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Back to the Future: A comprehensive analysis of carbon transactions in Phase 1 of the EU ETS

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The European Union chose a market based mechanism, the European Union Emission Trading Scheme (EU ETS), as the main economic instrument for pricing greenhouse gas emissions in the energy intensive industrial sectors. Due to a five years regulatory delay, the data relative to all trades of carbon allowances during the first trading period (2005-2007) has only been available in its entirety since January 2013. This article is the first comprehensive analysis of the CITL data relative to carbon trades in Phase 1 of the EU ETS.

This study focuses on three aspects of trading: the link between transfers of allowances and installations' compliance requirements, the intensity and frequency of trades at the account level, and the link with market exchange information (market exchanges volumes, values traded over time). We show that as expected, trades are primarily motivated by compliance obligations. Nevertheless our study reveals an extensive use of the time flexibility mechanisms (banking and borrowing of allowances) which are alternatives to trading. In particular, borrowing has been used at least by 25% of operators and involved large amounts of allowances, which has proved to be very economically efficient given the observed price over the period. The market participation has been quite high for large installations, especially in the energy sectors (power and heat, refineries), but remains low for smaller installations. Around 25% of installations did not participate to any trade. Finally, financial intermediaries and utilities trading desks seem to have been much more active than operators and have been actively intermediating trades: only 12% of the volumes traded took place directly between two operators. Nevertheless, volumes traded on market exchanges only represent a minor share of all allowance transfers. Even if all observed transfers did not have to be monetized, the value exchanged and the redistributive effects induced are important.

Whether these lessons are specific to the learning processes involved in Phase 1 or are a characteristic inherent to the system will not be known until Phase 2 transactions data is available. It is nevertheless essential to draw lessons from the past, in particular in the 2013 context of reforming the EU ETS.

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A comprehensive analysis of carbon transactions in Phase 1 of the EU ETS

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Abstract

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Outline

Introduction

The European Energy and Climate policies are implemented in a context where developed countries aim at a greenhouse gas emissions' reduction of at least 80% by 2050 compared to 1990, as advocated by the Intergovernmental Panel on Climate Change at the international level and in the European Union Roadmap 2050, European Commission (2011). Since the vote of the Climate Energy Package in 2008, European Member States are together committed to a reduction of 20% compared to 1990 by 2020. The 2030 objectives are currently being discussed.

To facilitate reaching these reduction targets, Europe decided in 2003 to create a "cap-and-trade" program covering the carbon dioxide emissions of energy intensive industries across Europe. The aim of this instrument is to generate a carbon price signal trajectory which in theory minimizes the total cost of reaching the associated reduction target in a context where the public authority has very little information on the costs involved.

Emission permits (also called allowances or quotas) - corresponding to the cap fixed by the regulator - are initially distributed among the participants to the system, and emitters included in the system eventually have to cover their verified emissions by a sufficient number of permits. Participants unable to reduce emissions can acquire permits from other sources. Inversely, emitters willing to reduce emissions can directly benefit from the carbon price by selling unused permits. Each incremental emission thus has a price fixed by the market.

Compared to taxation, the appeal of emissions trading comes primarily from its ability to achieve a pre-specified target at minimum cost even in the absence of any public authority information on the costs involved. The choice of emission trading has also been motivated by the flexibility it offers. Its potential adaptableness definitely played a major role in the acceptability and promotion of emission trading against other options.

For the covered entities, emissions market can provide three kinds of flexibilities (see Trotignon 2012). The first is trading. If a firm has high reduction costs, or is unwilling or unable to reduce emissions, it can always purchase allowances on the market, at a price which is in theory the lowest marginal abatement cost of covered entities.

The second is time flexibility, which is accounted for by the length of compliance periods as well as "banking" and "borrowing" provisions. Banking of permits occurs when regulated entities are allowed to hold unused permits for future compliance. In the EU ETS, banking is allowed between years, except in 2007 (Phase 1, which covers the 2005-2007 period, is separated from the subsequent phases). In the case of borrowing, permits from future years can be used in advance. Borrowing is also allowed between years within a phase, but not between different phases (i.e. not in 2007 and not in 2012), and it is limited to next year's free allocation amount.

The third is spatial flexibility offered by linking a cap-and-trade with an offset mechanism (emission reduction credits). The EU ETS is linked to the project based mechanisms associated to the Kyoto Protocol (CDM and JI), with qualitative and quantitative limits. Nevertheless in Phase 1 of the EU ETS, no offsets could be used and this aspect will thus be absent of our analysis.

Exchange of permits and temporal arbitrage of participants are at the core of the effectiveness of the scheme and can be analyzed *ex post*. Since the beginning of the program in 2005, the data relative to transactions between all market participants has been recorded in a central registry,

called the CITL. Though compliance data such as allocation, emissions and surrendered units is made publicly available each year, the data relative to transactions between market participants is deferred by a five years regulatory delay[1]. Since January 2013, the transaction data relative to Phase 1 of the EU ETS has been made entirely available on the CITL. This paper is the first attempt to analyze this huge amount of information.

The first section of this paper explains the structure of the transaction data, the methodology used to separate actual transfers between market operators from administrative transfers, and give the general picture of allowance transactions over the Phase. The second section focuses on the link between transfers of allowances and installations' compliance requirements, and estimates the relative use of trading compared to banking and borrowing. The third section deals more precisely with market participation, i.e. the intensity and frequency of trades at the account level. The fourth section is an attempt to reconcile market exchange data with transaction data, and to assess the value of exchanged allowances. Finally the fifth section is an example which consolidates the previous observations through an electricity producer case study.

Before the complete access to Phase 1 transaction data in January 2013, we only had an incomplete view of the EU ETS. The Compliance data sets certainly provided interesting information as static pictures, but the total access to the Transaction data allows us to access a dynamic dimension that was missing until now. In times of debate for EU ETS structural reform, it is very important to draw the most accurate lessons from the past, as they can enlighten the future or contradict some of the lessons on Phase 1 which were drawn without having access to the transaction data.

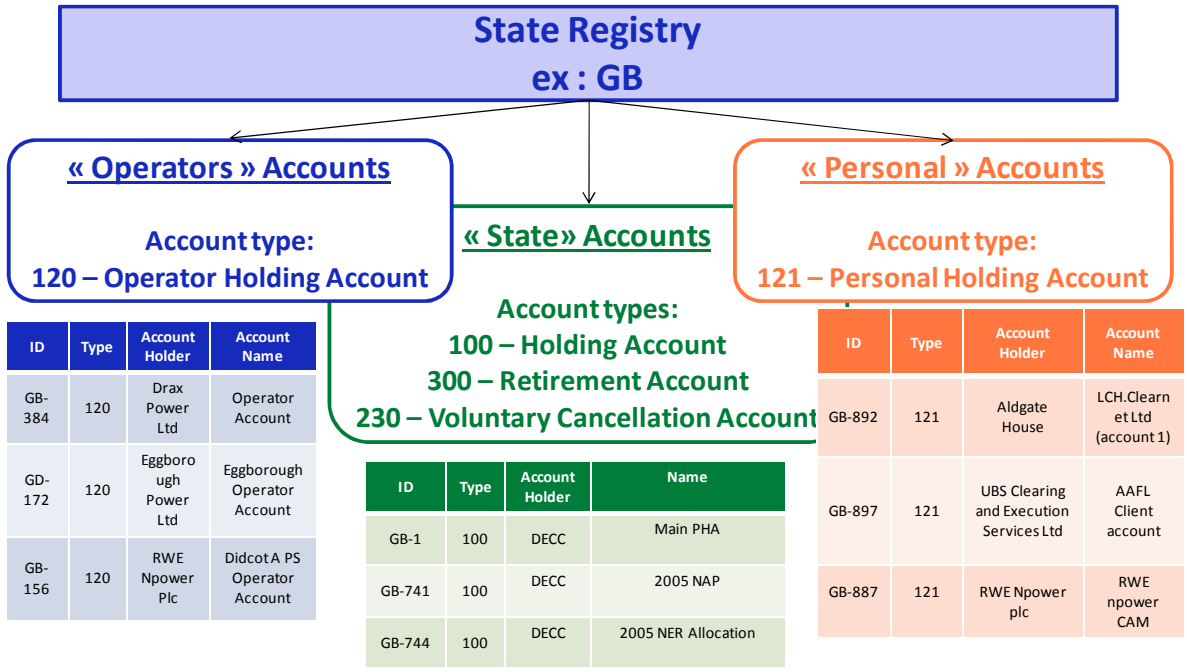
[1] See Annex XVI of European Commission (2004). This delay will be reduced to three years starting from 2014 compliance data release, as specified in Annex XIV of European Commission (2013).

1. General picture of transactions and definitions

Carbon allowances are held on computer registry accounts, like money on a bank account. There are three main categories of accounts: State accounts (used for issuing and allocating allowances etc.), Operator accounts (one account for each installation covered by the EU ETS), and Personal Accounts (accounts opened by any authorized market participant, operators trading desks or financial intermediaries for example).

In total, there are 11 950 accounts opened in the Phase 1 registries. The Operators Accounts are by far the most numerous (11 050 accounts match the covered installations). The 113 State Accounts form a small group which barely reaches 1% of the whole accounts total. The Personal Accounts have been created for trading only. They are fourteen times less numerous than the Operators Accounts (787 accounts). The Figure 1 below gives example of accounts on the British registry.

Figure 1 – The different types of account



ID	Type	Account Holder	Account Name
GB-384	120	Drax Power Ltd	Operator Account
GD-172	120	Eggborough Power Ltd	Eggborough Operator Account
GB-156	120	RWE Npower Plc	Didcot A PS Operator Account

ID	Type	Account Holder	Name
GB-1	100	DECC	Main PHA
GB-741	100	DECC	2005 NAP
GB-744	100	DECC	2005 NER Allocation

ID	Type	Account Holder	Account Name
GB-892	121	Aldgate House	LCH.Clearnet Ltd (account 1)
GB-897	121	UBS Clearing and Execution Services Ltd	AAFL Client account
GB-887	121	RWE Npower plc	RWE npower CAM

Source: Climate Economics Chair from CITL transaction data

In the EU ETS vocabulary, a transaction is the term used to describe any "physical" movement of allowances from one account to another. This is quite different than the common meaning of the word transaction. In particular in the meaning of the EU ETS, transaction do not automatically imply opposite money transfers, and do not include derivatives transactions but only movements of quotas at the moment they actually happen.

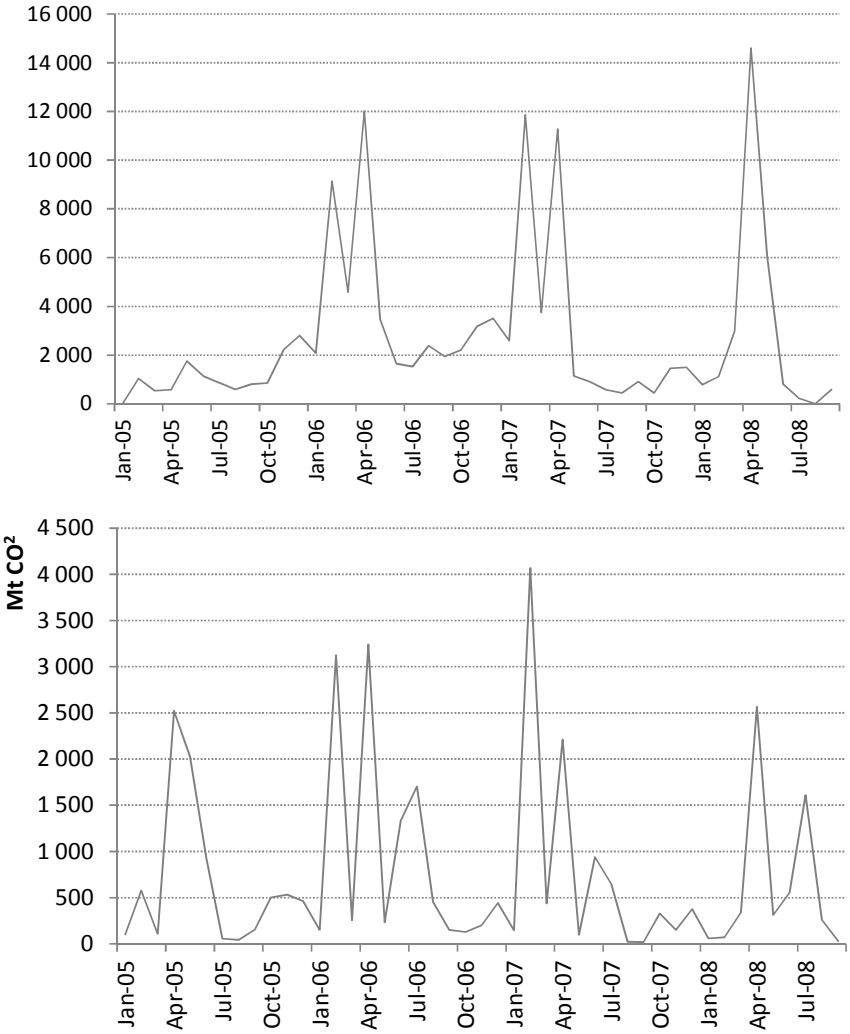
This section starts by giving the general pictures of the "raw" transaction data. We then describe the compliance process that structures the EU ETS and how this plays a strong role in explaining the variation of transactions in number and volume over time. Based on this observation, we define a set of categories for transactions corresponding to certain steps of the process (allocation, surrendering etc.) which allows us to isolate what we called Transfers, which are all

non-administrative movements of allowances between Operator and Personal accounts (i.e. real trades). We are then able to describe how each of those steps was implemented during the phase.

