The impact of the ETS exemptions for sectors at risk of carbon leakage on EU competitiveness
Disclaimer

The authors and the publisher of this work have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication. However, neither the authors nor the publisher nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for the results obtained from use of such information. The authors and the publisher expressly disclaim any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or that the use of the information contained in this work is free from intellectual property infringement. This work and all information are supplied "AS IS." Readers are encouraged to confirm the information contained herein with other sources. The information provided herein is not intended to replace professional advice. The authors and the publisher make no representations or warranties with respect to any action or failure to act by any person following the information offered or provided within or through this work. The authors and the publisher will not be liable for any direct, indirect, consequential, special, exemplary, or other damages arising therefrom. Statements or opinions expressed in the work are those of their respective authors only. The views expressed on this work do not necessarily represent the views of the publisher, its management or employees, and the publisher is not responsible for, and disclaims any and all liability for the content of statements written by authors of this work.

For more information, go to: www.fti-intelligence.com
FTI Consulting Compass Lexecon is an established advisory firm with an existing presence in the energy sector

Heritage & structure
- Established in 1982
- c. 4,000 staff across 24 countries
- Five divisions:
  1. Economic & Financial Consulting
  2. Corporate Finance
  3. Forensic & Litigation Support
  4. Strategic Communications
  5. Technology
- We’re about deploying senior experts to help clients navigate critical decisions

Energy capability
1. Competition, disputes
2. Regulation, policy
3. Strategy
4. Market modelling

Example offerings
- Economic support to large commercial disputes
- Policy, regulation and incentive design
- Scenario planning & corporate strategy formulation
- Business case development & investment decisions support
- Energy market modelling
- Renewables investment & international supply chain

Experience
- European Utilities: range of strategy assignments, involving power, gas, and carbon market modelling
- Financial players: technical and commercial due diligence for both regulated and merchant assets
- European utilities: range of gas market & renewables disputes
- Regulators and network operators: studies on incentive regulation, costs of capital, etc.
Agenda

- Context and motivation for the study

- The costs of removing carbon leakage exemptions
  - Steel sector case study
  - Cement sector case study
  - Scaling up to all sectors at risk of carbon leakage

- The benefits of recycling carbon auction’s revenues

- Conclusion: comparing costs and benefits
Context and motivation for the study
This study focuses on the interplay of carbon prices and economic competitiveness.

**Policy context**

<table>
<thead>
<tr>
<th>European Commission Green Paper - “A 2030 framework for climate and energy policies”</th>
<th>2013 Member States Competitiveness Performance and Implementation of EU Industrial Policy report</th>
<th>Consultation on ETS structural measures</th>
</tr>
</thead>
</table>

**Quantification of the impact of carbon and energy costs on competitiveness**

- The debate on the impact of the costs of carbon and energy and competitiveness has been focused on a narrow list of sectors
  - But competitiveness is a whole economy issue: costs on some sectors have to be weighted against the benefits in other parts of the economy
  - This study complements existing literature by modeling the aggregate economic effects of carbon and energy prices

- The policy discussions on competitiveness have been focused on production costs
  - This study introduces a framework to identify the different drivers of competitiveness in a given sector
  - A number of in-depth case studies (steel, cement, chemicals) explore the impact of carbon and energy costs as well as the other drivers of competitiveness in these sectors
As the ETS moves toward increasing auctioning of allowances in Phase 3 the EU addresses the issue of carbon leakage

**CARBON LEAKAGE ISSUE**

**What is carbon leakage?**
Carbon leakage is the situation when for reasons of costs related to climate policies production is transferred to countries which have laxer constraints on greenhouse gas emissions.

**How does the ETS impact firm competitiveness?**
The ETS impacts firms’ competitiveness vis-à-vis firms operating in countries without climate policies through two channels:

- **Direct carbon costs** – firms need to purchase and surrender allowances to cover their carbon emissions
- **Indirect carbon costs** – firms pay higher electricity prices as power generators pass on the carbon costs to downstream consumers

**How does the EU assess carbon leakage?**
The EU has developed a framework of quantitative and qualitative criteria to assess the increased costs and the trade intensity of sectors.

**Carbon leakage lists – 2013-2014 and 2015-2019**
Based on the carbon leakage assessment framework the EC developed a list of carbon leakage sectors in 2009 that is valid for the 2013-2014 period. A revised list for the 2015-2019 period is to be finalized in 2014.

**EU MEASURES TO ADDRESS CARBON LEAKAGE**

**Exemptions of carbon leakage sectors**
The sectors deemed exposed to a significant risk of carbon leakage receive the following exemptions:

- Carbon leakage sectors continue to receive free allowances in Phase 3 (up to a benchmark and considering the sectoral constraints)
- Additionally, they may obtain financial compensation through national state aid schemes for increases in electricity costs resulting from the ETS
The EU assesses exposure to carbon leakage through quantitative and qualitative criteria

### Quantitative Criteria
A sector is deemed to have a sufficient exposure to carbon leakage if it passes at least one of three quantitative criteria:

1. **Joint Carbon Cost – Trade Intensity**
   - Production costs would increase by at least 5% of GVA (Gross Value Added), AND
   - The sector’s trade intensity is greater than 10%

2. **Carbon Cost only**
   - The increase in production costs is greater than 30%, as a proportion of Gross Value Added

3. **Trade Intensity only**
   - The intensity of trade is greater than 30%.

