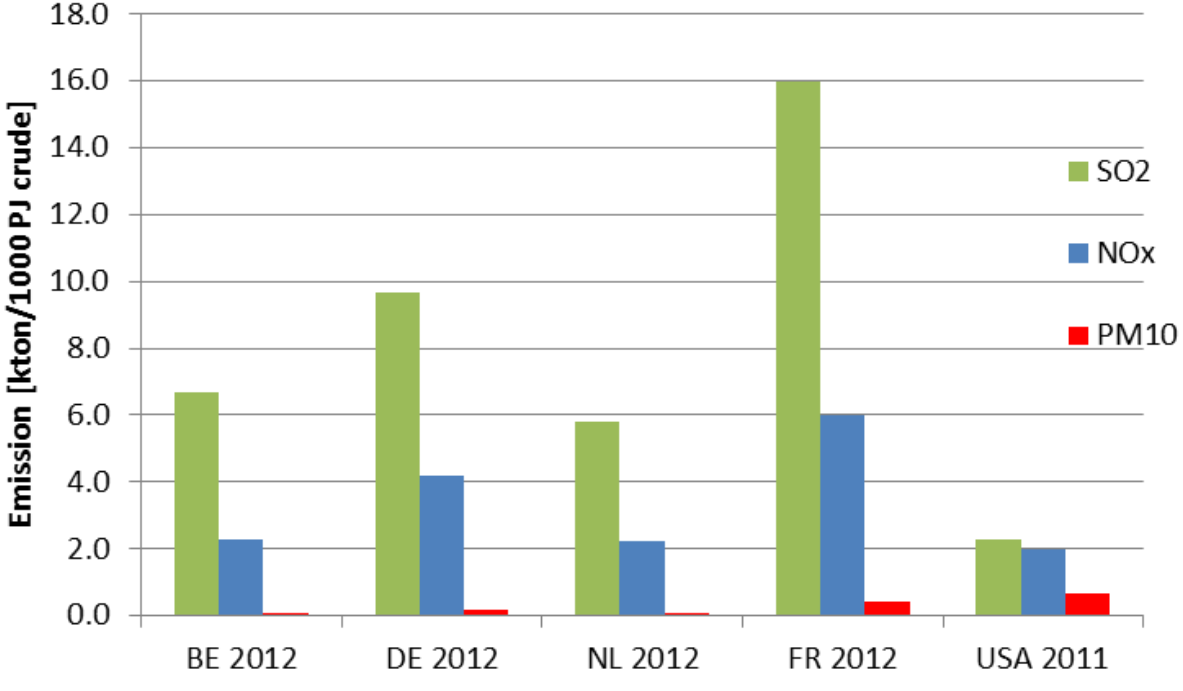
- Crude runs at northwest European refineries have recently declined significantly

- Average refinery utilisation rates at ~80% due to a number of refinery closures

Environmental performance Dutch refineries



Netherlands has relatively low emission rate



Methodology – costs and consequences

- Project developments until 2025 with three scenarios
- Assess costs and reduction in emissions due to stringent measures
- Identify impact of costs on refining competitiveness