1.1 All transactions: The general picture

In this subsection we look indifferently at all physical movements of Phase 1 allowances between accounts from January 1st 2005 to end 2008. We have listed 124 813 transactions, representing a total volume of 35 billion tonnes. The two graphs below present the general picture of transactions by month, in number and in volume, over this period.

Figure 2 – Number and volumes of transactions by month over 2005-2008



Source: Climate Economics Chair from CITL transaction data

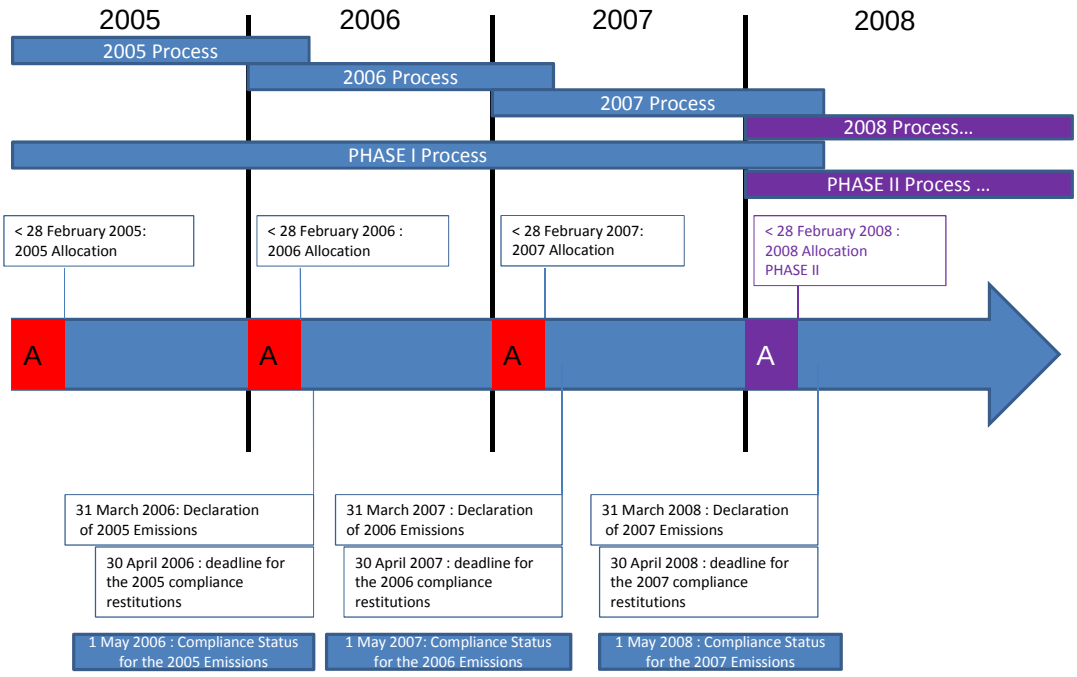
First, we can note an average number of transactions of around 2,000 per month with peaks at 12,000 or more. In terms of volume, the average volume of transactions is around 500 Mt per month with peaks at 3 billion tonnes and more. Second, the number of transactions and their volumes vary greatly over time. Although they have been at least a few transactions at any given time, there are specific sub-periods which show a much greater activity, such as in January-

February and in April-May. Obviously this picture does not only represent trades of carbon allowances between market participants, because it contains all transactions including administrative movements of allowances (issuance, allocation etc.). The next section details the compliance process which structures the EU ETS so that we can sort the different kinds of transaction into categories and explain the spikes on both of the above figures.

1.2 The compliance process and deadlines

The figure below represents the compliance process which structures the EU ETS and must be followed by all Member States and all market participants. The process is detailed in the directive for Phase 1, see European Parliament and the Council (2003). For a given year N, states must first distribute free allocations to installations' operators (allocation to utility and industrial companies covered by the directive) before the end of February of year N. Over the year N, companies emit CO_2 and must record information relative to these emissions that are verified by an independent auditor. After the end of year N, each operator must submit by the end of March of year N+1 a report on its verified emissions for year N. Following this report, each operator must surrender by the end of April N+1 as many allowances as verified emissions for year N. Finally, Member States cancel the surrendered allowances by the end of June of year N+1. The process then repeats for the following years.

Figure 3 – Phase 1 compliance process and deadlines



Source: Climate Economics Chair from European Parliament and the Council (2003)

One important thing must be noticed in this process: at the beginning of a year (except the first), both allowances for the year N and year N+1 are circulating, since the allocation for year N+1 are made in February, i.e. before allowances for year N are surrendered in April. This double allocation period makes borrowing of allowances possible for all installations which receive free allocations. The intra-period borrowing was possible in all years of Phase 1 except in 2007 (Phase 2 allowances are distinguished from Phase 1 allowances which cannot be used after the 2007 compliance deadline).

This process has many consequences on timing and volume of transactions, which take account of all movements of allowances, including allocation, surrendering etc. To properly describe these transaction categories, we create a specific timeframe made of successive "CITL years" which differ from the usual calendar years. This timeframe will be used in the following pages.

- CITL year 2005 covers the period from the first of January 2005 to the 30th of April 2006.
- CITL year 2006 starts on the 1st of May 2006 and end in April 2007
- CITL year 2007 is the period from the 1st of May 2007 until the end of the period.

1.3 Definition of transactions' categories

There are different kinds of allowance transfers designated by the term transaction. These are specified in the CITL by a field associated to each transaction and specifying its type, see European Commission (2004). Transfers can involve different account types (state accounts, operators accounts etc.). Unfortunately the descriptions from the CITL are not completely relevant for our purpose. We decided to create our own transactions' categories, which are based on the original categories with supplemental details. The correspondence between CITL categories and our own is detailed in Annex A, and the resulting categories are explained hereafter:

- **Issuance**: this category corresponds to the initial creation of allowances, "out of nowhere". Although it is not formally a transfer of allowance but a creation of allowances, the transactions in this category take the form of transfers from a State account to the same State account.

- **Administration**: this category corresponds to transfers between different States accounts. Those transfers are necessary for organizational purposes (management of reserves, preparation of free allocations before they are made etc.)

- **Allocation**: this category corresponds to actual transfers from State accounts to Operators accounts, usually happening between January and end-February for a given year.

- **Surrender**: this category gathers transfers from Operators accounts to States accounts, usually happening between March and end-April for a given year and corresponding to each operator's verified emissions over the past year.

- **Retirement/Revocation**: this category gathers all types of cancellation of allowances. Transactions of this type take the form of transfers from a State account to a State retirement/revocation account.

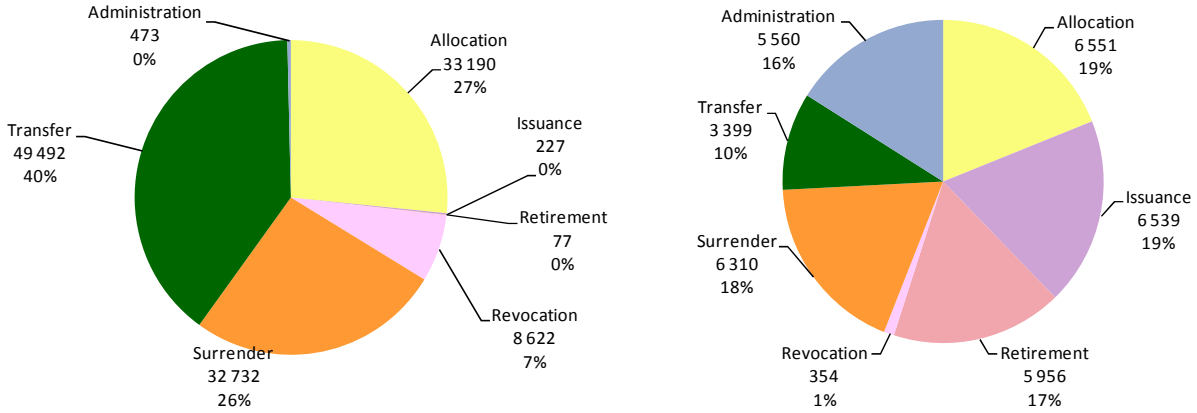
- **Transfers**: this is the last category which encompasses all remaining transactions which are not in previous categories. In practice, it corresponds to all transfers of allowances between Operator accounts, between Personal accounts, or between Operator and Personal accounts. It is meant to be the category which describes trades of carbon allowances between participants, excluding all other administrative or regulatory transfers of allowances.

The figure below represents the share of each category in the total number of transactions (left) and in the total volumes transferred (right), over the Phase as a whole. In terms of number, we see that most transactions (40%) are Transfers, i.e. movements of allowances between operators and personal accounts; 53% are Allocation and Surrender transfers, and the rest of

categories only make up 7% of the total number of transactions. Allocation and surrender transactions are expected to be quite numerous given that each of the 10,000+ operators usually receive at least one allocation per year and must cover its emissions (surrender) once a year.

In terms of volumes, there is much more equilibrium between the different transactions categories. Apart from Revocation transactions which remain exceptional, all categories represent around 15 to 20% of the total volume. In particular, a majority (55%) of transactions in volume (issuance, administrative and allocation) happen before the operators can actually use allowances.

Figure 4 – Share of categories in the total number (left) and volume (right, in Mt) of transactions in Phase 1



Source: Climate Economics Chair from CITL transaction data

To summarize, there are a few large administrative and management transactions, and a lot more smaller transactions linked to operators' behavior. Effective compliance trading requires that a lot of administration and management takes places. The Transfer category is the one that interest us the most. It represents 49 000 transactions representing 3.4 billion tonnes exchanged over Phase 1. But before going deeper in the analysis of the Transfer category, we need to look at how the rest of transactions happened over time in each category, so that we can better understand the general context in which Transfers happened.

1.4 Transactions in each category over time

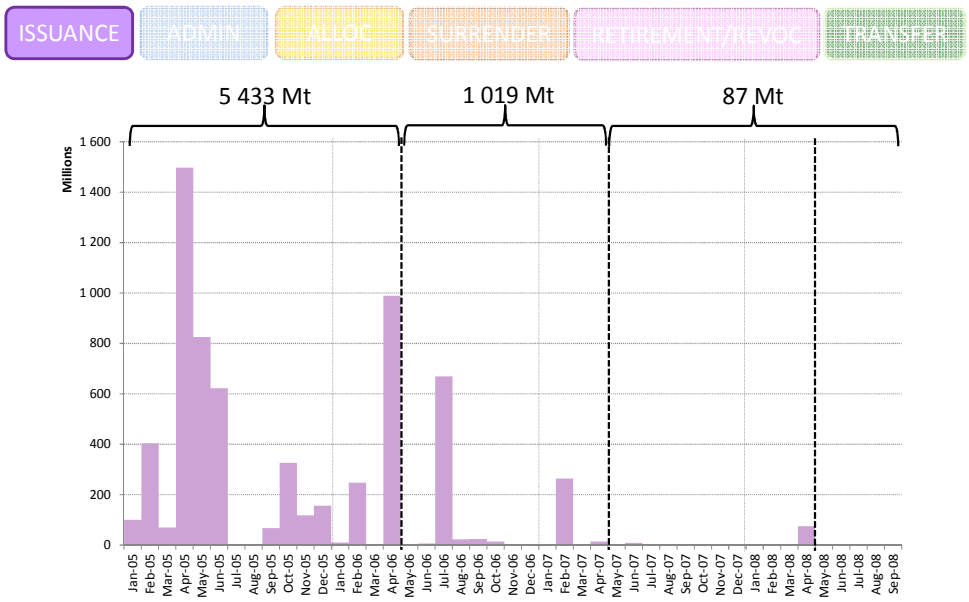
In this sub-section we briefly review all categories separately by looking at the transactions' volumes for each month between the start and the end of Phase 1.

Issuance

The first category is that of Issuance, corresponding to the creation of allowances on State accounts. This is the first step necessary for a cap-and-trade program to function: without allowances, there can be no trading or compliance. The figure below shows that most allowances were issued at once at the beginning in Phase 1. Nearly 64% of issuance were done before January 2006 and 83% before May 2006. This process has probably been delayed by the fact that some registries were not up and running in a few Member States (7 Member States did not make any issuance in 2005: Cyprus, Greece, Hungary, Italy, Luxembourg, Malta, and Poland). The volumes concerned are also concentrated in few transactions: the 6 biggest issuance transactions represent more than the half of the total volumes issued. The German issuance

done in one transaction on April 4th 2005 represents 22% of the total amounts issued in Europe over the Phase.

