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MORE THAN 800 AGRICULTURAL AND AGRI-FOOD SITES AFFECTED BY THE EU ETS

Claudine Foucherot[1] and Valentin Bellassen[2]

Agriculture accounts for 9% of Europe's anthropogenic emissions, counting only emissions of methane and nitrous oxide from cattle, crops and pasture. These emissions have two characteristics making their inclusion in the European Emission Trading Scheme (EU ETS) difficult: they are diffuse and depend on a range of fairly complex pedoclimatic factors.

Taking into consideration the whole of the agricultural sector, including upstream activities such as production of fertilizer, phytosanitary products, animal feed etc., as well as downstream emissions, dominated by the agri-food sector, and also emissions linked to energy consumption by farming installations, the sector's emissions contribution increases considerably. Within this expanded scope, some emissions sources are included in the EU ETS – mainly agri-food industries, but also producers of fertilizer, heated greenhouses and knackers' yards. Even if the proportion of the agricultural and agri-food sector's emissions covered by the emissions trading scheme is minimal, with just 1.5% of all emissions falling within the scope of the EU ETS, more than 800 industrial sites are covered, accounting for 8% of installations covered by the system.

The agricultural and agri-food sector are among the net beneficiaries of the EU ETS in the first two phases (2005-2012), with a surplus of 33 million allowances over the period 2008-2011. This surplus, combined with gains from trading in allowances and credits, represents an estimated asset of 495 million euros. Although it has not been fully exploited on the market, this asset largely exceeds the cost of transactions associated with emissions monitoring, reporting and verification (MRV) procedures and compliance work, which is estimated at 30 million euros over the same period. The emission trading scheme has therefore been both a source of additional revenue to the agricultural sector and an incentive to implement less polluting practices and technologies.

The rules are changing from 2013, with allowance allocation being defined according to a benchmark of carbon intensity – rather than historical emissions – and an end to free allocations for sectors with no risk of carbon leakage. This means that some agricultural and agri-food installations will have to pay for part of their emissions.

Installations covered by the EU ETS will therefore have to reduce their emissions – some have already begun – in order to achieve compliance. The main solution is the substitution of fossil fuels with biomass, which is considered to be carbon neutral. Other solutions are beginning to be developed, such as high-temperature catalysis among producers of nitrogen fertilizers, heat recovery in dairies and dryeration in dryers, etc.

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INTRODUCTION

The European emission trading scheme (EU ETS) was set up to achieve the European emissions reductions target set by the Kyoto protocol: an 8% reduction in greenhouse gas emissions over the period 2008-2012 compared with 1990. Since its launch in 2005, the EU ETS has undergone several adjustments to its scope, allowance allocation rules and emissions monitoring, reporting and verification (MRV) rules. The arrival of the third phase of the EU ETS (2013-2020) is an opportunity for more profound changes, drawing lessons from the first two phases and responding to the target set by Europe's 2009 climate and energy package, i.e. a 20% reduction in emissions by 2020 compared with 1990.

The EU ETS concerns various categories of activities such as combustion, the steel industry, production of paper, glass, cement and ceramic products and the petroleum refining industry. Approximately 11,000 installations are covered by the EU ETS, representing 41% of European emissions, 11% of emissions from developed countries and 4% of global emissions.

The agricultural sector, as defined by the UNFCCC, is not currently covered by the EU ETS. In other words, no limits on emissions of N_2O and CH_4 from enteric fermentation, animal waste management, rice growing, crops and grazing or burning of crop residues are imposed by the scheme.

However, if the agricultural industry is considered in a broader sense, from upstream industries (production of fertilizer, phytosanitary products, animal feed, etc.) to the agri-food sector and emissions linked to energy consumption by farming installations are included, some of its emissions do fall within the scope of the EU ETS.

