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## Research paper

### Accounting for Carbon Emission Allowances An analysis in the EU-ETS Phase 3

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The views expressed are those of the authors alone.

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## 1. Introduction

This study is part of the answer to a call for proposals by the French accounting standard-setter (ANC) on the topic of anti-pollution mechanisms, in a context of lack of international regulation. Specifically, it aims to examine the accounting practices regarding EU greenhouse gas (GHG) emission allowances (hereafter, EUAs) of the highest carbon emitters at the European level.

The European Union Trading System (hereafter, EU ETS) was one of the main policy responses of the European Union (EU) to the Kyoto Protocol commitment in order to reduce GHG emissions. The EU ETS is a market of EUAs that was created through the European Directive 2003/87/EC. EUAs are instruments that gives their holder the right to emit GHG emissions equivalent to the global warming potential of one ton of CO<sub>2</sub>. Firms owning installations subject to the EU ETS have to deliver a number of EUAs that equals their total emissions in a year by the end of April of the next year. If they fail to do so, they will face an economic sanction while they must still surrender the EUAs. Although at the beginning most EUAs were granted for free to firms, an auctioning allocated system started to operate since 2013 as part of the Phase 3 of the EU ETS implementation.

The establishment of the EU ETS carbon market created a new commodity (EUAs) that companies must account for in their financial statements (MacKenzie, 2009). This situation led IASB to issue an interpretation, IFRIC 3, in 2004, that was grounded on existing standards at that time. However, IFRIC 3 was quickly withdrawn in 2005 due to strong criticism and the EFRAG recommendation of not endorsing it. Since this withdrawal, carbon accounting has not been the subject of any recommendation of international scope, leaving space to companies compliant to IFRS for accounting choices in their consolidated financial statements (Giordano-Spring and Rivière-Giordano, 2018). Some national accounting regulators subsequently seized on the subject and proposed local regulations, sometimes far from the logic of international accounting. The different local standards offer guidelines for companies on how they should record EUAs in their consolidated accounts. Yet, the majority of firms subject to the EU ETS are listed companies that are required to elaborate financial statements following the IFRS; thereby there are not obliged to comply with their local standards.

Given this unsettled packing of accounting treatments for EUAs in financial statements, we aim to:

- (1) Identify local accounting standards in Europe and compare them,
- (2) Identify accounting patterns followed by highest emitting firms in the EU ETS, considering the objective of the transition between Phase 2 (free allocation system) and Phase 3 (auctioning system).

In this paper, we focus on EUAs for production purpose only and let aside trading allowances. Our study compares local standards within Europe, with reference to two contrasting accounting approaches, that is to say the “gross method” and the “net method”.

Relying on this distinction, we analyzed the accounting treatment of a sample of 107 firms in 2011 (Phase 2), and 122 firms in 2016 (Phase 3), that respectively represent the 61.8% and 67.6% of the total verified emission in the EU ETS. We document that half of the companies in the sample characterize by high level of non-disclosure as they do not provide sufficient information to categorize the method used. When all the required information is provided, the net method prevails. As explained later, this method offers a limited representation of the GHG emissions made by companies. Finally, some highest emitters disclose less information in Phase 3 than in Phase 2. These empirical findings raise question concerning the role of accounting in society with regards to help fighting climate change.

The remainder of the paper is the following. After this introduction, section 2 briefly explains the background and research question. Section 3 presents the method of research. Section 4 concludes by exposing the main results of the empirical study and proposes elements for discussion, section 5 gives our conclusions.

## **2. Background and research question**

The accounting of EUAs is a consequence of the creation of the EU ETS carbon market in 2005, with a global objective to contain climate change. Following an institutional wandering (Engels, 2006), Europe has chosen to create a cap-and-trade system to constrain companies to economize carbon emissions as time goes by. Thus, the EU ETS constitutes a unique setting as a new commodity is constructed by human beings in order to give a price to externalities of their economic activity. The market is then told to be socially constructed (Callon, 2009). According to Lohman (2009), accounting fails to measure and ensure disclosure of accounting externalities. In line with those approaches, we contend that accounts ignoring or providing a limited faithful representation of carbon emissions contribute to defining a particular reality that could be detrimental to our planet. This research is then motivated by the belief that accounting has a role to play in the fight against global warming.

Currently, the EU ETS covers over 11,000 installations in 31 countries, that represent around 50% of the GHG emissions produced within the EU. To increase the burden of GHG emission on production activity, the EU planned a shift from a system with free allocating method to an auctioning system by default. Until Phase 3 started in 2013 almost all EUAs were given to installations for free. If a participant has insufficient allowances, it must either take measures to reduce its emissions or buy more EUAs to other market participants. Since 2013, auctioning is the default method of allocation, with around 50% of the EUAs being auctioned, a percentage that will increase over time. Table 1 displays the key features of the 3 phases of EU ETS.

	<b>Phase 1 (2005 – 2007)</b>	<b>Phase 2 (2007 – 2012)</b>	<b>Phase 3 (2013 – 2020)</b>
<b>Geographic scope</b>	EU 27	EU 27 + Norway, Iceland, Liechtenstein	EU 27 + Norway, Iceland, Liechtenstein, Croatia
<b>Allocating method</b>	Free	Free	Auctioning is the default method (exceptions – carbon leakage)
<b>Sectors</b>	Power stations, combustion plants, oil refineries, coke ovens, iron and steel plants, cement clinker, glass, lime, bricks, ceramics, pulp, paper and board	Same as phase 1 + aviation (2012)	Same as phase 2 + aluminum, ammonia, nitric, adipic and glyoxylic acid production, CO2 capture
<b>Cap</b>	2,058 million tCO2	1,859 million tCO2	2,084 tCO2 in 2013, decreasing 38 million tCO2 per year

Table 1. 3 Phases of EU ETS

Lovell et al. (2010, 2013) have explored how carbon markets have entered the world of financial accounting and have studied financial reporting practices of 26 companies in 2010 in a context of absence of international guidance. They document a widespread extent of non-disclosure.

Our research extends the work of Lovell et al. (2010, 2013) in three ways. Firstly, the present study considers alternative standards to account for GHG emissions at an international level (IFRIC 3 withdrawn) and at country level (Spain, Italy, France, Portugal, Poland). Secondly, the study analyses and classifies accounting practices of highest emitters in Europe before (2011) and after (2016) the shift to the auctioning system in 2013. Our aim is to examine whether the change to an auctioning system has modified the accounting patterns regarding EUAs followed by companies. Accordingly, The first year of data collection is within Phase 2 (2011), where allocation was still free. During Phase 2, Member States were given EUAs for free according to a ‘grandfathering’ method, namely based on historical GHG emissions of considered installations.

The second year of data collection is within Phase 3 (2016) where auctioning was the system by default. Free EUAs were still handed out, but they were given in accordance to a benchmarking method, that is to say based on the 10% most efficient installations within

each sector. As such, inefficient installations have to make greater effort to cover their emissions with EUAs, either by reducing emissions or by purchasing more allowances.

Phase 3 is a setting of higher financial pressure stemming from the obligation to buy EUAs in a context of scarcity. Whereas the prices of EUAs have remained low (in fact they even slightly decreased from around 7€ in 2011 to 6€ in 2016), an increasing trend is observable and renders probable a higher pressure in a short-term period (see Figure 1).



Figure 1. EUA price during the period.

(Source: <https://markets.businessinsider.com/commodities/co2-emissionsrechte%20>, 18/11/2018)

Higher pressure is supposed to stem from the shift from the free allocation to the auctioning system. Starting from 2013 (Phase 3), around 50% of the total EUAs is auctioned, a proportion that increase over time. Figure 2 shows this trend. It indicates that the number of free allocated EUAs has been reducing since 2013. This implies that companies have to buy a growing number of EUAs through the auctioning system to meet the total verified emissions.

