# Matching EU ETS Accounts to Historical Parent Companies

# A Technical Note

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## Abstract

This note describes how Operator Holding Accounts (OHA) and Person Holding Accounts (PHA) from the European Union Emissions Trading System (EU ETS) were mapped to their respective parent companies. Its purpose is to provide users of our account-to-firm matching with detailed guidance on the construction and use of the dataset. Our goal is fully and systematically to link EU ETS accounts with their respective parent companies. Our work is based on information provided by Bureau van Dijk's Orbis database. We consider the full set of OHAs available in 2013. We consider the set of PHAs that performed transactions under the EU ETS during the period 2005-2007. We focus on the ownership situation during the period 2005-2007 for all accounts. We provide a combined variable capturing the parent company for the vast majority of EU ETS accounts from both the OHA and PHA groups of accounts during EU ETS Phase 1. Additionally, we provide disaggregated ownership information for each of the years 2005-2007. The information in this dataset provides users with the flexibility to easily connect to the appropriate Bureau van Dijk databases to obtain additional company data.

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## Note

This dataset is the result of a cooperation of several European institutions of higher learning and research-focused non-university entities. The project has been coordinated at the European University Institute, with collaborators based at Umeå University, University of Groningen, University of Graz, DIW Berlin, the London School of Economics and Political Science, Université Paris-Dauphine, CDC Climat and Sandbag. The project has also received crucial support by the European Commission, DG Climate Action, and by Bureau van Dijk.

## Acknowledgements

# Non-technical summary

Data regarding the EU ETS, both on compliance and trading, are administered and provided to the public by the European Union Transaction Log (EUTL) on the account level. There are two main groups of accounts of interest to researchers: Operator Holding Accounts (OHAs) and Person Holding Accounts (PHAs). Each installation regulated under the EU ETS is associated with exactly one OHA. However, the same account holder can and in many cases does control several OHAs. In turn, several operators of installations can ultimately belong to the same parent company. PHAs are voluntary accounts used for trading of permits under the EU ETS by unregulated entities. As in the case of OHAs, more than one PHA can be owned by the same account holder, and the same parent company can control several holders. Please refer to Appendix I for a list of definitions and abbreviations. Appendix II contains the list of variables constituting the dataset, as well as descriptions for each variable.

From the perspective of empirical researchers the raw data, as provided by the EUTL, are of limited use, since economic decisions are taken by firms, either at the level of the corporate parent or further down on the organizational chart, as determined by the parent. However, from the information provided by the EUTL the connection between EU ETS accounts and firms cannot be inferred directly. Some firms own a large number of installations and consequently a large number of associated OHAs, in several cases in addition to a number of PHAs, whereas other firms only consist of one installation and have no PHAs. Still other firms participate in the allowance trade purely voluntarily, only owning PHAs and no OHAs. Thus, systematically matching EU ETS accounts to firms who control them is important for making this treasure trove of data more amenable to economically meaningful empirical analysis. The goal of this exercise is to map as many individual EU ETS accounts as possible to their parent company, e.g. to their global ultimate owner (GUO) [6]. This will particularly help researchers correctly depict the behavior of the larger and more complex corporations with a number of both OHAs and PHAs, which represent a major part of the permit trade under the EU ETS.

To provide a clear picture of the ownership situation since the start of the EU ETS we focus on the ownership of accounts during the EU ETS's early years, 2005-2007. We constructed an algorithm to retrieve each account's historical GUO for the period 2005-2007. As an additional feature, we distinguish firms that are ultimately controlled by a government entity. Furthermore, we publish disaggregated information on the GUO for each account during each year of the period 2005-2007. This gives users of the dataset the flexibility to construct their own ownership variable. The ID codes provided for each account can also be used to link to Bureau van Dijk databases and retrieve additional company-level data.

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[6] Global Ultimate Owner (GUO) is the term used by Bureau van Dijk for entities ultimately controlling a company. We use the same abbreviation both in the document and in the dataset. We adopt the definition that a GUO controls at least 50.01% of all corporate levels below it. Also, the GUO itself does not have a shareholder that controls more than 50.01% of its shares. One exception is if the company is controlled by the government. In this case we define the GUO to be the penultimate level of the company's ownership structure, given that the government represents the ultimate level of ownership.

# 1 Introduction

In this part of the note we lay out in some detail how we constructed the key variable *GUO_past_BvD_ID*, the variable linking EU ETS accounts to historical parent companies.