In addition, since 2005, the combustion activities of a number of installations in the agricultural industry have been covered. And since 2008, extension of the scope of N_2O emissions linked to the production of nitric acid and ammonia in some countries has also increased the agricultural industry's coverage by the EU ETS. This coverage has further increased in 2013 as this extension was generalised. Emissions falling within the scope of the EU ETS are therefore not diffuse, localized at the sites bound by the allowances, making them easy to measure accurately.

For the purpose of simplicity, this document shall use the term "agricultural industry" to refer to all activities contributing to food production. The agricultural industry therefore particularly includes producers of inputs (fertilizers, phytosanitary products, etc.), activities carried out on farms and downstream activities (knackers' yards and the agri-food industry).

The first part of this study proposes a typology of more than 800 agricultural installations subject to the EU ETS, broken down into seven distinct classes, from upstream to downstream, from fertilizer producers to breweries via heated greenhouses. Apart from the implementation of an emissions reduction strategy, which will be addressed in the final part of the study, the EU ETS imposes two main commitments on installations: *i)* establishment of MRV procedures and *ii)* compliance management, which will be the subject of the second part. The third part will examine the 33 million surplus allowances over the period 2008-2011 for all installations in the agricultural industry, which have been supplemented by gains from trading in European allowances and Kyoto credits.

I. THE AGRICULTURAL INDUSTRY IN THE EU ETS: 8% OF INSTALLATIONS AND 1.5% OF EMISSIONS

A. *Widely diverse installations across the agricultural industry as a whole*

Two categories of agricultural installations are included in the EU ETS, as defined in Annex I of the EU ETS directive:

- **Combustion activity**: this only concerns combustion units with a total rated thermal input of more than 20MW, excluding those using only biomass and units of less than 3MW. For those only partially using biomass, only emissions from fossil fuels are taken into account. The vast majority of agricultural and agri-food installations covered by the EU ETS are only covered for their combustion activity. The units concerned are mainly boilers, dryers, furnaces and heating equipment. Until the end of 2012, this was the only activity carried out by agricultural and agri-food installations for which the EU ETS was compulsory.
- **Production of nitric acid and ammonia:** the Netherlands, followed by the UK, Austria, Norway and Italy have asked to include N_2O emissions from nitric acid production plants in their EU ETS scope for the period 2008-2012, pursuant to article 24 of the EU ETS directive[1]. Some nitrogen fertilizer production installations were already subject to the EU ETS, even though they were not located in countries invoking article 24. This cover applied only to CO_2 emissions resulting from their combustion activity. Since 2013, N_2O and CO_2 emissions linked to production of nitric acid and CO_2 emissions linked to ammonia production are compulsorily included in the scope of the EU ETS.

In this study, agricultural installations subject to the EU ETS are grouped into three categories – production of inputs, farming and downstream production – further divided into seven classes[2].

Production of agricultural inputs

This category corresponds to all activities contributing to the production of inputs used on farms:

- **Production of fertilizer**: this class corresponds to all producers of fertilizers, both nitrogen and non-nitrogen based. Production of nitrogen fertilizers generates far more emissions, however. It includes two types of activity covered by the EU ETS. Firstly, combustion activity. Extraction and production of fertilizer uses a lot of energy, which is the source of the CO_2 emissions. For example, in France consumption of natural gas represents 80% of the cost of producing ammonia, an intermediate product in the production of nitrogen fertilizers. Secondly, the manufacture of nitric acid involves oxidation of the ammonia which is a source of N_2O.
- **Production of chemical inputs**: this sector corresponds to all productions of phytosanitary products and also consumes a lot of energy.
- **Production of agricultural machinery**: this class corresponds only to the manufacture of agricultural tractors and farming equipment (silage harvesters, seeders, combine harvesters, etc.). The manufacture of machinery for the agri-food sectors or sectors upstream of the agricultural sector is not included in this definition.
- **Animal feed**: this sector corresponds to manufacturers of concentrates. It therefore includes alfalfa dehydrators, included only in phase III[3]. However, co-products from the sugar industry, the oil industry and manufacturers of starch used in animal feed are not included here, since these

[1] This article allows a country to voluntarily include activities and gases not listed in annexes 1 and 2 of2003/87/EC directive.

