The Sulphur Story and Air Quality
A look back at the last 30 years and a look forward to some future challenges

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10th CONCAWE Symposium

25-26th February 2013

Road Map

The 'journey so far':

- SO_2 Emission Trends from Refinery operations
- SO_2 Emission Trends from Products for combustion
- Contributions to reduction in acidification in Europe
- Contribution to improvements in statistical life expectancy from reduced exposure to fine particulates

The some challenges for the 'journey ahead'

- Sustaining cost-effective response strategies for residual issues
- Accounting for the climate influence of sulphur in developing future air quality policy

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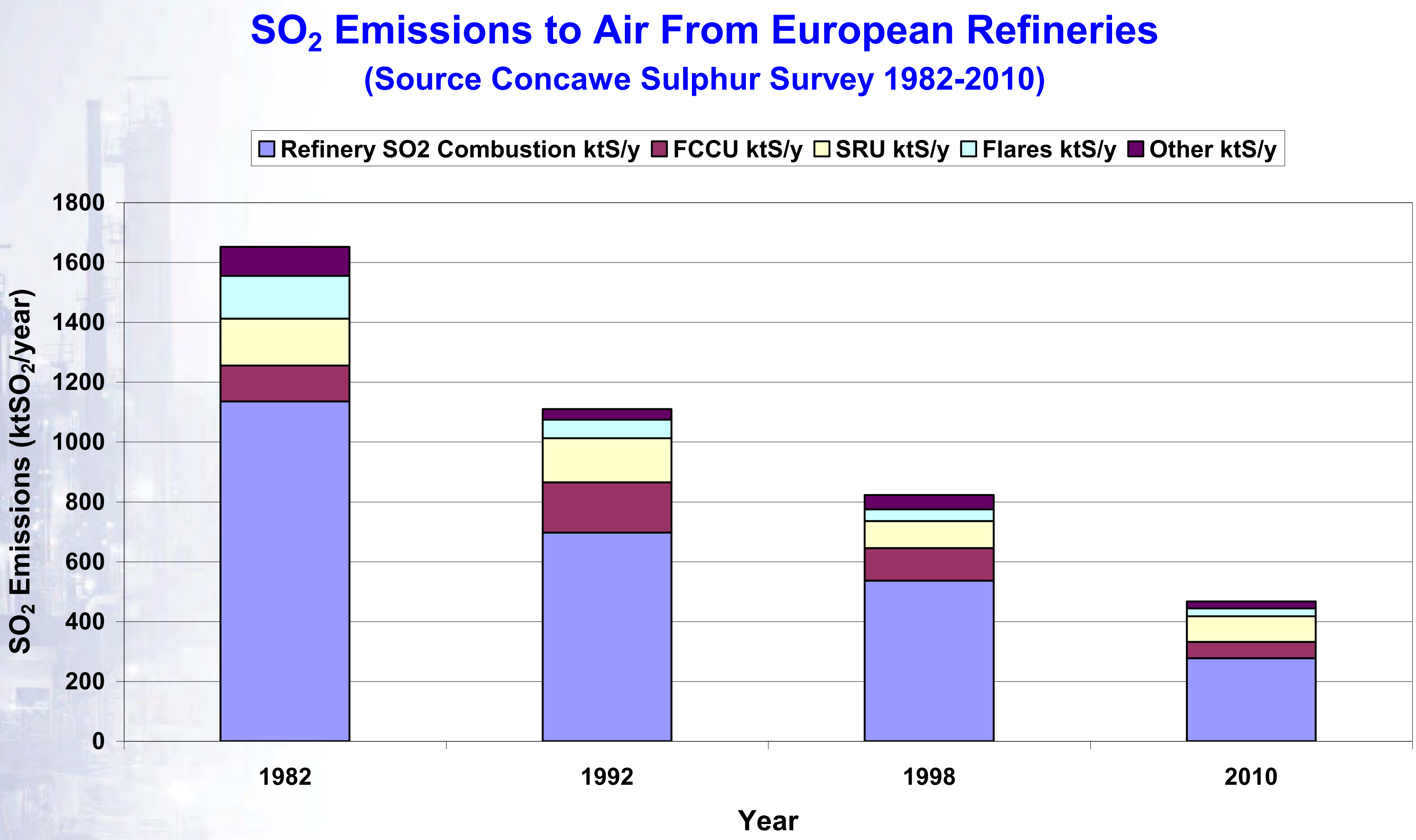
Refinery SO_2 Emissions Reduced by 75% by 2010



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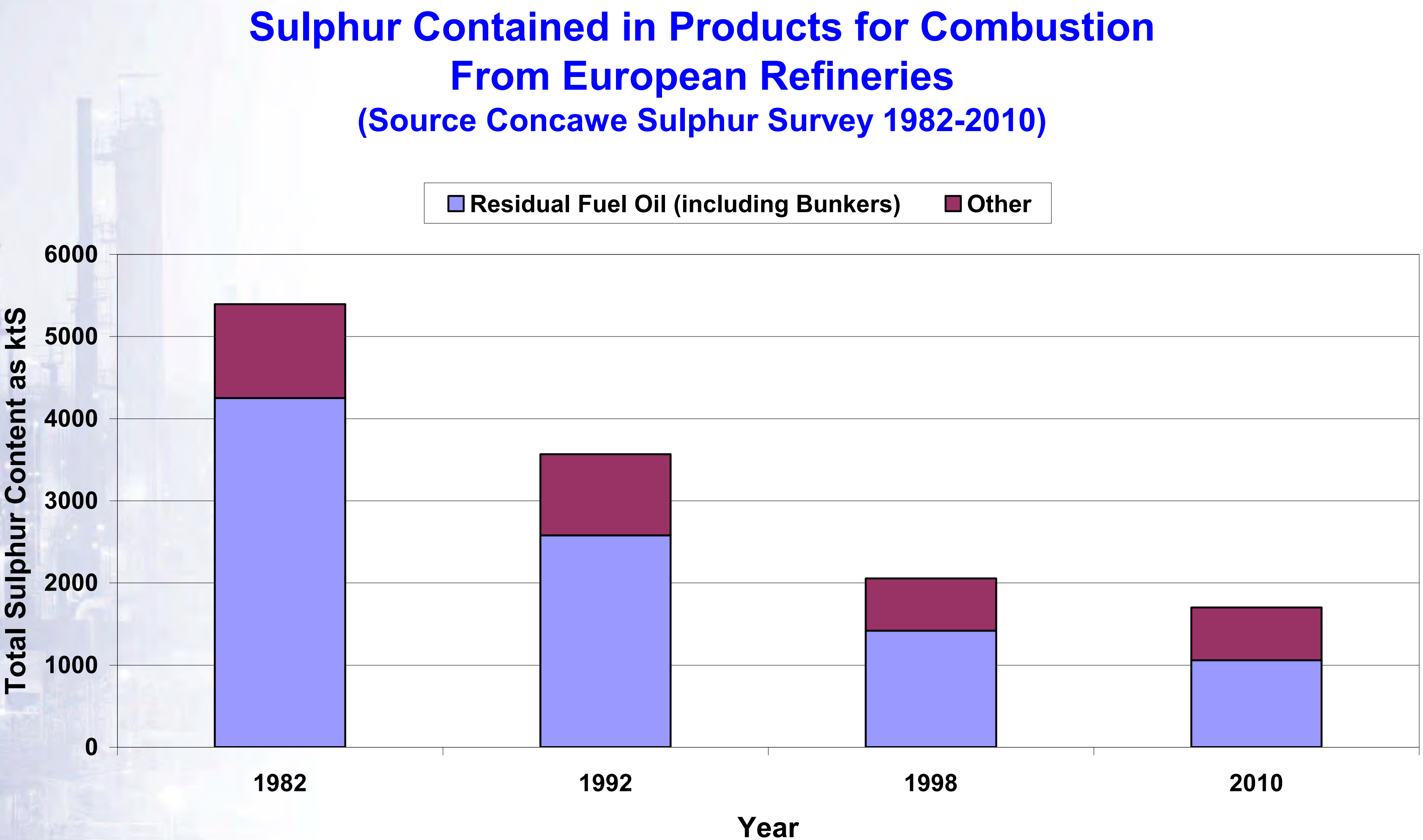
SO2 from products for combustion down to 1/3 of 1982 levels by 2010



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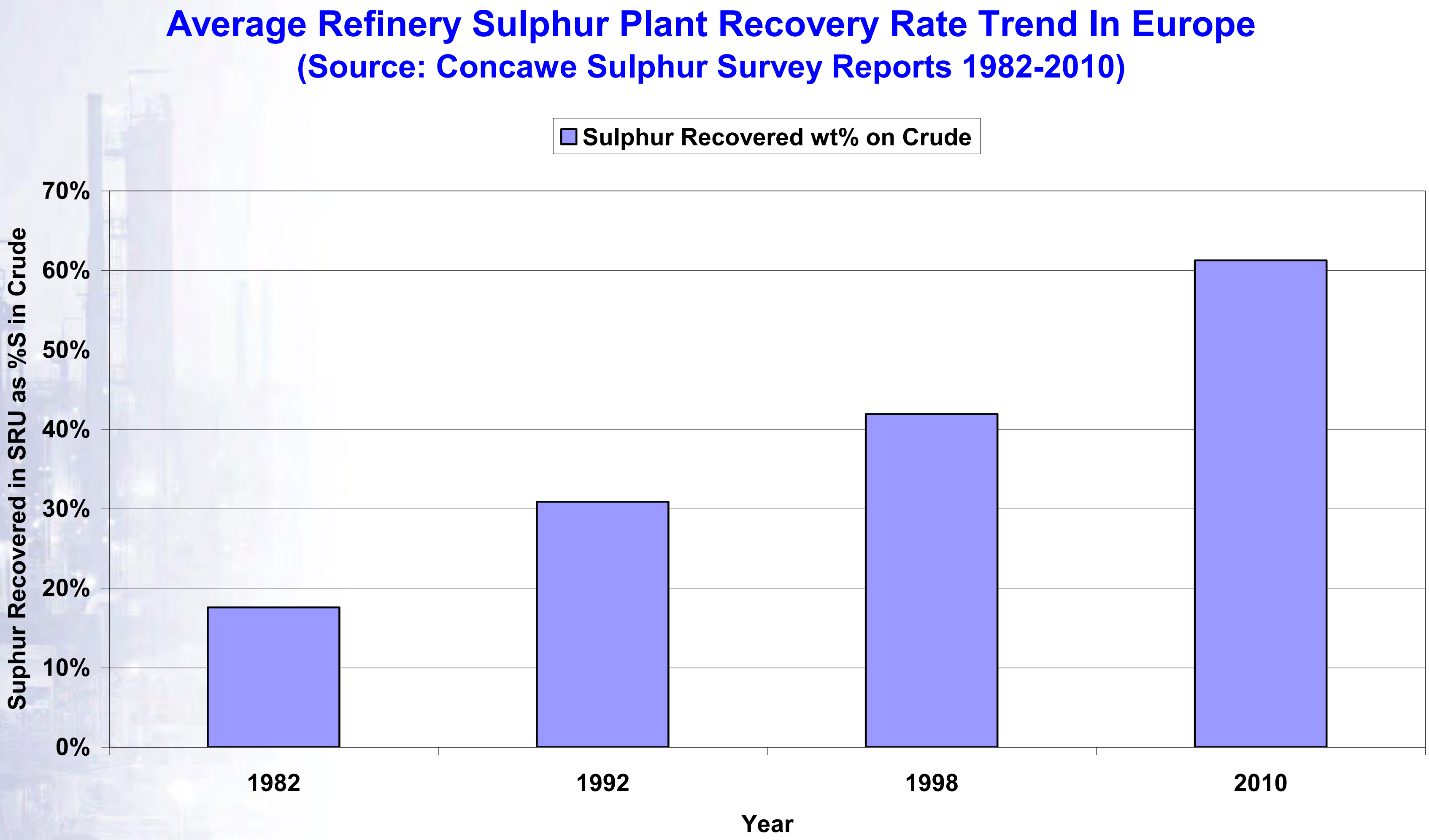
Sulphur recovery increased by factor of four