### Qualitative Criteria
A more detailed analysis based on the following criteria:
- The extent to which it is possible to reduce emission levels or consumption of electricity;
- Current and projected market characteristics; and
- Profit margins as an indicator of long-run investment or relocation decisions

### Carbon Leakage List
164 sectors are on the Carbon Leakage list:
- 2 sectors are in the carbon cost only group;
- 27 sectors are in the joint group
- 117 sectors are in the trade intensity group
- 13 sectors qualify at sub-NACE 4 level
- 5 sectors qualify on qualitative criterion
In 2005-06, the carbon leakage sectors emitted 95% of all industrial emissions

Carbon leakage sector characteristics

- There are 258 manufacturing sectors covered in the ETS
- Of the 258 manufacturing sectors, 162 sectors are on the carbon leakage list for 2013-14. These sectors receive free permits (up to benchmarks)
  - The 162 carbon leakage sectors produce 95% of total industrial emissions
- The vast majority of the sectors only qualify on the Trade Intensity criteria

<table>
<thead>
<tr>
<th>Reason for inclusion on CL list</th>
<th>Number of sectors</th>
<th>Verified emissions* (thousand tCO2)</th>
<th>% of industrial emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Joint carbon cost and trade intensity</td>
<td>13</td>
<td>219,303</td>
<td>36%</td>
</tr>
<tr>
<td>2. Carbon cost only</td>
<td>2</td>
<td>177,573</td>
<td>29%</td>
</tr>
<tr>
<td>3. Trade intensity only**</td>
<td>133</td>
<td>157,233</td>
<td>26%</td>
</tr>
<tr>
<td>4. Qualitative assessment</td>
<td>6</td>
<td>14,436</td>
<td>2%</td>
</tr>
<tr>
<td>NACE 6 and beyond***</td>
<td>8</td>
<td>5,779</td>
<td>1%</td>
</tr>
<tr>
<td>Total carbon leakage emissions</td>
<td>162</td>
<td>574,323</td>
<td><strong>95%</strong></td>
</tr>
<tr>
<td>Total industrial emissions</td>
<td>258</td>
<td>604,955</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Delft, 2013

Notes:
- * Average of 2005 and 2006 verified emissions
- ** Sixteen sectors that fall under Trade intensity only would also qualify for Joint carbon cost and trade intensity
- *** Maximum estimate of emissions of 16 sectors belonging to 8 sectors at the NACE 4 level
The top emitters are steel, cement and chemicals - according to the free allocations published by the EC in 2013

<table>
<thead>
<tr>
<th>Industry</th>
<th>Free allocations 2013-2020 (m EUAs)</th>
<th>% of total</th>
<th>Carbon leakage criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic iron and steel</td>
<td>1,512</td>
<td>23%</td>
<td>Joint criteria</td>
</tr>
<tr>
<td>Cement</td>
<td>1,110</td>
<td>17%</td>
<td>Carbon cost</td>
</tr>
<tr>
<td>Basic chemicals (including fertilizers)</td>
<td>998</td>
<td>15%</td>
<td>Various criteria</td>
</tr>
<tr>
<td>Refinery products (including coke)</td>
<td>878</td>
<td>13%</td>
<td>Joint criteria</td>
</tr>
<tr>
<td>Pulp and paper</td>
<td>247</td>
<td>4%</td>
<td>Trade intensity</td>
</tr>
<tr>
<td>Lime</td>
<td>202</td>
<td>3%</td>
<td>Carbon cost</td>
</tr>
<tr>
<td>Extraction of crude and natural gas</td>
<td>176</td>
<td>3%</td>
<td>Trade intensity</td>
</tr>
<tr>
<td>Ceramics (including bricks and tiles)</td>
<td>140</td>
<td>2%</td>
<td>Trade intensity and Joint criteria</td>
</tr>
<tr>
<td>Non-ferrous metals</td>
<td>129</td>
<td>2%</td>
<td>Trade intensity</td>
</tr>
<tr>
<td>Glass</td>
<td>121</td>
<td>2%</td>
<td>Joint criteria</td>
</tr>
<tr>
<td>Manufacturing total</td>
<td>6,600</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Source: European Commission, October 2013

<table>
<thead>
<tr>
<th>Carbon leakage group</th>
<th>Percentage of free allocations 2013-2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon cost</td>
<td>20%</td>
</tr>
<tr>
<td>Joint criteria</td>
<td>45%</td>
</tr>
<tr>
<td>Trade intensity</td>
<td>27%</td>
</tr>
<tr>
<td>Sub-NACE-4 level</td>
<td>1%</td>
</tr>
<tr>
<td>Qualitative</td>
<td>2%</td>
</tr>
<tr>
<td>Total CL</td>
<td>95%</td>
</tr>
</tbody>
</table>


Note: Due to lack of data, allocation estimates for the trade intensity and the joint criteria groups could have a significant margin of error (a magnitude of 5-10% points). We have run sensitivities to understand the impact of such difference on the analyses and the conclusions remain the same in the different scenarios.
The study quantifies the costs and benefits of removing carbon leakage exemptions of manufacturing sectors.