[2] In 2009, the European Commission identified the NACE codes (classification system for economic activities in the EU) of a large number of installations covered by the EU ETS. The resulting data has been updated using the latest information from the European register, the CITL, to make this classification as exhaustive as possible.

[3] This type of installation spans the crops and livestock farming sectors and so could have been classified in the "agriculture" category. Since they produce inputs for the livestock sector, for the purposes of this study they are classified in the "production of agricultural inputs" category.

coproducts represent a small proportion of these industries' output. The relevant emissions are attributed to the industries generating these coproducts.

Farming activities

This category corresponds to emissions generated by farming. This category currently only contains **heated greenhouses**.

Downstream of the sector

This category contains all installations downstream of the agricultural sector:

- **Knackers' yards**: this class corresponds to CO_2 emissions from the incineration of animal carcasses.
- **Agri-food**: this corresponds to the whole agri-food industry and is sub-divided in the rest of the study into eight sub-classes of dairies, meat processors, fruit and vegetable packers, sugar manufacturers, starch producers, oil and fat producers, manufacturers of alcoholic and non-alcoholic drinks, and a final category, referred to in the rest of this study as "other – agri-food", including the manufacturing of chocolate, biscuits, coffee and tea.

For the purposes of this study, agricultural installations therefore refers to all production of agricultural inputs, installations used for farming activities and installations downstream of the sector, including knackers' yards and the agri-food industry.

B. Scope of agricultural industry expanded by 10% between the first two phases

Context of the firstphase: a trial period

This period corresponded to the EU ETS test phase, and its aim was therefore more to gain experience and establish the structures required for it to operate properly than to reduce emissions. Nevertheless, the European Commission could reject a national allocation plan (NAP) if it was considered insufficiently ambitious and did not respond to the criteria established by the EU ETS directive, such as compatibility with the targets set by the Kyoto protocol. The result was a market with an allowance surplus which, due to the impossibility of transferring allowances in the second period, reduced the allowance price to almost zero by the end of the period.

The total amount of verified emissions was 6.2 billion tCO_2 for the whole scope of the EU ETS during this first period. The agricultural industry represented barely 85 million tCO_2 or 1.4% of total emissions covered by the EU ETS. In terms of number of installations, however, the agricultural industry represented 8% of sites. The discrepancy between emissions and number of installations reflects the modest size of agricultural installations compared with power plants or refineries.

Context of the second phase: the Kyoto target

This second period covers the implementation of the Kyoto protocol. This lowered the caps and made the emissions reduction effort more reliant on the sectors covered by the EU ETS, with states given a choice between three emission-reduction mechanisms:

- imposition of a binding cap on EU ETS sectors;
- establishment of emissions reduction measures in sectors not covered by the EU ETS;
- purchasing of AAUs (Assigned Amount Units) from other annex B countries or credits from carbon offsetting projects (Clean Development Mechanism, CDM, and Joint Implementation, JI).

In order to achieve their objectives it was imperative for states to set a sufficiently low cap for installations covered by the EU ETS. The cap was therefore lowered by 11.8% between the two periods, counting only installations covered in both the first and second phases, corresponding to a fall of 5.2% compared with

the first period's verified emissions. The European Commission was much stricter regarding the setting of national caps during this second phase although it did not have much involvement in the internal breakdown of allowances which it left at states' discretion.

Allowances were distributed between installations based on historic emissions ("grandfathering"), as in the first phase. The elaboration of NAPs was more rigorous in this second period since States had verified emissions data for each installation in 2005[1].

The total amount of verified emissions for the period 2008-2011 was 7.8 billion tCO_2 for the whole scope covered by the EU ETS, or just under 2 billion per year. The agricultural industry represents 124 million tCO_2 or 1.6% of total verified emissions. Over the period, these emissions come on average from 870 agricultural installations or 8% of installations subject to the EU ETS.