Figure 5 – Volume of Issuance transactions by month

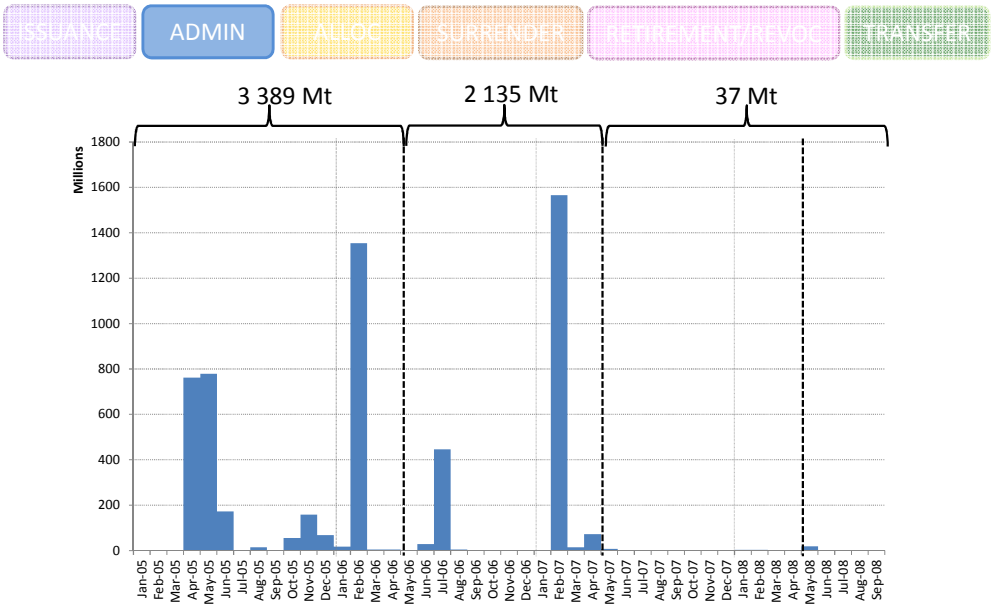


Source: Climate Economics Chair from CITL transaction data

Administration

Administrative transfers also occurred mainly at the start of the Phase. These are internal transfers between State accounts which often materialize the dispatching of allowances between different state accounts. Such transactions can be regarded as intermediary steps between Issuance and Allocation. This explains why the volumes are important in February (the deadline for allocation to operators) and why they are concentrated at the beginning of the Phase.

Figure 6 – Volume of Administrative transactions by month

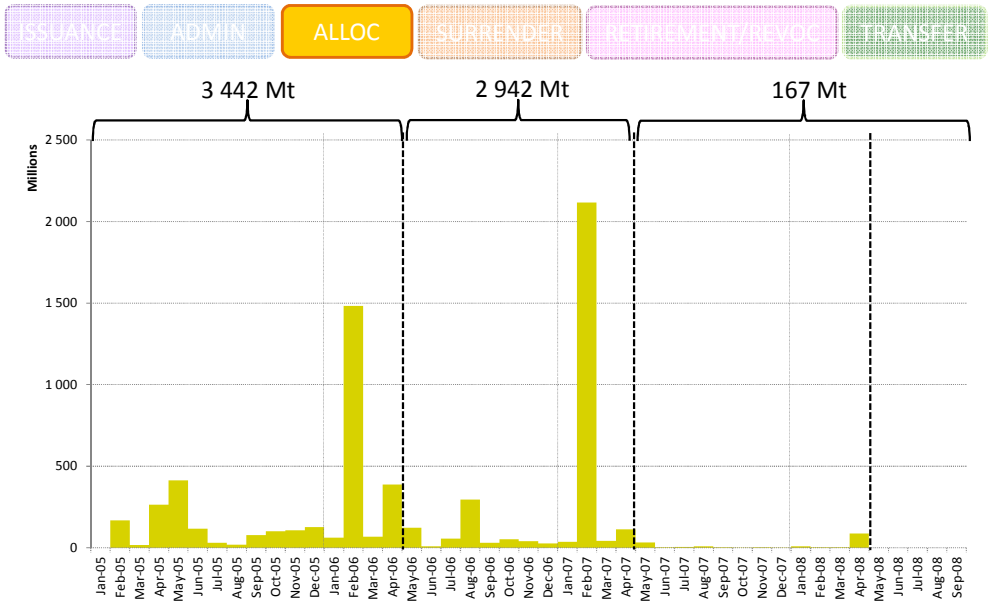


Source: Climate Economics Chair from CITL transaction data

Allocation

Allocations are synonymous of the carbon currency entering the circuit, and mark the effective start of the cap-and-trade mechanism. Allocation transfers are supposed to happen between the beginning of January and the end of February in each year. The figure below shows that this has not been the case. In 2005, only 8% of allocations have been made on schedule due to delays in the implementation of registries in Member States. Still in the majority of cases, 2005 allocations have been made before the end of the compliance year (end April 2006). In 2006 and in 2007, although there have been some smaller delays, things happened more or less on schedule. A small amount of allowances have been allocated as late as 2008, which is explained by adjustments made mainly in Romania, which joined the EU in January 2007. In total all issued allowances have been allocated except 225 Mt which never entered the market (undistributed reserves and other held allowances).

Figure 7 – Volume of Allocation transactions by month

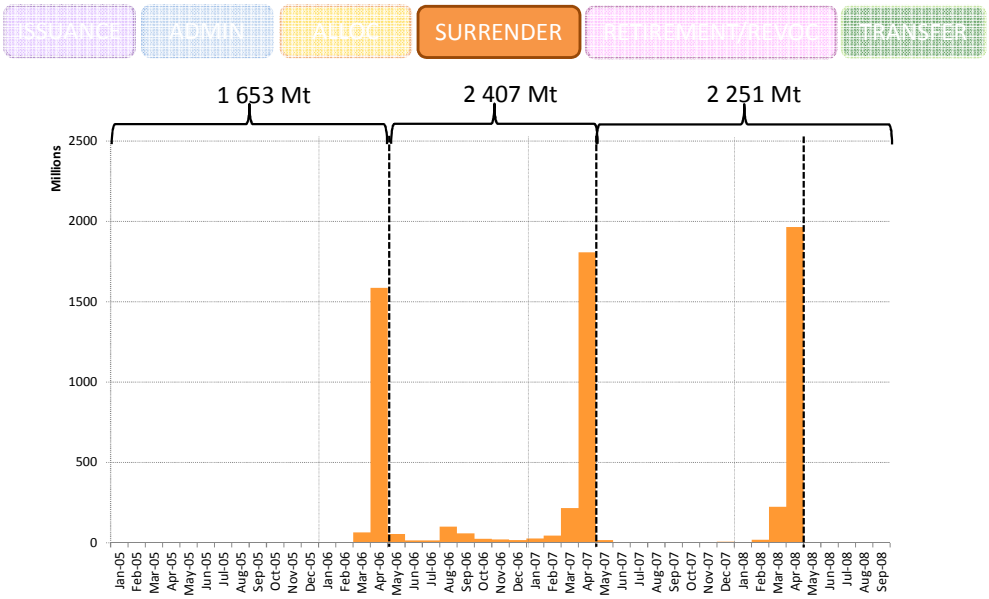


Source: Climate Economics Chair from CITL transaction data

Surrender

Surrender transfers for a given year are supposed to correspond to the verified emissions of covered entities over the previous year. The schedule for surrender transfers is before the end of May in each year, which explains the large peaks of such transactions at these times. In 2005, verified emissions amounted to approximately 2,010 Mt whereas surrender only amounts to 1,653 Mt. This can be explained by the delay in issuance and allocation mentioned before. In 2006, verified emissions amounted to 2,035 Mt, and surrender transfers have been 2,407 Mt: that was enough to cover 2006 emissions and the remaining uncovered emissions for 2005 (around 360 Mt). In 2007 the amounts surrendered (2,251 Mt) are slightly over verified emissions (2,150 Mt).

Figure 8 – Volume of Surrender transactions by month

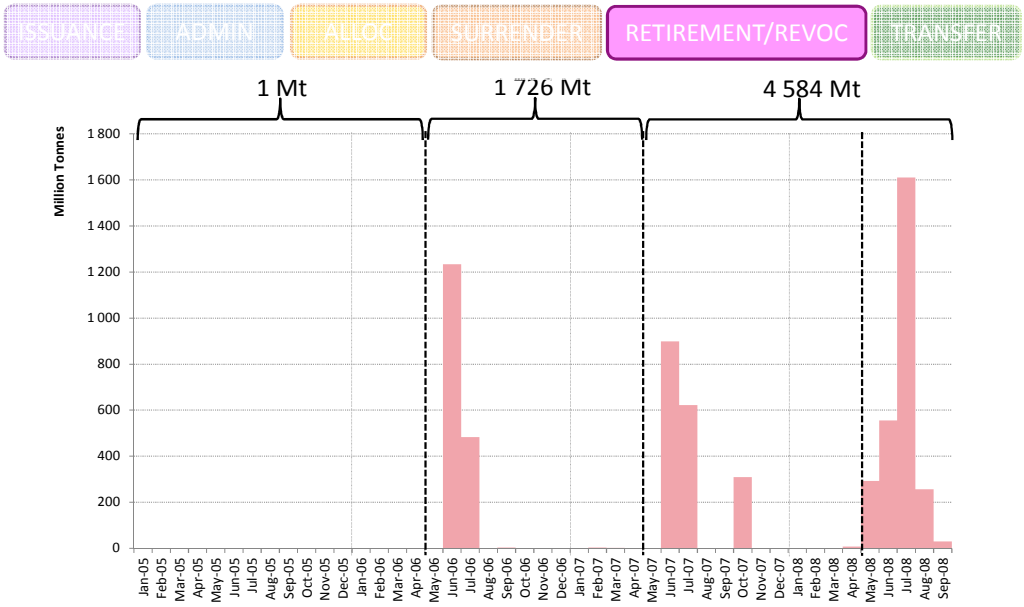


Source: Climate Economics Chair from CITL transaction data

Retirement/Revocation

Retirements and revocations consist in all transactions that cancel allowances. This kind of transaction usually happens after allowances are surrendered. This explains the peaks on the figure below in June and July. Phase 1 really ended on the September 18th 2008 with Italian and Swedish cancellations.

Figure 9 – Volume of Retirement and revocation transactions by month

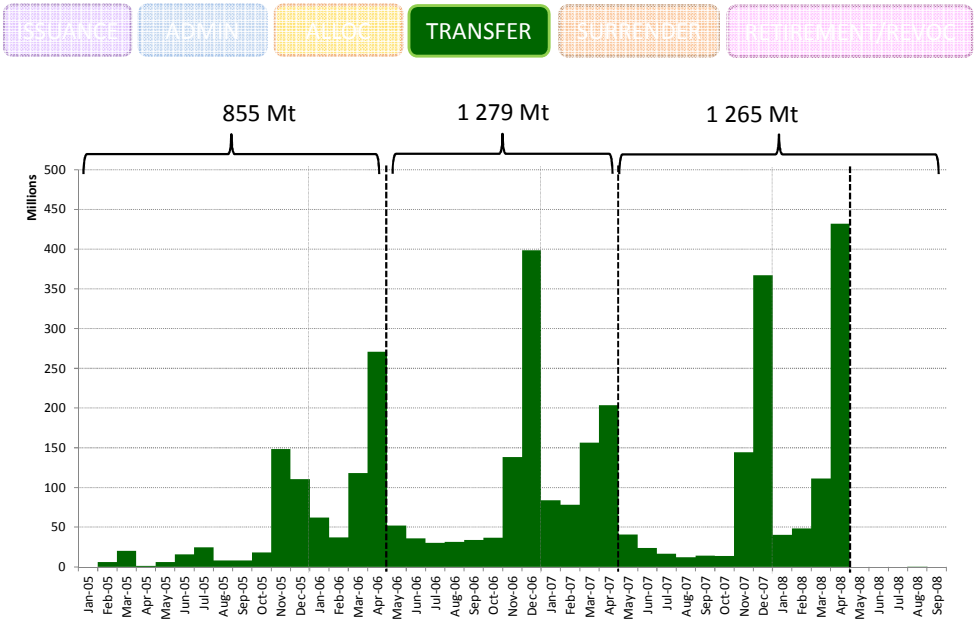


Source: Climate Economics Chair from CITL transaction data

Transfers

The remaining category is that of transactions between Operator and Personal accounts, which can be identified as the "trade" part of a cap-and-trade program, on which we will focus in the rest of the paper. In 2005, those transfers amounted to 855 Mt. They rose and stabilized to around 1,300 Mt per year in 2006 and in 2007. We can note that there seem to be cyclical patterns in Transfers, towards the end of civil years (November-December) and the end of CITL years (March-April). These can be explained, as will be shown in the following sections of the paper, by compliance and market exchanges processes.

Figure 10 – Volume of Transfer transactions by month



Source: Climate Economics Chair from CITL transaction data

The table below summarizes the key figures concerning the 50,000 transactions that fall in the Transfers category. We have seen on the previous graph that volumes in this category are almost constant between 2006 and 2007; this is not true in terms of number of transfers. The CITL year 2007 gathers around half less transactions that 2005 or 2006, but with an average size of Transfers almost doubling. The average Transfer represents around 60 kt in 2005 and 2006, and rise to around 105 kt in 2007. We must nevertheless note that the standard deviation is very large (between 4 and 6 times the average). The biggest transfer in each of those sub-periods amount to around 15 Mt, and involve either large industrial groups or financial intermediaries. They took place in April or December, periods where Transfers seem to peak cyclically.