We draw heavily on two databases. One is the EU Transaction Log (EUTL), which contains data on EU ETS accounts, transactions and compliance. The second one is Orbis, a set of company databases owned and operated by the commercial data provider Bureau van Dijk. We retrieved lists of accounts from the EUTL and used Orbis to match these accounts with historical GUOs.

We match 2013 information on account holders in the EU ETS with their associated historical GUOs for the period 2005-2007, as well as with their current GUOs[7]. Using the current GUO matching we then adapt the historical GUO variable to reflect changes in the ownership of account holders between any year of the period 2005-2007 and today. Finally, we provide a brief overview of the resulting account structure in the EU ETS, in particular showing that a significant number of GUOs can be tied to both OHAs and PHAs.

Section 2 of this note outlines the data-related preliminaries, while Section 3 contains information on the matching of current information on account holders to historical GUOs. Section 4 describes the process of mapping EU ETS accounts to current GUOs. Finally, Section 5 illustrates the linkages between GUOs and both OHAs and PHAs.

# 2 Preliminaries

## a. Retrieving data on EU ETS accounts from the EUTL

We first downloaded the full list of available OHAs for stationary installations from the EUTL database, i.e. excluding aircraft operator accounts.[8] Table 1 contains a summary of OHAs by country. We considered the full EU ETS, including accounts from non-EU countries that participate in the system.[9]

Table 1 – Overview of EU ETS OHAs by country

| Country | Frequency | Percent |
|---|---|---|
| Austria | 234 | 1.73 |
| Belgium | 369 | 2.73 |
| Bulgaria | 159 | 1.18 |
| Cyprus | 13 | 0.1 |
| Czech Republic | 436 | 3.23 |
| Denmark | 419 | 3.1 |
| Estonia | 58 | 0.43 |
| Finland | 670 | 4.96 |

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[7] The term current GUO means that information on GUOs is current as of August 2013.
[8] The precise vintage of the data is April 25, 2013.
[9] Note that the list of OHAs contains data on accounts that did not yet exist in EU ETS Phase 1, so that in some of the matched accounts will not be relevant when using currently available transaction data. However, we decided to provide the matching for the full list of OHAs.

Table 1 – cotd.

| | | |
|---|---:|---:|
| France | 1,136 | 8.41 |
| Germany | 2,213 | 16.38 |
| Great Britain | 1,176 | 8.7 |
| Greece | 170 | 1.26 |
| Hungary | 278 | 2.06 |
| Iceland | 4 | 0.03 |
| Ireland | 125 | 0.93 |
| Italy | 1,233 | 9.13 |
| Latvia | 112 | 0.83 |
| Liechtenstein | 2 | 0.01 |
| Lithuania | 115 | 0.85 |
| Luxembourg | 15 | 0.11 |
| Malta | 2 | 0.01 |
| Netherlands | 459 | 3.4 |
| Norway | 132 | 0.98 |
| Poland | 1,000 | 7.4 |
| Portugal | 286 | 2.12 |
| Romania | 281 | 2.08 |
| Slovak Republic | 204 | 1.51 |
| Slovenia | 103 | 0.76 |
| Spain | 1,255 | 9.29 |
| Sweden | 853 | 6.31 |
| Total | 13,512 | 100 |

Source: EUTL

The EUTL account structure underwent significant changes with the transition from the country-based to the Union-based registry system in 2012, which particularly impacted on PHAs. To avoid unnecessary complication at this stage of the project we used the available transaction data through December 2007 to identify the list of relevant PHAs.[10] Our list of PHAs includes accounts that transferred at least one EU Allowance (EUA) during the period February 2005 – December 2007, as indicated in the EUTL data on transactions, which in most cases were other PHAs or OHAs.[11] Table 2 provides an overview of the PHAs which were active during EU ETS Phase 1.

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[10] Since the transition in the EUTL to the Union account structure in 2012 the number of PHAs has increased dramatically. Also, the set-up of the PHA accounts has become more complicated. We held off on matching the full set of currently available PHAs, as doing so would be of little use before the relevant transaction data become available publicly. However, we decided to use the full current list of OHAs as this information is useful when working with more recent compliance data.

[11] A small number of PHAs were identified due to transfers between PHAs and government accounts. While the reasons for such transfers are not clear to us we nevertheless kept these PHAs as part of the list.