Emissions from the agricultural industry remain dominated by sugar manufacturers

The agricultural industry took up a larger share of the EU ETS in the second phase, with a 10% increase compared with the first phase in both emissions covered and the number of sites subject to the European market. This growth bucked the trend for verified emissions in other sectors, whose share decreased by an average of 5.4% between the two phases. The number of installations covered meanwhile increased by an average of 5.2% across all installations between the two phases.

[1] In the second period, NAPs were carried out after publication of verified data for 2005.

Table 1 – Agricultural installations subject to the EU ETS in phase 1 and 2 (2005-2011)

	Number of installations		Average verified emissions by installation (tCO_2)	
Activies	**2005-2007**	**2008-2011**	**2005-2007**	**2008-2011**
Production of fertilizer	25	30	134 576	142 857
Production of chemical inputs	10	12	87 522	90 305
Production of agricultural machinery	2	2	5 848	4 148
Animal feed	23	24	17 949	19 810
Dehydration	1	0	39 536	0
Subtotals	**61**	**67**		
Heated greenhouses	8	68	13 311	16 198
Knackers' yards	0	3	0	1 974
Dairies	135	121	21 187	21 266
Meat processors	49	43	13 279	14 281
Fruit and vegetable packers	93	109	17 173	15 841
Sugar manufacturers	154	125	51 038	56 539
Starch producers	41	39	92 884	93 878
Oil and fat producers	56	67	32 754	30 371
Manufacturers of alcoholic and non-alcoholic drinks	51	58	39 529	41 205
Breweries	71	82	14 563	13 214
Other - agri-food	70	89	23 159	22 799
Subtotals	**719**	**735**		

The number of installations corresponds to the average number of installations by activity over the period indicated.

Source: CDC Climat Research, based on CITL data

Downstream of the sector

The majority of sites belong to the agri-food sector, with more than 700 installations. This sector is dominated by sugar manufacturers with 154 installations during the first period and 125 during the second. This fall is linked to a restructuring in the sector towards larger capacity installations. This explains the rise in average verified emissions by installation between the two phases, with an increase from 51 to 56.5 $KtCO_2$. Sugar manufacturing installations are mainly located in France with around 30 sites, Germany with around 20 sites and Poland with around 10 sites. As a reminder, these installations have been categorised for this study as belonging to the agri-food sector, which is not exactly true. Some of their production is in fact destined for the energy market[1]. However, in terms of emissions we cannot separate this from their principal product, which is sugar. They are therefore all classed as sugar manufacturers, which are in turn included in the agricultural sector's downstream activities.

[1] Coproduct of sugar beet alcohol, rich in potassium.

There is also a relatively high number of dairies, with an average of 135 sites during the first period and 121 during the second. Most of these are also located in France, which accounts for around 30 sites. The EU ETS also covers around 15 sites in Poland and around 10 each in Germany, Spain, Italy, the Netherlands and the UK. These installations are responsible for fewer emissions, accounting for less than half those produced by sugar manufacturers.

Transformers of fruit and vegetables have around 100 sites subject to the EU ETS. These are mainly located in Italy, which has around 30 sites as well as Spain and France, with around 20 each.

Concerning drinks producers, breweries account for the majority of installations which is why they are given their own section. They are mainly located in Germany, which has around 15 installations, Spain and the UK, with around 10 installations each.

Starch producers only total around 40 sites, but are responsible for a large amount of emissions with more than 90 $ktCO_2$/year released on average per installation. They are mainly located in France, with 10 installations, along with Germany, Spain and the Netherlands which have six installations each.

Industries producing oils and vegetable fats have around 60 sites releasing an average of just over 30 $ktCO_2$/year. However, this result again requires nuancing since, like sugar and starch manufacturers, not all production is destined for the food market, since some goes to the energy market.

Production of agricultural inputs

Around 60 installations are operated by producers of agricultural inputs. Industries producing nitrogen fertilizers have the highest number, with around 30 installations. They are mainly located in France, Spain and Germany. These are large installations with significant emissions, producing an average of 135 $ktCO_2$/year during the first period and 143 $ktCO_2e$/year during the second period. This increase between the two periods is mainly due to inclusion of N_2O emissions from 2008 for a few installations.