Allowances and emissions

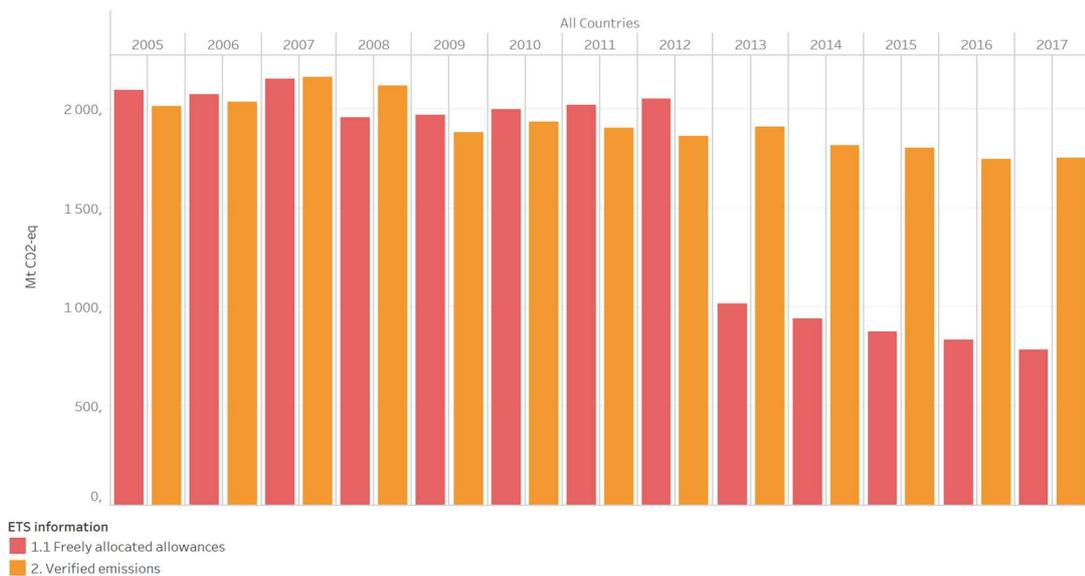


Figure 2. Freely allocated allowances/verified emissions (in Mt CO2 eq) for all countries within EU ETS (Source: <https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1> (15/112018))

The financial pressure stemming from the auctioning allocating system may have affected the way in which companies are recording EUAs in their financial statement (Lovell et al., 2013; MacKenzie, 2009). Therefore, we focus on these two dates of observation (2011 and 2016) to examine in which extent accounting patterns is impacted by the change in the EU ETS functioning.

Then thirdly, our research extends Lovell et al. (2010, 2013) that studied a sample representing 25 percent of emissions in the market, whereas we include emitters accounting for more than 60 percent of verified emissions in 2016.

In a very broad perspective, our question is “Do current accounting standards and related accounting practices by companies make carbon visible in financial statements?”

The following section explains the research method we used.

### 3. Method of research

We explain how we have analyzed and classified accounting treatments (standards and accounting practices) into alternative methods. Then, we explain sample selection and the categorization of firms based on their accounting practices.

### **3.1 Alternative accounting methods for EUAs**

Although it is a recent topic, accounting for emissions rights (EUAs in our study) has given raised to alternative approaches in the literature, namely the “gross method” and the “net method”. This section explains what characterized each accounting method, thus providing us with a benchmark to analyze the variety of local standards and accounting practices of companies in the sample.

According to the “gross method”, EUAs that are held, be they granted or purchased, are recognized as intangible asset, measured at cost or at fair value. Fair value is here market value, because emission rights “are measured at the price they could be sold in a transaction with a market participant at each reporting date” (Allini et al., 2018, p.2198). In case of allowances received for free (and recorded at market value), or for a lower price compared to their market value, the potential difference between the emissions rights value and the amount paid has to be recorded as a government grant. According to Wambsgans and Sanford (1996), aligning the recording of emission rights received for free to the purchased ones is considered more consistent because it is more representative of the economic consequences of the pollution. The pollution allowances should indeed be treated as a global asset and amortized. This way of recording was partly criticized on the fact that it contributes to assimilating emission rights as hedging instruments (MacKenzie, 2009) and that it creates greater volatility in financial statements as a consequence of the so called “measurement” and “reporting” mismatches (Bebbington & Larrinaga, 2008). Secondly, this “gross method” was supported because emission rights should not be seen as simple permits to pollute but rather as payment instruments to be used when pollution occurs (Giner, 2014). All along their activities, when firms pollute, they have to account simultaneously for expenses and for a liability that can never be compensated with assets. The liability takes into account the entire obligation settled, measured in line with the total number of emissions made. As a consequence, the emission rights become equity, as they were first recorded as an asset valued at market value, before occasioning a liability in compensation for the cost of pollution incurred. This liability must be valued at its current market value on reporting date, knowing that potential changes in value will be then recorded in the profit and loss account (Allini et al., 2018). This approach offers a reasonable representation of the actual harm to the environment produced by the company because it is not allowed to reduce the value of the GHG emissions that it made by subtracting from the liability the EUAs that it received for free. At the same time, it also translates the whole representation of pollution to the income statement by recording the expenses related to all the GHG emissions made against the liability.

In contrast to the “gross method”, the “net method” is so-called because it requests to offset assets and liabilities. Instead of being an asset in itself, the starting point of the net model is that the obligation creates the allowance and thus formerly a liability. At the same time, emission rights do not fulfill the definition of intangible assets but that of an administrative commodity, to be recorded as a production expense. Most importantly, either an inventory or a liability shall be recognized at the closing date, never both. Thus, on the one hand, an inventory is recorded if the EUAs hold by the entity exceeds GHG emissions for the period.

On the other hand, a liability must be recognized when there is a shortfall (i.e. EUAs hold do not cover GHG emissions). This method offers a limited representation of the GHG emissions of companies in the balance sheet, because it allows to reduce the impact of carbon emissions by compensating EUAs and the liability. Additionally, in contrast to the “gross method”, the “net method” considers EUAs as a commodity, and it seeks to mainly impact the income statement. Production cost shall increase as the amount of purchased EUAs becomes higher (for instance, in a setting of scarcity). Following the net model, as emission rights are not accounted for in the balance sheet, important information is missing in financial statements (Giner, 2007) and compromises “the societal cost of the environment and pollution actions to be fairly perceived by the stakeholders” (Allini et al., 2018, p.2199). According to Allini et al. 2018, this model is nevertheless mainly used by companies because they benefit from recording a lower amount of assets and liabilities and thus in overstating financial figures.

These two alternative accounting methods emerged on the sidelines of Lehman’s (1996) point of view whereby “accounting for the environment offers a one-sided and potentially disastrous environmental ethic” (p.671). It “devoid of a wider social critique, offers a potentially catastrophic appreciation of the relationships which exist between humanity and nature” (p.673). In line with the economic approach to the environment, would it be appropriated and possible to decouple economic-growth and environmental degradation, by considering that natural assets should be accorded the status of rights-bearing entities? (Lehman, 1996). However, this paper does not intend to conclude if accounting could contribute or not to an awareness of environmental matters, but to facilitate the understanding of various accounting practices. Even if the gross and net models remain questionable, they inspired different initiatives to capture the impact of companies’ carbon emissions in some countries.

These alternative approaches, net method and gross method, are used to analyze the various local standards for companies in our sample in the finding section.

### **3.2 Sample selection**

We used the following process (represented in Figure 3) to identify the highest carbon emitting corporate groups that were subject to the EU ETS. The EU ETS webpage provides a list of all the installations located in the EU that must surrender EU emission rights based on their number of GHG emissions (available at [https://ec.europa.eu/clima/policies/ets/registry\\_en#tab-0-1](https://ec.europa.eu/clima/policies/ets/registry_en#tab-0-1)). As of March 2018, this registry included 13,668 installations and provided information on the number of allocated emission rights and verified emission since 2008. Given that we wanted to study the accounting treatment of emission rights in 2016 and 2011, we only kept the 10,301 installations that were allocated emission rights and/or that had verified emissions in those years.