Figure 11 – Key figures for the Transfer category

	CITL Year 2005	CITL Year 2006	CITL Year 2007
Number of Transfers	15,361	22,279	11,852
Average Transfer (Mt)	55,672 t	57,403 t	106,737 t
Standard deviation (Mt)	341,425 t	322,609 t	488 803 t
Biggest Transfer	"1970 -ThyssenKrupp AG Personenkonto" ↓ "ThyssenKrupp AG" 17,9 Mt 21/04/2006	"RWE Supply & Trading GmbH" ↓ "1914 -RWE Power AG Personenkonto" 14,2 Mt 22/12/2006	"UBS Clearing & Execution Services Ltd" ↓ "LCH.Clearnet Ltd (account 1)" 13 Mt 17/12/2007

Source: Climate Economics Chair from CITL transaction data

This section showed that behind the good functioning of a cap-and-trade program, there is a need for a complicated infrastructure and many administrative transactions. The global picture given by all movements of allowances in fact hides the most interesting part of transactions which are the Transfers between Operators and Personal accounts. We have been able to isolate this category and to analyze the context in which Transfers happen (delays in issuance, allocation and surrender of allowances in 2005 and in a lesser extent in 2006). We are now able to study more precisely the nature of Transfers and their relationships with operators' compliance requirements.

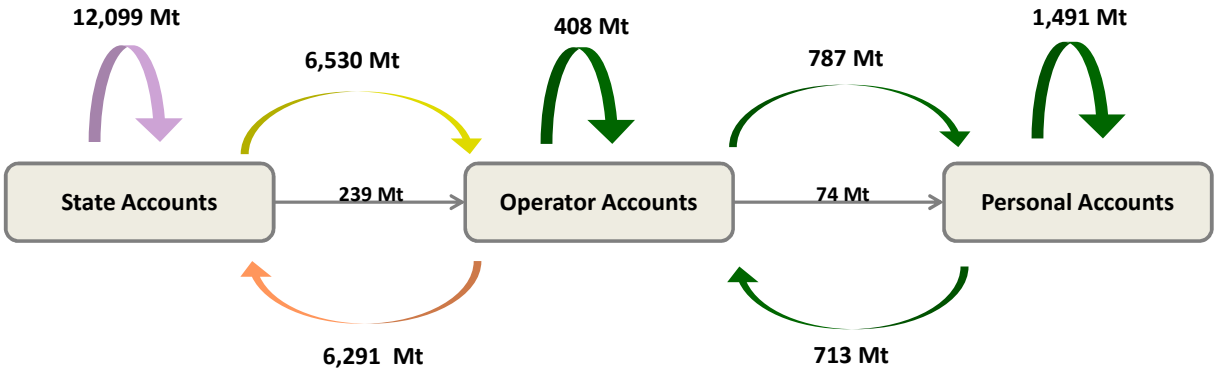
2. Allowance transfers and operators' compliance behavior

In this section we focus on the Transfer category by looking at the relationships between individual accounts transfers (Operator and Personal) and operators' compliance requirements. First, we decompose Transfers between Operators and Personal accounts. Then we introduce information on the "position" of operators, i.e. whether they hold enough allowances to cover their verified emissions or not in a particular year and before allowances are surrendered. In a last part, we deduct from observation the amount of banking and borrowing for every Operator and in each of the years.

2.1 The link between Operators and Personal accounts

The following graph describes the interaction between the different kinds of accounts over the Phase as a whole. On this graph, Transfers are shown with green arrows, the purple arrow show issuance and administrative transactions; the yellow arrow represents allocations, and the red arrow represents surrender transactions. Graphs for individual years are given in Annex B.

Figure 12 – Transactions between the different account types over Phase 1



Source: Climate Economics Chair from CITL transaction data

The total Transfers of 3400 Mt total is decomposed as such: only 12% have moved directly from one Operator account to another Operator account; 44% are transfers between Operator and Personal accounts, and the remaining 44% are Transfers between Personal accounts only. We note that the amount of allowances flowing towards Personal accounts is almost equal to the amount of allowances flowing out from Personal accounts, which show that Personal accounts are effectively intermediating trades between Operators.

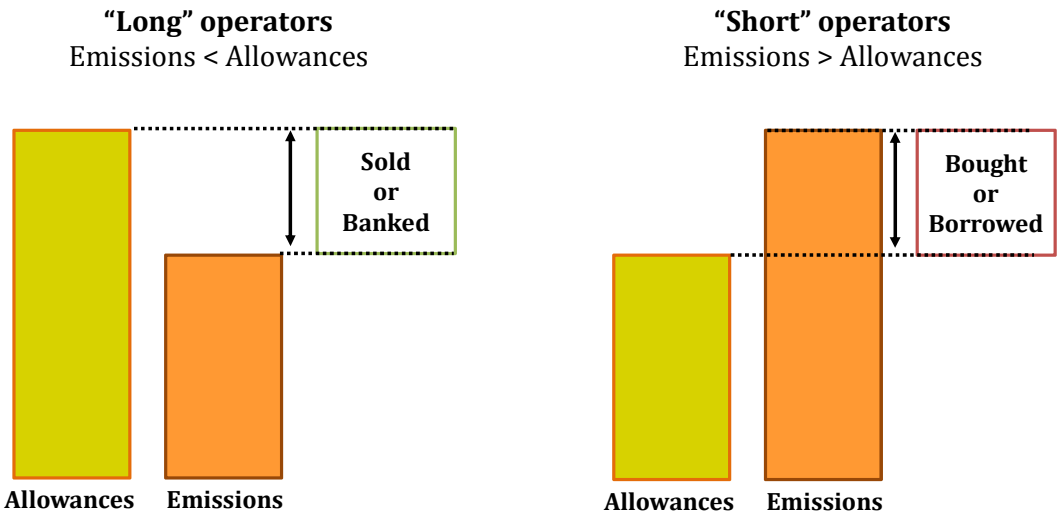
The trading activity of Personal accounts also seems much higher than that of Operators. The amount of allowances transferred from Operators to other accounts only represents 18% of the allowances received by Operators from States; comparatively the volume of transfers from Personal accounts to other accounts represents 280% of the volume received from Operators.

In terms of trading balance, there remained after the end of the Phase around 240 Mt expiring without any value on accounts (allowances allocated to Operators but not surrendered before the end of the Phase), two thirds of which were lying on Operator accounts (165 Mt) and one third (74 Mt) on Personal accounts.

2.2 The link between long and short Operators, and Personal accounts

We are now introducing a distinction between two sorts of Operators. In the first situation described on the left hand side of the figure below, the amount of allowance held by an operator on its account at the time of surrender is superior to its verified emissions. In that case, the operator generates a surplus, which can be either kept for a later use (banking) or sold on the market to another participant. In the other situation (right hand side of the figure), the operator has a deficit of allowance that needs to be covered for it to be compliant. Such an operator can either buy the missing allowances on the market, or borrow them from next year's free allocation.

Figure 13 – Simplified situation of an operator



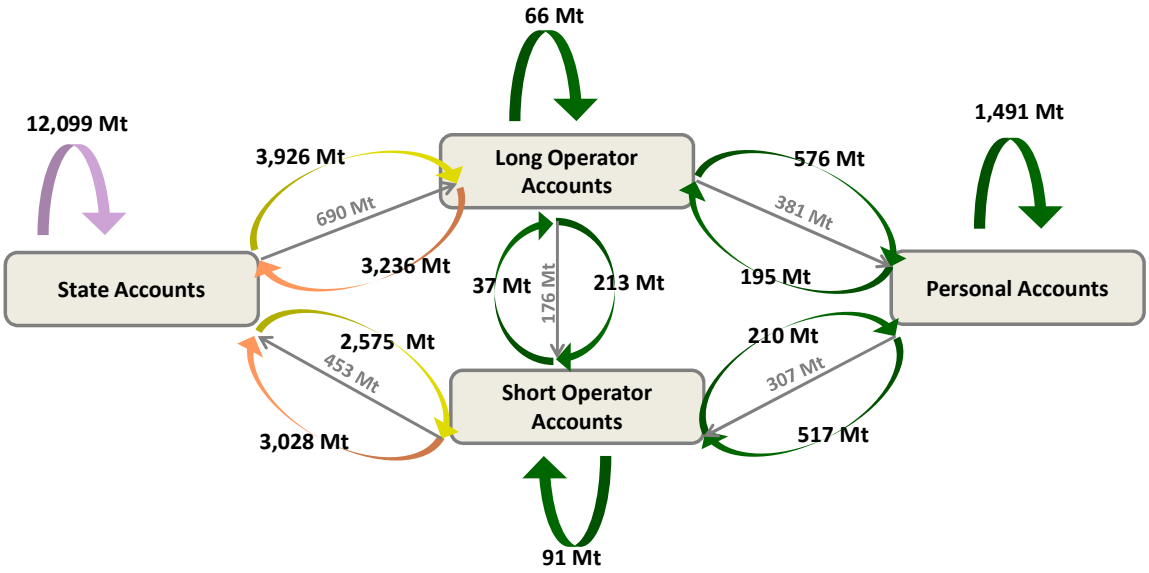
Source: Climate Economics Chair

There is an asymmetry between short and long operators in terms of compliance requirement; long operators can stay passive and simply hold on to their surpluses, whereas short operators have to turn to the market or use future entitlements in advance to be compliant. As a consequence, trades are primarily motivated by the need for allowances of short operators. This sub-section shows how this differentiation between short and long operators materializes in the transfers of allowances.

The Figure on next page represents the transactions between the different account types with a distinction now being drawn between long operators (emissions < allocation) and short operators (emissions > allocation) over the Phase as a whole. The same figures for each of the individual years are given in Annex C.

The graph underlines the importance of compliance positions to explain the observed Transfers. Long operators are responsible for a net transfer of 483 Mt towards short operators, 36% of which is achieved directly by trades between Operators, and 64% through the intermediaries of Personal accounts. This highlights again that the Personal accounts did play an important intermediating role between Long and Short Operators.

Figure 14 – Transactions between the different account types showing Operators' compliance positions



Source: Climate Economics Chair from CITL transaction data

We can also compare the volumes traded with actual deficit/surplus values calculated as the difference between allocated allowances and verified emissions for each operator account. The table below summarizes the results. All in all, long operators exported 75% of their surpluses, and short operators imported 95% of their deficits.

Figure 15 – Comparison of Transfers with compliance positions

Operators position	Surplus/Deficit (Allocation – Emissions)	Inward Transfers	Outward Transfers	Net Transfers
Long	745 Mt	298 Mt	855 Mt	- 557 Mt
Short	-506 Mt	821 Mt	338 Mt	483 Mt
Personal accounts		2,277 Mt	2,203 Mt	74 Mt

Source: Climate Economics Chair from CITL transaction data

This latter figure is not 100% because some of operators have been, although either short or long over the period, short and long in different years during the Phase and used the temporal flexibility provided by the rules. This use of temporal flexibility represents an alternative to trading, and is the subject we are now turning to in the rest of this section.

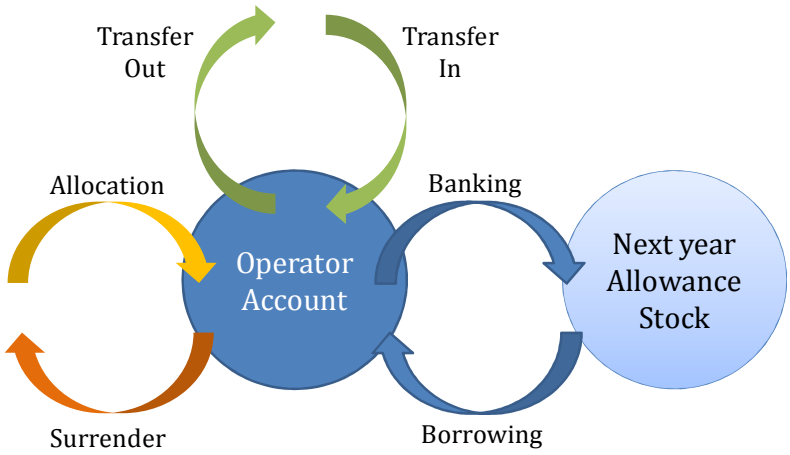
2.3 Banking and borrowing at the installation level

At the time of compliance on a given year, an operator knows the amount of allowances it is expected to surrender: this amount is equal to the verified emissions reported for the previous year. To surrender enough allowances, an operator can use its allocation for that year. Each participant is also allowed to trade allowances, so that at the time of compliance, operators can also surrender allowances they bought from the market. We can thus apply the model described in the following figure to the transaction dataset.

For each operator account on the CITL, we calculate the following allowance flows:

- The allocation flow over the considered year, by carefully separating the amount of next year allocation received in February N+1 from the allocation received in year N. Due to the delays in allocation described in the first section of this paper, we have not been able to perform this operation for all accounts.
- The surrender flow over the considered year: this flow is the sum of all surrender transactions from each account over a given CITL year.
- Transfers in and out: for an operator, the sum of Transfers (distinguishing in and out) from the start of the year to the surrender date.