Producers of phytosanitary products are also responsible for a high level of emissions with an average of 90 $ktCO_2$/year released by each installation, although they have only around 10 sites.

Animal feed producers have around 20 installations with a low level of emissions, at less than 20 $ktCO_2$/year. Alfalfa drying installations, included in the "animal feed producers" category have their own category here since they benefited from exclusion from the EU system under article 27. This article allows the exclusion of small installations which are subject to equivalent measures (see box 1). The only alfalfa drying installation subject to the EU ETS, located in the Netherlands, was excluded from its scope during the second period.

Farming operations

Heated greenhouses are the only farming activity subject to the EU ETS. Their number has sharply increased, from eight installations during the first phase, to 68 during the second. This can be explained by the fact that the vast majority of these installations are located in the Netherlands. However, during the first phase, the Netherlands chose to invoke article 27 of the EU ETS directive (opt-out) for installations with less than 25 $ktCO_2$ of annual emissions, arguing that a number of measures existed for these small installations allowing emissions reductions equivalent to those under the EU ETS[1]. Heated greenhouses were included since they are small installations with emissions of around 15 $ktCO_2$/year.

[1] See Box1 for more information on the opt-out

Box 1 – Alfalfa dehydrators excluded from the EU ETS until 2012

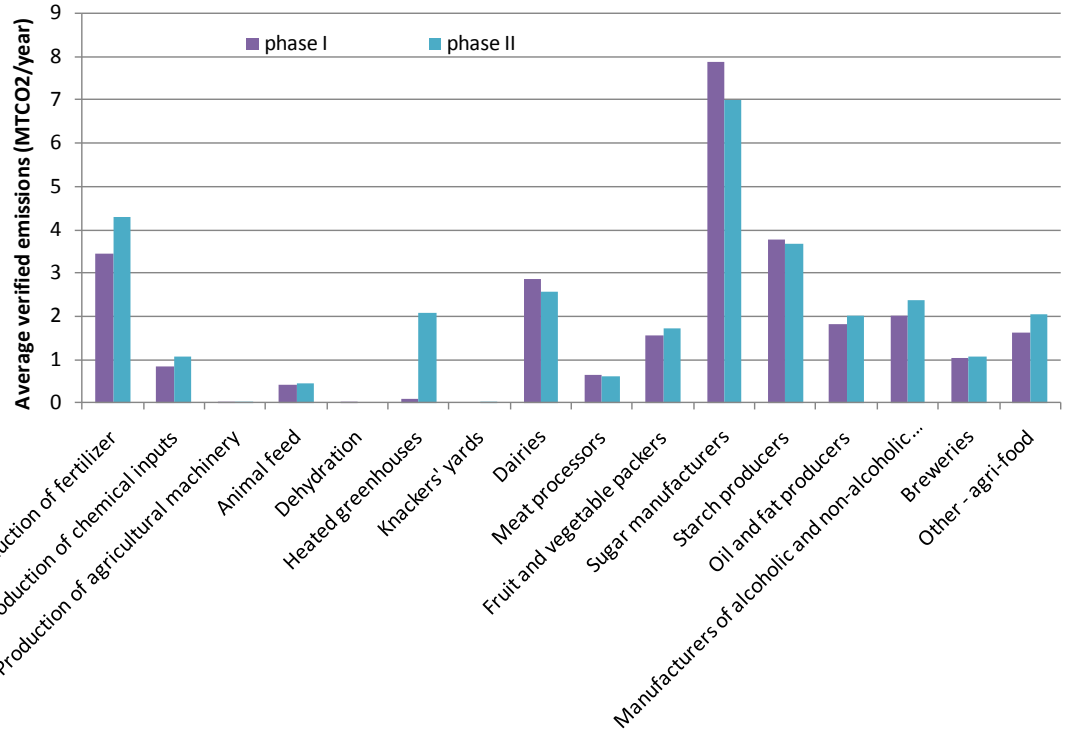
Under article 27 of directive 2003/87/EC, some installations may opt-out of the EU ETS provided they reduce their emissions by the same amount as would have been the case under the EU ETS. These installations are subject to the same MRV requirements as under the Community scheme and can be penalised if they do not comply.

