Analysis of the possibilities of SO2 and NOx emission trading

TFIAM 38th session

Tuesday 18th May 2010

Presentation by Alistair Ritchie, Entec UK Ltd
Agenda

- Objectives & overview
- Environmental constraints
- Installation database
- Reference scenario
- Options for trading scenarios
- Models
  - Trading Simulation Model
  - Health & Environmental Modelling
- Results
Objectives of project

- To assess environmental, economic & social impacts of various possible designs of an ETS for SO2 and NOx under certain EU-wide rules for IPPC installations (instead of individual BAT-based permitting)

- Health & environmental impacts not to exceed those under current legislation (IPPCD, LCPD, NECD, AQD) and IED Proposal (Reference scenario)

- Constraints due to potential NECD 2020 ceilings to be assessed, as well as benefits of flexible ceilings

- Provide insight on whether a trading mechanism for SO2 & NOx in the EU would be appropriate. If so, under which rules, safeguarding environmental objectives & ensuring practicability & enforceability
Overview of approach

- Beyond BAU measures
- IPPC installation database
- EMEP Source-Receptor modelling
  - Inform geographic / sector aspects

Options for emissions trading scenarios

- EMEP + Entec health, env & AQ modelling
- Specialist input
  - Revise trading rules if necessary

Emissions trading simulation model

- Costs & emissions
- Health & env impacts

Cost-benefit analysis
Environmental constraints

- **BAT equivalence**
  - Emissions trading should not lead to increased overall emissions compared to IED proposal
  - Targets equivalent to applying BAT-based permit conditions
  - BAT-AEL ranges - different options considered
    - Upper BAT-AELs
    - Intermediate BAT-AELs (Upper -20%)
    - Lower BAT-AELs

- **NECD**
  - 2010 ceilings part of BAU scenario
  - Impact of potential 2020 ceilings needs to be considered
    - Assuming IPPC installations meet cost-optimised targets from GAINS
    - Ref scenario emissions (without flexibilities) – 16% NOx, -6% SO2 [GAINS optimisation to meet TSAP / GAINS CP]
    - Option for flexible national ceilings (+10% NOx, +20% SO2)

- **Air quality limit values**
  - IED Proposal requires compliance with AQD limit values
  - Assessment against SO2, NO2, PM10, PM2.5 limit values
Installation database

- **Sectors**

- **Data**
  - Source location & stack characteristics
  - Current emissions
  - Current fuel type and quantity
  - BAU abatement installed / planned (LCPD, IPPCD, National legislation, etc)
  - Beyond BAU abatement options and costs
  - Activity projections (capacity, fuel, GVA)

- **Data sources**
  - Consultation with MS and sector specialists
    - MS policy / regulatory contacts
    - EU industry associations
    - BREF review authors
  - Databases & studies
    - LCPD inventories; EPER; CoalPower
    - Supporting: other Entec / partner studies, in-house data & contacts; PRIMES (activity trends on basis of GVA or fuel consumption/capacity)
  - Expert knowledge of project team (Entec, Okopol, Garrigues, IHE)
Reference scenario

- **IED Proposal**
  - text on which Council reached political agreement June 2009

- **Approach for LCPs**
  - Applied ‘minimum requirement’ ELVs (Annex V)
  - Accounted for:
    - Minimum desulphurisation rate option
    - Less stringent ELVs for LCPs at refineries and plants firing gases other than natural gas
  - Not accounted for:
    - Derogation for certain district heating plants
    - Low load factor and limited life derogations
    - Transitional National Plan
  - If BAU emissions below ELVs, applied BAU emissions

- **Approach for non-LCPs**
  - Assumed permit ELVs based on techniques equivalent to Upper BAT-AELs from latest BREFs
Options for trading scenarios (1)

Type of Scheme

- **Cap and Trade (C&T)**
  Allocation = Emission rate * Production (historical)

- **Baseline and Credit (B&C)**
  Allocation = Emission rate * Production (actual)

- **Hybrid**
  Allocation = Emission rate * Production * Adjustment Factor (to achieve emissions target)
Options for trading scenarios (2)
Allocation level

<table>
<thead>
<tr>
<th>Type of scheme</th>
<th>C&amp;T Cap</th>
<th>B&amp;C Performance standard rate (PSR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper BAT-AEL</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Intermediate BAT-AEL (Upper –20%)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lower BAT-AEL</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sum of potential NECD 2020 ceilings</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Reference scenario emissions</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Dutch NOx trading scheme approach</td>
<td></td>
<td>Yes</td>
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</tbody>
</table>
Options for trading scenarios (3)
Allocation Method

- All allocation methods apply to all types of trading schemes

Diagram:
- Free allocation
  - Grandfathering
  - Benchmarking
- Hybrid
  - Revenue recycling
  - No revenue recycling
- Auctioning

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Options for trading scenarios (4)
Sectoral coverage

- All IPPC installations covered by Revised EU ETS
- All IPPC installations covered by Revised EU ETS (excl 20-50 MW combustion installations)
- Installations that meet specific coverage criteria, eg
  - Average emissions per installation above certain % of average across all sectors (50% in this study)
  - Total emissions per sector above certain % of emissions from all sectors (1% in this study)
Options for trading scenarios (5)
Trading zones

- All EU27 Member States together (ie one overall zone)
- An intermediate level
  - Based on large optimal control areas from TNO study: North West, North East and South
- Each individual Member State (ie 27 individual zones)
Options for trading scenarios (6)
Other