The register indicates the account holder (firm) that owns each installation. Therefore, we merged the installations at the account holder level. This process yielded a sample of 6,268 account holders. We selected only the 317 account holders that were considered highest

emitters because they had verified emissions of at least 1,000,000 tons of CO<sub>2</sub> in 2016. These account holders represent the 74.37% of total verified total emissions (54.55% allocated rights) in 2016, and the 69.21% of total verified total emissions (64.84% allocated rights) in 2011.

Account holders are normally owned by a parent company. We identified whether or not this was the case and, if so, the group to which they belong. Five account holders were excluded at this point because we were unable to retrieve this information. The remaining account holders were part of 166 groups. Due to merging processes and other corporate changes, there were 156 groups in 2016, and 158 groups in 2011.

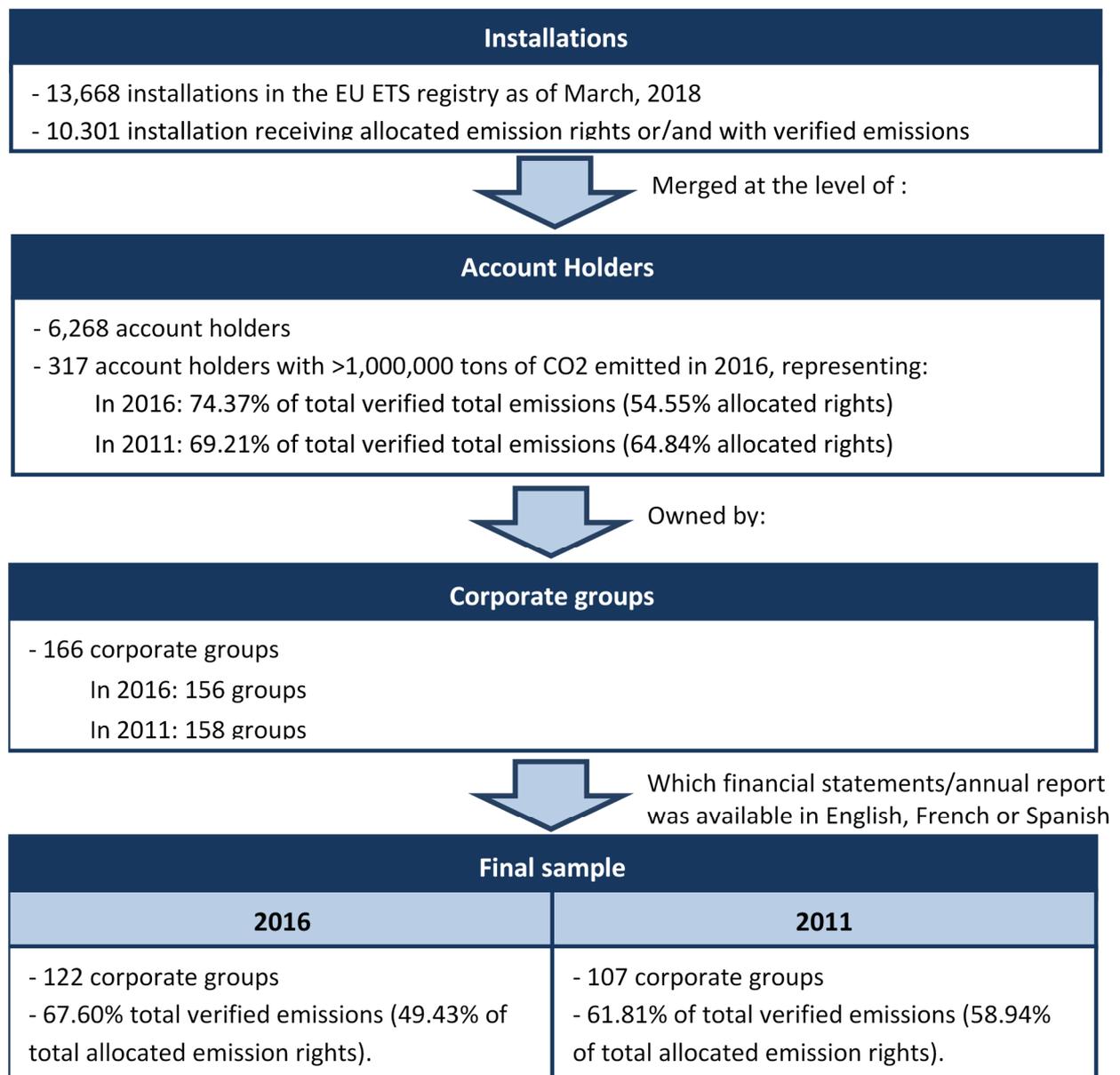


Figure 3. Sampling procedure

Once the groups were identified, we looked for their financial statements or annual reports in corporate webpages. We could not obtain the reports of 28 in 2016 and 35 groups in 2011, respectively. Additionally, we removed 6 (2016) and 7 (2011) groups because their

report was in a language different to English, Spanish or French. We also removed 9 companies in the 2011 sample because they could not be expected to provide information on the accounting treatment of EUAs given that they were not subject to the EU ETS at that time (they were incorporated to the system later between 2011 and 2016). After these adjustments, our final sample consists of 122 groups in 2016, and 107 in 2011, which respectively account for the 67.60% and 61.81% of the total verified emissions in those years (49.43% and 58.94% of the total allocated emission rights). The list of companies included in the sample for 2011 and 2016 is given in Appendix I.

### **3.3 Grid of analysis of the accounting practices**

We used the distinction between “gross method” and “net method” described in the background section to classify the existing accounting treatments. Nonetheless, some of them may not completely fit within these categories. So, we also consider an additional method, the “hybrid method”, that covers those cases in which the recording of EUAs or/and the corresponding liability do not fall in any of the previous methods.

We performed a desk-based survey of the financial statements and annual reports of the selected firms in order to determine whether or not their accounting practices align with one of the three methods considered (i.e. gross method, net method, hybrid method). Specifically, for making that classification, we identified the following aspects related to the accounting treatment of EUAs:

- Granted EUAs – Initial recognition
- Granted EUAs – Initial measurement
- Purchased EUAs – Initial recognition
- Business model
- Trading EUAs - Initial recognition
- Trading EUAs – Subsequent valuation
- Amortization
- Subsequent valuation
- Liabilities – measurement

The following table (Table 2) summarizes the key features of each method and provides examples of firms that we coded as following them. Given that our analysis revealed that most of the firms do not disclose all the information needed to classify them, we added an additional category for considering when there is no sufficient information to classify the accounting treatment of a firm.