Table 2 Overview of EU ETS PHAs by country

| Country | Frequency | Percent |
|---|---|---|
| Austria | 17 | 2.34 |
| Belgium | 5 | 0.69 |
| Czech Republic | 53 | 7.31 |
| Denmark | 58 | 8 |
| Estonia | 3 | 0.41 |
| Finland | 48 | 6.62 |
| France | 120 | 16.55 |
| Germany | 122 | 16.83 |
| Great Britain | 107 | 14.76 |
| Greece | 1 | 0.14 |
| Hungary | 3 | 0.41 |
| Ireland | 4 | 0.55 |
| Italy | 27 | 3.72 |
| Latvia | 3 | 0.41 |
| Lithuania | 4 | 0.55 |
| Luxembourg | 1 | 0.14 |
| Netherlands | 48 | 6.62 |
| Poland | 29 | 4 |
| Portugal | 1 | 0.14 |
| Slovak Republic | 11 | 1.52 |
| Slovenia | 6 | 0.83 |
| Spain | 18 | 2.48 |
| Sweden | 36 | 4.97 |
| Total | 725 | 100.00 |

Source: EUTL

## b. Assigning national registration numbers and Bureau van Dijk IDs to EU ETS accounts

To conduct the account-to-firm matching a variable was desirable that could be used for identification of both EU ETS accounts from the EUTL and firm entries in Orbis. A list of accounts published by the European Commission provided official firm registration numbers of account holders for the majority of EU ETS accounts.[12]

By correcting errors in the list of registration numbers and filling in missing ones using Orbis we were able to assign registration numbers for the vast majority of OHAs.[13] We then retrieved the corresponding Bureau van Dijk (BvD) ID numbers, which are used as the main identifiers in Orbis. We were able to assign BvD ID numbers for 13,217 out of 13,512 OHAs. Of the 295 remaining OHAs some were owned by hospitals, universities or governments, some of which did not have registration numbers provided in Orbis. Others had insufficient or unclear information on account holders, so that we could not trace them in the Orbis database. In the case of PHAs we were able to retrieve BvD ID numbers for 679 out of 725 accounts. An additional difficulty when matching PHAs to GUOs was

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[12] An Excel document entitled "List of Stationary Installations in the Union Registry" is provided under the heading "Miscellaneous" at http://ec.europa.eu/clima/policies/ets/registry/documentation_en.htm.
[13] The published dataset contains the set of firm registration numbers as downloaded from Orbis.

that less identifying information is available for PHAs. In several instances a person's name was provided as the account holder, which could not be traced in Orbis. In other instances accounts were owned by private individuals, so that these accounts could also not be assigned ID numbers.

# 3 Mapping EU ETS accounts to historical parent companies

## a. Constructing the baseline version of the historical ownership variable

The assignment of historical GUOs to EU ETS accounts is complicated by the fact that in contrast to extracting information on the current GUO the Orbis database does not allow for direct extraction of historical GUO data for given account holders. We therefore devise an algorithm that constructs the historical GUO variable for the period 2005-2007 in an iterative process based on the following observations: First, for many of the firms participating in the EU ETS several levels of corporate ownership lie between the entities registered as the holders of accounts in the EU ETS and the ultimate parent company, the GUO. Second, the Orbis database does allow for the extraction of the largest shareholder of an entity with an associated current BvD ID number for a given historical year and a given minimum ownership share that the Orbis user can determine freely. In other words, if we restrict Orbis to report largest shareholders only if their share of the entity is at least 50.01% total (i.e. combined direct and indirect) ownership share we can find the controlling entity on the next-higher ownership level of the corporation. By repeating this process we can iterate through the levels of the company until we can no longer find a top shareholder satisfying the 50.01% ownership minimum. Then we have reached the level of the parent company. The process can be applied in the same manner to find past GUOs of both OHAs and PHAs. Box 1 provides an example to illustrate this process.

**Box 1: Obtaining information on historical GUOs for current EU ETS account holders**

Suppose we would like to find the December 2006 GUO for the holder of an EU ETS installation currently owned by RENAULT S.A.S., i.e. the current holder-level BvD ID number is FR780129987. While searching for shareholders we require Orbis to report owners with shares equal to or in excess of 50.01% for each corporate level, i.e. we impose the restriction that the top shareholder must be the controlling shareholder of the company level below. Then the algorithm proceeds as follows:

1. Extract the top shareholder of FR780129987 for Dec 2006 given that it must own at least 50.01 % of FR780129987. Save this shareholder's BvD ID number, suppose it is called XXX01.

2. Extract a top shareholder with a minimum of 50.01% direct or total ownership for XXX01 for Dec 2006. Save this shareholder's BvD ID number, suppose it is called XXX02.