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Acidification trend since 1980

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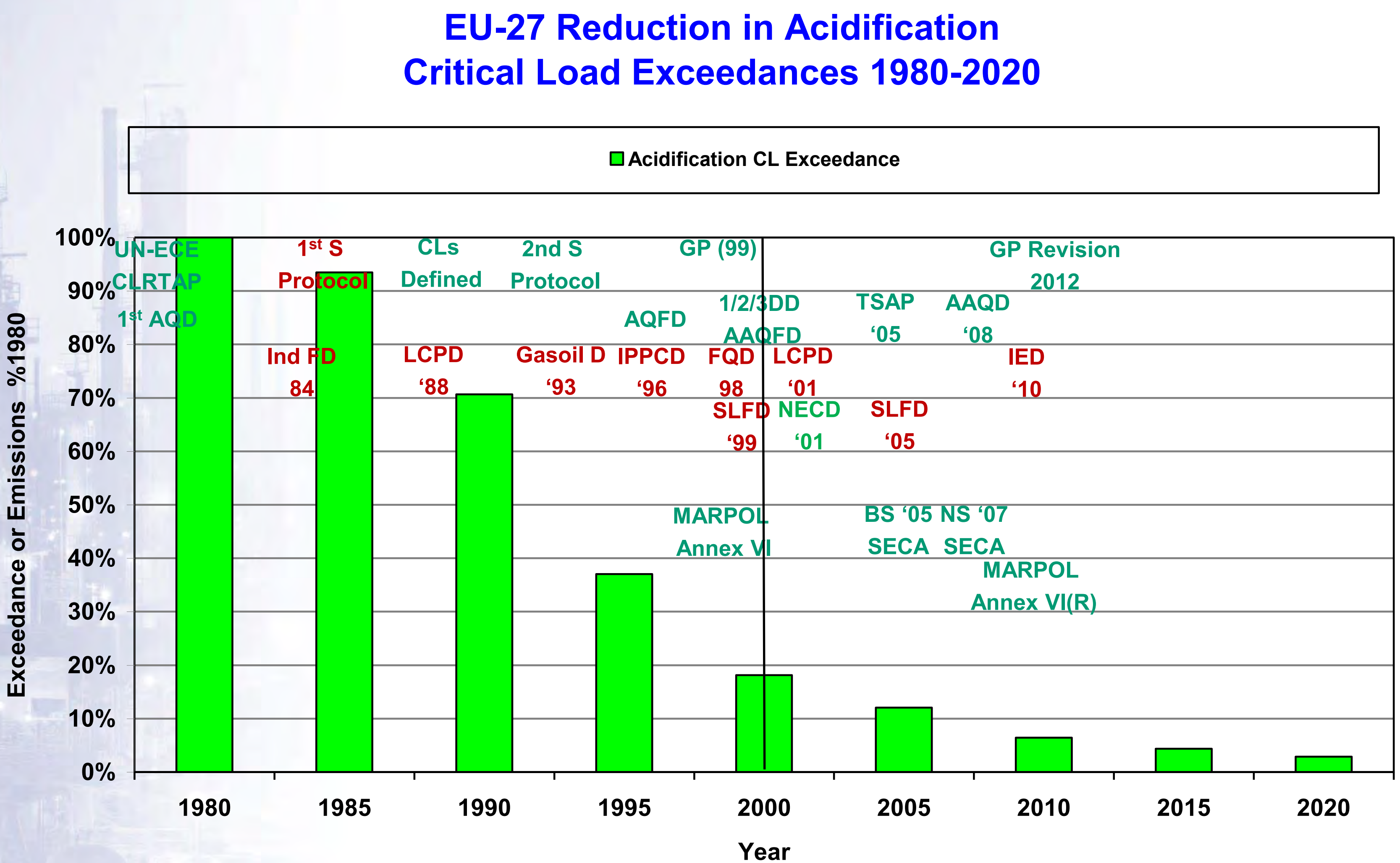
Significant Reductions in Acidification in the EU



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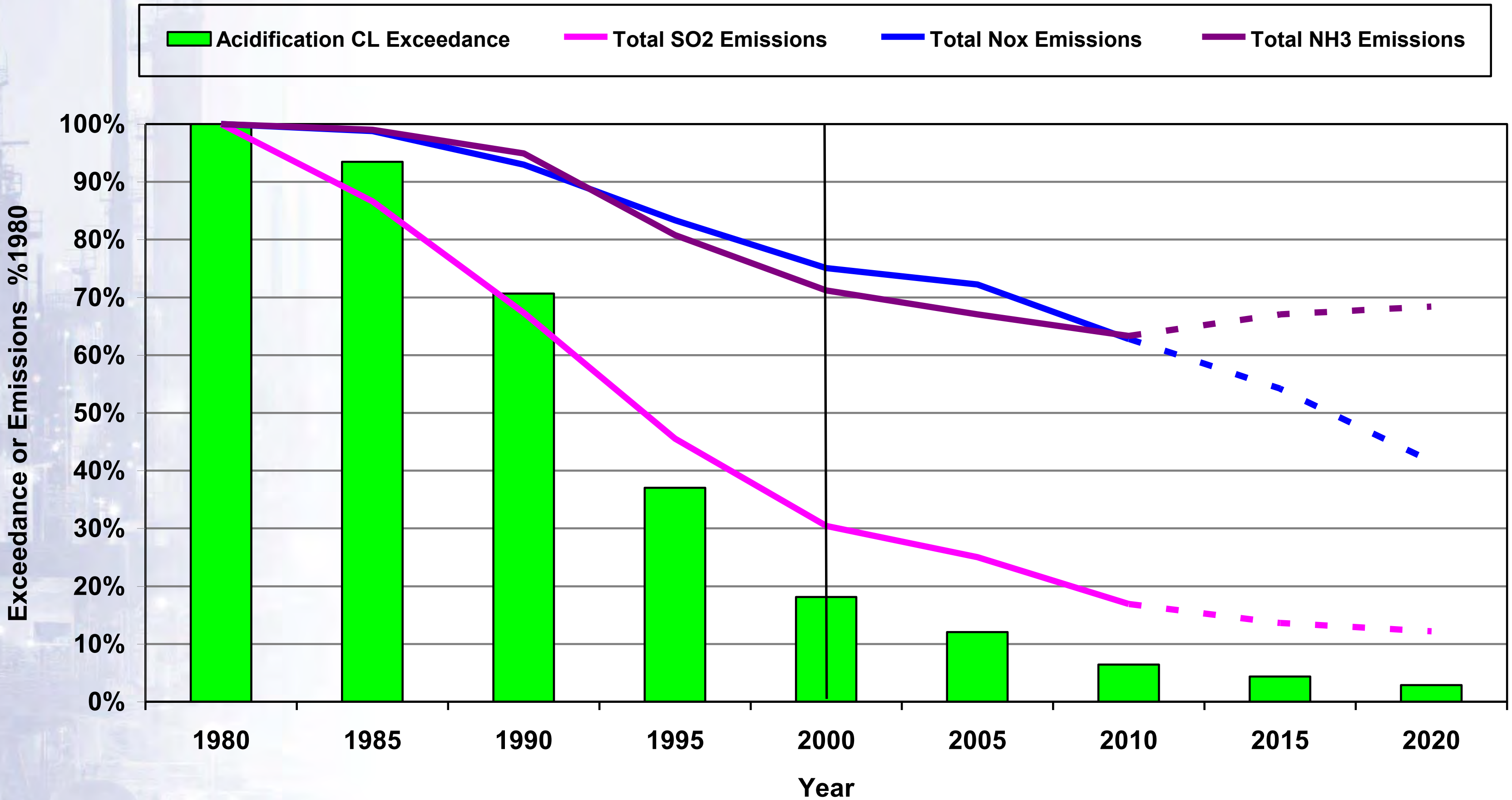
EU-27 Reduction in Acidification Critical Load Exceedances 1980-2020



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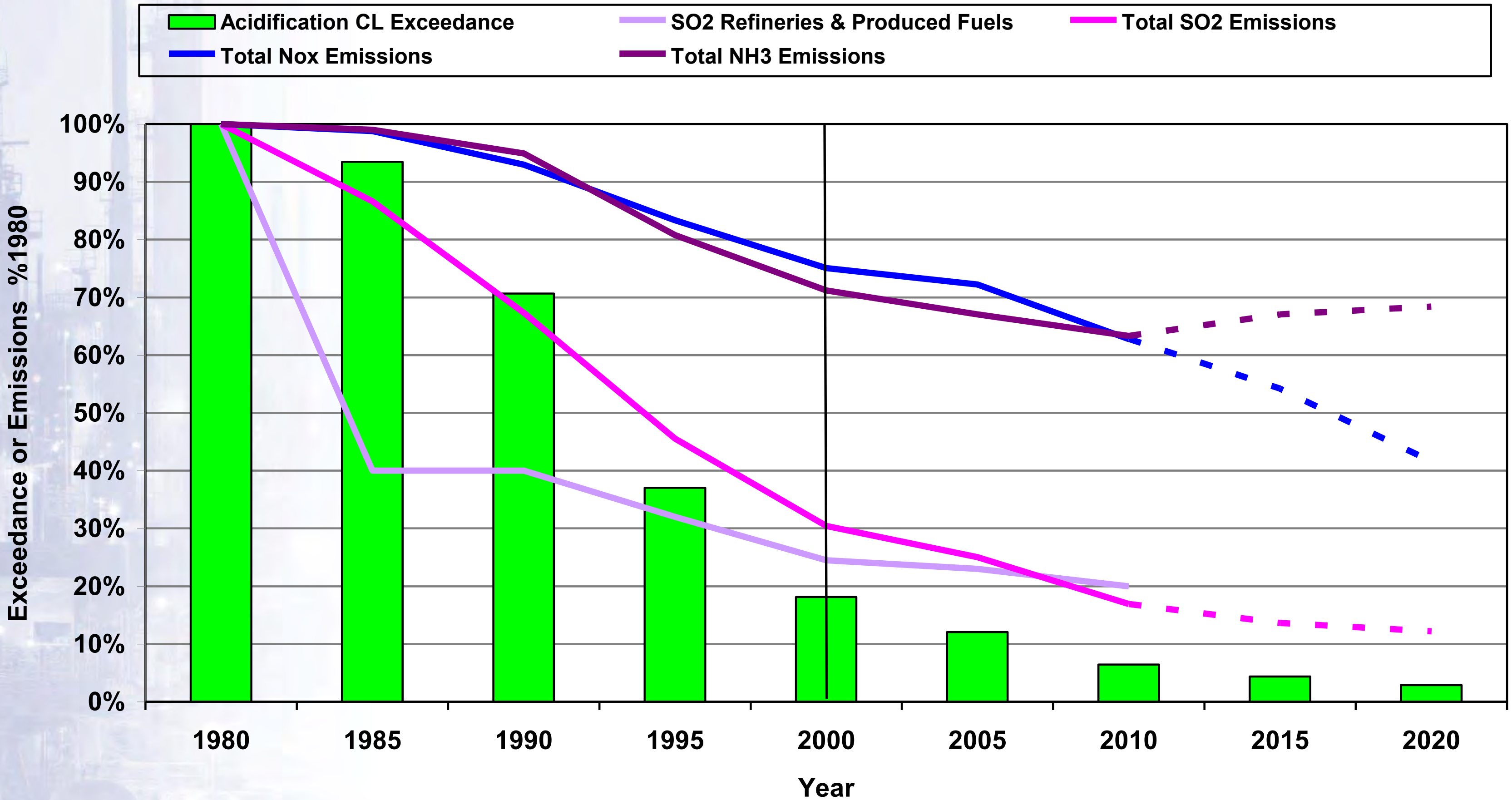