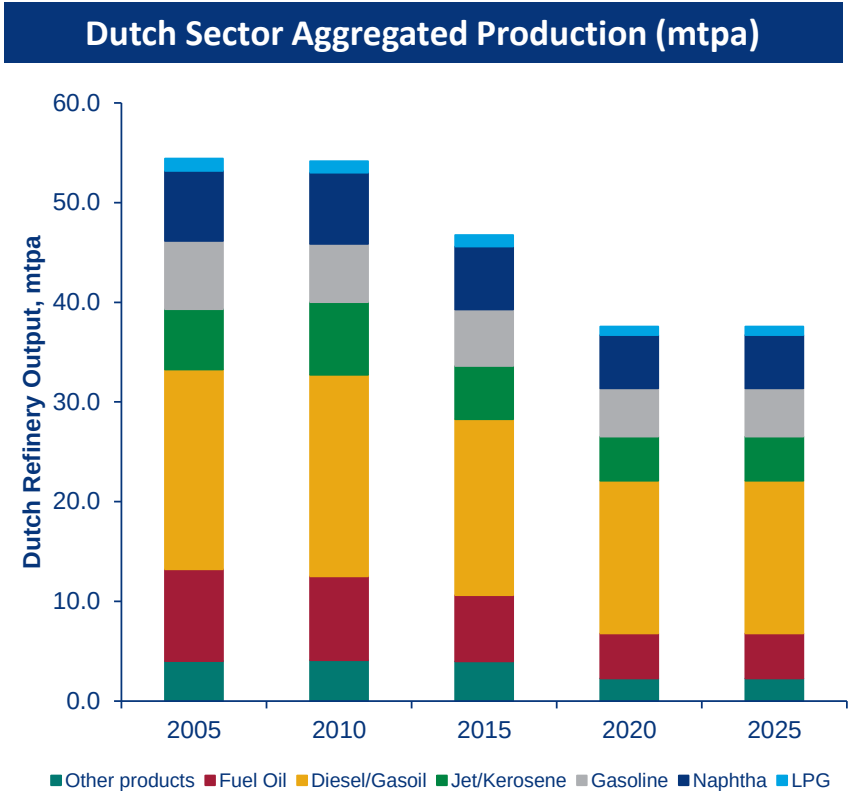
Three scenarios until 2025

1. Basic Plant Scenario (BPS): reference scenario with lean implementation of EU legislation

2. Stringent Plant Scenario (SPS): scenario with stringent environmental measures and measures for Major Hazard Regulation,
   - e.g. PGS29 and stringent side of BREF to fulfil to NEC ceilings

3. Sustained Utilisation Scenario (SUS): reference maintaining 2012 level of operation, lean implementation of EU legislation

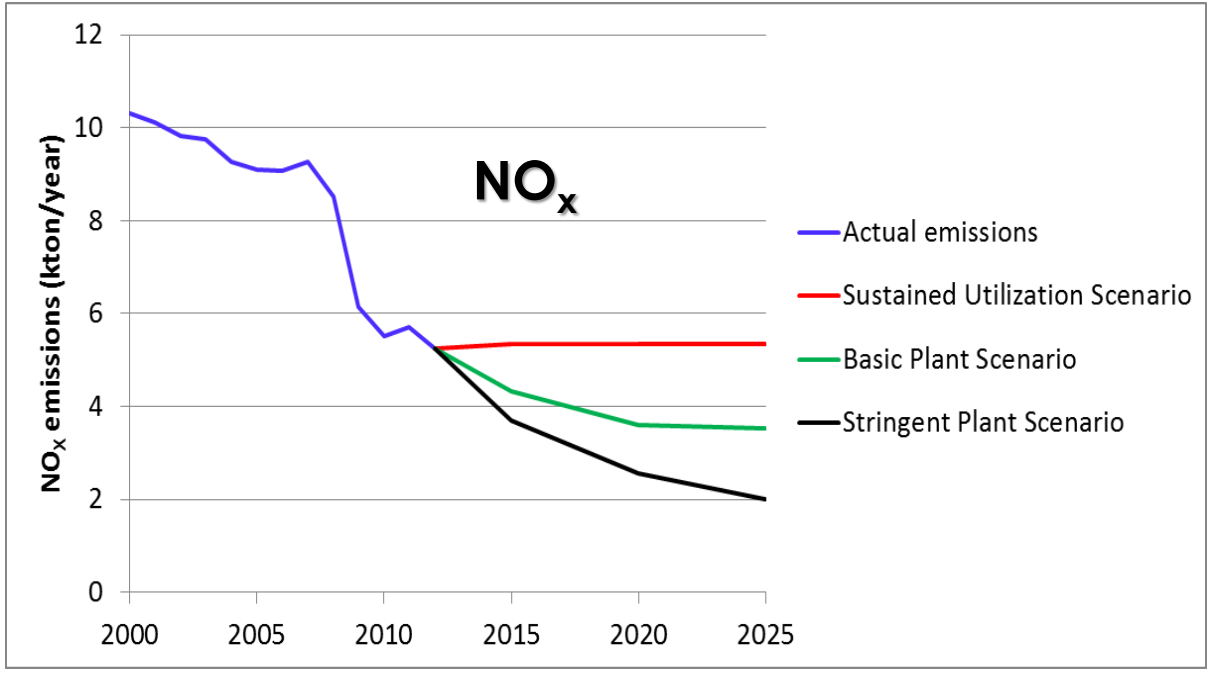
Basic Plant Scenario – Modelling outputs