This is why alfalfa dehydration installations were excluded from the EU ETS up until 2012, even though they are major consumers of energy. They nevertheless undertook reduction measures, as stipulated by the directive. In France, two types of carbon offsetting projects have been established, relying on Joint Implementation (JI). These projects are coordinated by Coop de France Déshydratation and aim to reduce fossil fuel consumption during the alfalfa dehydration process. The first involves leaving mowed alfalfa to dry in the field for around a day, saving around 20% of the energy used in traditional harvesting without field-drying. The second project involves replacing fossil fuels with biomass. As with any carbon offsetting project, each tonne of CO2 avoided compared with the reference scenario generates carbon credits. The number of credits expected for these two projects is 800,000 tonnes of CO2 between 2008 and 2012, 194,000 of which had already been issued in 2011.

In phase III, the option of excluding installations was combined with a dual limit relating to thermal power (35MW) and quantities of CO2 released (25,000 tCO2/year) by industrial sites. Alfalfa installations which exceed at least one of the two criteria will be obliged to be covered by the EU ETS in phase III.

Generally, across the whole agricultural industry, sugar manufacturers are the clear leaders in terms of verified emissions with around 7 million tCO_2/year on average during the second phase. They are followed by producers of nitrogen fertilizers with an average of 4.3 million tCO_2 over the same period and by starch manufacturers with 3.7 million tCO_2 (see Figure 1).

Figure 1 – Average annual total verified emissions for phases I and II



Source: CDC Climat based on CITL data

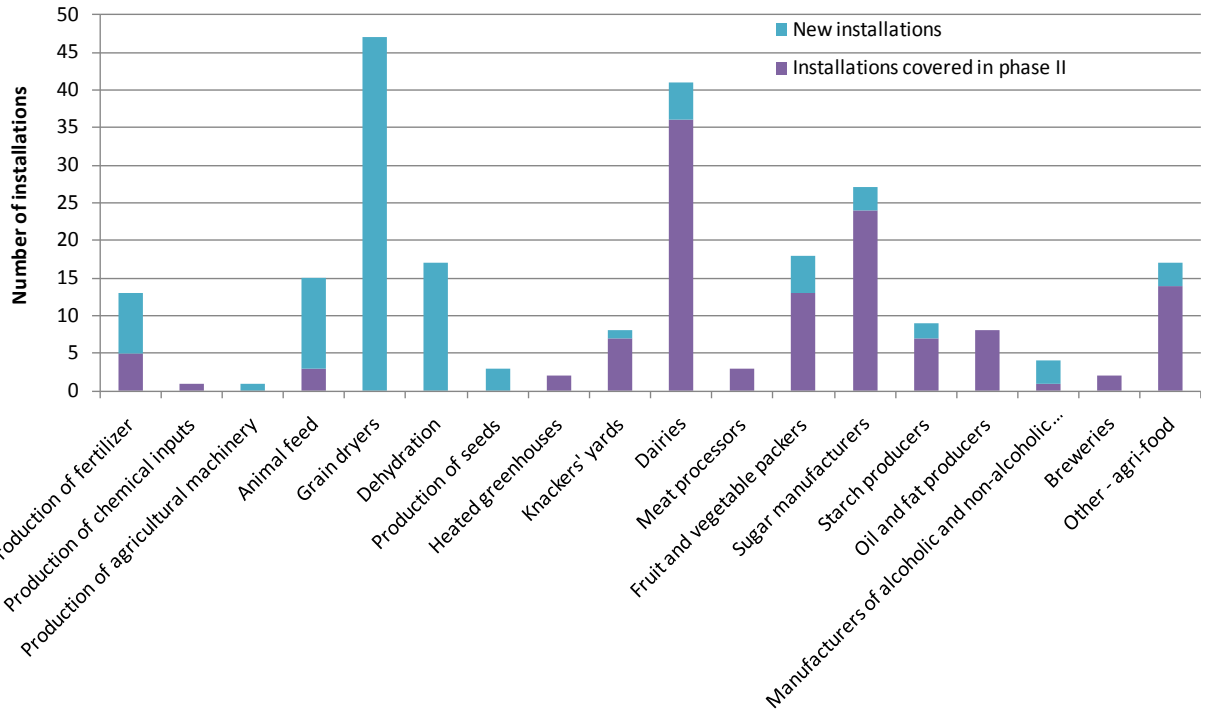
C. *In France, phase III of the EU ETS features the inclusion of dehydrators and grain dryers*