Quantification of the impact of carbon and energy costs on competitiveness

- Costs of removing carbon leakage exemptions
  - Sector models
    - Detailed modelling of impact of carbon costs on select, representative sectors
    - Cement sector
    - Steel sector
    - Chemicals sector
  - Scaling up
    - Using representative sector results to estimate impact on all carbon leakage sectors
    - Carbon cost group
    - Joint criteria group
    - Trade intensity group
    - All other groups

- Benefits of removing carbon leakage exemptions
  - Recycled government revenue
    - Using representative sector results to estimate impact on all carbon leakage sectors
    - Auction revenue
    - State aid savings
    - Recycling to economy

Estimated costs
- Impact on EBITDA, GDP and employment
  - EBITDA loss
  - GDP loss
  - Employment loss

Estimated benefits
- Impact on GDP and employment
  - GDP gain
  - Employment gain

The chemicals sector is presented through a case study.
We modelled 9 scenarios

Baseline scenario assumptions:
- The carbon price is €14/tonne CO2 (the average during Phase I and Phase II of the ETS)
- CL sectors receive 100% of their EUAs for free, no compensation for indirect costs
- The CL sectors’ volume, price, turnover and profit are at an ‘average’ level (2003-2010 average)

Removing CL sectors’ exemptions – scenarios:

Carbon prices:
- €5 / tonne of CO2 = “Ineffective ETS”
- €20 / tonne of CO2 = “Moderately effective ETS”
- €40 per tonne of CO2 = “Effective ETS”

Auctioning percentages:
- 34% (as applies to the non-CL manufacturing sectors in 2015) = “ETS with high compensation”
- 70% (as applies to the non-CL manufacturing sectors in 2020) = “ETS with medium compensation”
- 100% (full auctioning) = “ETS with no compensation”

<table>
<thead>
<tr>
<th>Carbon Price</th>
<th>Auctioning percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34%</td>
</tr>
<tr>
<td>€5 / tonne of CO2</td>
<td>Ineffective ETS with high compensation</td>
</tr>
<tr>
<td>€20 / tonne of CO2</td>
<td>Moderately effective ETS with high compensation</td>
</tr>
<tr>
<td>€40 / tonne of CO2</td>
<td>Effective ETS with high compensation</td>
</tr>
</tbody>
</table>
The steel sector and carbon leakage
Steel sector: Removal of exemptions would impact BOF and EAF plants differently

<table>
<thead>
<tr>
<th>Carbon costs and competitiveness</th>
<th>Impact of removing Carbon Leakage exemptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ The steel industry is suffering from overcapacity and as a result from very strong intra-European competition. Import substitution is a secondary issue</td>
<td>■ Steel plants have been operating at low long term EBITDA margin levels due to overcapacity and strong intra-EU competition. Attempts to take out capacity have been met with political resistance</td>
</tr>
<tr>
<td>■ Part of steel production is carbon intensive but not energy intensive and the other part is energy intensive but not carbon intensive</td>
<td>■ EAF and BOF plants are facing very different risk of carbon leakage</td>
</tr>
<tr>
<td>■ 43% of production is with EAF technology that hardly emits carbon but is energy intensive</td>
<td>■ The impact of auctioning and indirect costs:</td>
</tr>
<tr>
<td>■ 57% of production is with BOF technology which is carbon intensive but significantly less energy intensive</td>
<td>■ The impact on EAF plants is less than 2% point of EBITDA even at full auctioning and high carbon prices (€40)</td>
</tr>
<tr>
<td>■ EU producers are the highest cost producers. Carbon costs would increase production costs significantly for BOF producers but not for EAF producers</td>
<td>■ The impact on BOF plants is significantly larger driven by their high emission intensity and not by their energy intensity. The fall in EBITDA margin remains under 2% point if</td>
</tr>
<tr>
<td>■ There are important barriers to import substitution and relocation</td>
<td>– carbon prices remain low (€5/tonne of CO2). In this case even full auctioning would not lead to higher than 2% point loss in EBITDA margin</td>
</tr>
<tr>
<td>■ Barriers to import substitution include switching costs, qualification process, standards, transport costs, etc.</td>
<td>– carbon prices are at medium level (€20/tonne of CO2) but auctioning percentage remains low (at 34% level)</td>
</tr>
<tr>
<td>■ There are very few examples of successful relocation and few regions where relocation could be economical</td>
<td></td>
</tr>
</tbody>
</table>
While the steel sector is facing strong intra-EU competitive pressures there are important barriers to import substitution

**Strong supplier power**
- High volatility of raw material prices demonstrates supplier power:

  “Iron ore moved from $35/ton in 2004, to $200/ton in 2008, then went back in 2009 to $85 and bounced back in 2011 to $200”  
  *Steel industry expert*

**Strong rivalry within the EU**
- High overcapacity: mills are trying to place some volume at all costs
- Relatively large number of competitors
- Part of production is differentiated but the other part is commodity
- Buyers’ switching costs are lower for the commodity segment and higher for the specialty segment
- High capex is an important exit barrier

**Buyer power is strong in the commodity but less so in the specialty segment**

**Specialty segment:**
- Large buyers buy large volumes
- But qualification process and long term co-design relationship makes switching costly

**Commodity segment:**
- No product differentiation
- Price is key purchase criterion
- Switching costs are lower

**Important barriers to import substitution**

Although EU producers are the highest cost producers there are several barriers to import substitution:

- Imports are constrained by issues such as exchange rate volatility, lead time, working capital restrictions, lot sizes, serviceability, etc.

  Specialty segment:
  - OEMs have long term relationships with suppliers, switching costs are high
  - EU has quality standards that few importers can meet

  Commodity segment:
  - Both volume and price of commodity orders are lower making transport costs significant

**Important barriers to entry**
- Economies of scale are extremely important for long term viability
- There are very high capital requirements
- Incumbents are ruthless in defending their market share
- There is significant overcapacity in the steel industry already
BOF plants are significantly impacted at higher carbon prices and auctioning, EAF plants are only marginally impacted.

Impact of removing Carbon Leakage exemptions on BOF plants:

- BOF plants’ EBITDA margin declines less than 2% point even at full auctioning if carbon prices remain at the €5 level.
- In the effective ETS scenario with no compensation, BOF plants’ EBITDA margin declines dramatically from 10% to 2%.