Source: Wood Mackenzie

- Under BPS, a reduced refinery throughput is expected for the Dutch sector: utilization 77% in 2012 → 58% in 2025
- This output is very low and is a proxy for further rationalisation
- For SPS, the same production level is assumed as for BPS
- For SUS, the 2012 production level assumed to remain flat out (the full sector remains in business)

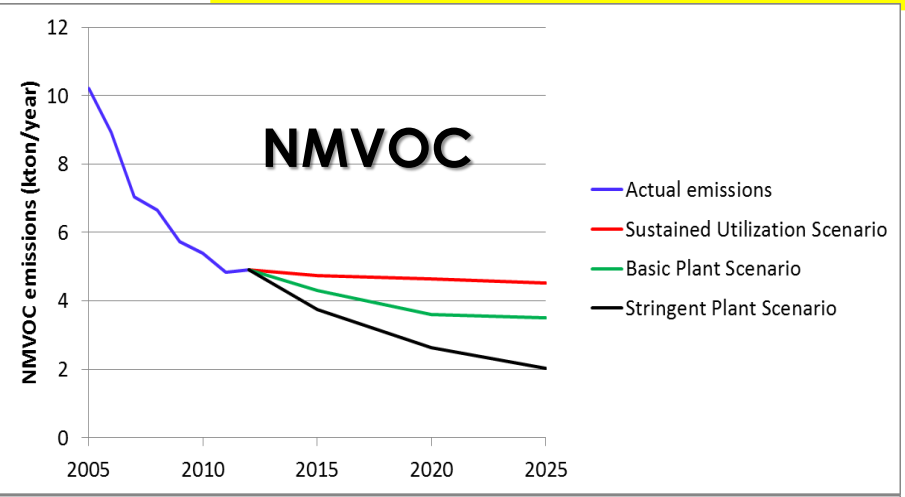
Emission outlooks – example for NO_x

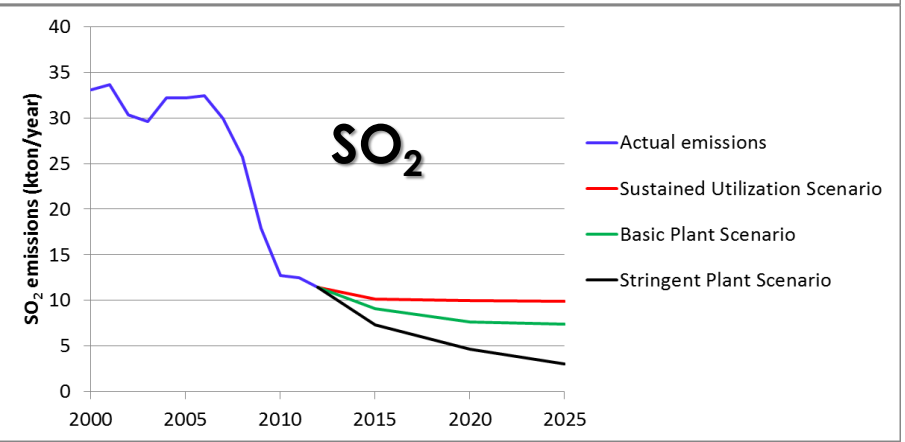


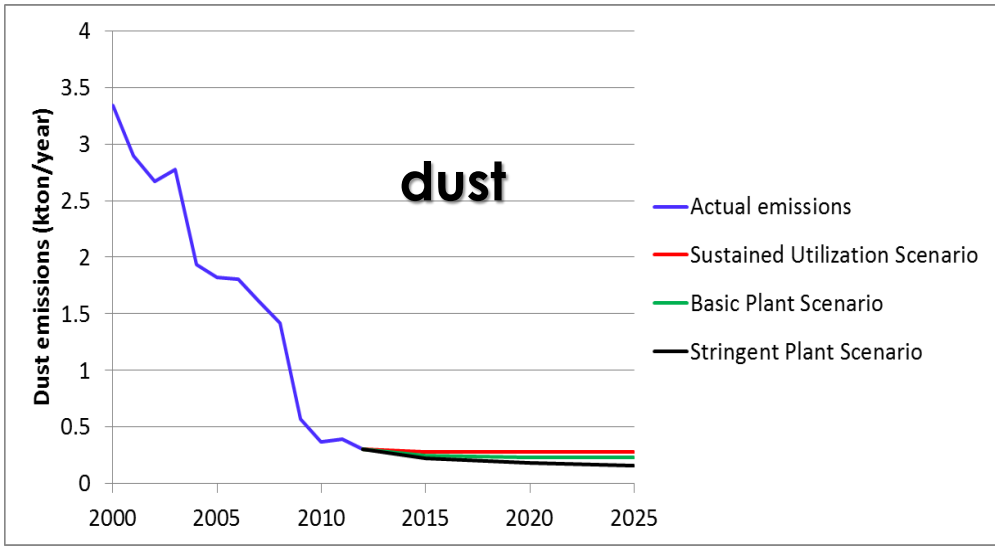
- SUS: 5.4 kton NO_x
- BPS: 3.5 kton NO_x
- SPS: 2.0 kton NO_x