3. Repeat the above steps until a top shareholder with a minimum of 50.01% direct or total ownership for XXX0X can no longer be found. Then XXX0X is the BvD ID number of the Dec 2006 GUO for FR780129987.

This process allows us to iterate through the various firm levels until we reach the ultimate ownership level, no matter how many levels lie between the entity registered as the holder of an EU ETS account and the GUO.

In this manner we construct GUOs for Dec 2005, Dec 2006 and Dec 2007.[14] One reason is that the focus of this exercise is to track the ultimate ownership of EU ETS accounts during the early years of the EU ETS, while another is that Orbis does not contain information on 2006 GUOs for some account holders. Using GUO information for all three years, we construct a "past GUO" variable, giving priority to observations for 2006. For observations where data for Dec 2006 are missing we consider Dec 2005 information and, finally, data for Dec 2007.[15] Table 3 provides an illustrative example. The rows of the table contain fictitious BvD IDs associated with GUOs of the account holder in question. For instance, the first row shows that the GUO of the account has changed in every year of the period 2005-2007. Since 2006 is chosen as the benchmark year we select the BvD ID for 2006 as the entry for the past GUO variable (XXX016). In the third row, only the GUO information for 2007 is available in Orbis, so that we fill in this information, while in the fourth row only 2005 and 2007 GUOs are available. Given our choices in constructing the past GUO variable, we give priority to the entry for 2005 when entering the information for the GUO variable.

**Table 3 – Constructing the historical GUO variable based on 2005-2007 GUO data – an example**

| GUO ID - Dec 2005 | GUO ID - Dec 2006 | GUO ID - Dec 2007 | Past GUO |
|---|---|---|---|
| XXX012 | XXX016 | XXX005 | XXX016 |
| n/a | XXX002 | n/a | XXX002 |
| n/a | n/a | XXX024 | XXX024 |
| XXX001 | n/a | XXX004 | XXX001 |

To understand whether there has been a change in OHA ownership since the introduction of the EU ETS and August 2013, we decided to do the following. We compare past GUOs for Dec 2005, Dec 2006 and Dec 2007 with current GUOs. If a particular historical GUO matches with its current GUO, we suppose that there has been no change in the ownership of the entity holding the account since the first phase of the EU ETS. We update the past GUO variable using this information, even if the 2006 observation contains differing information. Table 4 provides an illustrative example. Consider the first row of Table 4 to understand the change due to this replacement. Comparing the current GUO variable with the initial entry of the past GUO variable we notice that the entry for 2007 corresponds to the current GUO entry. We thus change the entry for the past GUO variable to XXX05. Adapting the past GUO variable in this way has led to changes in 684 accounts.

**Table 4 – Adapting the historical GUO variable based on current GUO information – an example**

| GUO Dec 2005 | GUO Dec 2006 | GUO Dec 2007 | Current GUO | Past GUO |
|---|---|---|---|---|
| XXX012 | XXX016 | XXX005 | XXX005 | XXX005 |
| n/a | XXX002 | n/a | XXX009 | XXX002 |
| n/a | n/a | XXX024 | n/a | XXX024 |
| XXX001 | n/a | XXX004 | XXX001 | XXX001 |

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[14] Orbis reports company data annually. We consider ownership data valid at the end of each calendar year.
[15] We choose 2006 as the benchmark year because it is the midpoint of our period of choice. However, our inclusion of informaiton for all three years provides the user with the flexibility to choose differently.

### b. Constructing the final version of historical ownership variable

For the majority of accounts we proceeded in the manner described in the above paragraph. However, a significant number of accounts ultimately belong to government-owned enterprises. In these cases the GUO noted in Orbis is the name of the government and is classified as "Public authority, State, Government". However, it is not useful to classify the various government-owned entities from the same country as one company, since doing so would assume that all installations and therefore companies ultimately controlled by the same government would be run in a centralized fashion as one corporation. Instead, we enter the ultimate corporate level, i.e. the level just beneath the GUO as indicated in Orbis in these cases. We call this the TOP-1 ownership level.[16] When the past GUO is categorized as "One or more named individuals or families", "Other unnamed shareholders, aggregated", "Public (publicly listed companies)", "Unnamed private shareholders, aggregated", or "Employees/Managers/Directors" either BvD ID numbers or GUO names or both are not provided in Orbis. In these cases we followed the approach described for government-owned companies. As shown in Tables 6 and 7 these two situations apply to a total of 2,436 OHAs and 116 PHAs. For these cases the algorithm changes as outlined in Box 2.