Figure 16 – Methodology for calculating "banking" or "borrowing"



Source: Climate Economics Chair

We calculate banking and borrowing as follows:

- If the total surrendered by an operator is less than its allocation plus allowances acquired (Transfers In) less those transferred (Transfers Out), then the operator generates a surplus which stays on its account, and remains available for next year compliance (banking). In this case
  Banking = Allocation + Transfers In – Transfers Out – Surrendered
- If the total surrendered by an operator is greater than its allocation plus allowances acquired (Transfers In) less those transferred (Transfers Out), then part of the amount surrendered had to come from next year allowance stock (borrowing). In this case **Borrowing = Surrendered + Transfers Out – Allocation – Transfers In**.

Our methodology requires isolating each allocation and surrender flow for distinct years and for each operator. Unfortunately allowances are not marked with particular vintages and this operation is complicated due to the delays in the setup of registries described in section 1. We decided to exclude from our perimeter of study all operators which did not have a clear allocation and surrender pattern.

The resulting perimeter covers 6,700 installations (60% of operators' accounts), and represents annual emissions of around 1,350 Mt (65% of total EU ETS emissions). The results detailed below are calculated on this perimeter.

The use of banking and borrowing in 2005

Out of the 6,700 installations in the perimeter, 4,391 (65%) have been eventually long in 2005 (i.e. generated a surplus). These are the installations that bank allowances (see Figure 17).

- Out of those, two thirds of installations (3,213, 73%) were initially long (emissions < allowances) and did not participate to any trade. This results in a banking of 65 Mt, corresponding to 15% of those operators' allocation in 2005. Installations in this category can be qualified of passive bankers, because they just hold on to the surplus without neither selling nor buying allowances. There number is surprisingly high: this analysis suggests that at least one installation in the EU ETS out of three in 2005 was a passive banker.

- Approximately 900 installations (20%) were also initially long but participated to trades. The large majority of them exported allowances. Their surplus of 47 Mt has been divided in two: two thirds were exported and one third has been banked, i.e. 16 Mt. 62 installations were initially long and chose to import more allowances. The effect remains small (total imports are less than 1 Mt); the resulting banking is 3 Mt.

- Finally, out of the installations eventually long, there are 280 installations (7%) that were initially short (emissions > allowances) but which ended up with surpluses after trading. These installations were short of 20 Mt, imported more than that (27 Mt), and banked the remaining surplus after the surrender (banking of 7 Mt, i.e. 8% of their allocation).

Figure 17 – Banking of allowances in 2005

Position before Transfers	Importer/ Exporter	Nb of accounts	Allocation (Mt)	Net imports (Mt)	Net exports (Mt)	Surrendered (Mt)	Banking (Mt)
Initially Long	Exporter	834	190	0	31	144	16
	Importer	62	25	1	0	23	3
	No Transfer	3 213	421	0	0	356	65
Initially Short	Importer	282	87	27	0	106	7
Total		**4 391**	**723**	**28**	**31**	**629**	**91**

Source: Climate Economics Chair from CITL transaction data

On the other hand, out of the 6,700 installations in the perimeter, 2,287 (34%) have been eventually short in 2005 (i.e. generated a deficit of allowances). These are the installations that borrow allowances (see Figure 18).

- Out of those, half of installations (1,088, 47%) were initially short (emissions > allowances) and did not participate to any trade. This results in a borrowing of 29 Mt, corresponding to 14% of those operators' allocation. Installations in this category can be qualified of passive borrowers, because they did not turn to the market. As in the case of banking, there number is surprisingly high: this analysis suggests that at least one installation in the EU ETS out of ten in 2005 was a passive borrower.

- Approximately 300 installations (13%) were also initially short but participated to trades. 185 of them imported allowances. Their deficit of 21 Mt has been divided in two: half has been imported and the other half has been borrowed, i.e. 9 Mt. 125 installations were initially short but nevertheless chose to export allowances. The effect is quite high: despite being short of 26 Mt, they exported 49 Mt and borrowed all the deficits from next year. This behavior generated an intense borrowing of 75 Mt (38% of the total borrowing coming from less than 2% of installations in the EU ETS).

- Finally, out of the installations eventually short, there are 890 installations (40%) that were initially long (emissions < allowances) but which ended up with deficits after trading. These installations were long of 56 Mt, exported more than that (140 Mt), and borrowed the resulting deficit (borrowing of 85 Mt, i.e. 30% of their allocation). This category is the most striking because it reveals a behavior which has been very profitable given the price trajectory observed over this period.

Figure 18 – Borrowing of allowances in 2005

Position before Transfers	Importer/ Exporter	Nb accounts	Allocation	Net imports	Net exports	Surrendered	Borrowing
Initially Long	Exporter	889	269	0	140	213	85
Initially Short	Exporter	125	127	0	49	153	75
	Importer	185	63	12	0	84	9
	No Transfer	1 088	210	0	0	239	29
Total		**2 287**	**669**	**12**	**189**	**690**	**197**

Source: Climate Economics Chair from CITL transaction data

In 2005, the cumulated banking on our perimeter is 91 Mt, which is 13% of installations' allocations. Two thirds of this amount comes from passive banking. The cumulated borrowing is very high at 197 Mt, nearly 10% of next year's allocation. It results both from passive borrowing but also from an intense use of borrowing by exporters of allowances, both short and long, which proved afterwards to be a very efficient compliance behavior.

The results of these calculations for 2005 are then accounted for in the calculations for 2006 (banking is added to next year allocation). The results for 2006 are detailed on next page.

The use of banking and borrowing in 2006

In 2006, out of the 6,700 installations in the perimeter, 4,557 (68%) have been eventually long (i.e. generated a surplus). These are the installations that bank allowances (see Figure 19).

- Out of those, 2,853 installations (63%) were initially long (emissions < allowances) and did not participate to any trade. This results in a banking of 81 Mt, corresponding to 22% of those operators' allocation in 2006. The number of installation in this category is still particularly high, but less than in 2005.

- Approximately 1,230 installations (27%) were also initially long but participated to trades. The large majority of them exported allowances. Their surplus of 80 Mt has been divided in two: quite similarly as in 2005, 60% were exported and 40% have been banked, i.e. 33 Mt. 125 installations were initially long and chose to import more allowances. The effect is higher than in 2005 (total imports are 13 Mt); resulting in a banking of 21 Mt.

- Finally, out of the installations eventually long, there is 464 installations (10%) that were initially short (emissions > allowances) but which ended up with surpluses after trading. In 2006, these installations were short of 40 Mt, imported more than this deficit (47 Mt), and banked the remaining surplus after the surrender (banking of 7 Mt, i.e. 8% of their allocation).

Figure 19 – Banking of allowances in 2006

Position before Transfers	Importer/ Exporter	Nb of accounts	Allocation (Mt)	Net imports (Mt)	Net exports (Mt)	Surrendered (Mt)	Banking (Mt)
Initially Long	Exporter	1 115	282	0	47	202	33
	Importer	125	38	13	0	31	21
	No Transfer	2 853	375	0	0	294	81
Initially Short	Importer	464	87	47	0	127	7
Total		**4 557**	**783**	**60**	**47**	**655**	**141**

Source: Climate Economics Chair from CITL transaction data

On the other hand, out of the 6,700 installations in the perimeter, 2,121 (32%) have been eventually short in 2006 (i.e. generated a deficit of allowances). These are the installations that borrow allowances (see Figure 20).

- Out of those, a little less than half of installations (910, 43%) were initially short (emissions > allowances) and did not participate to any trade. This results in a borrowing of 50 Mt, corresponding to 24% of those operators' allocation. The number of installation in this category is still particularly high, but less than in 2005 – but the effect is stronger due to the cumulative nature of borrowing: the volumes borrowed in 2005 are not available in 2006, and must be borrowed from 2007 if not bought on the market.

- Approximately 570 installations (27%) were also initially short but participated to trades. 345 of them imported allowances. Their deficit of 121 Mt has been divided in two: 51 Mt have been imported (40%) and 69 Mt have been borrowed (60%). 228 installations were initially short but nevertheless chose to export allowances. The effect is again high: despite being short of 44 Mt, they exported 16 Mt and borrowed all the deficits from next year. This behavior generated a borrowing of 60 Mt.

- Finally, out of the installations eventually short, there are 638 installations (30%) that were initially long (emissions < allowances) but which ended up with deficits after trading. These installations were long of 44 Mt, exported more than that (78 Mt), and borrowed the resulting deficit (borrowing of 34 Mt, i.e. 17% of their allocation).

Figure 20 – Borrowing of allowances in 2006

Position before Transfers	Importer/ Exporter	Nb accounts	Allocation	Net imports	Net exports	Surrendered	Borrowing
Initially Long	Exporter	638	202	0	78	158	34
Initially Short	Exporter	228	31	0	16	75	60
	Importer	345	61	51	0	182	69
	No Transfer	910	212	0	0	263	51
Total		**2 121**	**506**	**51**	**93**	**678**	**214**

Source: Climate Economics Chair from CITL transaction data

In 2006, the cumulated banking on our perimeter is 141 Mt, which is 7% of annual EU ETS allocations. The amount resulting from passive banking is proportionally lower in 2006 (56%) but still considerably high. The cumulated borrowing is very high at 214 Mt, again nearly 10% of next year's allocation. Those results corroborate the findings of Ellerman and Trotignon (2009) who identified an intense use of borrowing in 2005 and 2006 from the analysis of country-level CITL surrender data.

Allowances expiring worthless in 2007

Phase 1 of the EU ETS is completely separated from Phase 2 (2008-2012). Banking and borrowing of allowances is thus impossible in 2007. Consequently, any allowance remaining on accounts at the end of the phase is not carried forward to the next year but definitively cancelled. It can nevertheless be interesting to look at how the surpluses were dealt with before the end of the compliance period in May 2008.

In 2007, out of the 6,700 installations in the perimeter, all have been eventually long; this is a direct consequence of the total emissions over the phase being less than total allowances distributed (see Figure 21).

- 2,755 installations (40%) were initially long (emissions < allowances) and did not participate to any trade. This corresponding surplus is 44 Mt, corresponding to 22% of those operators' allocation in 2007. The number of installation in this category is still particularly high.

- Approximately 1,970 installations (30%) were also initially long but participated to trades. The large majority of them exported allowances. Their surplus of 173 Mt has been divided in two: 85% of which has been successfully exported, and 15% expiring worthless. 109 installations were initially long and chose to import more allowances. The effect is small (total imports are 3 Mt); resulting in a surplus of 5 Mt at the end of the period.

- Finally there are 1,917 installations (30%) that were initially short (emissions > allowances) but which ended up with surpluses after trading. In 2007, these installations were short of 282 Mt, and imported almost exactly the amount needed (287 Mt), remaining with a small surplus 5 Mt.

Figure 21 – Allowances expiring worthless in 2007

Position before Transfers	Importer/ Exporter	Nb of accounts	Allocation (Mt)	Net imports (Mt)	Net exports (Mt)	Surrendered (Mt)	Banking (Mt)
Initially Long	Exporter	1 864	689	0	147	516	26
	Importer	109	25	3	0	23	5
	No Transfer	2 755	199	0	0	155	44
Initially Short	Importer	1 917	415	287	0	697	5
Total		**6 645**	**1 329**	**290**	**147**	**1 391**	**81**

Source: Climate Economics Chair from CITL transaction data

More than half of the total surplus identified on our perimeter expired worthless on passive accounts. All installations which heavily borrowed allowances in 2005 and 2006 ended up being very short in 2007, nevertheless they have been able to import large amount of allowances thus paying back the borrowed allowances at a very advantageous price: at this time, Phase 1 allowances' price had drop down to less than 1€/tCO_2.

3. Intensity and frequency of trades at the account level

The two previous sections have shown first that many transfers between operators effectively took place, and that most of the transfers between operators were made through the intermediary of Personal accounts; and second that despite many transfers of allowances, a large share of operators did not participate to any trade thanks to the banking and borrowing provisions. In this section, we try to characterize these aspects of market participation in Phase 1, by examining the frequency and intensity of Transfers by sector, by size category, and by compliance position.

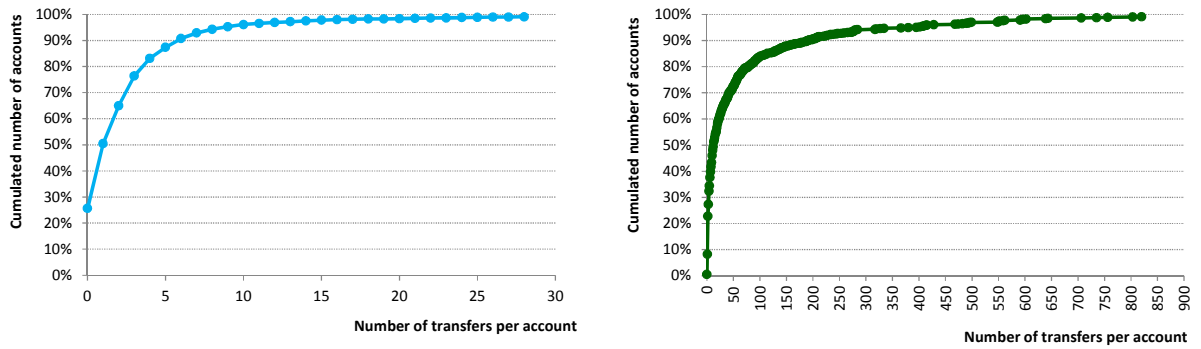
3.1 Concentration of trading activity

We start by looking at the concentration of transfers among operators and among personal accounts. The Figure 22 below represents the repartition of accounts between those that are the most actively trading and those that are less actively trading.