Scenarios:

<table>
<thead>
<tr>
<th>Carbon Price</th>
<th>34%</th>
<th>70%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>€5/t</td>
<td>Ineffective ETS with high compensation</td>
<td>Ineffective ETS with medium compensation</td>
<td>Ineffective ETS with no compensation</td>
</tr>
<tr>
<td>€20/t</td>
<td>Moderately effective ETS with high comp.</td>
<td>Moderately effective ETS with med. comp.</td>
<td>Moderately effective ETS with no comp.</td>
</tr>
<tr>
<td>€40/t</td>
<td>Effective ETS with high comp.</td>
<td>Effective ETS with medium comp.</td>
<td>Effective ETS with no comp.</td>
</tr>
</tbody>
</table>

Source: FTI Consulting analysis

Impact of removing Carbon Leakage exemptions on BOF plants:

- EAF plants’ EBITDA margin improves at the €5 carbon price level. This improvement is driven by the lower carbon prices compared to the baseline (€14 EUA).
- In the effective ETS scenario with no compensation, EAF plants’ EBITDA margin declines by less than 2% points.
The impact on BOF plants is driven by **direct** carbon costs

Composition of BOF revenue at different carbon prices and auctioning percentages

Source: FTI Consulting analysis
The impact on EAF plants is driven by *indirect* carbon costs
The cement sector and carbon leakage
Cement sector: Removal of exemptions would impact inland and coastal plants differently

**Carbon costs and competitiveness**

- The cement sector's production volume fell by 70% since 2007. However, the industry managed to keep EBITDA margins at over 20% and European operators have among the highest margins globally.

- The cement industry does not qualify for indirect cost compensation. Indirect costs in the cement sector are about 3% of production costs even at high carbon prices (€40).

- The industry will be significantly impacted if it did not get free permits but there are strong barriers to import substitution and relocation:
  - EBITDA margins could decline by 0.5% point to 19% point depending on carbon prices and auctioning percentages.
  - Inland operators would be significantly less impacted than coastal operators:
    - At high carbon prices and full auctioning, the EBITDA margin of inland operators would stay close to 20%, that of coastal operators would fall to 2%.
  - High transport costs, concentrated market structure, and quality restrictions create barriers to import and relocation.

**Impact of removing Carbon Leakage exemptions**

- The impact of auctioning varies significantly between coastal and inland operators:

  **Inland operators**
  - Inland operators appear to have significantly higher margins than coastal operators.
  - The impact of auctioning on inland operators is negligible at low carbon price level (€5) even with full auctioning – less than 2% point of EBITDA.
  - The impact is significant at high carbon prices (€40) and full auctioning – a fall of 13% point in EBITDA, however, operators would retain close to 20% EBITDA margin even in this scenario.

  **Coastal operators**
  - Coastal operators face larger threat of import substitution than inland operators.
  - The impact of removing exemptions on these operators would be marginal at low carbon prices (€5).
  - At higher prices and auctioning levels, the impact on margins becomes significant, and EBITDA margins drop to 2% at €40 carbon prices and full auctioning.
Cement sector competitiveness framework highlights significant market power of cement firms

- **Very weak/ no supplier power**
  - Highly vertically integrated industry, quarrying, processing, manufacturing, sales and distribution done by single firm
  - Overall, the monopsony power of few, powerful incumbents minimises supplier power

- **Established firms, weak rivalry repeatedly found throughout the EU**
  - Collusive behaviour has been punished throughout the EU. Most recently by the UK Competition Commission in 2013.
  - Good understanding of operations between established incumbents and limited geographical scope place limits to fierce rivalry

- **Weak buyer power**
  - Cost of cement in buyer’s budget is marginal
  - Limited availability of alternative suppliers
  - Feasible to alter cement intensity in construction with some scope to change cement grades
  - Buyer power is limited by unfavorable and localised competition dynamics

- **Substantial barriers to entry**
  - Limited access to raw materials, typically controlled by incumbents
  - Transport costs limit competitive geographical market
  - European cement dominated by small number of established, incumbent firms

- **Few threat from substitutes/imports**
  - Homogeneous product with few substitutable goods, only available at project’s design stage
  - EU restrictions on quality of cement to use - incumbents typically supply all accepted grades
  - Coastal areas are more exposed to import threat

Factors strengthening EU plants’ competitiveness
Factors neutral to EU plants’ competitiveness
Factors weakening EU plants’ competitiveness
Coastal plants are significantly impacted at higher carbon prices, inland plants retain close to 20% EBITDA margins even in the strictest scenario

Impact of removing Carbon Leakage exemptions on coastal operators:

- Coastal operators’ EBITDA margin declines less than 3% point even at full auctioning if carbon prices remain at the €5 level
- In the effective ETS scenario with no compensation, coastal operators’ EBITDA margin declines dramatically from 26% to 2%

Impact of removing Carbon Leakage exemptions on inland operators:

- Impact on inland operators’ EBITDA margin is negligible at €5 carbon price level
- In the effective ETS scenario with no compensation, inland operators are significantly impacted (a fall of 13% point EBITDA) but are able to retain close to 20% margins

Scenarios:

<table>
<thead>
<tr>
<th>Carbon Price</th>
<th>Auctioning percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34%</td>
</tr>
<tr>
<td>€5/t</td>
<td>Ineffective ETS with high compensation</td>
</tr>
<tr>
<td>€20/t</td>
<td>Moderately effective ETS with high comp.</td>
</tr>
<tr>
<td>€40/t</td>
<td>Effective ETS with high comp.</td>
</tr>
</tbody>
</table>

Source: FTI Consulting analysis
The impact on cement plants is driven by **direct** carbon costs.
Scaling up to all sectors at risk of carbon leakage
All sectors: Removal of exemptions would impact the “carbon only” and the “joint criteria” groups but less so the “trade intensity” group