**Box 2: Obtaining information on historical GUOs for current EU ETS account holders when the parent company is government-controlled or belongs to GUO type with missing GUO information**

1. Extract the top shareholder of FR780129987 for Dec 2006 given that it must own at least 50.01 % of FR780129987. Save this shareholder's BvD ID number, suppose it is called XXX01.

2. Extract a top shareholder with a minimum of 50.01% direct or total ownership for XXX01 for Dec 2006. Save this shareholder's BvD ID number, suppose it is called XXX02.

3. Repeat the above steps until a top shareholder with a minimum of 50.01% direct or total ownership for can no longer be found. Suppose that XXX04 is the BvD ID number of the Dec 2006 GUO for FR780129987, but its type belongs to the group outlined in the above paragraph. We thus select the BvD ID of the penultimate level, XXX03, as the historical GUO for FR780129987.

For a number of account holders we failed to find majority shareholders in Orbis. We then checked whether Orbis listed  historical shareholders with a share of less than 50.01% in the account holder for any of the years 2005-2007. If so we entered the current account holder itself as the historical GUO, as it became clear that we were already at the GUO level, and the entity holding the account was already the GUO.[17] For cases in which Orbis contained no information on shareholders in any of

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[16] An example would be accounts belonging to *Electricité de France*, for which the GUO is indicated as *Government of France* in Orbis. We enter *Electricité de France* as the GUO for these accounts.

[17] Note that we do not have historical information on account holders for the period 2005-2007 available. Since the information on account holders is kept up-to-date by te EUTL, we have to assign current account holders to their historical parent companies.

the years 2005-2007 we entered that the historical GUO could not be identified. Overall, we identified historical GUOs for 10,031 OHAs and 494 PHAs. The data construction sources of past GUOs are summarized in Tables 6 and 7.

**Table 6 – Past GUOs of OHAs, by classification type**

| Classification type | Number of accounts |
|---|---|
| GUO constructed according to Orbis | 6,091 |
| GUO, TOP-1 ownership level according to Orbis | 2,436 |
| Holder of OHA is GUO | 1,504 |
| Information on GUO not available in Orbis | 3,068 |
| BvD IDs not traceable in Orbis | 413 |
| **TOTAL** | 13, 512 |

Source: Authors' calculations.

*Note*: A small number of manual adjustments were performed in the cases when the algorithm for the automatic past GUO construction did not converge to the GUO level.

**Table 7 – Past GUOs of PHAs, by classification type**

| Classification type | Number of accounts |
|---|---|
| GUO constructed according to Orbis | 304 |
| GUO, TOP-1 ownership level according to Orbis | 116 |
| Holder of OHA is GUO | 74 |
| Information on GUO not available in Orbis | 179 |
| BvD IDs not traceable in Orbis | 52 |
| **TOTAL** | **725** |

Source: Authors' calculations.

*Note*: A small number of manual adjustments were performed in the cases when the algorithm for the automatic past GUO construction did not converge to the GUO level.

Figure 1 summarizes the construction of the past GUO visually.

