The EU ETS: allocation, competitiveness and longer term design options

Karsten Neuhoff

Commissioned by Climate Strategies and The Carbon Trust (Michael Grubb)

with Kim Keats, Jos Sijm, Felix Matthes, Angus Johnston, Misato Sato

Cement: Damien Demailly & Philippe Quirion - CIRED
The components of the work

- Price pass through in the electricity sector (Sijm, Neuhoff, Yihsu)
- ETS in the cement sector (Demailly, Quirion)
- The economic impact of Carbon Policy on UK companies (Smale)
- Allowance allocation in the electricity sector (Neuhoff, Keats, Sato)
- Legal aspects (Johnston)
- Auctions (Grubb, Hepburn, Neuhoff)
- Policy conclusions
  (Grubb, Neuhoff, Johnston, Keats, Matthes, Neuhoff, Sijm)

Background papers, at www.electricitypolicy.org.uk
- Border Tax Adjustment: A feasible way to address non-participation in Emission Trading (Ismer, Neuhoff)
- Impact of the allowance allocation on prices and efficiency (Neuhoff, Grubb, Keats)
Power generators pass through CO2 price

Evolution of German spot prices (example day ahead 3-4 pm)

RWE announced*
   a) high fuel and CO2 prices reasons for price increase
   b) record profits

Competition Authority opens investigation

*Handelsblatt, 19/8/2005
Pass through, based on 2006 forward prices

Table 1 Empirical estimates of CO$_2$ pass through rates in Germany and the Netherlands for the period January-December 2005, based on year ahead prices for 2006 (in %)

<table>
<thead>
<tr>
<th>Country</th>
<th>Load period</th>
<th>Fuel (efficiency)</th>
<th>OLS</th>
<th>Bootstrap (2 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>min</td>
</tr>
<tr>
<td>Germany</td>
<td>Peak</td>
<td>Coal (40%)</td>
<td>117</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>Off-peak</td>
<td>Coal (40%)</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Peak</td>
<td>Gas (42%)</td>
<td>78</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Off-peak</td>
<td>Coal (40%)</td>
<td>80</td>
<td>69</td>
</tr>
</tbody>
</table>
Relative exposure of sectors will depend on value at stake and price pass through

Value at stake as a proportion of sector profit

“Value at stake based on potential increase in energy costs*”

Ability to pass on costs to customers

“Cost pass through and impact on consumer demand linked to location, number and behaviour of competitors”

Note: *e.g. cost increase if 40% uplift in electricity price and allowances need to be purchased for ~10% of emissions – indicative value at stake in phase 2 of ETS scheme

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Cournot model of change of cement profitability under ETS (90% grandfathering)

Value of CO2 allowances

- EBITDA on cement minus CO2 costs
- Sold in market (output < 90% historic)
- To cover emissions

Based on Damien Demailly & Philippe Quirion
Higher ETS price and allocation cutbacks could bring cement and steel, as well as Al. (if not integrated) potentially into range of competitiveness concern

<table>
<thead>
<tr>
<th>High scenarios*</th>
<th>Net value at stake** (% of current EBITDA)</th>
<th>Product price rise required to keep profits flat (% of current price)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>€15/5%</td>
<td>€30/15%</td>
</tr>
<tr>
<td>Cement (UK)</td>
<td>20%</td>
<td>52%</td>
</tr>
<tr>
<td>Steel</td>
<td>9%</td>
<td>27%</td>
</tr>
<tr>
<td>Newsprint (UK)</td>
<td>1%</td>
<td>3%</td>
</tr>
<tr>
<td>Petroleum</td>
<td>0.5%</td>
<td>1%</td>
</tr>
</tbody>
</table>

EU ETS sectors

- Need detailed exploration of cement & steel import exposure under higher prices and cutbacks

CCA sectors

- Aluminium very exposed to EU ETS electricity price rises across EU

Note: *Includes impact of doubled CCL plus direct and indirect EU-ETS effects **= (inc. in total costs after allocation)/(starting EBITDA), ETS prices 2010:15 €/tCO2, 2020:30€/tCO2, allocation cut back 1%pa from 2005; ***Assuming 100% auctioning at EU ETS prices
Value of ETS allowances bigger than in US cap and trade programs

Value of allowances in ETS/year billion €

SO₂ €2.8–8.7 billion
10 mio t at 270-850 $/short ton

NOₓ €1.1 billion East Coast 640.000 t at 2000$/short ton

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Allocation methods effect ETS effectiveness

- Production cost
- CO2 Cost
- Uniform updating value

Cost

Coal | Improved Coal | Gas | Usage efficiency

Efficiency increase
Technology/fuel choice
Substitute output
Analytic and numerical analysis of allocation

• Effect of allocation to existing facilities
  – Perfect grandfathering / auctions
  – Contingent on availability
  – Uniform benchmarking using moving base
  – Fuel specific benchmarking using moving base

• Effect of allocation to new facilities
  – Uniform benchmark
  – Fuel specific benchmarking
Effect of auction – UK simulation

CO2 prices are assumed, starting with 10 Euro/t CO2 in 2005-2007 and followed by 20€/tCO2.