Carbon leakage sectors in policy discussions

- Policy discussions are dominated by a few sectors: steel, cement, chemicals, oil refining, aluminium and paper and pulp. These are not representative of the 164 sectors on the Carbon Leakage list
  - The sectors dominating the policy discussions belong to two groups on the carbon leakage list: carbon cost only and joint criteria. There are no sectors representing the 117 trade intensity sectors and the 18 ‘other’ sectors

- Albeit the second largest polluter, the cement sector is actually a very small sector in terms of turnover and employment
  - The cement sector employs around 60 thousand employees compared to the steel sector’s over 400 thousand. Turnover of the cement sector is €20 billion while that of the steel sector is €165 billion†

- Several recent studies have argued that the trade intensity criterion was set extremely conservatively and resulted in a highly inflated carbon leakage list
  - There is no detailed analysis of any of these sectors in the academic and consulting literature
  - Yet these sectors account for 64% of the turnover and 82% of the employment of the carbon leakage groups†

Impact of removing Carbon Leakage exemptions

- The impact of removing exemptions varies significantly across the 3 main carbon leakage groups:
  - **Carbon only group**
    - The carbon only group’s EBITDA margin and employment is essentially unchanged at low carbon price levels (€5) but margins decline by 18% point and employment by 8% in the most severe scenario
    - Total turnover and employment of this group is very small relative to the other groups’

  - **Joint criteria group**
    - Despite the steel sector’s sensitivity to carbon costs, the group as a whole does not seem to be impacted by carbon costs
    - This is driven by the fact that the steel sector alone emits as much carbon as the other 26 sectors in this group altogether

  - **Trade intensity group**
    - Even at conservative estimates (i.e. the group is expected to not pass on any of the carbon costs to consumers), the impact on the trade intensity group’s margin is negligible. As costs are not expected to be passed through a significant volume or employment decline for these sectors is not expected

---

†Employee and turnover figures are averages for 2003-2010
Only the carbon cost group experiences significant declines in EBITDA margin— the impact on the carbon leakage groups’ overall EBITDA margin is modest.

Source: FTI Consulting analysis
Note: Only the carbon cost, joint and trade intensity groups of the Carbon Leakage list are included in the analysis
Employment decline is negligible for the carbon leakage groups as a whole but it is up to 8% for the carbon cost group.

Trade intensity sectors are assumed to absorb the costs by in EBITDA. There is no estimated employment impact.

Source: FTI Consulting analysis
Note: Only the carbon cost, joint and trade intensity groups of the Carbon Leakage list are included in the analysis.
**Methodology and calculations**

**GDP loss**
- Typical impact of cost shock on GDP: 1ppt increase in labour social contributions decreases GDP by 0.3ppt
- This is a relatively optimistic order of magnitude since the profitability of capital is also lessened when the carbon price increases.
- We considered two scenarios: 1.) The lower case assumes that only the cost of labour is modified. 2.) The upper case assumes that both the labour cost and the remuneration of capital are modified.
- Then we calculated a 0.3-0.4% increase in costs and a corresponding upper case of -0.02% GDP loss and a lower case of -0.01% GDP loss
- We used EU GDP (of 12,899 billion) to calculate the total GDP loss.

**Employment loss**
- An increase in labour costs impacts employment through the elasticity of labour supply to the cost of labour.
- We use standard macroeconomic simulations of a rise in the cost of labour and its impact on employment in France.
- We apply a limited correction to the result obtained so that the average wage of labour flowing from these estimates corresponds to the average EU remuneration of labour.
GDP loss ranges from €2bn to €24bn and employment from 16K to 255K in the different scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>EBITDA loss</th>
<th>GDP loss</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon price: €5/t</td>
<td>€ 2,2bn</td>
<td>€1,5bn - €2,0bn</td>
<td>◦ If carbon leakage exemptions are removed the economy is expected to lose between €1,5bn - €23,6bn (0.01-0.2% of EU GDP) depending on the scenario.</td>
</tr>
<tr>
<td>Auctioning: 34%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon price: €20/t</td>
<td>€ 10,6bn</td>
<td>€7,0bn - €9,5bn</td>
<td></td>
</tr>
<tr>
<td>Auctioning: 70%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon price: €40/t</td>
<td>€ 26,3bn</td>
<td>€17,5bn - €23,6bn</td>
<td></td>
</tr>
<tr>
<td>Auctioning: 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Direct employment loss</th>
<th>Total employment loss</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon price: €5/t</td>
<td>600</td>
<td>16,000 - 22,000</td>
<td>◦ If carbon leakage exemptions are removed the economy is expected to lose between 16,000 - 255,000 employees (0.1-1.7% of Carbon Leakage sectors’ employment and 0.01-0.1% of EU employment) depending on the scenario.</td>
</tr>
<tr>
<td>Auctioning: 34%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon price: €20/t</td>
<td>26,000</td>
<td>76,000 - 103,000</td>
<td></td>
</tr>
<tr>
<td>Auctioning: 70%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon price: €40/t</td>
<td>80,000</td>
<td>189,000 - 255,000</td>
<td></td>
</tr>
<tr>
<td>Auctioning: 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The benefits of recycling carbon auction revenues
The main source of benefits from removing carbon leakage exemptions is government revenues that can be recycled into the economy.

Benefits of abolishing the Carbon Leakage sectors’ exemptions

- Government revenue
  - Auction revenue
  - State aid savings
    - Targeted economic investment
      - GDP and employment growth
If carbon leakage exemptions are abolished governments will receive revenue from auctioning permits...