**Figure 1 – Schematic overview of the construction of Past GUO variable**
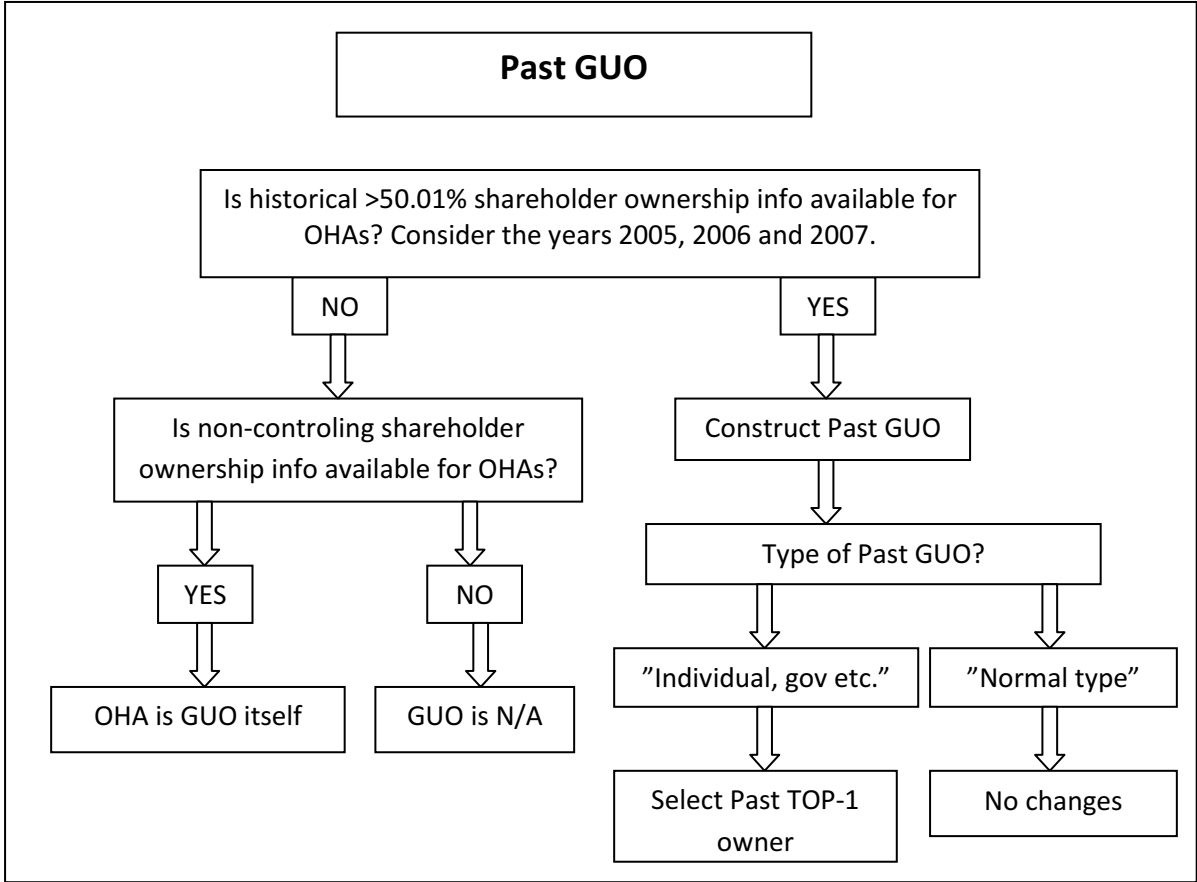


## 4 Mapping EU ETS accounts to current parent companies

### a. Extracting information on current GUOs from Orbis

Using the assigned current BvD ID numbers, we extracted information on the current GUOs for OHAs and PHAs from Orbis.[18] For the majority of accounts assigning current GUOs was straightforward. However, as outlined in the previous section, in the case of government-controlled entities it is not useful to assign the name of a government as the GUO. Analogously to the construction of the past GUO variable, for these cases we assign the penultimate ownership level indicated in Orbis, which we call the TOP-1 level.

Again, for a number of accounts information on the GUO was unavailable in Orbis. In these cases we again checked whether non-controlling shareholders could be identified. If non-controlling shareholders could be found, applying our definition of the GUO we determined that the holder of

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[18] Note that a number of OHAs for which BvD ID numbers were found could not be traced back in the Orbis database. One explanation could be that these accounts were under maintenance at the time the data were downloaded. Another reason could be that changes have been made to BvD ID numbers since when they were assigned. This applies to a relatively small number of accounts, 413 OHAs and 52 PHAs.

the account was already the GUO and entered it accordingly. In case we could not find any information on shareholders we concluded that in these cases no GUO could be identified. Tables 8 and 9 summarize the distribution of accounts according to the categories laid out above for OHAs and PHAs, respectively.

Table 8 – Current GUOs of OHAs, by classification type

| Classification type | Number of accounts |
|---|---|
| GUO constructed according to Orbis | 8, 196 |
| GUO, TOP-1 ownership level according to Orbis | 2, 417 |
| Holder of OHA is GUO | 798 |
| Information on GUO is not available in Orbis | 1,688 |
| BvD IDs not traceable in Orbis | 413 |
| **TOTAL** | **13, 512** |

Source: Authors' calculations.

Table 9 – Current GUOs of PHAs, by classification type

| Classification type | Number of accounts |
|---|---|
| GUO constructed according to Orbis | 383 |
| GUO, TOP-1 ownership level according to Orbis | 145 |
| Holder of PHA is GUO | 29 |
| Information on GUO is not available in Orbis | 116 |
| BvD IDs not traceable in Orbis | 52 |
| **TOTAL:** | **725** |

Source: Authors' calculations.

Figure 2 summarizes the construction of the Current GUO variable visually.