In the case of Operator accounts, we see that 25% of accounts did not participate to any Transfer over the entire period. 85% of operator accounts participated in less than 5 Transfers over the period. Only 434 of the 11,000 accounts made more than 10 Transfers, and the maximum is attained by Tata Steel Scunthorpe Integrated Steelworks (GB) with 216 transfers over the Phase.

Compared to Operators, Personal Accounts were much more active. They all made at least one Transfer; and 75% of Personal accounts made 50 Transfers or less. The remaining 25% were the most active, with number of Transfers from 50 to 10,050 per account. This maximum number of transfers is attained by Powernext Carbon/Bluenext account; it is not surprising given the functioning of market exchanges (this will be detailed in section 4 of this paper).

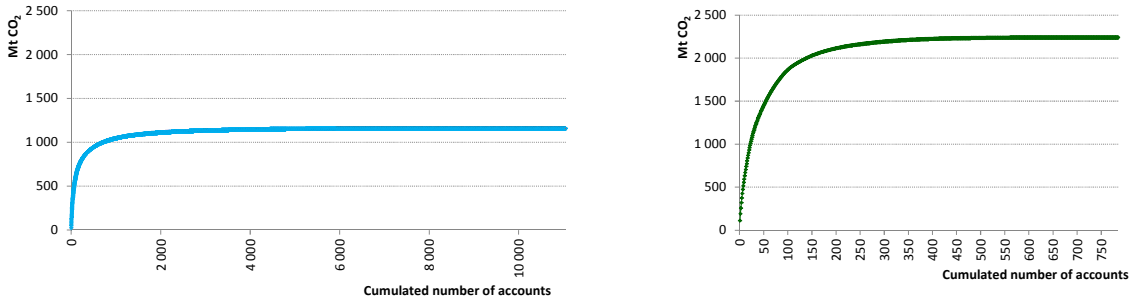
Figure 22 – Transfer Activity of Operator Accounts (left) vs. Personal Accounts (right)



Source: Climate Economics Chair from CITL transaction data

Note: The right ends of distributions are not shown on the above figures. For Operators, the graph does not show 106 accounts which made more than 28 Transfers over the Phase, representing less than 1% of accounts. For Personal Accounts, the graph does not show 7 accounts which made more than 820 Transfers, again representing less than 1% of accounts

Figure 23 – Transfer Volumes of Operator Accounts (left) vs. Personal Accounts (right)



Source: Climate Economics Chair from CITL transaction data

These both graphs clearly enlighten the fact that Personal Accounts are much more active than Operator Accounts. Indeed the total amount of EUAs received or transferred by the 11 050 Operator accounts is reached by the thirty most active Personal accounts.

3.2 Frequency and intensity of trades by sector

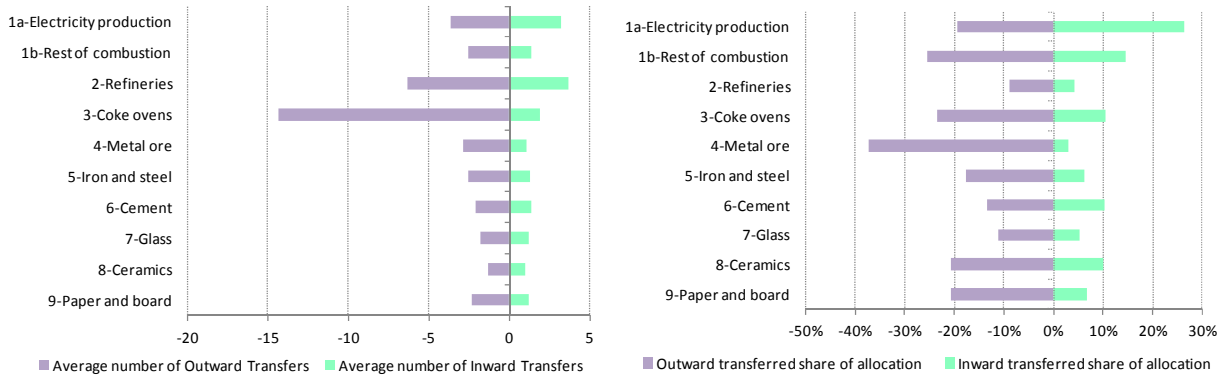
The variety of market participation identified previously must be characterized. In the following three sub-sections, we will be looking at two indicators showing different aspects of market participation: the frequency of transfers and the intensity of transfers.

- The first is called the frequency of Transfer, and is calculated for each considered category as the total number of Transfers in that category divided by the number of accounts in that category. This corresponds to the average number of transfers in/out of accounts in that category over the period.

- The second is called the intensity of Transfer, and is calculated for each considered category as the total quantity of allowance transferred by that category, divided by the total allocation of that category. It corresponds to the average share of allocation transferred in/out of that category over the period.

The categories considered are the sectors, detailed hereafter, then the size categories and the compliance positions categories.

Figure 22 – Frequency (left) and Intensity (right) of Transfers by sector



Source: Climate Economics Chair from CITL transaction data

The Figure above describes how operators in the different sectors participated to Transfers. In terms of Transfer frequency, the three most active sectors are Coke oven (gathering only 20 installations which frequently exported allowances), the Refinery sector (both frequent in imports and exports of allowances), and the Electricity production sector (idem).

In terms of intensity, the most active operators are, on the export side, the Metal ore sector (again gathering few installations), the Rest of Combustion (i.e. heat and externalized combustion plants), and Coke ovens; on the import side, the most intense operators are in the Electricity and the Rest of Combustion sector.

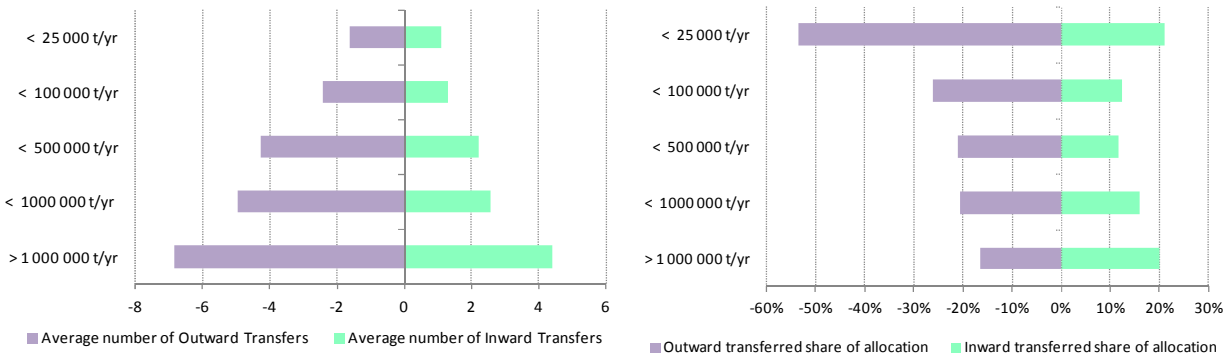
Although there are big discrepancies among sectors, we note that the Electricity sector is quite intense in its Transfers, but no so frequent; whereas the Refinery sector makes frequent Transfers but not as intensively.

3.3 Frequency and intensity of trades by size category

Figure 25 represents the same frequency and intensity indicators, but grouped by size categories. We see that there is a striking relationship between installations size and the frequency of Transfers: smaller operators have less frequent participation. Large installations (emissions > 1 Mt/yr) make at least three times more transfers than the smallest installations (emissions < 25 kt/yr). In all categories of size, exports are more frequent than imports.

In terms of intensity though, the picture is different. The smaller an installation, the more intense the Transfers will be, at least on the export side. On the import side, there is no striking difference between the different size categories.

Figure 23 – Frequency (left) and Intensity (right) of Transfers by size

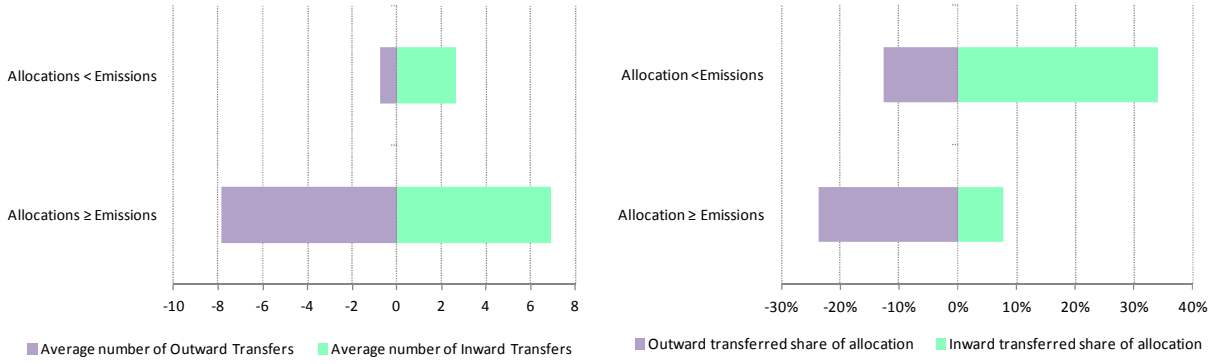


Source: Climate Economics Chair from CITL transaction data

3.4 Frequency and intensity of trades by compliance position

Figure 26 represents the same frequency and intensity indicators, but grouped by compliance position (emissions > allocation or emissions < allocation). On the export side, long installations are very frequent and intense in Transfers, contrary to short installations. They participated 8 times more frequently and twice more intensively than short installations. On the import side, the two pictures are mirroring: long installations are importing allowances frequently but not intensively, whereas short installations are importing allowances less frequently but much more intensively.

Figure 24 – Frequency (left) and Intensity (right) of Transfers by position



Source: Climate Economics Chair from CITL transaction data

In the end, this section has shown that there was a strong diversity among participants. A fringe of actors is acting frequently/intensively on the market: those are mainly large operators in the energy sector and large financial intermediaries or trading desks. The compliance position of operators definitely plays a strong role in explaining market participation, which is not surprising. More importantly, the size of the installations seems to have a strong impact on market participation and might explain why a large share of operators did not participate much to trading.

4. The link with market volume and price data

If all physical movements of allowances are tracked in the CITL, all trades on the market do not correspond to a physical movement of allowance. There are nonetheless two aspects which are interesting to study in linking transactions data with market exchange data: the volume and the price. In this section, we start by describing briefly how spot and futures trades can be identified in the transaction dataset. We then focus on the volume aspect by reconciling spot trades and futures trades' delivery with Transfers of allowances. We then turn to the most active Personal Holding Accounts, trying to identify key actors' categories.

4.1 Physical movements of allowances induced by market trades

In the transaction data, which represents all "physical" movements of allowances, we are going to be able to identify two things:

- The exchange-based spot trades and OTC spot trades cleared on market-exchange, because the allowances "physically" pass through the exchange account at the time of delivery (almost immediately). We are nevertheless not capable of identifying spot trades happening outside of a market-exchange (OTC) because they are, in the transactions data, not distinguishable from basic Transfers between accounts.
- For derivatives contracts, all non-physical trades which could happen between the transaction date and the delivery date will not be seen in the transaction data because they do not imply physical movements of allowances. Nevertheless, the part of those contracts which will actually be delivered on accounts at the expiry date will be observable in the CITL transaction data thanks to its transit through clearers and compensation chamber accounts.

4.2 The spot market: only a minor share in Transfers

The major platform for spot allowance trading in Phase 1 was Powernext Carbon, which became Bluenext in December 2007. In this sub-section we focus on this platform because it has been the most liquid spot exchange in Phase 1. The figure below is a comparison between the historical market data from Bluenext (exchanged volumes) with the observed Transfers in/out of Bluenext account in the transaction data. It shows clearly that, as expected, the physical movements induced by those trades can be traced in the CITL transaction data. Over the entire Phase 1, around 65 Mt have transited through Bluenext account. Our analysis detects slightly more Transfers (3 Mt) in/out of Bluenext account than what the historical market data indicates; which we have not been able to explain.