Calculation of additional auction revenue if carbon leakage exemptions are removed:

\[
\text{Additional auction revenue} = \text{Number of permits freely allocated to the carbon leakage sectors} \times \% \text{ of these permits that will be auctioned} \times \text{Carbon price}
\]

Estimates of additional auction revenue range from €1 billion - €30 billion:

<table>
<thead>
<tr>
<th>EUA price (€/tonne)</th>
<th>Estimates of EUA auction revenue (€ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Auctioning percentage</td>
</tr>
<tr>
<td></td>
<td>34%</td>
</tr>
<tr>
<td>5</td>
<td>1.3</td>
</tr>
<tr>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>40</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Source: FTI Consulting analysis
... and will save state aids offered as a compensation for indirect costs

Estimates of the magnitude of the state aid differ between Member States

- The German government has set aside €350 million for 2013 (Source: BUND, 2013), and the aid intensity is expected to be approximately 70% (Oeko Institute for Applied Ecology, 2013)
- The UK government has allocated up to £113 million over the Spending Review Period (approximately £50m or €59m annually), and the aid intensity is intended to be the maximum permissible 85% (BIS, 2013)
- The Dutch government intends to provide €624m over eight years (approximately €78m annually)

Our modelling approach – 2 scenarios:

- Other Member States may also intend to provide such aid, but details have not been published
- We therefore estimate state aid savings in two scenarios:

<table>
<thead>
<tr>
<th>State aid saving scenario</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ONLY Germany, the UK and the Netherlands provide state aid</td>
<td>The total state aid is therefore €487m (sum of €350m for Germany, €59m for UK, and €78m for the Netherlands)</td>
</tr>
<tr>
<td>2</td>
<td>All Member States provide state aid</td>
<td>We assume the average EU wide aid intensity is 77.5% (i.e. the average of the UK and Germany)</td>
</tr>
</tbody>
</table>

Modelling method and assumptions:

\[
\text{Maximum state aid savings} = \text{Indirect carbon cost} \times \text{Average aid intensity of 77.5%}
\]

- Estimated benchmark electricity consumption (MWh)
- Electricity suppliers’ direct carbon cost pass-through rate (100% pass-through assumed)
- Average CO2 emissions factor (tonnes of CO2/MWh) (We assume 0.80, the average of maximum emission factors given by the EC)
- Carbon price (€/tonne of CO2)
We also estimate the fall in corporate tax revenue as a result of the carbon leakage sectors’ loss of EBITDA

- We estimate the fall in corporate tax revenue as:

\[
\text{Fall in corporate tax revenue} = \text{Fall in taxable income} \times \text{Corporate tax rate}
\]

**Fall in taxable income**
- We estimate the fall in taxable income using the fall in EBITDA modelled for the carbon leakage sectors.
- We recognise that EBITDA is not the same as taxable income – so this is a simplifying assumption.
- For example, although tax rules differ between Member States, adjustments are made to EBITDA to calculate taxable income (for example, a depreciation expense may be deducted).
- The fall in EBITDA varies from €2.2bn (when the carbon price is €5 and 34% of permits are auctioned), to €42.4bn (when the carbon price is €40 and 100% of permits are auctioned).

**Corporate tax rate**
- We use a representative corporate tax rate of 27.8%.
- Since our modelling is at the EU level (and not country by country), we use a single tax rate.
- Corporate tax rates vary within the EU, from 10% (in Bulgaria and Cyprus) to 35% (in Malta).
- We calculate a weighted average corporate tax rate of 27.8%, using the Member States’ GDP in 2012 (at market prices) as a weight.

We model this as a reduction in government spending across the economy, in proportion to the government’s existing pattern of spending.
We model three scenarios for the recycling of government revenues into the economy

Scenarios:

1. The additional revenue is spent in line with the existing pattern of government spending
   - Member States’ governments spend the majority of their budgets on public administration, defence, education, health and social work
   - In this scenario, we assume that the additional revenue is distributed similarly to other general tax revenues

2. The additional revenue is earmarked for research and development and clean technologies
   - In this scenario, we assume that the funds are designated according to the EC’s six “Priority Action Lines” for investment, based on an example of the sectors in which this investment could take place

3. The additional revenue is earmarked for the manufacturing sector
   - In this scenario, we assume that the funds are distributed back to the manufacturing industry

<table>
<thead>
<tr>
<th>Product category</th>
<th>Allocation of additional government spending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing pattern of spending</td>
</tr>
<tr>
<td>Products of agriculture, forestry and fishing</td>
<td>0%</td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>0%</td>
</tr>
<tr>
<td>Manufactured products</td>
<td>2%</td>
</tr>
<tr>
<td>Electricity, gas, steam and air conditioning</td>
<td>0%</td>
</tr>
<tr>
<td>Water supply; sewerage, waste management and remediation services</td>
<td>0%</td>
</tr>
<tr>
<td>Constructions and construction works</td>
<td>0%</td>
</tr>
<tr>
<td>Wholesale and retail trade services; repair services of motor vehicles and motorcycles</td>
<td>2%</td>
</tr>
<tr>
<td>Accommodation and food services</td>
<td>0%</td>
</tr>
<tr>
<td>Transportation and storage services</td>
<td>1%</td>
</tr>
<tr>
<td>Information and communication services</td>
<td>0%</td>
</tr>
<tr>
<td>Financial and insurance services</td>
<td>0%</td>
</tr>
<tr>
<td>Real estate services</td>
<td>0%</td>
</tr>
<tr>
<td>Professional, scientific and technical services</td>
<td>2%</td>
</tr>
<tr>
<td>Administrative and support services</td>
<td>0%</td>
</tr>
<tr>
<td>Public administration and defence services; compulsory social security services</td>
<td>38%</td>
</tr>
<tr>
<td>Education services</td>
<td>20%</td>
</tr>
<tr>
<td>Human health and social work services</td>
<td>31%</td>
</tr>
<tr>
<td>Arts, entertainment and recreation services</td>
<td>2%</td>
</tr>
<tr>
<td>Other services</td>
<td>0%</td>
</tr>
<tr>
<td>Services of households as employers; undifferentiated goods and services produced by households for own use</td>
<td>0%</td>
</tr>
<tr>
<td>Services provided by extraterritorial organisations and bodies</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Eurostat Input-Output tables (2009), FTI Consulting analysis
Multiplicative effect of targeted investments