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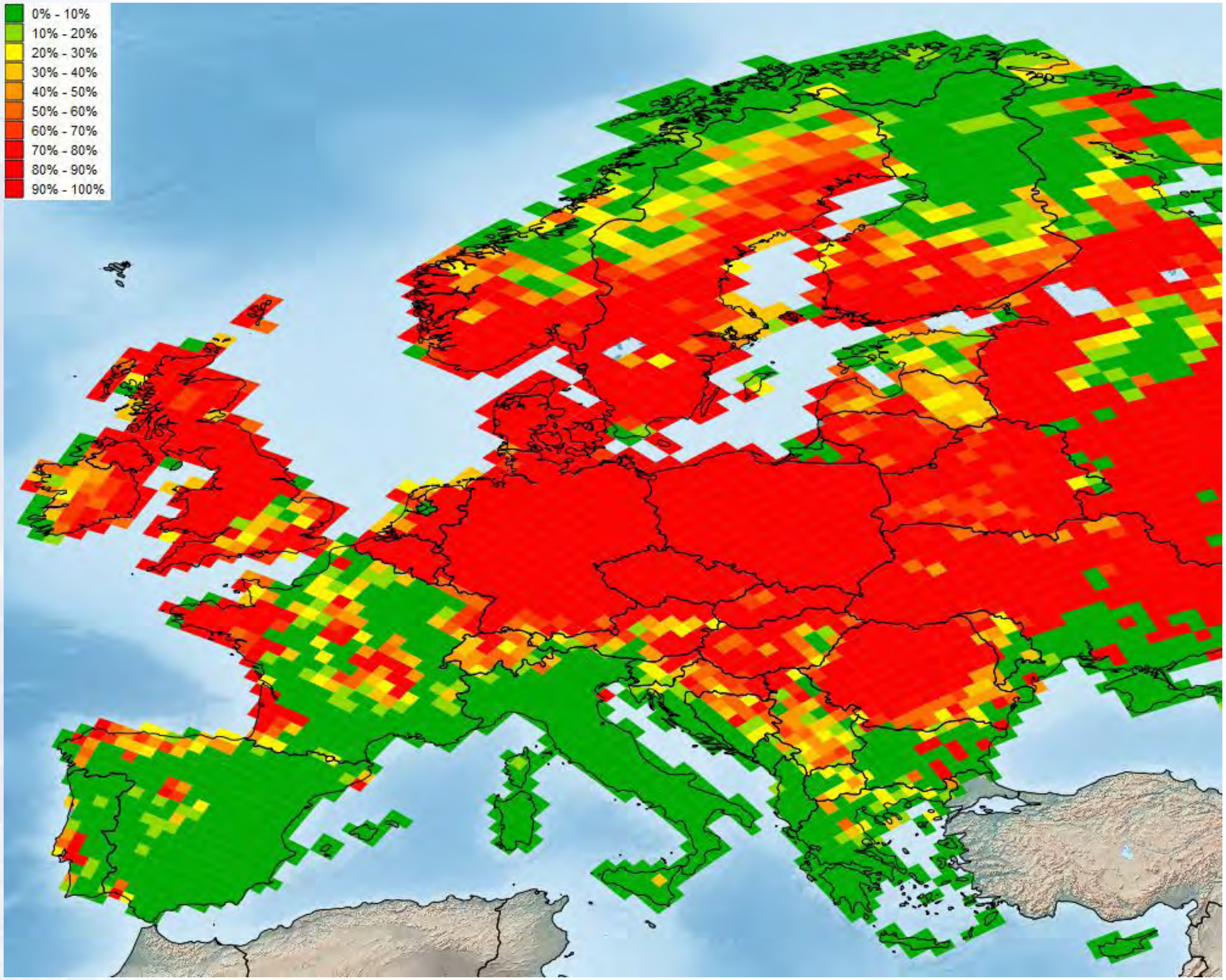
Forest Areas Exceeding Acidification Critical Loads (%): 1980



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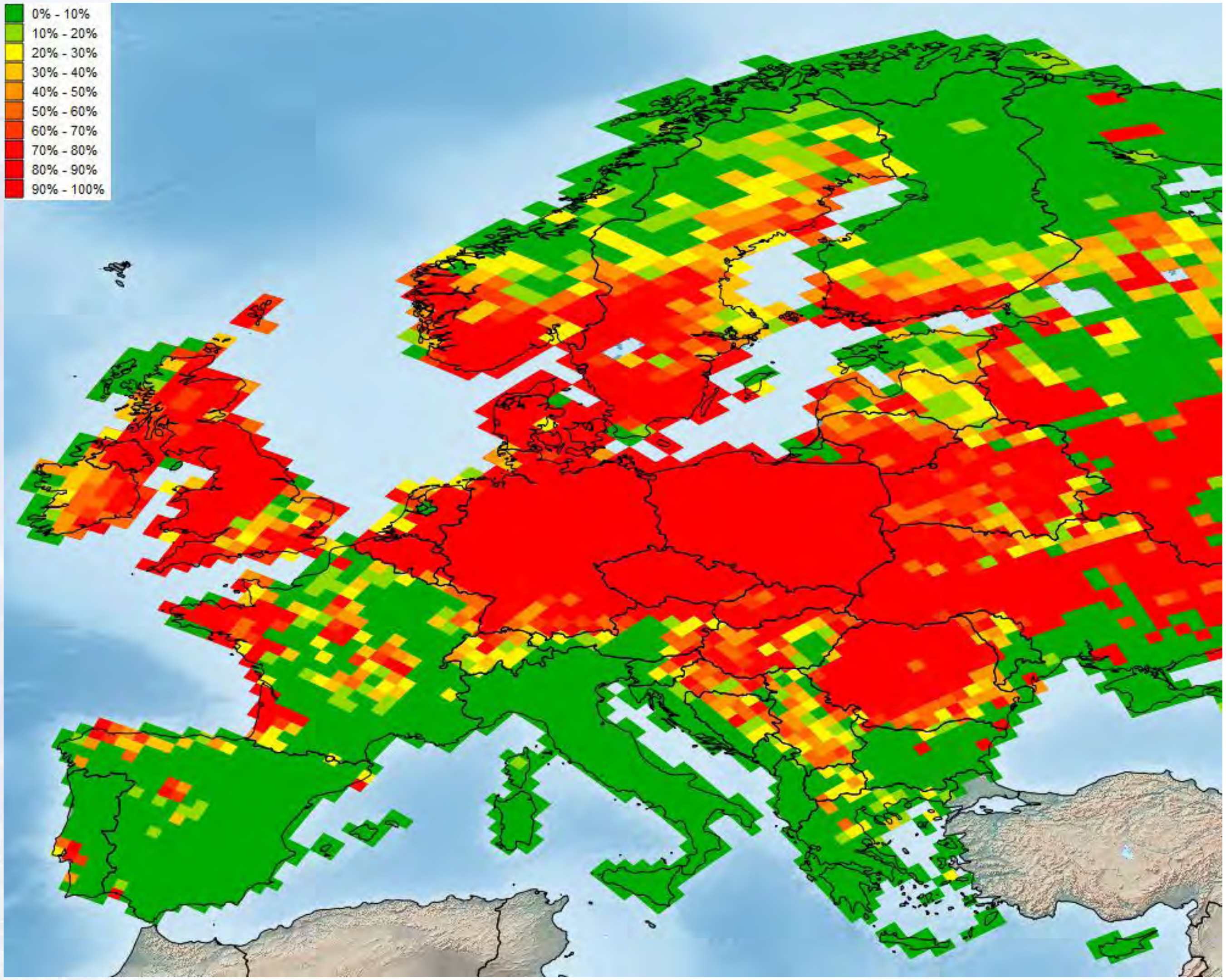
Forest Areas Exceeding Acidification Critical Loads (%): 1990