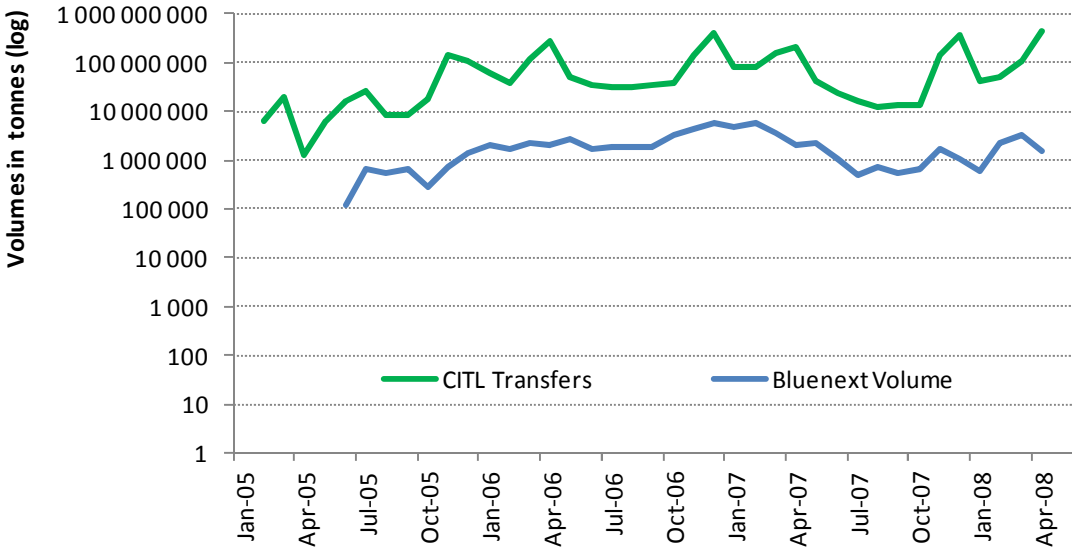
Figure 25 – Phase 1 volume exchanged on Bluenext versus Bluenext account Transfers

	2005	2006	2007	2008	Total
Bluenext Volumes	4 Mt	31 Mt	25 Mt	5 Mt	66 Mt
CITL Transfers Bluenext account (In+Out/2)	4 Mt	32 Mt	28 Mt	5 Mt	69 Mt

Source: Climate Economics Chair from Powernext Carbon/Bluenext and CITL transaction data

After identifying the Spot transactions, we can compare this amount with the total Transfers which occurred over the same period. This will allow us to identify the share, among all physical movements observed, of Transfers which were made through market exchange. Figure 28 below shows first that the two flows are correlated, and secondly that they differ by a factor from 11 to 143. In other words, spot trading through Bluenext, the most liquid platform, represents between 0.7 and 9% of all physical Transfers of allowances between accounts in Phase 1 (Operators and Personal).

Figure 26 – Volume exchanged on Bluenext versus CITL Transfers



Source: Climate Economics Chair from Powernext Carbon/Bluenext and CITL transaction data

4.3 The futures market: allowance transfers are the visible side of the iceberg

The European Climate Exchange – ECX – is the environmental division of The Intercontinental Exchange (ICE). This latter exchange is specialized in derivatives, providing liquidity on long term maturities with dedicated Futures contracts. Regarding EUAs, the most liquid maturities are the December contracts. The Figure below shows a comparison between the Open Interest[2] figures from ICE with the movements from and toward the Clearing House (LCH Clearnet) in the CITL transaction data. Each trading actor willing to be active on ICE-ECX needs an intermediary called clearer registered at LCH. This is how we have tracked the deliveries of future contracts in the transaction data.

[2] The Open Interest – OI – is an indicator relevant for derivatives markets, i.e. options or futures. It is often used for the observation of commodity futures markets to assess the strength of a market (activity, liquidity). For a specific underlying, the OI is the number of contracts that have not been settled, delivered, closed or offset by an opposite transaction at the time of observation.

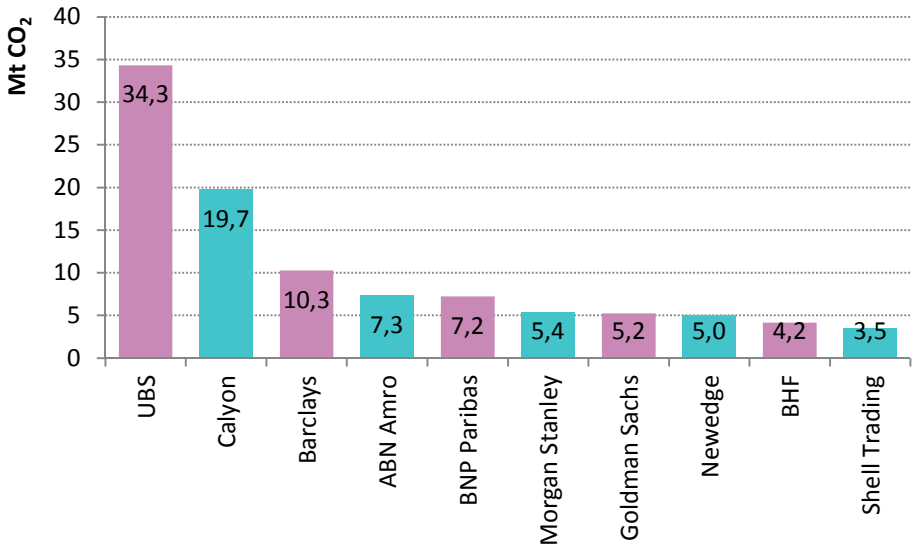
Figure 27 – Volume exchanged on ICE-ECX versus Clearing House Transfers

Maturity	ICE-ECX cumulated volume until the date of delivery	Open Interest at the date of delivery	CITL observed volume transiting through the clearing house at the date of delivery
Dec-2005	52 Mt	5 Mt	5 Mt
Dec-2006	247 Mt	46 Mt	48 Mt
Dec-2007	213 Mt	52 Mt	52 Mt

Source: Climate Economics Chair from ICE-ECX and CITL transaction data

We can underline the fact that the delivered volumes have increased through time, with a huge increase between the first and the second maturities. A second point is that the volume delivered by the Exchange closely matches the ICE-ECX Open Interest. Who did receive and deliver these volumes? Who are the main financial actors registered at the LCH?

Figure 30 – Main clearers, by volume cleared over Phase 1



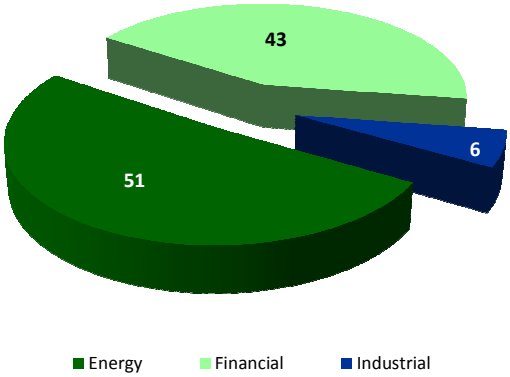
Source: Climate Economics Chair from ICE-ECX and CITL transaction data

The graph only shows clearing counterparts that have dealt above the four-million tons threshold. World-class financial actors lead this ranking such as UBS, Calyon, Barclays or BNP. This latter, and the following financial institutions have capitalized their commodity market clearer's experience to invest the carbon field. The first non-financial actor is Shell Trading (about 3.5 million).

4.4 The most active Personal Holding Accounts

Analyzing the most active Personal accounts (see Figure below) reveals three different categories of actors: financial actors, energy actors, and industrial actors. Some actors may have several Personal Holding Accounts.

Figure 31 – Number of accounts per category among the top-100 most active personal accounts



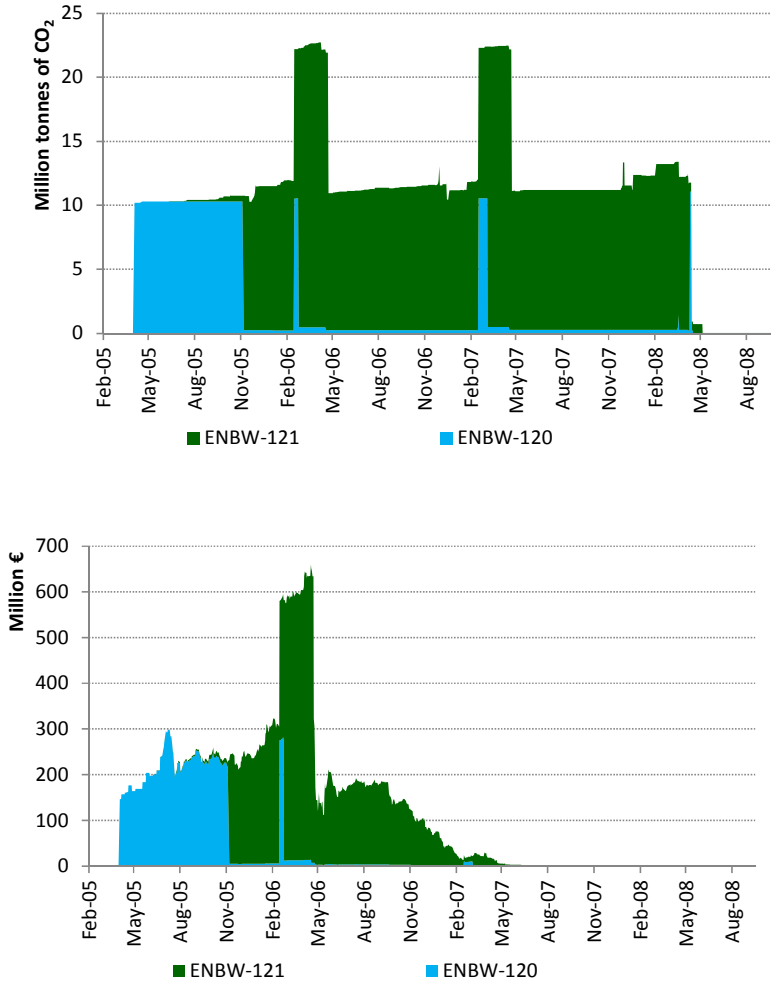
Source: Climate Economics Chair from TheIce-ECX and CITL transaction data

In addition to the above-stated financial actors the first category includes other exchanges and clearers (European Commodity Clearing, STX, APX-Endex, Sendeco2…) as well as European banks (Commerzbank, Deutsche Bank, Société Générale, Credit Agricole, Fortis, etc) or financial services providers (JP Morgan, Morgan Stanley, Merrill Lynch…). This group reaches 43% of the hundred most active Personal Accounts. Also in this category, joint ventures such as Orbeo and Gaselys or a top-class Trading House (Cargill International) are ranked among the top actors. Major energy companies have their own trading structures (RWE, E.ON, EnBW, SSE, Nuon, CEZ, Endesa, EDP…) with huge volumes traded. This group reaches more than half of the most active Personal Holding Accounts. Finally, the industrial actors Italcimenti, Lafarge, ThyssenKrupp and Arcelor Mittal complete the picture of the most active accounts.

5. Example of allowance management: the case of ENBW

The building of the two graphs below was made after consolidating ENBW EUA stocks and transfers for each of its accounts. We found 15 Operator Holding Accounts and 5 Personal Holding Accounts which we aggregated together. The upper graph is the reconstitution of these 20 positions aggregated at the group level showing the EUAs amounts held by account type (120 = Operator accounts; 121 = Personal accounts) through the whole phase. The graph on the bottom shows the value held over time by account type, using the usual mark-to-market method (value at the spot price).

Figure 32 – ENBW EUAs Holdings and mark to market by account type



Source: Climate Economics Chair from CITL transaction data

Both graphs show that allowances are held on Operator accounts at the beginning of the phase. In November 2005, EUAs are transferred to Personal accounts. For the rest of the Phase, allowances are mostly held on Personal accounts, except in the critical period of allocations and restitutions where allowances are reinjected in Operators accounts for compliance purposes.

ENBW took part in 649 transactions, among which 544 were Transfers. The Below table enlightens ENBW activity on the markets. For any of the three CITL years, ENBW had a short net position (i.e. Emissions > Allocations), which was covered by Transfers. To that end ENBW bought all its EUAs with the exclusive help of Personal Accounts.

Figure 33 – ENBW compliance behavior

CITL YEAR	ALLOCATIONS	SURRENDERED	NET POSITION	DYNAMIC POSITION	TRANSFERS	DYNAMIC POSITION +TRANSFERS	BK	BR	Residual Cancelled
2005	10 302 328	-11 231 689	-929 361	/	1 583 727	654 366	654 366	0	
2006	10 310 527	-11 263 461	-952 934	-298 568	1 098 019	799 451	799 451	0	
2007	10 302 766	-12 272 530	-1 969 764	-1 170 313	1 900 655	730 342	730 342	<=>	730 342

Source: Climate Economics Chair from CITL transaction data

Methodology note – Example for 2006: the difference between Allocations and Surrendered is the Net Position (-952 934 t CO_2). The Net Position added to the previous year's Banking/Borrowing figures (+654 366 – 0 = +654 366 t CO_2) is the Dynamic Position (-298 568 t CO_2). The addition of the 2006 Transfers to the Dynamic Position is the 2006 Banking/ Borrowing figure. In our example, the sum is positive (+799 451 t CO_2), so it stands for ENBW 2006 Banking.

Regarding the CITL years 2005 and 2006, ENBW bought more than its compliance needs requirements, implying positive residual positions at the end of April, which is actually *Banking*. For the ending Phase 2007 CITL year, ENBW covered its deficit through purchases for the most significant part (96%) but also with its banked position. Finally holding a long position at the very end of the period, ENBW had its Emissions cancelled at the changing of period (beginning of May 2008). The residual value of it was 7.3 k€, the CO_2 value melting through time.

This case study underlines some of the previous lessons about Transfers analysis, especially the Personal Accounts intermediary role. The Personal Accounts high activity level is also obvious, with ENBW buying 4.4 times its total Phase 1 net deficit.

Conclusion

The main target of this paper consisted in proposing a dynamic view of allowance trading over Phase 1 of the EU ETS, when until now we only had a static vision through the annual CITL compliance data release. In this paper we studied three aspects of trading: the link between transfers of allowances and installations' compliance requirements, the intensity and frequency of trades at the account level, and the link with market exchange information (market exchanges volumes, allowance price and values traded over time).