Methodology and calculations

Relevant multipliers in the literature

- Tax expenditures in favour of R&D can also entail sizeable dynamic, leverage effects. Mulkay and Mairesse (2004) find that 1€ of tax expenditures fostering R&D increase total R&D by 3€ to 4.6€, including 2€ to 3.6€ from the private sector.
- The QUEST III model used by the European Commission (Arpaia, Roeger et al., 2007) suggests that a rise in R&D spending of 1.1% of GDP would trigger an upward effect on GDP of slightly less than 2.6%.

Total GDP and employment impact calculation

- Assuming that the elasticity of employment to GDP is 1 in the long-run – which has strong theoretical justifications, we directly derive the effect on employment using the average cost of labour in the EU27.
The impact of removing carbon leakage exemptions on economic output ranges from €3bn in an ineffective ETS scenario to €61bn in an effective ETS scenario.

<table>
<thead>
<tr>
<th>(€ billions)</th>
<th>Ineffective ETS with high compensation</th>
<th>Moderate ETS with medium compensation</th>
<th>Effective ETS with no compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon price</td>
<td>€5</td>
<td>€20</td>
<td>€40</td>
</tr>
<tr>
<td>% auctioning</td>
<td>34%</td>
<td>70%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Initial change in EU wide final demand**

| (1) Additional EUA auction revenues† | €1.3bn        | €10.3bn       | €29.5bn    |
| (2) State aid savings†              | €0.8bn        | €3.3bn        | €6.6bn     |
| (3) Reduction in corporation tax†   | -€0.6bn       | -€2.9bn       | -€7.3bn    |

Total (1 + 2 + 3) €1.5bn €10.7bn €28.8bn

**Multiplicative change in economic output and employment**

<table>
<thead>
<tr>
<th>Additional EU GDP</th>
<th>€3bn (0.02% of EU GDP)</th>
<th>€23bn (0.2% of EU GDP)</th>
<th>€61bn (0.5% of EU GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional employment††</td>
<td>33,000 – 34,000 (~0.01% of EU employment)</td>
<td>242,000 – 310,000 (~0.1% of EU employment)</td>
<td>653,000 – 790,000 (~0.4% of EU employment)</td>
</tr>
</tbody>
</table>

Source: FTI Consulting analysis
Note: †Through the use of IO tables, government spending is earmarked to R&D and clean technology. All member states are assumed to provide state aid.
††Employment impact was estimated using two methods: assuming a constant ratio of GDP/employment and back calculating the increase in labour remuneration as a result of increased GDP and the number of employees corresponding to the given remuneration.
Conclusion: comparing costs and benefits
Our findings suggest that benefits will likely outweigh the costs of abolishing the carbon leakage sectors’ exemptions.

<table>
<thead>
<tr>
<th>Costs of carbon leakage</th>
<th>Benefits of abolishing CL exemptions</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ineffective ETS, high compensation</strong></td>
<td><strong>Ineffective ETS, high compensation</strong></td>
<td><strong>Ineffective ETS, high compensation</strong></td>
</tr>
<tr>
<td>GDP loss</td>
<td>GDP loss</td>
<td>GDP gain</td>
</tr>
<tr>
<td>€1.5 - 2.0 billion</td>
<td>€16,000 - 22,000 employees</td>
<td>€3.2 billion</td>
</tr>
<tr>
<td>Employment loss</td>
<td>Employment gain</td>
<td>Employment gain</td>
</tr>
<tr>
<td>16,000 - 22,000 employees</td>
<td>33,000 – 34,000 employees</td>
<td></td>
</tr>
</tbody>
</table>

| **Moderately effective ETS, medium comp.** | **Moderately effective ETS, med comp.** | **Moderately effective ETS, med comp.** |
| GDP loss | GDP loss | GDP gain |
| €7.0 - 9.5 billion | €76,000 – 103,000 employees | €22.6 billion | 242,000 – 310,000 employees | The economy gains €23 billion in GDP (0.2% of the EU’s total GDP) compared to the carbon leakage sectors’ €7.0-9.5 billion GDP loss. |
| Employment loss | Employment gain | Employment gain |
| 76,000 – 103,000 employees | 242,000 – 310,000 employees | |

| **Effective ETS, no compensation** | **Effective ETS, no compensation** | **Effective ETS, no compensation** |
| GDP loss | GDP loss | GDP gain |
| €17.5 – 23.6 billion | €189,000 – 255,000 employees | €60.6 billion | 653,000 – 790,000 employees | The economy gains €61 billion in GDP (0.5% of the EU’s total GDP) compared to the carbon leakage sectors’ €17.5-23.6 billion GDP loss. |
| Employment loss | Employment gain | Employment gain |
| 189,000 – 255,000 employees | 653,000 – 790,000 employees | |