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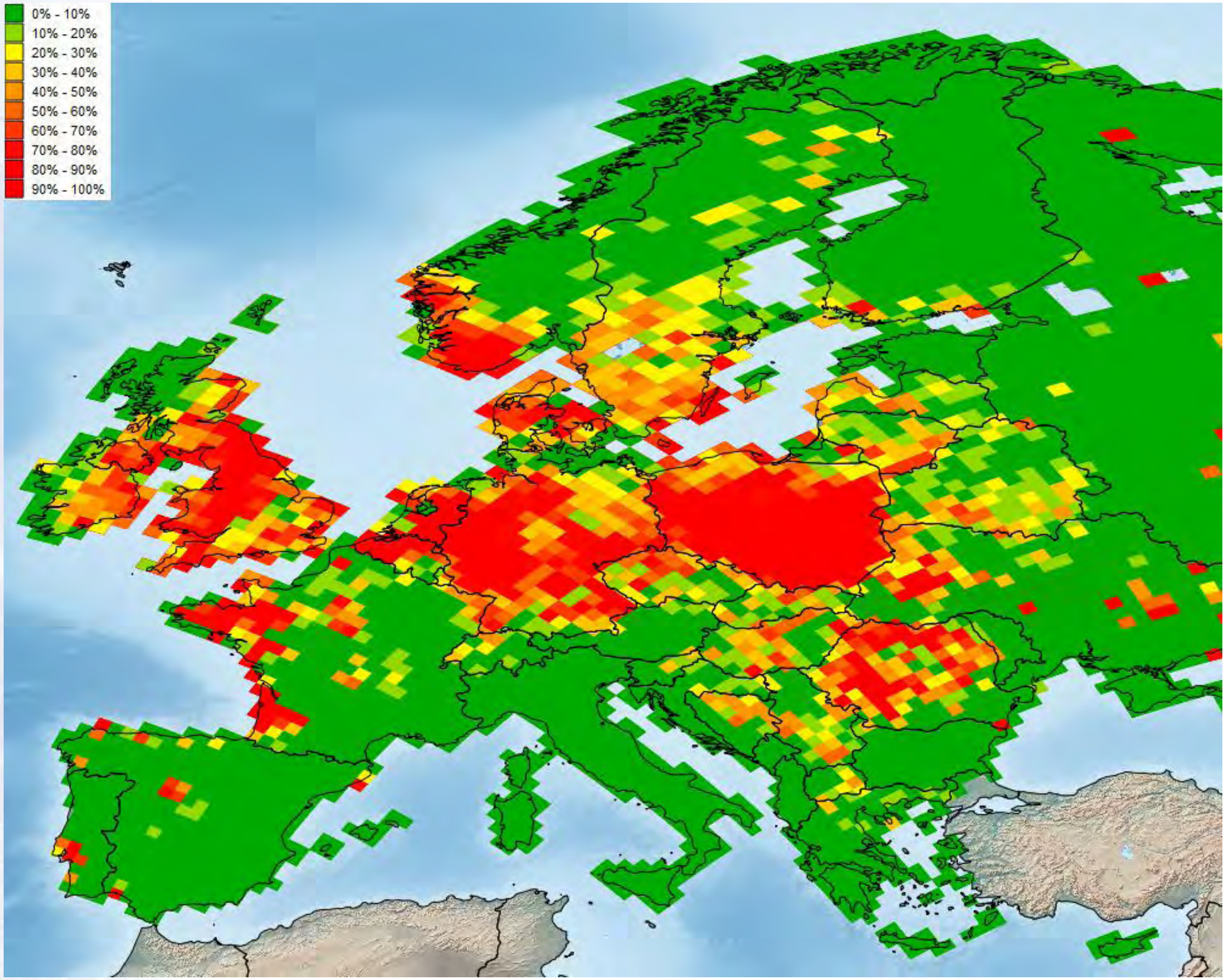
Forest Areas Exceeding Acidification Critical Loads (%): 2000



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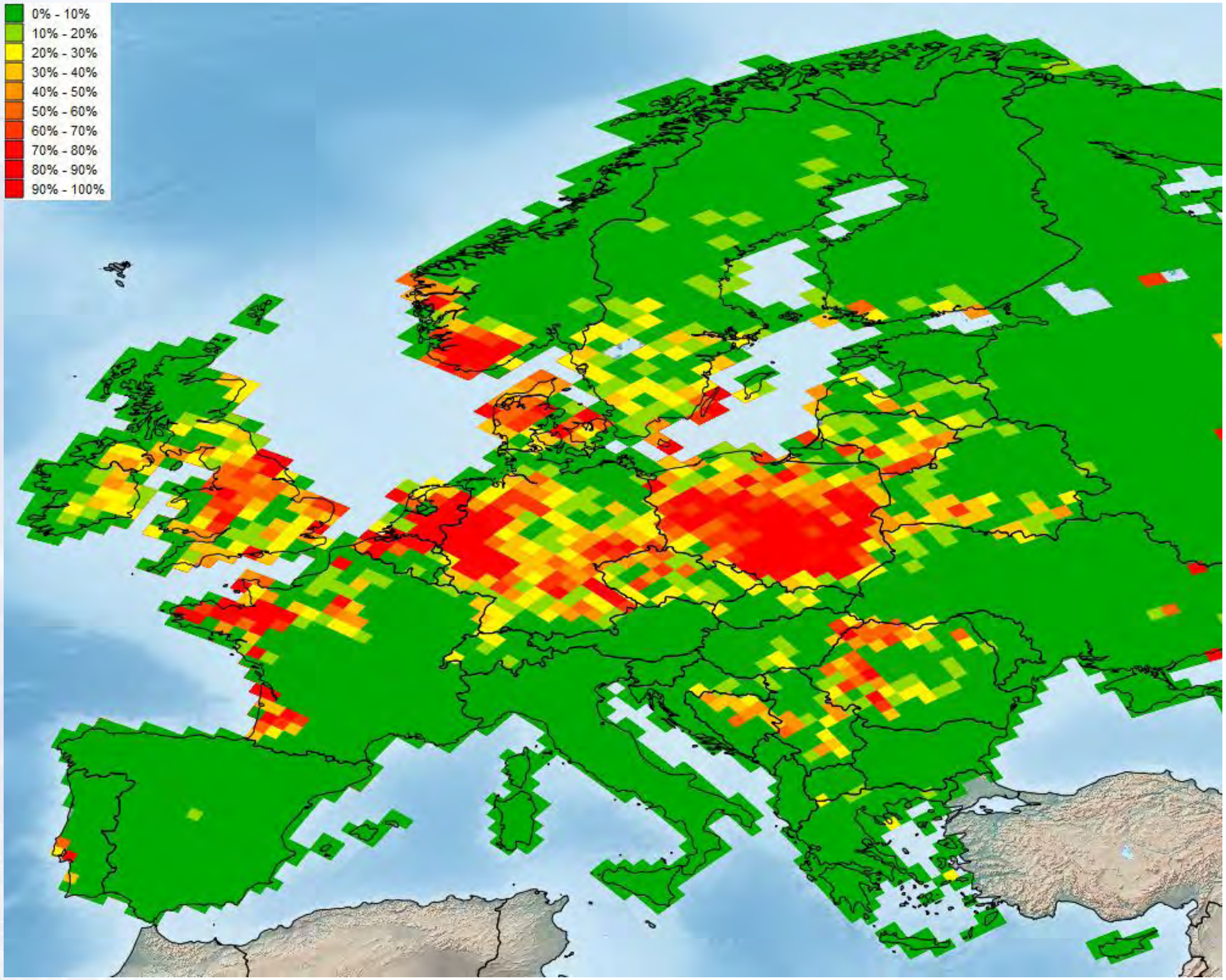
Forest Areas Exceeding Acidification Critical Loads (%): 2010



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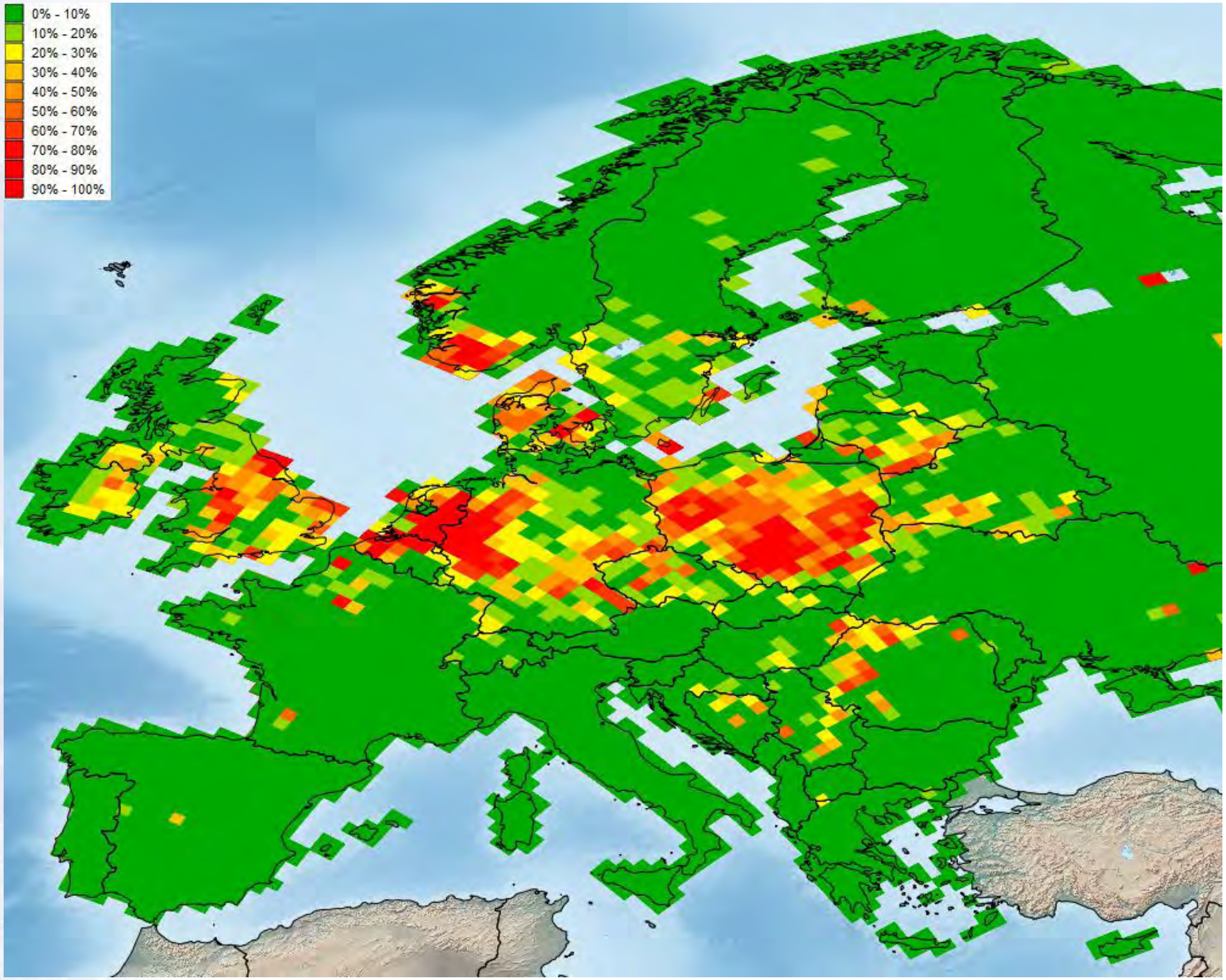
Forest Areas Exceeding Acidification Critical Loads (%): 2020



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Long Term Health Impact of Fine Particulates Reductions Since 1980