Classification	Key features	Examples
<b>Gross Method</b>	<ul style="list-style-type: none"> <li>- Assets recognized when granted or purchased</li> <li>- Granted allowances at fair value</li> <li>- Liability for the amount of emissions</li> </ul>	<b>REPSOL (Spain)</b> <ul style="list-style-type: none"> <li>- Granted allowances (at FV – deferred income) and purchased allowances in Intangible assets</li> <li>- Liability at cost (carrying value) with balance at market value</li> </ul>
<b>Net Method</b>	<ul style="list-style-type: none"> <li>- Granted allowances initially recognized at nil value or not measured at all</li> <li>- Assets recognized only if there is a surplus to cover emissions</li> <li>- Liability only for shortfalls to cover emissions</li> </ul>	<b>EDISON SPA (Italy)</b> <ul style="list-style-type: none"> <li>- Intangible assets, only recognized if there is a surplus to cover emissions</li> <li>- Granted allowances at Nil Value</li> <li>- Raw materials and service used in the income statement</li> <li>- No obligation recognized unless there is a shortfall compared to granted allowances ( measurement is not specified)</li> </ul>
<b>Hybrid Method</b>	<ul style="list-style-type: none"> <li>- Other methods that having all information, the treatment of EUAS or/and of the liability did not fall in any of the previous methods</li> </ul>	<b>OMV (Austria)</b> <ul style="list-style-type: none"> <li>- Allowances are recognized in the income statement as a reduction in financial obligations related to CO2 emissions</li> <li>- No obligation recognized unless there is a shortfall (measurement not specified)</li> </ul>
<b>No information</b>	<ul style="list-style-type: none"> <li>- Not enough information to classify the method</li> </ul>	<b>Salzgitter AG (Austria)</b> <ul style="list-style-type: none"> <li>- Granted allowances recorded as inventory at nil value</li> <li>- Purchased allowances: Inventory</li> <li>- No information provided regarding the liability</li> </ul>

Table 2. Classification coding

#### 4. Findings and discussion

Findings are developed at two different levels.

First, we have identified few European countries that issued national standard or recommendations for the accounting treatment of EUAs. Given the lack of homogeneity of these local standards, we classified them based on the methods (gross method vs. net method) that we presented above to better consider convergences and differences among them. This analysis is presented in section 4.1. The classification of local standards is then used in section 4.2 to analyze accounting choices from highest emitters in 2011 and 2016. Accordingly, we identify trends in accounting patterns and examine to what extent firms in

our sample are compliant to their local standards. To conclude, we also discuss specific cases in local trends.

#### **4.1 Classification of local standards for EUAs according to accounting methods**

As a former accounting proposal, IFRIC 3 Emission Rights constitutes a benchmark for alternative accounting standards to be considered. At the date of first issuance (2003), the EU ETS handed out EUAs for free to all installations. Then, one important topic to deal with was how to account for free EUAs. According to IFRIC 3, EUAs were to be accounted as intangible assets and measured at fair value through deferred income when firms received them (similarly to grants). In subsequent valuations at reporting dates, changes in the value of EUAs were to be recorded in assets, against equity. As firm emitted pollutants, deferred income was debited against a revenue in the income statement. Besides, an expense was accounted against a liability at fair value at the reporting date. The liability is recognized for the entire obligation to deliver EUAs (i.e. that emissions that were made by the installation during the whole economic period). Thus, the accounting treatment proposed by IFRIC 3 is typically a “gross method”.

Then, given that IFRIC 3 was withdrawn 14 years ago, our approach has consisted in identifying local accounting standards for EUAs within the European countries to which highest emitters included in our sample belong. To the best of our knowledge, there is no common resource that details and compares accounting treatments within the EU. We have identified 5 countries that have issued local standards involving highest emitters in the sample: France, Spain, Italy, Poland and Portugal. We have analyzed the prescription of each them to classify them according to the categories describes in the method section. Then, Table 3 describes the key features of local standards and indicates the type of method that best fits each of them.

In a first step, we studied France, Italy, Poland and Spain because they are the countries of origin of the biggest emitters, which were defined according two criteria (see Table 3 below). First, each of these countries (through their emitters submitted to ETS) are responsible for more than 3% of the verified emissions not only in 2016, but also in 2011. Second, the number of these big emitters in the selected countries must be at least of four to be considered as representative of these countries' responsibility in terms of greenhouse gas emissions.

Even if Germany appears as the country of origin of the highest emitters, we were obliged to exclude this county in our sample because no compulsory local accounting standard has been issued to date. Indeed, the IDW RS HFA 15 can not be considered as a local accounting standard because it was issued by the auditors committee, that is to say the Institut der Wirtschaftsprüfer (IDW) and not by the Deutsches Rechnungslegungs Standards Committee (DRSC), which is the accounting standard committee in Germany.

In a second step, we considered the case of Portugal, Austria and Greece, which also gather more than 4 high emitters, even if they represent less than 3% of the verified emissions in 2016 and in 2011. We nevertheless decided to exclude Austria and Greece

because of the absence of a local standard of accounting for carbon promulgated by the local accounting standard setter. For example, even if an Austrian standard exists<sup>1</sup>, it was proposed by the Austrian Financial Reporting and Auditing Committee (AFRAC), which is different from the Austrian accounting regulation body, that is to say the [Institut Osterreichischer Wirtschaftsprufer](#). At last, USA were also excluded because they do not belong to the European Union and are thus not submitted to the EU ETS.

Country	% Verified emissions 2016	% Verified emissions 2011	Number of big emitters in 2016 and 2011
Austria	1,46%	0,80%	6
Belgium	0,13%	0,09%	1
Croatia	0,35%	0,00%	1
Cyprus	0,28%	0,24%	1
Czech Republic	2,66%	2,24%	3
Denmark	0,48%	0,67%	3
Estonia	0,63%	0,65%	1
Finland	0,58%	0,67%	3
France	5,74%	7,09%	7
Germany	16,99%	15,32%	15
Greece	2,31%	2,79%	5
Hungary	0,28%	0,16%	2
India	1,26%	1,19%	2
Ireland	1,31%	0,53%	2
Italy	4,99%	5,35%	8
Jersey	0,07%	0,06%	1
Lithuania	0,15%	0,01%	1
Luxembourg	2,91%	2,53%	1
Mexico	0,33%	0,32%	1
Norway	1,18%	0,64%	3
Poland	6,93%	5,55%	9
Portugal	1,30%	1,05%	4
Romania	0,06%	0,04%	1
Rusia	0,45%	0,12%	2
Saudi Arabia	0,07%	0,07%	1
Slovenia	0,25%	0,87%	1
Spain	3,97%	4,16%	7
Sweden	3,43%	2,38%	4
Switzerland	1,34%	0,52%	3
The Netherlands	0,31%	0,23%	2
UK	2,76%	3,67%	3
USA	1,97%	1,66%	6

Table3: Justification of the countries analyzed

<sup>1</sup> Austrian standard Stellungnahme 1 CO2-Emissionszertificate UGB (AFRAC, 2006, 2015)

We have analyzed the prescription of each to classify them according to the categories describes in the method section. Then, Table 4 describes the key features of local standards and indicates the type of method that best fits each of them.

For example, the Spanish standard requires companies to account for granted EUAs at fair value and to record the liability at cost with balance at fair value. Then, according to Allini et al (2018, p. 2199) “The Spanish standard imposes a gross approach that is relatively consistent with IFRIC 3, although it introduces some changes to avoid volatility (Giner, 2014)”.

In contrast to this, the French accounting standard imposes not to account for granted EUAs and imposes offsetting between asset and liability related to emissions and allowances. Thus, a liability is recorded only when the company faces a shortfall of allowances at the reporting date. Accordingly, we classify the French standard as a “net method”. Similarly to the French standard, the Italian local standard, OIC8, has adopted an accounting treatment that is consistent with a net method approach.

Country	Reference	Year of issuance	Method	Classification of asset	Recognition of asset (and measurement)/ income	Recognition of liability (and measurement)
<b>IASB</b>	IFRIC 3	2004	<b>Gross</b>	Intangible	When granted (fair value) or acquired (at cost)	When entity emits pollutant (against expenses), at fair value at the reporting date
<b>Spain</b>	Real Decreto 602/2016	2016	<b>Gross</b>	Inventory	When granted (fair value) or acquired (at cost)	When entity emits pollutant (against expenses), at cost with balance at fair value
<b>France</b>	ANC N°2012-03	2012	<b>Net</b>	Inventory	Production expense in the income statement; inventory if allowances exceed emissions, at reporting date	If shortfall, at the best estimate of the outflow of resources
<b>Italy</b>	OIC 8	2013	<b>Net</b>	NA	Allowances expenses in income statement	If shortfall

Country	Reference	Year of issuance	Method	Classification of asset	Recognition of asset (and measurement)/ income	Recognition of liability (and measurement)
<b>Portugal</b>	FRAS n° 26	2010	<b>Hybrid</b>	Intangibles	Granted allowances at fair value, emissions as an expense (at cost)	If shortfall
<b>Poland</b>	Article 28§2 Accounting Law	2015	<b>Hybrid</b>	Intangibles	When granted or acquired (at cost)/ amortization is a production expense	If shortfall, at market value at the closing date.