- Investments costs for NO_x only measures in SPS: circa 190 million euro

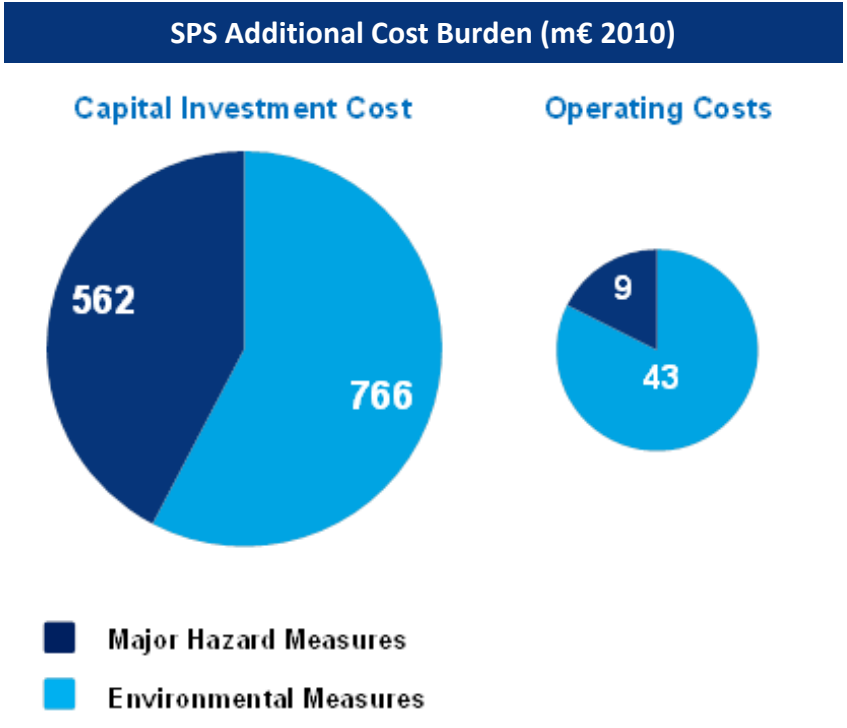
Emission outlooks for three scenarios





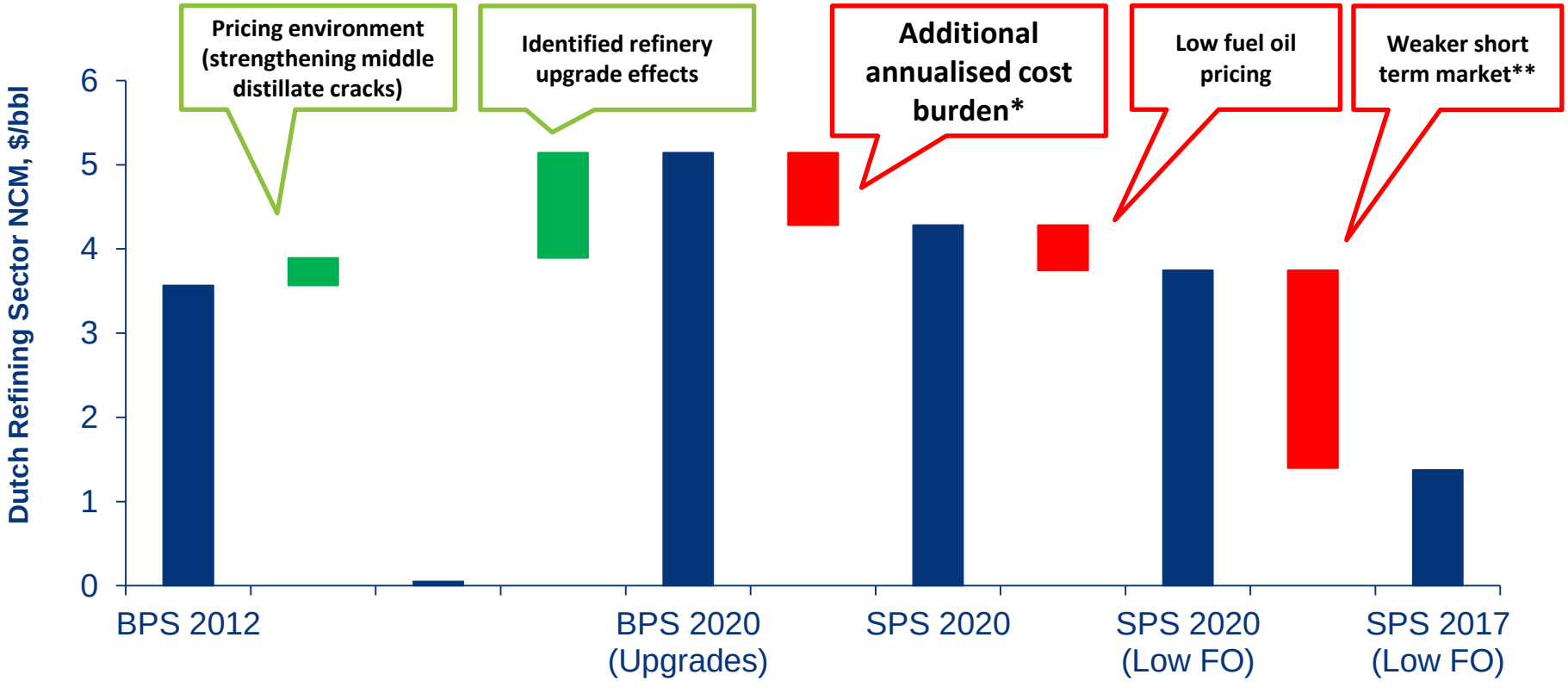


Cost related to the stringent plant scenario



- Investments cost
  € 1.33 billion
- Yearly operating cost
  € 53 million
- Equivalent to $ 0.86/bbl or
  € 295 million/year