- Opt-ins and opt-outs
- Banking & borrowing
- Phase duration
- New entrants & closures
- Monitoring, reporting and verification (MRV)
Trading Simulation Model
Approach to modelling

- Aims to meet emission limits imposed on it while minimising compliance (abatement) costs

- Key inputs
  - BAU emissions and abatement for each installation
  - Emission limits and reduction requirements:
    - Under ref scenario emission limits apply at installation level
    - Under C&T and B&C overall allowance pool limit applies at trading zone level
    - NECD ceilings apply at MS level (2010 ceilings are BAU; potential 2020 ceilings apply to some scenarios)
  - Beyond BAU emission reduction measures (abatement potential and costs)

- Key outputs
  - Abatement measures, emissions reductions and costs at each installation
Health & environmental impact modelling (1)

- **EMEP model (Met.no)**
  
  **Applications**
  
  1. Source–receptor analysis to understand environmental sensitivity and drivers for impacts
  2. Detailed AQ, health and env impact modelling of trading scenarios

  **Emissions data**
  
  - All key pollutants inc SO2, NOx and primary PM
  - IPPC installations - from database
  - Non-IPPC sources – EMEP / TNO estimates

  **Outputs:**
  
  - 50x50km2 for source–receptor analysis;
  - 10x10km2 for impact modelling
  - Includes secondary particulates from SO2 and NOx
  - Ecosystem damage: exceedances of critical loads
  - Health damage: YOLL from PM; O3; AQ impacts of SO2, NO2, PM2.5, PM10
  - Areas with exceedances of AQ LVs
  - Maps of changes in AQ vs Ref scenario
Monetary valuation

- Health
  - PM related impacts
    - Years of Life Lost (YOLL) * valuation (see below)
    - Low estimate based around CAFE Value of Life Year (VOLY) €52k
    - High estimate based around CAFE Value of Statistical Life (VOSL) €2m
  - Ozone related impacts
    - SOMO35 (Sum of ozone means over 35ppb) * population * valuation factor (0.0027)

- Crops
  - Ozone (from NOx) related impacts on crops covered

- Materials
Costs vs reference scenario

- BAU Ref
- €1,331
- C&T U
- €2,145
- C&T L
- €0
- Cap= NECD 2020
- €1,905
- Cap= Ref Sc
- €378
- B&C U
- €722
- B&C L
- €1,331
- B&C Dutch
- €755
- €831
- €921
- €1,913
- €232
- €376
- €2,111
- €1,749
- €3,000
- €2,513

NOx
SO2
Emissions vs reference scenario

Difference in total EU27 emissions relative to reference scenario (kt)

BAU

Ref + NECD 2020
C&T + NECD 2020
C&T + NECD 2020 Flex

Opt-in 3 MS
Opt-in 5 MS

Higher emissions than reference scenario

Lower emissions than reference scenario

Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Scenario 7
Scenario 8
Scenario 9
Scenario 10
Scenario 11
Scenario 12
Scenario 13
Scenario 14
Scenario 15
Scenario 16
Scenario 17

Ref
C&T
C&T
Cap = NECD 2020
Cap = Ref
B&C
B&C
B&C

BAU

Ref +
C&T +
C&T +
3z
27z
Opt-in
3 MS
Opt-in
5 MS

Flex

Entec

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Trading zones - NOx

![Graph showing €/t NOx reduced and Final NOx emissions (kt).]

- **NOx Summary Cost Effectiveness**
- **Final NOx emissions (kt)**
- **€/t NOx reduced**
- **€ /t of pollutant**

- **Ref**
- **U**
- **Cap**
- **I**

- **NECD**
- **2020**
- **Opt-in**
- **5MS**
- **3MS**

- **C&T**
- **Dutch**
- **U**
- **NECD**
- **27z**

- **Ref+**
- **C&T**
- **L**
- **U**

- **Flex**

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Impact of NECD 2020 ceilings - NOx

![Graph showing €/t NOx reduced vs. Final NOx emissions (kt)]

- **C&T U**
- **C&T Cap NECD 2020**
- **Ref+ NECD 2020**
- **Ref**

- €/t of pollutant
- Final Emissions (ktonnes)
Impact of NECD 2020 ceilings – SO2

- **Final SO2 emissions (kt)**
- **€/t SO2 reduced**
- **C&T U**
- **NECD 2020**
- **C&T Cap NECD 2020**
- **Ref NECD 2020**
- **Ref+ NECD 2020**

- **Final Emissions (ktonnes)**
- **€/t of pollutant**

- REF: 10,738
- Flex: Neutrality to carbon neutrality

**SO2 Cleaning Technologies (U):**
- Cap NECD 2020
- Flex NECD 2020
Air quality impacts

- Relatively limited impacts on compliance with air quality limit values in comparison to the reference scenario
- All trading scenarios estimated to result in fewer areas of exceedence of AQ limit values compared to BAU
- Maps in Appendix A show areas with increased and decreased (mainly) ambient air concentrations compared to reference scenario
- Under IED Proposal, in event of exceedances, additional measures will be required to safeguard air quality
Sensitivity analysis

- Projected BAU activity growth rates
- BAU & ref scenario abatement assumptions for cement sector
- Costs of key abatement options in ref scenario
- Investment sensitivity analysis
- Impacts of SO2 and NOx abatement measures on CO2 costs
Thank you for your attention

Contact details for further information:

Alistair Ritchie
Entec UK Ltd
Tel +44 1606 354851
Email ritca@entecuk.co.uk