Table 4. Classification of Local standards for carbon allowances

We then use this classification to analyze accounting practices within our sample in the next section.

#### 4.2 Result: Patterns of accounting practices from highest emitters

##### i) For the overall sample

Disclosures collected at the company-level have been coded according to the grid of analysis presented below, mainly based upon the frame “gross” or “net” method. As explained, when the way in which a firm records EUAs or/and in which it records the corresponding liability does not fall in any of the previous methods, we classify the accounting practice as a “hybrid” method. The summary of the classification for all companies of our sample in 2011 and 2016 is given in Table 5. For comparison purposes we added the column “2016 both”, which considers only the companies that were subject to the EU ETS in both years, 2016 and 2011, because there were some companies that are covered in 2016, but that were not operating within the EU ETS in 2011. The differences between the “2016” and “2016 both” columns indicate the change in accounting practices driven by new enters to the system.

Method	2016		2016 both		2011	
<b>Gross method</b>	7	5.74%	7	6.19%	9	8.41%
<b>Net method</b>	45	36.89%	41	36.28%	43	40.19%
<b>Hybrid method</b>	2	1.64%	2	1.77%	3	2.80%
<b>No accounting method</b>	68	55.74%	63	55.75%	52	48.60%
	<b>122</b>	<b>100.00%</b>	<b>113</b>	<b>100.00%</b>	<b>107</b>	<b>100.00%</b>

Table 5. Method used by companies

The main findings showed in Table 4 are the following:

Firstly, around half of the highest emitters participating to EU ETS does not disclose sufficient information related to EUAs accounting. Indeed, more than half of companies does not appear to comply with any of the accounting method related to the identified local standards in 2016. This proportion is even increased between 2011 and 2016.

Secondly, among companies disclosing sufficient information to be classified according to an accounting method, a majority seems to comply with the net method. This proportion slightly decreases between 2011 and 2016, while there is an increase in the proportion of companies in the “No accounting method” category.

Thirdly, the transition to Phase 3 with auctioning system by default does not come along with a shift in accounting patterns in the sample. Before and after the auctioning system, EUAs accounting mainly impacts the income statements of emitters, whereas less and less the balance sheet. This trend is consistent with the prevalence of the use of net method in the sample.

In additional analysis (not reported here) we examined if accounting choices varies depending on the name of the auditor. This analysis was not conclusive.

#### **ii) At the level of countries with local standards**

We built a subsample considering those highest emitters which country of origin have issued local standards. In Table 6, we examine the proportion of firms that comply with their local standards concerning the specific topic of allowances in consolidated accounts, whereas they have to comply with IFRS with no specific guidance on the topic. We have identified that, in 2011, 96 companies used IFRS to produce their financial statements, and 16 of this firms have done so in combination with local standards. Regarding 2016, 105 firms followed IFRS, 25 of which used them jointly with local standards.

Additionally, Table 6 offers the percentage of firms that followed a different method to the one suggested by their local standard. The difference between the sum of the percentages of firms following and not following the local standard up to 100% represents the percentage of firms that did not offer enough information to make the classification of their accounting practices. We cannot evaluate whether or not firms that did not provide enough information were complying with their local standard or not are doing it.

Country	Method	Year issuance of the standard	2016			2011		
			# firms	% firms local standard	% firms method different to local standard	# firms	% firms local standard	% firms method different to local standard
Poland	Hybrid	2015	9	0.00%	88.89%	7	0.00%	57.14%
France	Net	2012	8	87.50%	0.00%	8	87.50%	0.00%
Italy	Net	2013	8	37.50%	12.50%	10	30.00%	0.00%
Spain	Gross	2016	7	14.29%	14.29%	8	37.50%	12.50%
Portugal	Hybrid	2010	4	0.00%	0.00%	3	0.00%	0.00%

Table 6. Compliance to local standards

In relation to prior tables, firms belonging to countries prescribing a net method (i.e. France and Italy) appear to be the most compliant. In that vein, it is interesting to observe that even though Spain impose a gross method, Spanish companies do not disclose compliance information related to this requirement, unless based on those of which we have information to make the analysis.

Another main finding of the empirical study is that, except from French ones, the majority of highest emitters do not follow an accounting treatment compliant with any presumably relevant standard, neither IFRIC 3 nor their local standard.

### iii) The case of Germany

The case of Germany raises some questions (Table 7). To date the Accounting Standards Committee of Germany (DRSC) has not issued any authoritative standard related to EUAs. Besides, as seen in Table 3, although German companies represent the most significant polluters within the sample (and within the EU ETS), they provide very poor information about EUA accounting treatment, far behind other countries.

	Germany		France	
	2016	2011	2016	2011
N° Firms	17	13	8	8
% Allocated allowances respect total EU ETS	7.62%	12.02%	2.65%	7.09%
% Allocated allowances respect total sample	15.42%	20.40%	5.36%	12.03%
% Verified emissions respect total EU ETS	16.99%	15.32%	5.74%	7.09%
% Verified emissions respect total sample	25.14%	24.79%	8.50%	11.47%
Allocated allowances/verified emissions	0.21	0.82	0.22	1.05

	Germany		France	
	2016	2011	2016	2011
Granted allowances - initial recognition				
Intangible assets	41.18%	30.77%	25.00%	12.50%
Inventory	5.88%	23.08%	62.50%	37.50%
OAT	5.88%	7.69%	0.00%	37.50%
Off-balance item	0.00%	0.00%	0.00%	0.00%
No disclosure	47.06%	38.46%	12.50%	12.50%
Granted allowances - Measurement in initial recognition				
Nil value/cost	35.29%	46.15%	87.50%	62.50%
Fair value	0.00%	7.69%	0.00%	0.00%
OAT	0.00%	7.69%	0.00%	0.00%
No disclosure	64.71%	38.46%	12.50%	37.50%
Purchased allowances - initial recognition				
Intangible assets	41.18%	30.77%	25.00%	37.50%
Inventory	5.88%	23.08%	62.50%	37.50%
OAT	5.88%	7.69%	0.00%	0.00%
No disclosure	47.06%	38.46%	12.50%	25.00%
Liabilities - Measurement				
Entire obligation at fair value	0.00%	0.00%	0.00%	0.00%
Entire obligation, measurement no specified	0.00%	0.00%	0.00%	0.00%
Cost with balance at (forward contract and) fair value	41.18%	38.46%	12.50%	12.50%

	Germany		France	
	2016	2011	2016	2011
No obligation recognised unless there is a shortfall, measured at fair value	0.00%	0.00%	12.50%	12.50%
No obligation recognised unless there is a shortfall, measured at cost of already held with balance at fair value	5.88%	7.69%	25.00%	12.50%
No obligation recognised unless there is a shortfall, measurement not specified	0.00%	7.69%	12.50%	37.50%
OAT	0.00%	0.00%	12.50%	0.00%
No disclosure	52.94%	46.15%	25.00%	25.00%

	At least 50% of firms apply the same treatment
	Highest applied treatment (but <50% firms)
	No disclosure is the highest option

Table 7. Comparison of accounting practices between Germany and France

## 5. Conclusions

This study explores how the highest emitters account for the carbon emission allowances. Their accounting treatments are analyzed in line with the requirements of five local accounting standards within Europe, which make reference to two contrasting accounting approaches, called the “gross method” and the “net method”. This research is based on the implicit assumption that the opening of this EUAs market would be accompanied by a generalization of the acquisition of quotas, which should induce a certain homogenization of accounting practices. In line with our main findings, the following concluding comments might be addressed and raise question on the role of the accounting in the fight against the global warming.