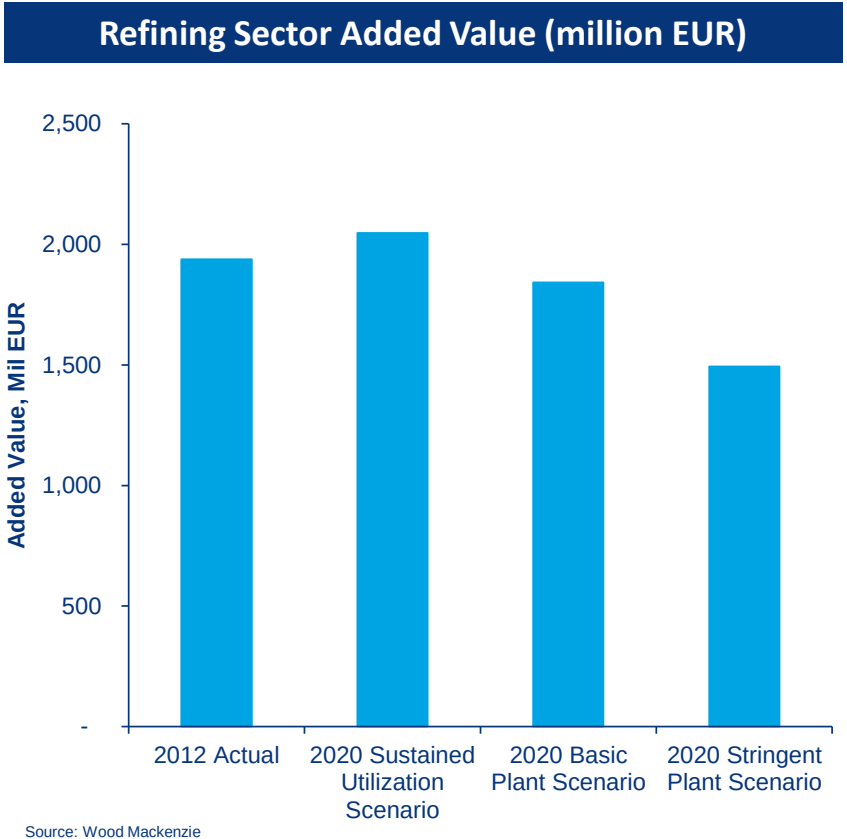
Net cash margin outlook for the Dutch sector



Source: Wood Mackenzie

*Annualised capital cost would not normally be accounted for in a Net Cash Margin
**Assuming no identified refinery upgrade effects

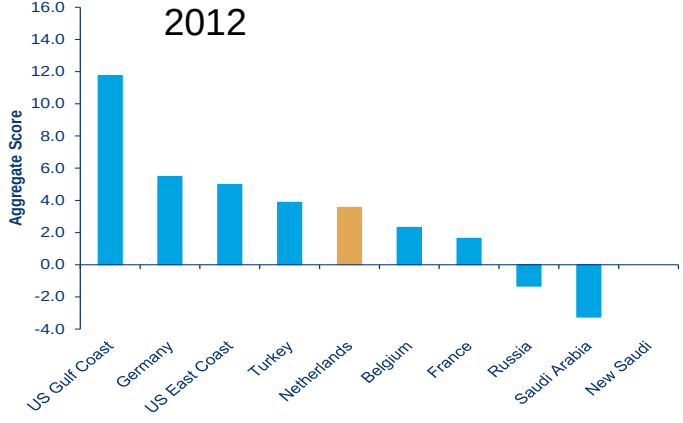
Added value of the refining sector declines under SPS