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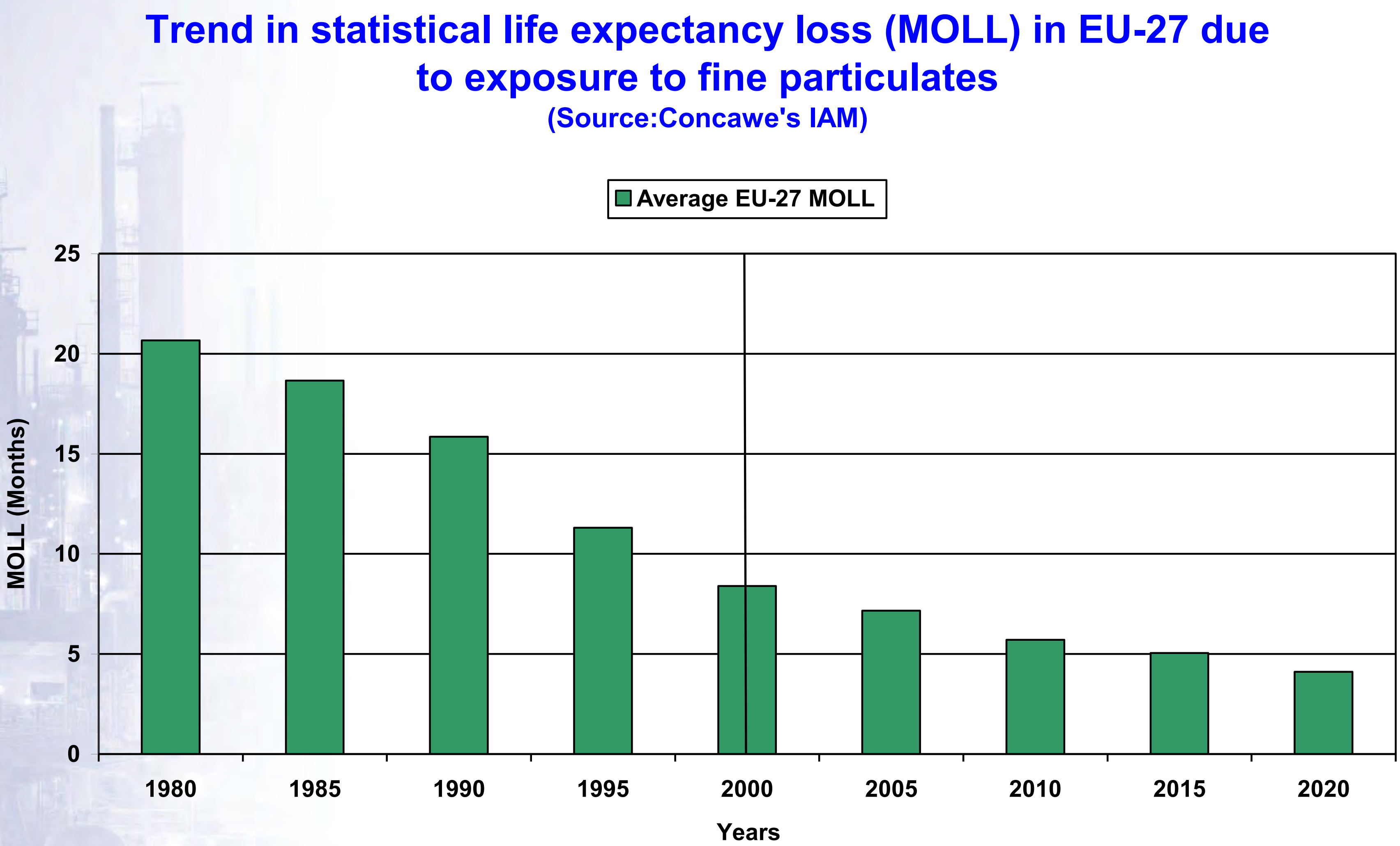
EU-27 Trend in Average Statistical Life Expectancy Loss From PM Exposure (Months): 1980-2020



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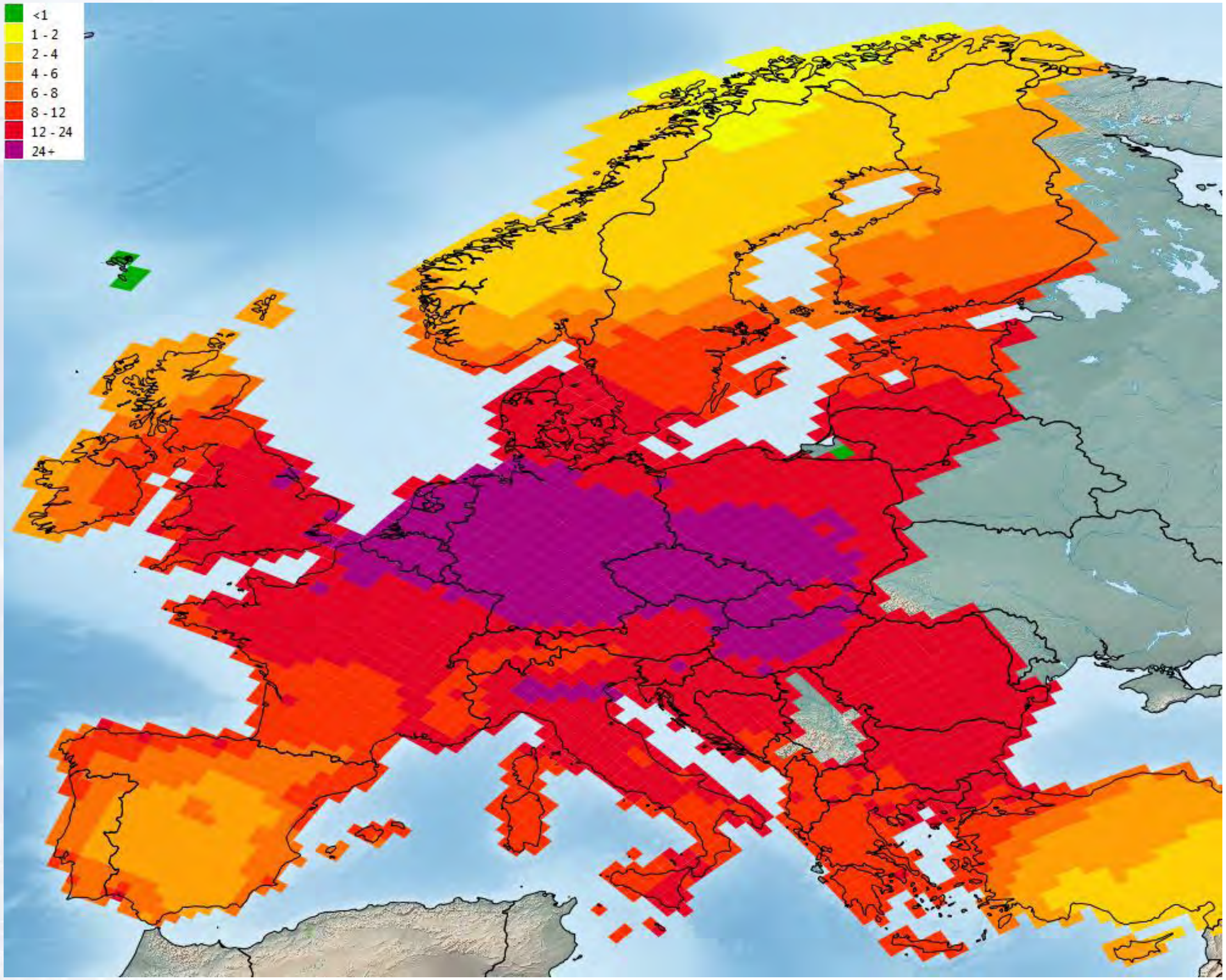
Statistical Life Expectancy Reduction From PM Exposure (Months): 1980



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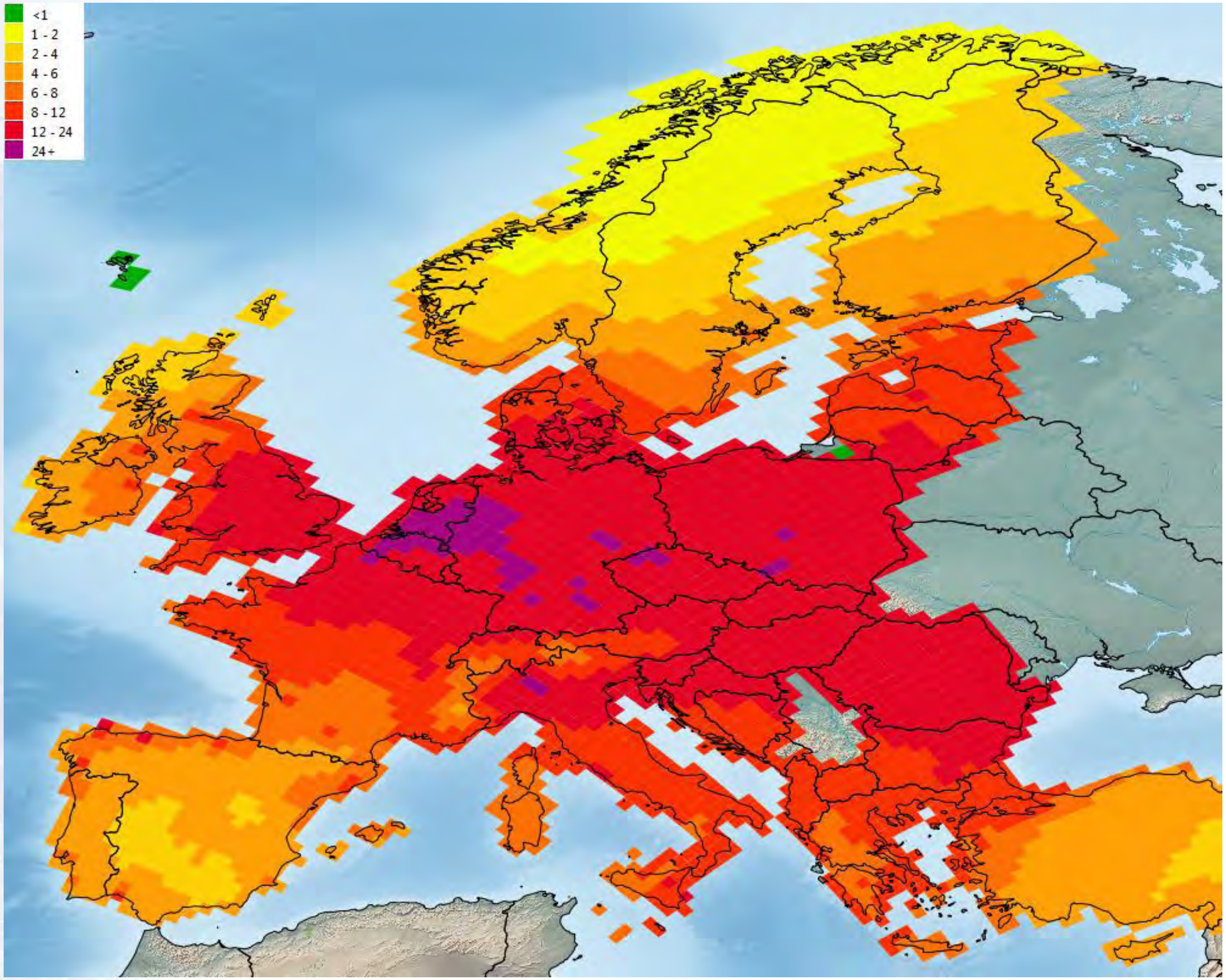
Statistical Life Expectancy Reduction From PM Exposure (Months): 1990