Firstly, firms (managers) do not seem to experiment sufficient pressures to be compliant with an accounting method, that would have presumably provided readability to users. Companies do not widely provide effort to signal which kind of accounting method they follow to financial statements users. This widespread silence on accounting method is likely to render carbon invisible in financial accounts.

Secondly, we document no significant shift in accounting patterns along with the transition to Phase 3, in contrast to what was expected. As our empirical findings show, accounting treatments are similarly distributed before (2011) and after (2016) the entrance of the auctioning allocation systems. It seems that the auctioning system is not increasing the financial pressure on firms to date. This could be explained, partly, by the fact that

companies could buy EUAs from other firms in the market at a low price. During the period analyzed the traded price was lower than 8 €/CO<sub>2</sub>t.

Thirdly, even though the net method is not disseminated by local standards of other European countries (except for France and Italy), we document that it is highly considered by highest emitters in our sample. Thus, adoption of an accounting method for GHG emissions is not apparently country -driven. The idea that the net method leads to the recording of smaller liabilities than the gross method (a kind of “in substance defeasance” for environmental liability) needs to be discussed. In Table 8, we reported the materiality of EUAs in the financial statements for which we have enough data to calculate it. The findings show that even if the firms were following a net method, the materiality could even be high. This increase in materiality depends on the percentage of EUAs that they have to buy. Therefore, reducing the free allocation of allowances may not have a direct effect on changing accounting treatments, but it could increase the importance of EUAs within financial statements.

	<b>Materiality</b>					
	<b>Data availability</b>		<b>Mean</b>		<b>Max -</b>	<b>Min</b>
	<b>2016</b>	<b>2011</b>	<b>2016</b>	<b>2011</b>	<b>2016</b>	<b>2011</b>
Allowances/Assets	43	38	0,77%	0,92%	0,00% - 8,07%	0,00% - 5,73%
Provision/liabilities	33	34	1,38%	2,50%	0,04% - 9,65%	0,00% - 17,85%
Income statement item/Operating profit	31	25	13,23%	10,16%	1,21% - 47,65%	0,00% - 28,08%

Table 8. Materiality analysis

Finally, a brief comparison between the German sub-sample and the French sub-sample shows that the members of the EU ETS market deliver very heterogeneous information to users, whereas all of those companies have to comply the same European Directive 2014/95/UE. The interplay between financial statement and non-financial reporting has to be further explored in the perspective of global climate warming.

There are several limitations to this research and thus further research questions have to be addressed such as: what is the relevance of these accounting approaches for stakeholders? In other words, which kind of accounting could urge emitters to economize carbon in their business? In that perspective, the question encompasses how carbon accounting contributes to the definition of the public interest.

## References

- Allini, A., Giner, B., & Caldarelli, A. (2018). Opening the black box of accounting for greenhouse gas emissions: The different views of institutional bodies and firms. *Journal of Cleaner Production*, 172, 2195-2205. <https://doi.org/10.1016/j.jclepro.2017.11.194>.
- Bebbington, J., & Larrinaga-Gonzalez, C. (2008). Carbon trading: accounting and reporting issues. *European Accounting Review*, 17(4), 697-717. <https://doi.org/10.1080/09638180802489162>.
- Callon, M. (2009). Civilizing Markets: Carbon Trading between in Vitro and in Vivo Experiments. *Accounting, Organizations and Society*, 34(3-4), 535-48. <https://doi.org/10.1016/j.aos.2008.04.003>.
- Engels, A. (2006). Market creation and transnational rule-making: The case of CO2 emissions trading. In Djelic ML & Sahlin-Andersson (Eds) *Transnational Governance*, 329-348. Cambridge.
- Giner B. (2007). La contabilización de los derechos de emisión: una perspectiva internacional. *Revista Española de Financiación y Contabilidad*. 36(133): 175-193.
- Giner, B. (2014). Accounting for Emission Trading Schemes: A Still Open Debate. *Social and Environmental Accountability Journal*, 34(1), 45-51. doi:10.1080/0969160X.2014.885670.
- Giordano-Spring S. et Rivière-Giordano G. (2018), « La comptabilité carbone : entre innovation et difficulté de normalisation », in Giordano-Spring S. et Naro G., *Reporting, Innovations et Société*, EMS Management & Société, 85-102.
- Lehman G. (1996). Environmental accounting: pollution permits or selling the environment. *Critical Perspectives in Accounting*. 7(6), 667-676.
- Lohmann, L. (2009). Toward a Different Debate in Environmental Accounting: The Cases of Carbon and Cost–Benefit. *Accounting, Organizations and Society*, 34(3-4), 499-534. <https://doi.org/10.1016/j.aos.2008.03.002>.
- Lovell, H., Sales de Aguiar, T., Bebbington, J., & Larrinaga, C. (2010). *Accounting for carbon*. The Association of Chartered Certified Accountants and the International Emissions Trading Association, London.
- Lovell, H., Bebbington, J., Larrinaga, C., & de Aguiar, T. R. S. (2013). Putting carbon markets into practice: a case study of financial accounting in Europe. *Environment and Planning C: Government and Policy*, 31(4), 741-757. <https://doi.org/10.1068/c1275>.
- MacKenzie, D. (2009). Making things the same: Gases, emission rights and the politics of carbon markets. *Accounting, Organizations and Society*, 34(3-4), 440-455. <https://doi.org/10.1016/j.aos.2008.02.004>
- Wambsganss JR, Sanford B (1996). The problem with reporting pollution allowances. *Critical perspectives in accounting*. 7, 643-652.

## Appendix I. List of firms

The following tables provide the list of companies analyzed in each year ordered by their number of verified emissions (from the highest to the lowest). They also offer information on the number of EUAs that they were allocated and the ratio of allocated EUAs respect to their total verified emissions.

<b>2011</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
<b>RWE</b>	139,742,775	88,143,561	0.63
<b>E.ON</b>	79,778,919	71,649,371	0.90
<b>PGE Polska Grupa Energetyczna S.A.</b>	59,793,135	53,056,740	0.89
<b>ΔEH</b>	46,806,180	44,973,397	0.96
<b>ENEL</b>	33,648,715	40,850,020	1.21
<b>ARCELORMITTAL</b>	47,142,143	75,265,369	1.60
<b>GDF Suez</b>	45,333,112	36,699,645	0.81
<b>EDF</b>	42,586,848	40,730,449	0.96
<b>ČEZ</b>	37,202,480	41,659,526	1.12
<b>ENDESA</b>	32,124,550	22,989,088	0.72
<b>Vattenfall AB</b>	25,941,460	22,178,255	0.85
<b>Tauron Polska Energia S.A</b>	24,440,357	23,498,743	0.96
<b>Drax Group plc</b>	21,465,607	9,501,265	0.44
<b>Eni S.p.a</b>	20,837,071	22,090,683	1.06
<b>Heidelberg Cement</b>	20,964,937	24,937,678	1.19
<b>SSE</b>	20,473,908	12,686,230	0.62
<b>TATA Steel Limited</b>	19,394,838	35,539,830	1.83
<b>Total S.A.</b>	19,218,485	23,559,791	1.23
<b>Exxon</b>	15,560,631	15,731,943	1.01
<b>Iberdrola S.A</b>	16,637,763	15,198,499	0.91
<b>EDP-Energías de Portugal S.A.</b>	14,613,901	13,277,805	0.91