We show that as expected, trades are primarily motivated by compliance obligations. Nevertheless our study reveals an extensive use of the time flexibility mechanisms (banking and borrowing of allowances) which are alternatives to trading. In particular, borrowing has been used at least by 25% of operators and involved large amounts of allowances, which has proved to be very economically efficient given the observed price over the period.

The market participation has been quite high for large installations, especially in the energy sectors (power and heat, refineries), but remains low for smaller installations. Around 25% of installations did not participate to any trade. Financial intermediaries and utilities trading desks seem to have been much more active than operators and have been actively intermediating trades: only 12% of the volumes traded took place directly between two operators. On the main derivatives market, three categories of actors were active. Industrial actors weren't the most active, contrasting with the Energy actors and the Financial Services providers. The study of the example of ENBW is a case in point. Nevertheless, volumes traded on market exchanges only represent a minor share of all allowances transfer. Even if all observed transfers did not have to be monetized, the value exchanged and the redistributive effects induced are important.

Whether these lessons are specific to the learning processes involved in Phase 1 or are a characteristic inherent to the system will not be known until Phase 2 transactions data is available. It is nevertheless essential to draw lessons from the past, in particular in the 2013 context of reforming the EU ETS.

In practice, this work will help us improving the understanding of the EU ETS and can help us calibrate the compliance behavior parameters in our simulation model (Zephyr-Flex). It can also be the basis of further investigations on more specific topics: the intertemporal management through banking and borrowing, the role of Personal Holding Accounts in relation to the functioning of the market, and market transactions and transaction cost theory.

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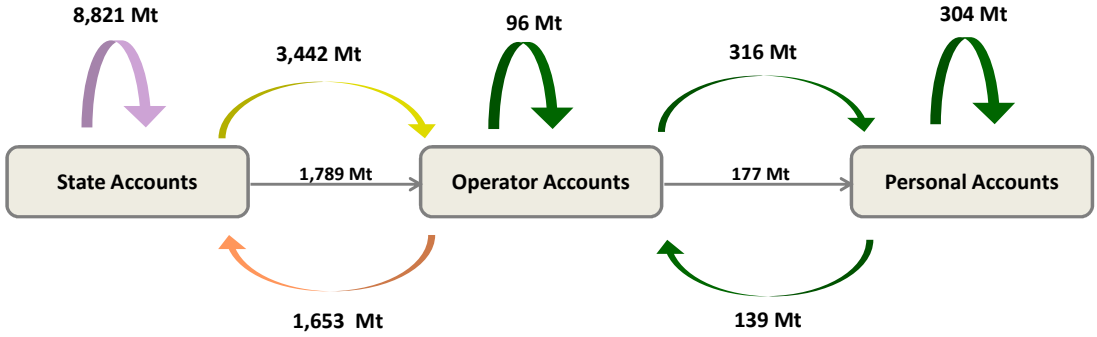
Annex A – Correspondance of Categories (CITL vs CEC Categories)

ISSUANCE | ADMIN | ALLOC | SURRENDER | RETIREMENT/REVOC | TRANSFER

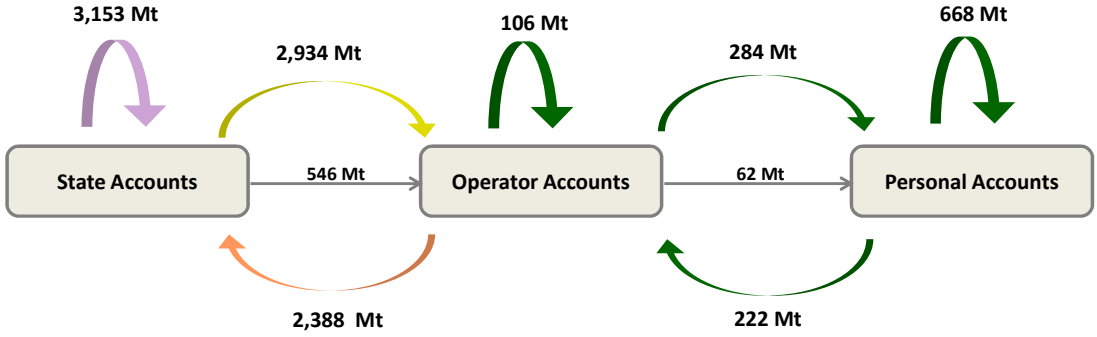
CEC Transaction Type Code	CEC Original Transaction Type	Account types involved	CEC "Mega-CAT"	CEC Category	CEC-Sub-Category
10-41	Cancellation and replacement	100->230	Administration	Revocation	Revocation:100->230
		120->230	Administration	Revocation	Revocation:120->230
		121->230	Administration	Revocation	Revocation:121->230
1-51	Allowance issue	100->100	Administration	Issuance	Issuance:100->100
10-53	Allowance allocation	100->120	Compliance	Allocation	Allocation:100->120
10-55	Correction to allowances	100->230	Administration	Revocation	Revocation:100->230
10-1	Allowance cancellation	100->230	Administration	Revocation	Revocation:100->230
		120->230	Administration	Revocation	Revocation:120->230
		121->230	Administration	Revocation	Revocation:121->230
10-2	Allowance surrender	120->100	Compliance	Surrender	Surrender:120->100
4-3	Retirement	100->300	Administration	Retirement	Retirement:100->300
3-21	External transfer	100->100	Administration	Administration	Administration:100->100
		100->120	Compliance	Allocation	Allocation:100->120
		100->121	Compliance	Allocation	Allocation:100->121
		120->100	Compliance	Surrender	Surrender:120->100
		121->100	Compliance	Surrender	Surrender:121->100
		120->120	Transfer	Transfer	Transfer:120->120
		120->121	Transfer	Transfer	Transfer:120->121
		121->120	Transfer	Transfer	Transfer:121->120
		121->121	Transfer	Transfer	Transfer:121->121
10-0	Internal Transfer	100->100	Administration	Administration	Administration:100->100
		100->120	Compliance	Allocation	Allocation:100->120
		100->121	Compliance	Allocation	Allocation:100->121
		121->100	Compliance	Surrender	Surrender:121->100
		120->120	Transfer	Transfer	Transfer:120->120
		120->121	Transfer	Transfer	Transfer:120->121
		121->120	Transfer	Transfer	Transfer:121->120
		121->121	Transfer	Transfer	Transfer:121->121
3-0	External transfer	100->100	Administration	Administration	Administration:100->100
		100->120	Compliance	Allocation	Allocation:100->120
		100->121	Compliance	Allocation	Allocation:100->121
		120->120	Transfer	Transfer	Transfer:120->120
		120->121	Transfer	Transfer	Transfer:120->121
		121->120	Transfer	Transfer	Transfer:121->120
		121->121	Transfer	Transfer	Transfer:121->121

Annexe B – Transactions between the different account types

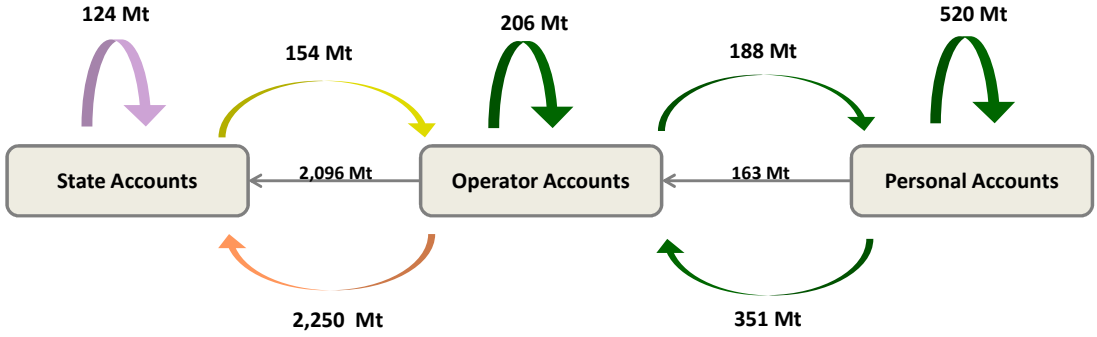
CITL Year 2005



CITL Year 2006



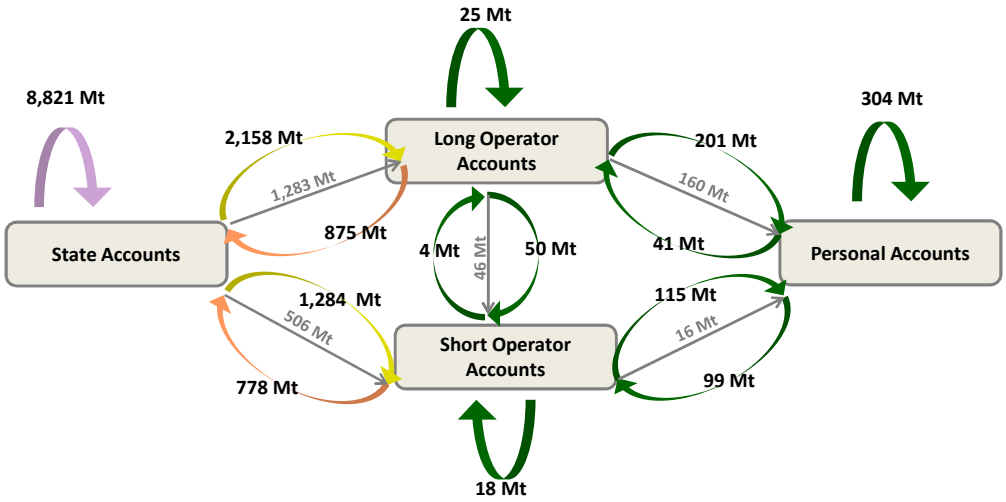
CITL Year 2007



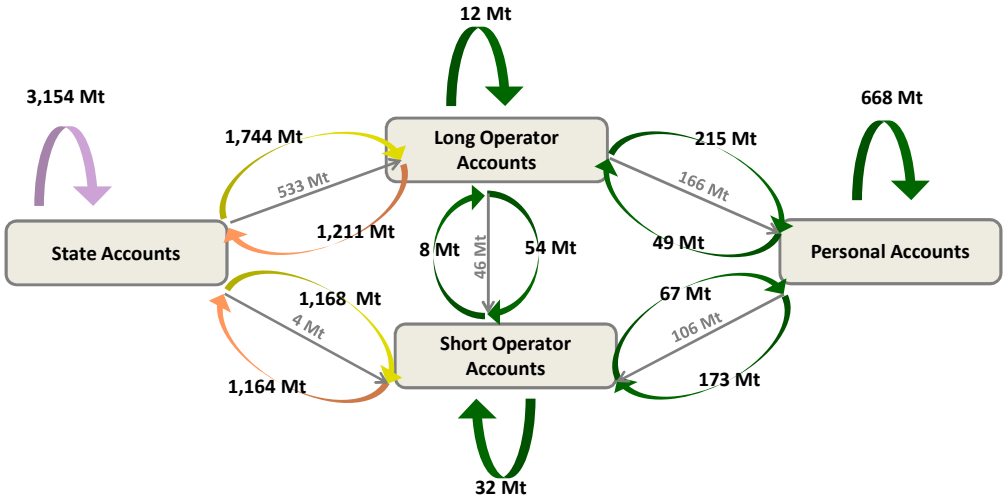
Source: Climate Economics Chair from CITL transaction data

Annexe C – Transactions between the different account types showing Operators' compliance positions

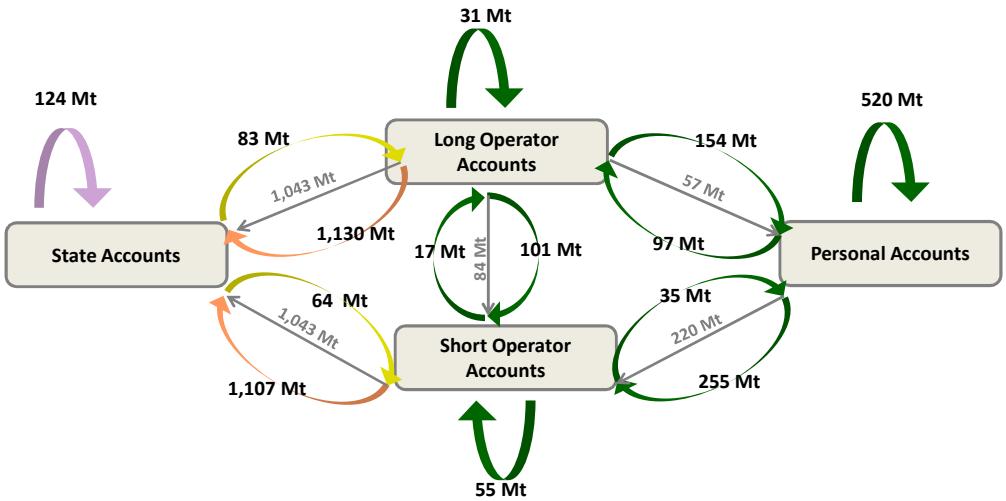
CITL Year 2005



CITL Year 2006



CITL Year 2007



Source: Climate Economics Chair from CITL transaction data

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