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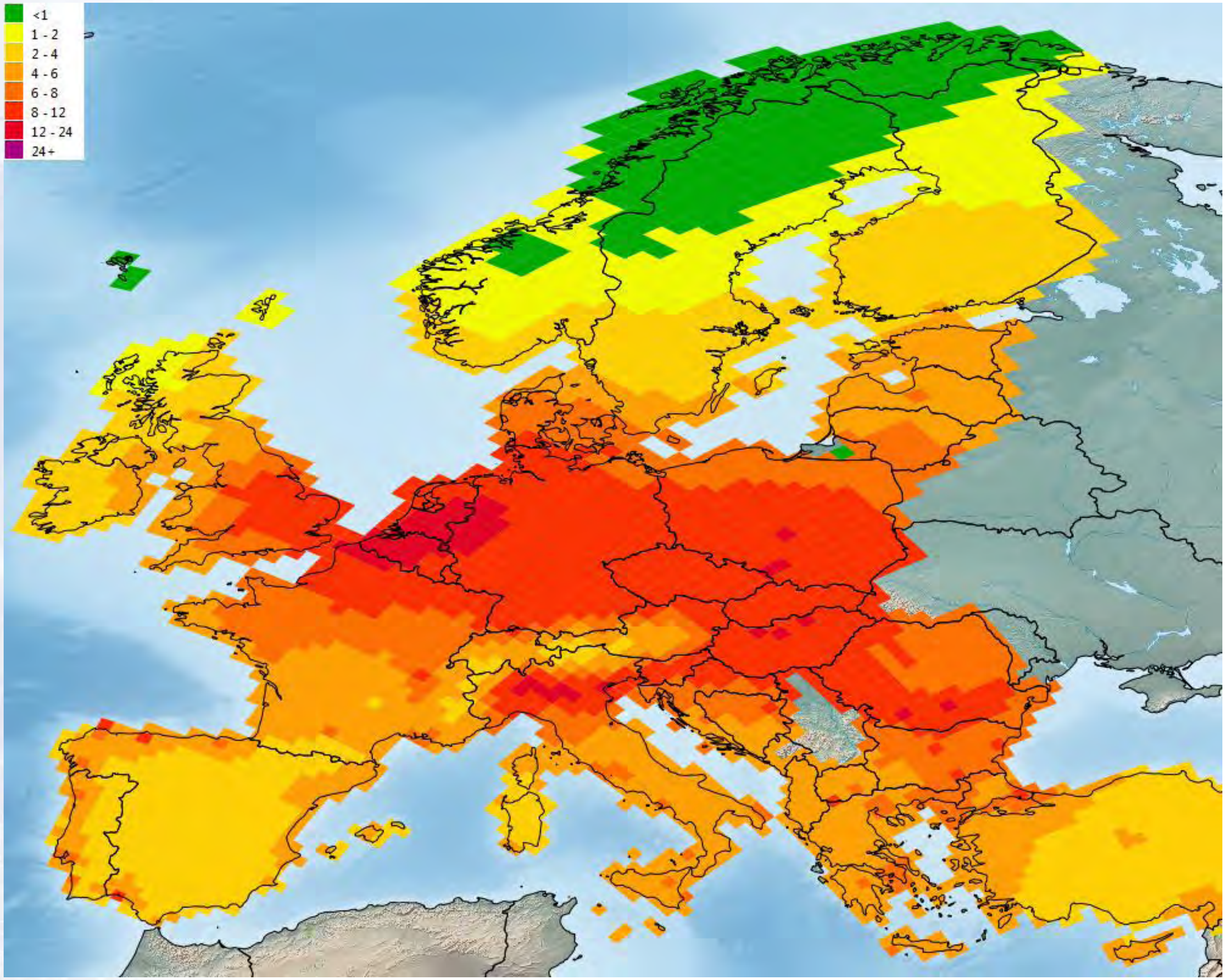
Statistical Life Expectancy Reduction From PM Exposure (Months): 2000



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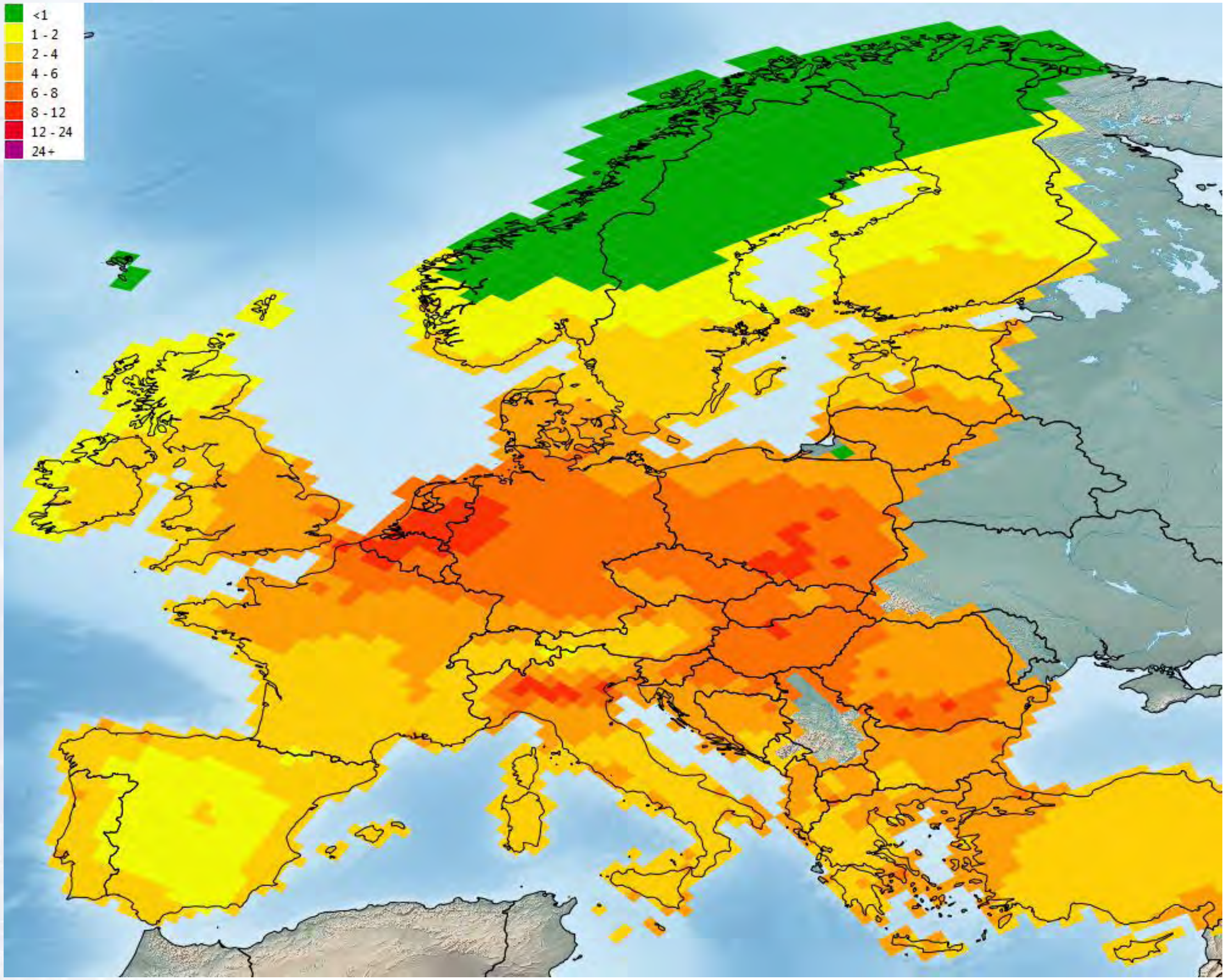
Statistical Life Expectancy Reduction From PM Exposure (Months): 2010



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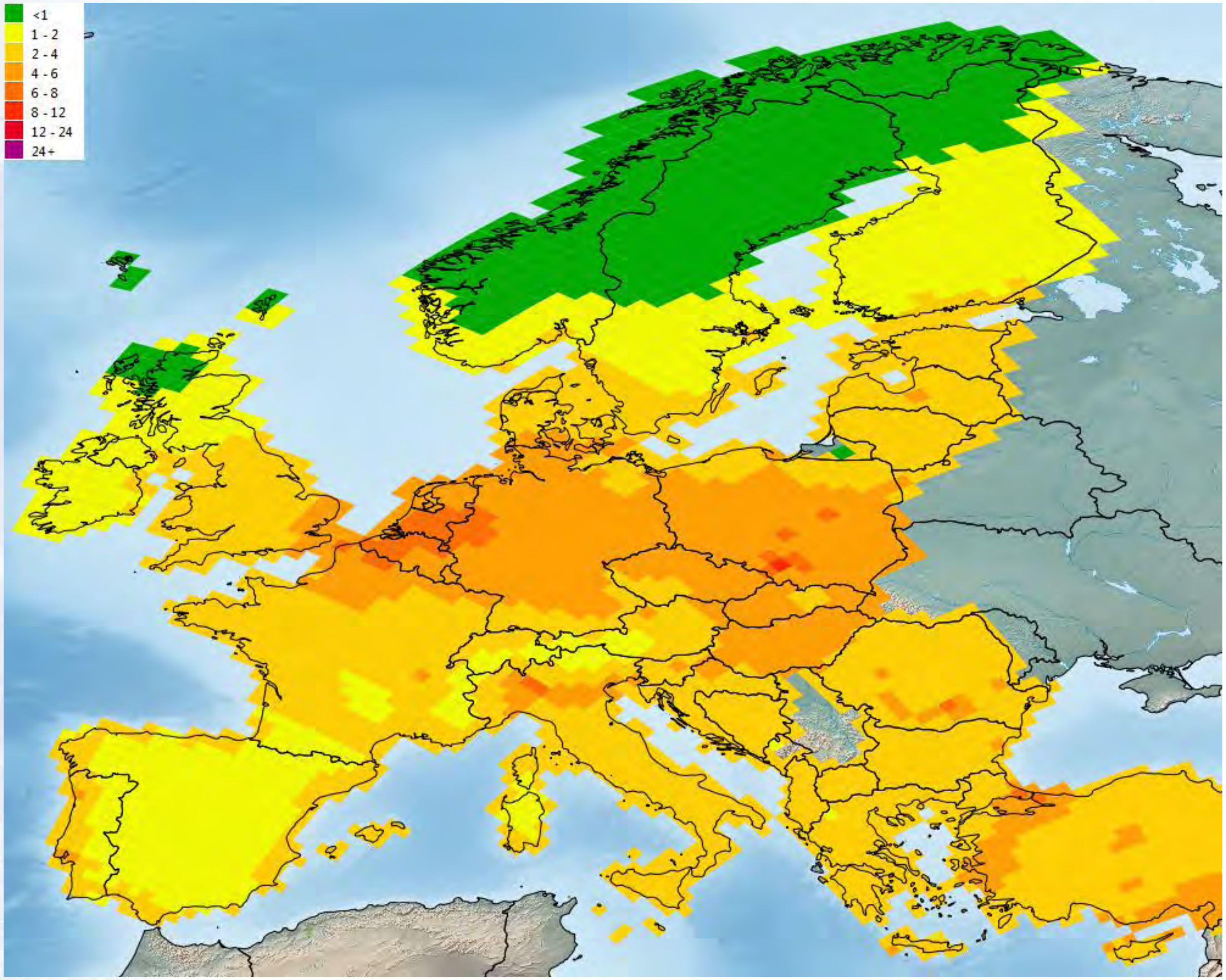
Statistical Life Expectancy Reduction From PM Exposure (Months): 2020