<b>2011</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
<b>Lafarge</b>	14,268,634	24,772,736	1.74
<b>SHELL</b>	13,684,047	15,911,230	1.16
<b>Gas Natural</b>	13,134,095	10,527,597	0.80
<b>BP plc</b>	12,763,400	13,370,402	1.05
<b>EESTI</b>	12,132,138	11,343,240	0.93
<b>Statoil ASA</b>	10,868,992	2,082,336	0.19
<b>Enea Group</b>	10,784,116	10,332,372	0.96
<b>PKN Orlen, S.A.</b>	10,219,707	12,386,230	1.21
<b>Dong</b>	9,352,138	9,457,752	1.01
<b>EnBW</b>	9,256,600	8,605,981	0.93
<b>A2A</b>	9,014,303	12,095,301	1.34
<b>Repsol</b>	8,900,736	11,736,732	1.32
<b>U. S. Steel Košice, s.r.o.</b>	8,493,163	10,793,886	1.27
<b>Salzgitter AG</b>	7,849,176	9,485,511	1.21
<b>Holcim</b>	7,841,601	11,511,850	1.47
<b>Edison Spa</b>	6,909,510	8,960,857	1.30
<b>ESB</b>	6,762,453	7,870,540	1.16
<b>Buzzi Unicem S.p.A.</b>	6,882,262	8,033,162	1.17
<b>Veolia</b>	6,131,237	7,315,674	1.19
<b>Cemex</b>	5,974,465	9,953,677	1.67
<b>Sara Spa</b>	5,872,638	2,604,100	0.44
<b>SSAB</b>	5,771,647	7,445,218	1.29
<b>Conoco Phillips</b>	5,212,911	5,795,963	1.11
<b>Voestalpine AG</b>	5,210,499	6,513,792	1.25
<b>Fortum Oyj</b>	5,173,305	3,720,710	0.72
<b>OMV</b>			1.47

<b>2011</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
	5,112,357	7,538,791	
<b>HSE-Holding Slovenske Elektrane</b>	4,676,085	4,300,824	0.92
<b>Italcementi</b>	6,385,278	9,138,577	1.43
<b>Dillinger Group</b>	4,529,235	7,238,004	1.60
<b>Dow Chemical</b>	4,516,182	5,058,331	1.12
<b>Electricity Authority of Cyprus</b>	4,513,940	5,484,738	1.22
<b>Trinecke Zelezamy a.s.</b>	4,434,494	4,756,952	1.07
<b>BASF</b>	4,302,698	4,992,406	1.16
<b>ERG S.p.A.</b>	6,595,115	4,694,209	0.71
<b>EWE</b>	5,479,149	2,283,085	0.42
<b>Ruuki</b>	4,048,866	4,694,456	1.16
<b>Lyondelbasel N.V.</b>	3,932,428	4,613,299	1.17
<b>Ineos</b>	3,836,362	4,097,275	1.07
<b>CEPSA</b>	3,452,419	4,747,422	1.38
<b>Neste</b>	3,359,069	3,226,312	0.96
<b>AES Corporation</b>	3,194,764	3,202,258	1.00
<b>Verbund</b>	3,048,631	2,713,794	0.89
<b>MOL Group (Magyar Olaj)</b>	3,056,629	3,240,326	1.06
<b>CRH</b>	3,049,025	4,988,016	1.64
<b>Slovenské Elektrárne</b>	2,972,154	5,406,520	1.82
<b>Energa</b>	3,186,732	2,711,988	0.85
<b>NEK EAD</b>	2,829,204	2,266,770	0.80
<b>Essar Oil</b>	2,765,094	2,781,245	1.01
<b>Volkswagen</b>	2,717,458	1,905,098	0.70
<b>GALP</b>	2,612,182	3,279,823	1.26
<b>Grupa AZOTY</b>	2,512,534	2,504,136	1.00

<b>2011</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
<b>Valero</b>	2,408,734	2,103,973	0.87
<b>Cimpor</b>	2,365,507	4,053,897	1.71
<b>Cementos Portland Valderrivas, S.A.</b>	2,223,250	4,387,379	1.97
<b>Lukoil</b>	2,219,299	2,389,785	1.08
<b>Corral Petroleum Holdings AB</b>	2,208,420	2,467,428	1.12
<b>Evonik</b>	2,197,763	2,695,027	1.23
<b>Grammer</b>	2,714,519	3,666,096	1.35
<b>Iren S.p.A.</b>	2,114,548	2,351,280	1.11
<b>Bayer</b>	2,066,468	2,219,851	1.07
<b>Lotos Group S.A.</b>	2,004,734	1,889,131	0.94
<b>Motor Oil</b>	1,945,300	2,004,170	1.03
<b>Alpiq</b>	1,802,062	1,933,948	1.07
<b>Hellenic Petroleum SA</b>	1,710,678	2,176,364	1.27
<b>Aalborg Portland Holding</b>	1,683,864	2,567,177	1.52
<b>Solvay Group</b>	1,603,777	1,898,013	1.18
<b>Titan</b>	1,547,094	4,266,358	2.76
<b>Sorgenia S.p.A.</b>	1,464,713	1,230,819	0.84
<b>Maersk AS</b>	1,450,317	1,845,924	1.27
<b>EVN Group</b>	1,354,164	1,452,924	1.07
<b>VICAT</b>	2,270,498	2,802,247	1.23
<b>Air Liquide</b>	1,315,921	1,622,263	1.23
<b>SABIC</b>	1,237,302	1,566,878	1.27
<b>Kogeneracja S.A.</b>	1,233,614	1,626,966	1.32
<b>Gassco AS</b>	1,138,656	1,050,262	0.92
<b>Uniland Cementera S.A.</b>	1,068,000	2,182,751	2.04
<b>Tereos</b>			1.02

<b>2011</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
	1,061,929	1,079,427	
<b>United Company RUSAL plc</b>	1,028,687	1,146,694	1.11
<b>Rompetrol Rafinare S.A.</b>	700,255	867,150	1.24
<b>Eneco Holding N.V.</b>	422,920	-	-
<b>Borealis Group</b>	186,927	458,203	2.45
<b>Achema</b>	112,079	212,557	1.90
<b>Mytilneos Corporation</b>	87,821	96,319	1.10
<b>CF Industries</b>	87,392	479,078	5.48
<b>Agrofert</b>	65,499	16,588	0.25
<b>Grupo Villar Mir</b>	14,675	34,437	2.35

<b>2016</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
<b>RWE</b>	151,229,239	1,850,592	0.01
<b>PGE Polska Grupa Energetyczna S.A.</b>	55,936,776	873,465	0.02
<b>ARCELORMITTAL</b>	48,986,059	57,550,449	1.17
<b>Engie S.A.</b>	41,024,792	159,953	0.00
<b>UNIPER</b>	39,438,670	860,661	0.02
<b>ENEL</b>	34,247,940	-	-
<b>ČEZ</b>	32,624,185	1,036,747	0.03
<b>Vattenfall AB</b>	31,708,104	2,499,094	0.08
<b>ΔEH</b>	28,413,882	39,629	0.00
<b>ENDESA</b>	28,355,289	-	-
<b>EDF</b>	25,326,233	823,763	0.03
<b>Heidelberg Cement</b>	23,663,922	23,090,326	0.98
<b>Eni S.p.a</b>	19,918,329	7,286,261	0.37