**Figure 2 – Schematic Overview of construction of Current GUO variable**
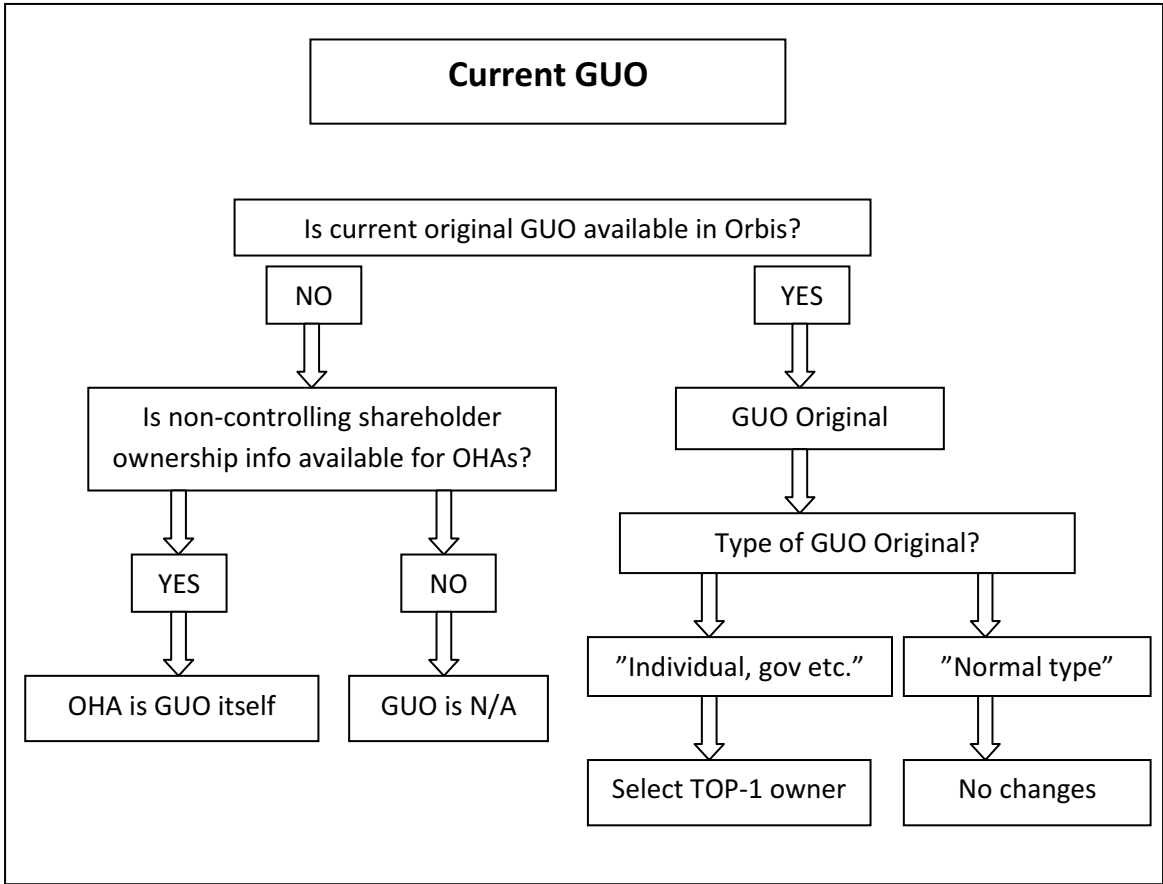


## 5   Illustration – Companies' combined ownership of OHAs and PHAs

Having assigned historical parent companies to EU ETS accounts we can evaluate the extent to which parent companies owned both OHAs and PHAs. Table 10 shows that the ultimate owners of a significant number of OHAs, more than 3,000 past GUOs, also own at least one PHA. When considering the ultimate ownership of PHAs (see Table 12) we see that about half of all PHAs were controlled by GUOs that also had at least one installation account. We therefore conclude that matching both OHAs and PHAs to their parent companies is required to obtain a complete picture of trading in the EU ETS.

**Table 10 – Extent of PHA ownership by past GUOs of OHAs**

| Categories | Number of accounts |
|---|---|
| GUOs owning both OHAs and PHAs | 3, 103 |
| GUOs owning OHAs only | 6, 928 |
| GUO information not available | 3, 481 |
| **TOTAL** | 13, 512 |

Source: Authors' calculations.