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Illustration of distortions from updating

Updating shifts ‘price’ curve of marginal abatement
UK Simulation – uniform updating

Assuming fixed CO2 price

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**All-In Price (Euro2005/MWh) in GB**

- Auctioning Base Case
- Uni Upd, No NER
- No CO2

**Emissions - CO2 (MMTonnes) in GB**

- No CO2
- Auctioning Base Case and Uni Upd, No NER

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UK simulation – fuel specific updating

Assuming fixed CO2 price

All-In Price (Euro2005/MWh) in GB

Emissions - CO2 (MMTonnes) in GB

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What happens if only some countries update?

Marginal abatement curves for two identical countries...

Grandfathering

Updating

Joint marginal abatement curve

Extra abatement costs

Avoided abatement costs
European simulation

Assuming fixed CO2 price
Impact of closure test

Assuming fixed CO2 price

All-In Price (Euro2005/MWh) in GB

Auctioning Base Case

Auctioning with Closure test

No CO2

Emissions - CO2 (MMTonnes) in GB

No CO2

Auctioning with Closure test

Auctioning Base Case
Distortions from allocations to existing plants

Allocation method

Auction
Capacity X
Capacity and technology X X
Historic output X X X
Historic output and technology X X X X
Historic emissions X X X X X

Distortions
Extend all plant life
Extend plant life of inefficient plant
Increase use of inefficient plant
Reduce efficiency investment
Closure test
Updating
Fuel specific updating
Illustration of investment equilibrium

- Infra-marginal rents cover fixed costs

- Demand response (no fixed costs)

- Price above variable costs technology I covers fixed costs technology I

- Price above variable costs technology II covers fixed costs technology II

8760 hours/year
Impact of small new entrant allocation (uniform benchmark)

In competitive equilibrium mod:
- $P_{\text{elec}}$ reduced by value of new entrants allocation to investors
- Subsidy to new investment is wasted: generation costs > consumer value
- Emissions increased by (slightly higher) demand
Impact of higher new entrant allocation (uniform benchmark)

- Further reduction of electricity price
- More subsidy wasted on choice of tech. II instead of tech I
- If technology II coal, technology I gas -> emissions increase
National perspective, uniform new entrant allocation

Installed capacity
- Demand response/peaker replaced by CCGT
- At high levels of subsidy coal replaces CCGT

Electricity prices
- Decrease due to capacity subsidy

Emissions
- Increase if demand response replaced by CCGT
- Decrease if CCGT replaces peaker
- Increase if at high subsidy coal replaces gas
- Demand elasticity not modelled
National v.s. harmonised perspective

Installed capacity

Price

CO2 Emissions

(a)

(b)
Impact of fuel specific new entrant allocation

- Uniform subsidy
- Additional subsidy to CO2 intensive technology

Technology I
- replaces
- a) demand response
- b) peaking capacity

Technology II
- replaces technology I

Price/MWh vs. Hours/year

8760
Fuel based benchmarking new entrant allocation

Installed capacity
- Coal replaces gas and peaker

Electricity price
- Reduced as before

Emissions
- Increase
National vs. harmonised perspective

Installed capacity

Electricity, CO2 Price
- CO2 price increase to compensate coal incentive

Emissions
- Constant due to cap
UK, New entrant allocation and emissions

CO2 (Million Tonnes) in England and Wales: difference from No Updating, no NER

<table>
<thead>
<tr>
<th>CO price</th>
<th>0</th>
<th>20</th>
<th>20</th>
<th>20</th>
<th>20</th>
<th>20</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas price</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>Updating</td>
<td>uniform</td>
<td>fuel sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrant alloc.</td>
<td>uniform</td>
<td>fuel sp.</td>
<td>fuel sp. stays high</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UK – New entrant allocation and elec prices
Allocation, profit and competitiveness: 