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Future Challenges (1)

The challenge of sustaining cost-effective response strategies in dealing with residual issues

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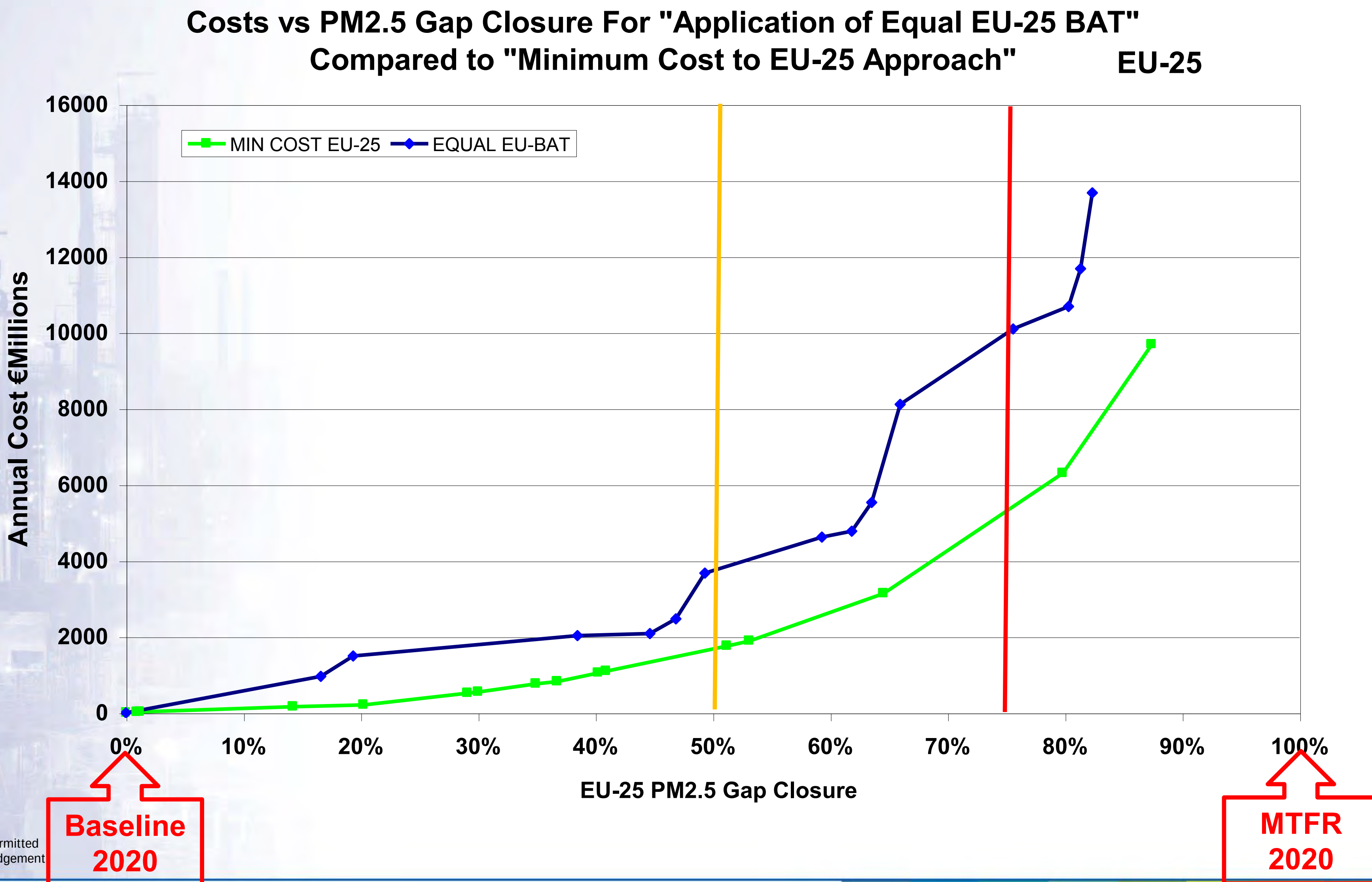
Why cost-effectiveness should remain a priority (1)



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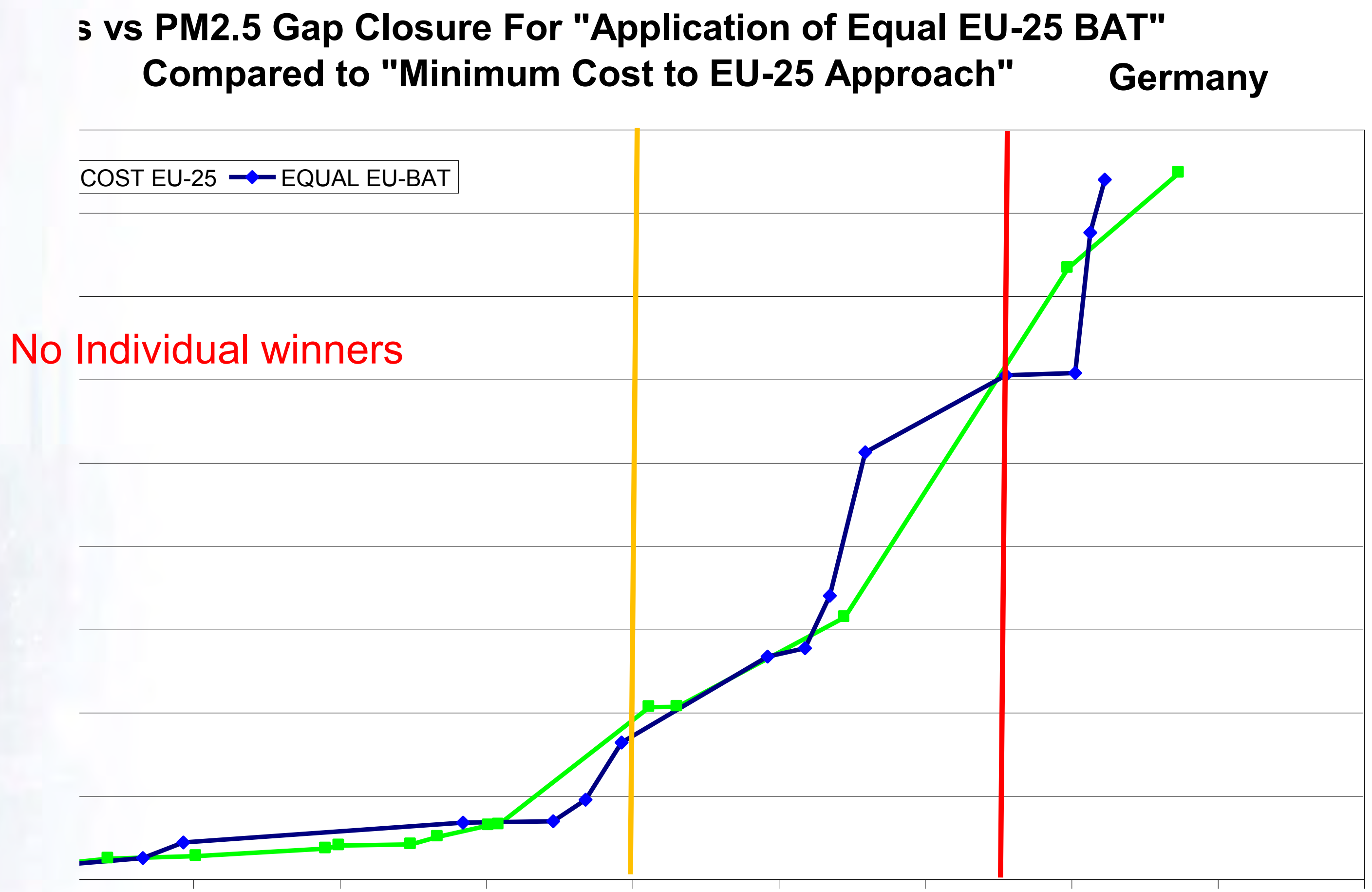
Why cost-effectiveness should remain a priority (2)



Baseline 2020

MTFR 2020

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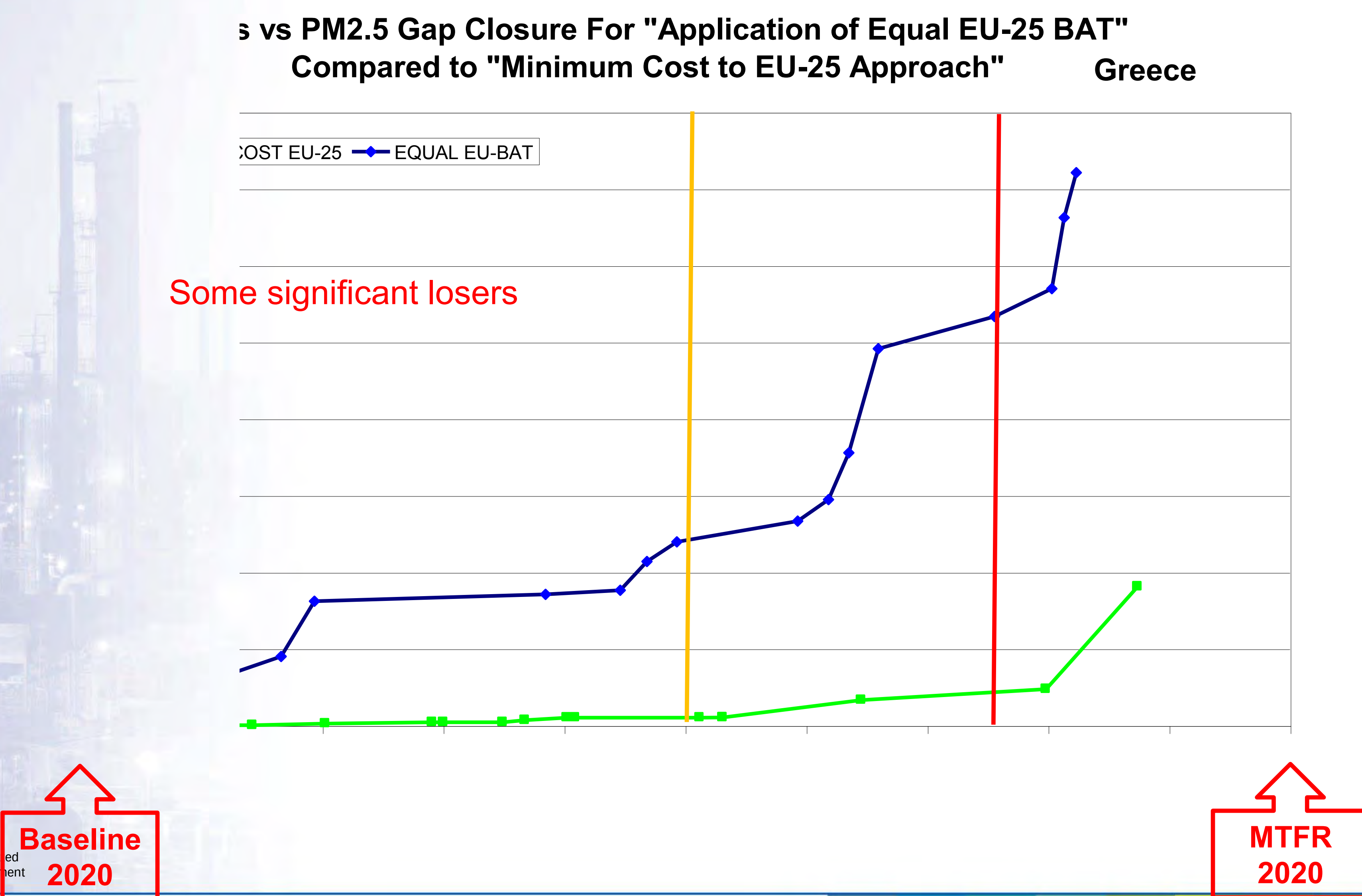
Why cost-effectiveness should remain a priority (3)