<b>2016</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
<b>LafargeHolcim</b>	19,184,293	20,995,121	1.09
<b>TATA Steel Limited</b>	18,867,903	23,200,901	1.23
<b>Tauron Polska Energia S.A</b>	18,756,951	632,539	0.03
<b>Total S.A.</b>	17,571,002	14,131,830	0.80
<b>SHELL</b>	15,714,810	11,639,678	0.74
<b>EDP-Energías de Portugal S.A.</b>	15,291,710	-	-
<b>Exxon</b>	15,231,321	11,715,748	0.77
<b>BP plc</b>	12,705,833	9,765,906	0.77
<b>E.ON</b>	12,688,891	1,592	0.00
<b>Enea Group</b>	12,372,636	160,976	0.01
<b>Voestalpine AG</b>	11,803,863	8,590,492	0.73
<b>Repsol</b>	11,792,365	7,022,103	0.60
<b>ZEPAK</b>	11,456,099	101,259	0.01
<b>Statoil ASA</b>	11,327,315	5,715,666	0.50
<b>PKN Orlen, S.A.</b>	11,013,743	6,120,230	0.56
<b>BASF</b>	10,914,539	10,445,139	0.96
<b>Gas Natural</b>	10,867,486	-	-
<b>EESTI</b>	10,611,904	163,556	0.02
<b>SSAB</b>	9,268,279	8,738,230	0.94
<b>U. S. Steel Košice, s.r.o.</b>	8,867,366	6,075,671	0.69
<b>EnBW</b>	8,837,368	404,211	0.05
<b>Iberdrola S.A</b>	8,450,667	14,173	0.00
<b>Ryanair Holdings plc *</b>	8,438,841	4,610,591	0.55
<b>Salzgitter AG</b>	8,085,489	6,076,674	0.75
<b>EPH</b>	7,748,334	211,761	0.03
<b>ESB</b>			-

<b>2016</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
	7,330,825	-	
<b>PGNiG</b>	7,133,133	2,610,902	0.37
<b>SSE</b>	7,030,244	-	-
<b>Grupa AZOTY</b>	6,550,500	4,096,951	0.63
<b>Sara Spa</b>	6,506,939	2,464,835	0.38
<b>Edison Spa</b>	6,483,301	130,701	0.02
<b>CRH</b>	6,344,488	6,208,041	0.98
<b>Drax Group plc</b>	6,261,692	-	-
<b>OMV</b>	6,112,054	3,077,344	0.50
<b>Yara International ASA</b>	5,990,876	5,054,416	0.84
<b>Buzzi Unicem S.p.A.</b>	5,531,311	6,143,695	1.11
<b>Cemex</b>	5,516,765	6,423,571	1.16
<b>Phillips66 Ltd.</b>	5,444,067	1,990,184	0.37
<b>A2A</b>	5,425,360	3,895	0.00
<b>Dow Chemical</b>	5,336,884	4,687,882	0.88
<b>Veolia</b>	5,335,368	1,437,700	0.27
<b>EWE</b>	5,078,874	96,813	0.02
<b>Lufthansa Group *</b>	4,969,206	2,506,078	0.50
<b>Dong</b>	4,751,583	1,359,641	0.29
<b>IAG *</b>	4,673,021	1,913,992	0.41
<b>Electricity Authority of Cyprus</b>	4,649,223	821,723	0.18
<b>Trinecke Zelezamy a.s.</b>	4,355,618	3,708,463	0.85
<b>Ineos</b>	4,311,300	3,619,991	0.84
<b>HSE-Holding Slovenske Elektrane</b>	4,148,697	73,070	0.02
<b>Air France-KLM *</b>	3,968,154	2,111,825	0.53
<b>Dillinger Group</b>	3,911,756	5,896,192	1.51

<b>2016</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
<b>Lyondelbasel N.V.</b>	3,836,962	2,678,272	0.70
<b>Rosfnet</b>	3,760,795	1,890,540	0.50
<b>Lukoil</b>	3,745,250	3,106,848	0.83
<b>Hellenic Petroleum SA</b>	3,715,221	1,513,013	0.41
<b>ERG S.p.A.</b>	3,499,853	150,895	0.04
<b>GALP</b>	3,424,131	1,594,088	0.47
<b>AES Corporation</b>	3,353,404	-	-
<b>Fortum Oyj</b>	3,316,748	726,595	0.22
<b>Titan</b>	3,305,506	3,331,709	1.01
<b>CEPSA</b>	3,301,424	2,554,980	0.77
<b>Helen</b>	3,268,465	889,390	0.27
<b>HEP</b>	3,190,090	300,461	0.09
<b>Neste</b>	3,167,327	2,353,958	0.74
<b>MOL Group (Magyar Olaj)</b>	2,910,410	2,702,705	0.93
<b>Cementos Portland Valderrivas, S.A.</b>	2,829,246	3,349,588	1.18
<b>Volkswagen</b>	2,816,007	407,444	0.14
<b>SWM</b>	2,690,147	528,528	0.20
<b>Borealis Group</b>	2,565,258	2,463,607	0.96
<b>Achema</b>	2,440,359	1,978,283	0.81
<b>SAS *</b>	2,432,546	1,275,339	0.52
<b>Valero</b>	2,355,362	1,817,320	0.77
<b>Alpiq</b>	2,315,657	102,355	0.04
<b>Slovenské Elektrárne</b>	2,305,147	56,144	0.02
<b>Energa</b>	2,300,685	53,182	0.02
<b>Essar Oil</b>	2,286,012	1,703,435	0.75
<b>Iren S.p.A.</b>			0.11

<b>2016</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
	2,260,405	259,252	
<b>Motor Oil</b>	2,164,076	1,548,781	0.72
<b>Solvay Group</b>	2,149,657	2,192,374	1.02
<b>Cimpor</b>	2,112,355	3,265,923	1.55
<b>Aalborg Portland Holding</b>	2,054,900	1,966,040	0.96
<b>Wiener Stadwerke</b>	1,966,972	489,915	0.25
<b>Corral Petroleum Holdings AB</b>	1,931,626	1,986,606	1.03
<b>Lotos Group S.A.</b>	1,899,938	1,408,191	0.74
<b>Grammer</b>	1,891,257	663,591	0.35
<b>Wizz Air Holding plc</b>	1,832,991	734,441	0.40
<b>Bayer</b>	1,830,950	1,092,476	0.60
<b>Air Berlin plc *</b>	1,742,996	1,519,995	0.87
<b>Evonik</b>	1,698,072	759,882	0.45
<b>Kogeneracja S.A.</b>	1,551,437	361,074	0.23
<b>CF Industries</b>	1,469,969	1,522,753	1.04
<b>INA d.d. *</b>	1,414,668	739,913	0.52
<b>Norwegian Air Shuttle ASA *</b>	1,373,324	824,183	0.60
<b>Eneco Holding N.V.</b>	1,309,359	-	-
<b>Maersk AS</b>	1,292,944	1,329,945	1.03
<b>SABIC</b>	1,259,770	929,866	0.74
<b>Petrokemija d.d. *</b>	1,247,205	943,074	0.76
<b>United Company RUSAL plc</b>	1,235,106	778,671	0.63
<b>Air Liquide</b>	1,228,840	8,651	0.01
<b>Mytilineos Corporation</b>	1,218,625	680,065	0.56
<b>Gassco AS</b>	1,199,778	895,417	0.75
<b>Grupo Villar Mir</b>	1,180,892	964,387	0.82

<b>2016</b>			
<b>Firm</b>	<b>Verified emissions</b>	<b>Allocated EUAs</b>	<b>Alloc./Verif.</b>
<b>VICAT</b>	1,124,619	1,395,027	1.24
<b>Axpo Group</b>	1,120,756	-	-
<b>TAP</b>	1,115,287	499,254	0.45
<b>Tereos</b>	1,047,478	711,743	0.68
<b>EVN Group</b>	1,035,417	74,334	0.07
<b>Rompetrol Rafinare S.A.</b>	1,030,991	646,496	0.63
<b>Verbund</b>	1,009,625	88,374	0.09

\*Firm that was not in the 2011 sample (excluded in “2016 both” analyses)