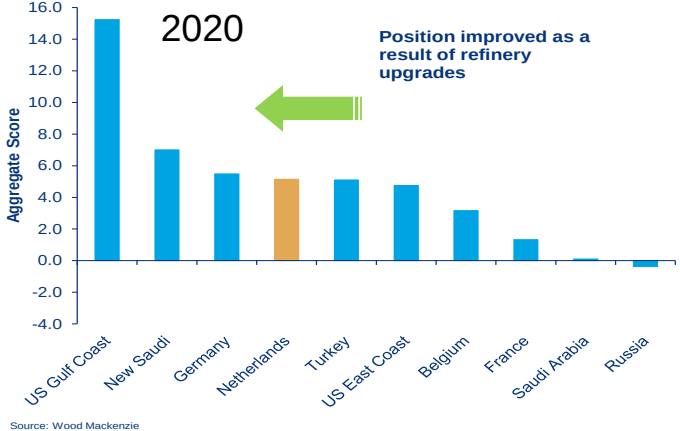


Source: Wood Mackenzie

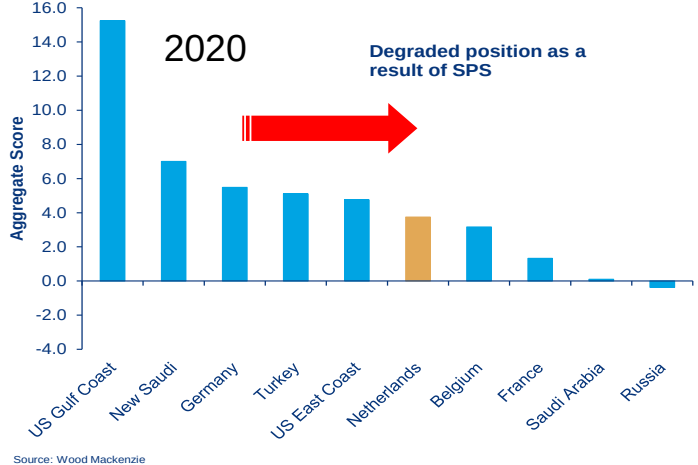
- Refining industry: € 1.9 billion to the Dutch economy (added value, 2012)
- Under SPS in 2020: decrease to € 1.5 billion
- Indirect effects are relevant as well:
  - Chemical sector
  - Port of Rotterdam
  - 4100 employees and 2200 contractors working in the sector

The impact of stringent measures on margins and position





Source: Wood Mackenzie



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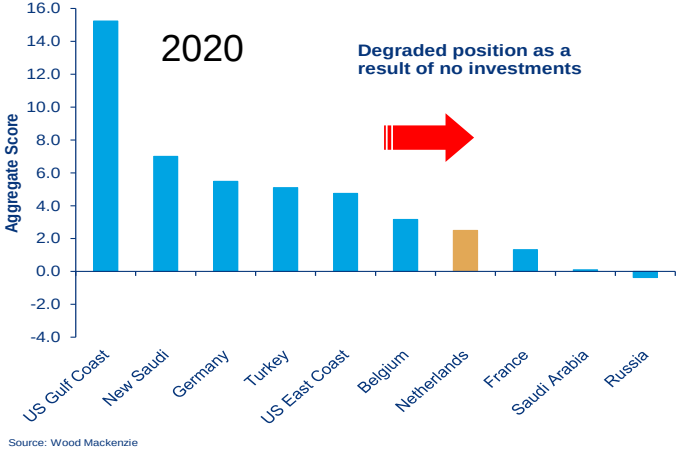

Source: Wood Mackenzie

Conclusions

- The refining industry faces challenges and external threats.
- The Dutch refining sector is a front-runner with respect to environmental performance.
- Further stringent environmental measures were identified together with refineries and governmental bodies.
  - To implement them requires an investment of € 1.3 billion, or € 295 million annually.
- This adds cost to the refinery industry and may increase the risk of closure and the potential loss of added value to the Dutch economy.