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Future Challenges (2)

Accounting for climate influence of sulphur in developing future air quality policy

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Why accounting for SLCFs is important in AQ policy

Global Warming Potentials relative to CO_2 (GWP CO_2 = 1)

Source IIASA

	20 year GWP	100 year GWP
SO2	-140	-40
BC	2200	680
OC	-240	-75

Implications for CO2 ‘compensation costs’ at 30€/tCO2:

To stay ‘Climate neutral’ with a 20 year horizon: Additional cost per ktSO2 reduced is €5,200

Over the same horizon CO2 mitigation savings for BC rich PM reduction is some €66,000/tBC

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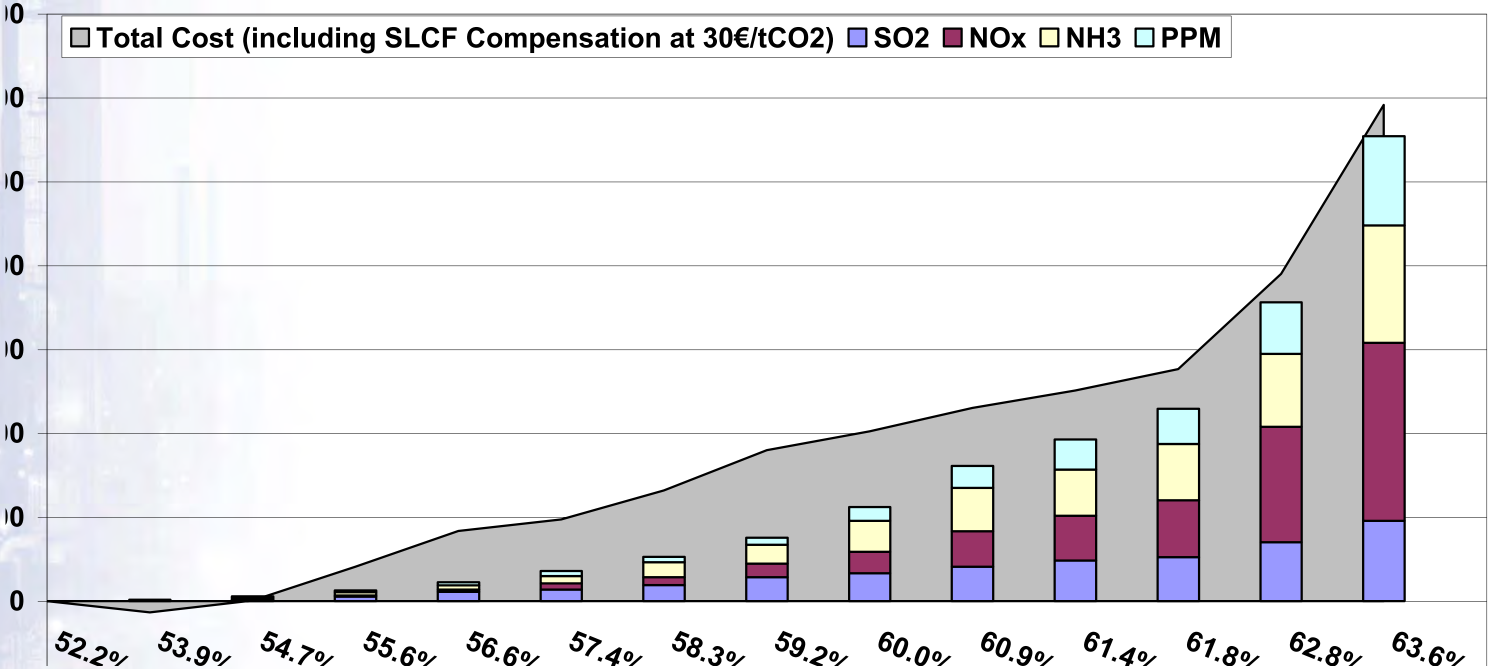
Without SLCF In optimisation

Annual Abatement Costs for EU-27 by Pollutant For Stationary Sources (Including Agriculture) Above the 2020 Baseline versus PM Impact Reduction Including Carbon Compensation Cost for SLCFs
Case 1: 30 €/tCO_2 and SLCFs Compensation Costs not in Optimisation
Source: Concawe IAM



Baseline 2020

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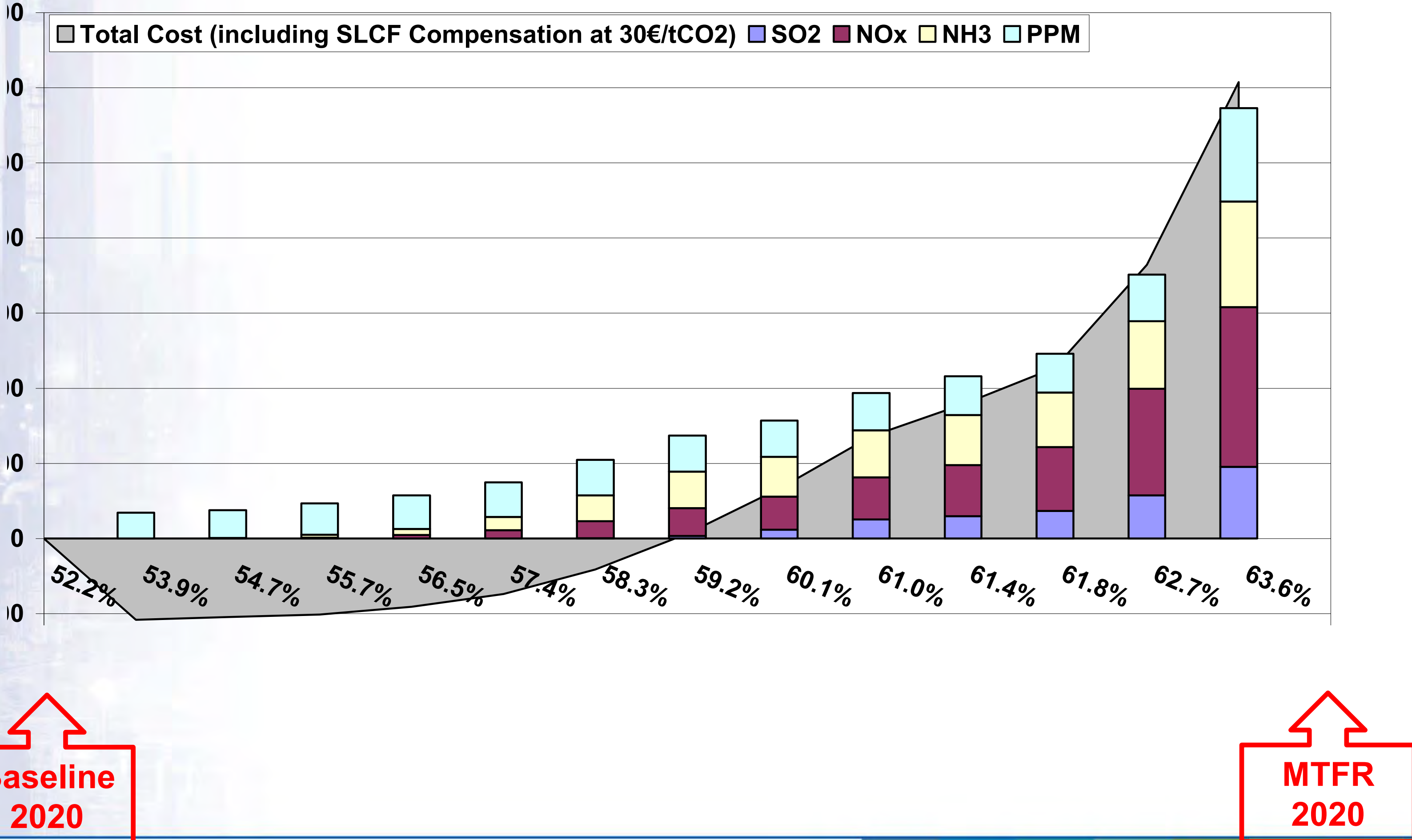
With SLCF in Optimisation

Annual Abatement Costs for EU-27 by Pollutant For Stationary Sources (Including Agriculture) Above the 2020 Baseline versus PM Impact Reduction Including Carbon Compensation Cost for SLCFs

Case 2: 30 €/tCO_2 and SLCFs With Compensation Costs in Optimisation Strategy

Source: Concawe IAM



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Concluding Remarks

Looking Back:

- The refining sector 'sulphur story' is a very positive one:
  - SO_2 from refinery in 2010 at 25% of levels in 1980
  - Sulphur recovery by 2010 at >60% of crude intake v some 15% in 1980
  - SO_2 from products for combustion in 2010 down to <30% of levels in 1980
    - Direct and Indirect benefits
- This has contributed to the significant reduction in acidification and the long term impacts of PM on human health
  - Acidification exceedances in 2010 reduced to only 7% of 1980 levels
  - Long term impacts from exposure to fine particulates reduced by some 2/3 between 1980-2000 and is set to half again between 2000-2020

Looking forward:

- While recognising the EU has more to do on air quality issues: Retaining a commitment to cost-effective AQ policy design, including accounting for the 'CO_2 compensation cost' implications of further sulphur reductions, must be good for the both the environment and the EU Economy

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