**Table 11 – Extent of OHA ownership by past GUOs of PHAs**

| Categories | Number of accounts |
|---|---|
| GUOs owning both OHAs and PHAs | 322 |
| GUOs owning PHAs only | 172 |
| GUO information not available | 231 |
| **TOTAL** | 725 |

Source: Authors' calculations.

We can see that large companies, in terms of the number of installations owned, account for a significant share of the OHA to PHA link. As Table 12 shows, the 5 largest parent companies in terms of the number of installation accounts also controlled a significant number of PHAs.

**Table 12– Top 5 companies by number of installations owned and related PHAs**

| Past GUO name | No. of ETS installations | No. of related PHAs |
|---|---|---|
| E.ON SE | 207 | 6 |
| VEOLIA ENVIRONNEMENT | 202 | 2 |
| WIENERBERGER | 173 | 1 |
| SUEZ | 137 | 4 |
| VATTENFALL AB | 113 | 9 |

Source: Authors' calculations.

# Appendix I - List of abbreviations and definitions

| | |
|---|---|
| **Amadeus** | **Amadeus** is a company-level database owned and operated by BvD. |
| **Bureau van Dijk (BvD)** | **BvD** is a commercial data provider. It owns and operates databases such as **Amadeus** and **Orbis** . |
| **European Union Allowance (EUA)** | One **EUA** entitles a holder to emit one ton of $CO_2$ or its equivalent. |
| **European Union Emission Trading System (EU ETS)** | The **EU ETS is** the EU's tradable permit system for $CO_2$ or its equivalent. |
| **European Union Transaction Log (EUTL)** | The **EUTL** administers the EU ETS and logs every transaction during which a permit traded under the EU ETS changes ownership. The **EUTL** also provides a variety of data to the public, including data on accounts, transactions and compliance. Before 2012 the **EUTL** was called **Community Independent Transaction Log (CITL)**. |
| **Global Ultimate Owner (GUO)** | The **GUO** of an entity is defined as its ultimately controlling shareholder. In Orbis and Amadeus, as well as in our case, a controlling shareholder is defined to hold at least 50.01% of total (i.e. direct and indirect) ownership. |
| **Installation** | Roughly speaking, an **installation** corresponds to a plant, either a factory or power plant. The EU ETS is administered on an **installation** level. |
| **Operator Holding Account (OHA)** | Each installation regulated under the EU ETS is owns exactly one **OHA**, which can be used for trading all permits tradable under the EU ETS. OHAs are legally required to be in compliance with the EU ETS. |
| **Orbis** | **Orbis** is a company-level database owned and operated by BvD, with wider coverage than **Amadeus**. |
| **Person Holding Account (PHA)** | For the time period relevant to this dataset, **PHAs** are voluntary trading accounts that can be used for trading EUAs under the EU ETS by both regulated and unregulated entities. With the transition to the Union Registry in 2012, the structure of **PHAs** underwent significant changes that are beyond the scope of the current project. |

## Appendix II - List of variables contained in the dataset

| Name in Database | Description | Source |
|---|---|---|
| installation_ID | Installation number | EUTL |
| permit_ID | Permit number | EUTL |
| installation_name | Installation name | EUTL |
| main_activity_code | Main activity type code of installations | EUTL |
| national_ID_OHA_PHA | National firm registration number of OHA/PHA | Orbis |
| name_OHA_PHA | OHA/PHA name | EUTL |
| country_code_OHA_PHA | Country code indicating a country in which an OHA/PHA account is located. | EUTL |
| type_of_OHA_PHA | Type of OHA/PHA holder | Orbis |
| PHA_OHA_D | A dummy variable that identifies OHA and PHA variables. It equals 1 for PHAs and 0 for OHAs. | constructed |
| GUO_2005_BVD_ID | GUO in 2005 –  BvD ID number | constructed |
| GUO_2006_BVD_ID | GUO in 2006 –  BvD ID number | constructed |
| GUO_2007_BVD_ID | GUO in 2007 –  BvD ID number | constructed |
| GUO_past_CLASSIFICATION | Classification type for past GUO construction (numbering follows order in Tables 6 and 7) | constructed |
| GUO_type_TOP_past | Type of  top+1 GUO when it is government, individual etc. owned (see Box 2) | constructed |
| GUO_past_BVD_ID | Combined past GUO variable – BvD ID number | constructed |
| GUO_past_name | Name of GUO_past_BVD_ID | Orbis |
| type_of_GUO_past | Type of past GUO (GUO_past_BVD_ID variable) | constructed |