*Four principles*

- *In general*, the rents associated with CO2 constraints mean ‘grandfathered’ allocation gives *potential* to profit, subject to:
  
  (a) degree of alignment of allowances with costs (e.g. Not sectors outside EU ETS or affected primarily by electricity pass-through costs)
  
  (b) constraints on cost pass-through due to imports and other factors

- Power sector in liberalised markets will pass through (opportunity) costs of CO2 allowances to electricity price and thereby profit

- Net impact on other sectors less clear and complicated by details of electricity retail market regulation, by international trade, and by downstream company, regional and product differentiation

- New entrant, closure, and incumbent allocation rules all affect the incentives, pricing and efficiency of the scheme; Key is to understand the difference between
  
  – *marginal incentives* – which affect prices and long-run competitiveness
  
  – and *allocation transfers* – which determine short run cash flows
The pursuit of long-term objectives using instruments that have to adapt to shorter term cycles requires institutional independence

• Governments decide on the distribution of free allowances
  – Unlike SO₂/NOx in US, not lump sum because of 5 year cycles
  – Therefore, market repeatedly exposed to government intervention
  – This creates uncertainty for investment (technology choice, timing), and distorts operation and consumption decisions

• Historically monetary policy was in government hands
  – But political process too short-sighted for long-term commitment
  – Complex economic interactions difficult to manage in political process
  – Therefore, independent central banks were created

➢ Minimise government influence on ETS via allocation process, e.g. creating institutional independence.
The ‘terms of reference’ for allocation institutions should focus on a specific clearly articulated objective, not a diverse collection of conflicting goals

- Allocation process aims to achieve security of supply, secure industry support, and compensate for forgone profits
  - Political process with multiple objective creates complex NAPs
  - NAPs create perverse economic incentives (section 4 and 5)
  - Investment delayed/distorted because future NAPs unpredictable
- Historically monetary policy had multiple objectives
  - Governments could not credibly commit to low inflation target as market knew employment and GDP growth are important
  - Therefore, they had to compromise more on GDP growth and employment to convince market of low inflation objective
  - Central banks now have one objective: control inflation

➢ Use allocation process only to compensate existing installations for the reduction in profitability under ETS
Efficient response to the ETS requires clarity post-2012
Expectation drives investment, available options determine competitiveness

- Phase I 2005-07
- Phase II 2008-12
- Return on today’s investment
- Sustained international cost difference would effect energy intensive industry
- Global / sectoral agreements
- Output based benchmark
- Border tax adjustment

Efficient
- Technology
- Input choice
- Consumption
- Trade

Return on today's investment requires clarification post-2012. Expectation drives investment, and available options determine competitiveness.
### The post 2012 options in detail

<table>
<thead>
<tr>
<th>Option</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Global agreement</td>
<td>The “first-best” but highly unlikely</td>
</tr>
<tr>
<td>(2) Embed in a sectoral agreement for a specific energy intensive product</td>
<td>• More credible in terms of “high politics”</td>
</tr>
<tr>
<td></td>
<td>• Institutionally wholly unprecedented</td>
</tr>
<tr>
<td></td>
<td>• How to reach binding deal with global sectors?</td>
</tr>
<tr>
<td>(3) Move to output-based (intensity) and/or downstream allocations for core competitively exposed sectors</td>
<td>• Output-based allocation maintains market share by curtailing pass-through, but:</td>
</tr>
<tr>
<td></td>
<td>–Undermines internalisation of CO2 price</td>
</tr>
<tr>
<td></td>
<td>–Inefficient choice of intermediate products and consumption</td>
</tr>
<tr>
<td></td>
<td>–Increases macroeconomic costs</td>
</tr>
<tr>
<td></td>
<td>–Complex system</td>
</tr>
<tr>
<td>(4) Level playing field through Border Tax Adjustment</td>
<td>• Fall back option for (1) and (2)</td>
</tr>
<tr>
<td></td>
<td>• Maintains core incentives</td>
</tr>
<tr>
<td></td>
<td>• For WTO compatibility: Allowance auction so that compensation is for average costs</td>
</tr>
</tbody>
</table>
Conclusions

• In liberalised markets opportunity costs are passed through – unless strong international competition
• Competitiveness issues in sector with high energy costs and exposure to international competition
• Address Investment and post 2012 to address competitiveness issue
  – International (sectorial) agreement
  – Output based allocation / new entrant allocation
  – Border tax adjustment
• Vivid and creative industry core for European competitiveness -> Simple regulatory framework!