Source: FTI Consulting analysis
Note: Ineffective ETS assumes 34% auctioning and €5 EUA, Moderately effective ETS assumes 70% auctioning and €20 EUA and Effective ETS assumes 100% auctioning and €40 EUA. Government spending assumed to be earmarked for R&D and cleantech. All countries assumed to provide state aid at 77.5% intensity.
### Key sources

<table>
<thead>
<tr>
<th>Topic</th>
<th>Reference</th>
<th>Key contribution</th>
</tr>
</thead>
</table>
- World Energy Council (2013) Energy for Germany 2013  
- IHS. The challenge to Germany’s global competitiveness in a new energy world  
- European Commission (2013) Stronger European industry for growth and economic recovery  
- Wuppertal Institute (2013) The impact of electricity demand reduction policies on the EU-ETS: Modelling electricity and carbon prices and the effect on industrial competitiveness  
- Fortum, To combine decarbonisation and competitiveness, 2013 | - Gas and electricity prices are significantly higher in the EU than in US and Asia. Gap is expected to persist. EU is projected to lose export market share of energy-intensive products  
- EU end-user energy prices increase (due to renewables costs) despite declining wholesale prices  
- EU industry has lost competitiveness. Key problems: lack of investments, market opportunities, access to finance and skilled human capital  
- The effects of the ETS on cost and competitiveness are modest  
- Complementary policies (e.g. energy efficiency targets) reduce effectiveness of the ETS if the fixed cap is not adjusted |
| **No leakage except for a small number of sectors argument** | - Delft (2013) Carbon Leakage and the Future of the EU ETS Market  
- Ellerman, Convery, de Perthus (2010) Pricing Carbon, Ch.8 on competitiveness effects of ETS 2005-2008  
- Using updated and more realistic assumptions the vast majority of sectors should be removed from the carbon leakage list  
- Out of 159 UK manufacturing activities studied, only a few are potentially exposed to carbon leakage (notably, steel, cement and some chemicals)  
- Ex post studies find no impact of CO2 prices on trade flows of examined sectors |
- Ex-ante studies predicted significant carbon leakage at high carbon prices and without mitigation efforts |
| **Over-allocation and windfall profits in the EU ETS** | - Greenstream (2013): Oversupply and structural measures in the EU ETS.  
- Sijm, Neuhoff, Chen (2006) CO2 Cost Pass Through and Windfall Profits in the Power Sector, Climate Policy  
- Sandbag (2011). Carbon fat cats. The companies profiting from the EU Emission Trading Scheme  
- Smale et al (2006) Free allocation and carbon leakage risks for UK industry, Climate Policy | - Factors behind the oversupply of the ETS are the recession, overlapping policy instruments, international credits, influence of individual member states  
- In the early phases of the ETS electricity companies passed on the costs of free permits and generated windfall profits  
- The manufacturing sectors have been consistently over-allocated |
**Additional key sources**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Reference</th>
<th>Key contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macroeconomic shock</strong></td>
<td>Burriel, P. et al. (2010), &quot;Fiscal policy shocks in the euro area and the US: an empirical assessment&quot;. <em>Fiscal Studies</em> 31(2), 251–285.</td>
<td>An increase in net taxes (including taxes on capital) has an overall multiplier effect of -0.5 in Europe.</td>
</tr>
<tr>
<td></td>
<td>Arpaia, Roeger et al., 2007, &quot;Quantitative assessment of structural reforms: modeling the Lisbon Strategy&quot;, European Commission.</td>
<td>Suggests that a rise in R&amp;D spending of 1.1% of GDP in Europe would trigger an upward effect on GDP of slightly less than 2.6</td>
</tr>
<tr>
<td></td>
<td>Cahuc P. et A.Zylberberg (2001), <em>Le marché du travail</em>, De Boeck.</td>
<td>Finds that expenditures multipliers in France and Germany are, broadly speaking, twice as much as tax multipliers</td>
</tr>
<tr>
<td></td>
<td>Rosen H. (2001), <em>Public finances</em>, McGraw Hill.</td>
<td>Find that the multiplier for military expenditures in high tech have a 1.5 multiplier effect.</td>
</tr>
<tr>
<td></td>
<td>Klein C. and O.Simon, “Le modèle Mésange réestimé en base 2000”, G2010/3, INSEE, Paris</td>
<td>Find that 1€ of tax expenditures fostering R&amp;D increase total R&amp;D by 3€ to 4.6€, including 2€ to 3.6€ from the private sector.</td>
</tr>
</tbody>
</table>
We would like to acknowledge the advice, support and data received from:

- **Jesse Scott, Eurelectric**  
  — Providing project steering, political context, helpful resources and discussions

- **Simon Blakey, Eurogas**  
  — Providing project steering, political context, helpful resources and discussions

- **Sanjeev Kumar, Change Partnership**  
  — Providing project steering, political context, helpful resources and discussions

- **Prof. Frederic Gonand, Universite Paris Dauphine**  
  — Providing a macroeconomic robustness check and dynamisation of some computations

- **Prof. Pantelis Capros, NTUA School of Electrical and Computer Engineering**  
  — Providing data and support based on the Power Choices Reloaded study

- **Oliver Sartor, IDDRI**  
  — Providing helpful resources and feedback on the study
Key contacts

Dr Fabien Roques
Senior Vice President
CompassLexecon
Contact information
froques@compasslexecon.com
Direct: +33 153053629
Mobile: +33 788371501

Dr Meloria Meschi
Managing Director
FTI Consulting
Contact information
meloria.meschi@fticonsulting.com
Direct: +44 20 7632 5119
Mobile: +44 75 4530 1465

Dr Dora Grunwald
Director
FTI Consulting
Contact information
dora.grunwald@fticonsulting.com
Direct: +44 20 7632 5127
Mobile: +44 7912 561 093