This third phase (2013-2020) features a new European target introduced by the climate and energy package, to reduce emissions by 20% by 2020 compared with 1990. This therefore implies an additional effort for the sectors subject to the EU ETS, which need to reduce their emissions by 21% compared with 2005. In addition to this measure, the Effort Sharing Decision (ESD) stipulates a 10% reduction in emissions by 2020 compared with 2005 for the exempt sectors of transport, buildings and agriculture in the strict sense of the term (CH_4 and N_2O emissions). Overall, this will make it possible to meet the target set by the climate and energy package.

Based on preliminary demand for allowances in France, the agricultural sector has seen a sharp increase in the number of installations between phase II and phase III, particularly due to inclusion in the EU ETS of alfalfa dehydrators, accounting for around 20 sites, and grain dryers, representing 50 sites (see Figure 2). Grain dryers do not produce a high level of emissions (<10,000 tCO_2e), so their inclusion in the EU ETS will not have a significant impact on the level of cover of agricultural emissions. Dehydration sites produce slightly more emissions, although still less than 30,000 tCO_2e on average.

However, the inclusion of N_2O emissions resulting from nitric acid and ammonia production will have more of an impact on the level of EU ETS coverage of agricultural sector emissions with installations receiving an average of 230,000 free allowances during the third phase in France.

Figure 2 – Change in the number of agricultural sector installations covered by the EU ETS in France between phase II and phase III



Source: CDC Climat based on CITL and MEDDE data

II. CONSTRAINTS OF THE EU ETS: MRV PROCEDURES AND COMPLIANCE MANAGEMENT

Inclusion in the EU ETS scope has two consequences on the installations concerned: they must carry out annual monitoring, reporting and verification (MRV) of their emissions and surrender allowances or carbon credits equivalent to their verified emissions.

A. MRV procedures

The EU ETS MRV procedure is governed by two rules: "Monitoring and reporting"[1] and "Verification"[2] .

Monitoring is generally based on calculation, combining data regarding activities such as mass of coal burnt and an emission factor such as quantity of CO_2 released per tonne of coal. Direct measurement of emissions from chimneys is also authorized and is obligatory for N_2O emissions. In both cases, uncertainty must be estimated and be below a certain threshold, which is lower the larger the installation, i.e. 7.5% for smaller installations and 2.5% for larger ones[3]. Operators must initially submit a monitoring plan explaining what they are doing to comply with the rules in this respect.

Emissions are **declared** annually, in the first quarter, according to the monitoring plan. This declaration is accompanied by the verification report.

Verification of the monitoring plan and declaration of emissions by an auditing body accredited by the relevant authority is mandatory. This verification involves a site visit at least every three years.

The majority of agricultural and agri-food installations release less than 50,000 tonnes of CO_2 a year, or even less than 25,000 tonnes for animal feed producers, greenhouses, breweries, knackers' yards, canning plants and a number of dairies. Permissible uncertainty is therefore generally generous – between 5% and 7.5% on the quantity of fuel consumed – and these installations are authorised to use default values for the fuel's calorific value and emission factor. However, producers of nitrogen fertilizers and chemical inputs and transformers of grain and starch generally release more than 50,000 tonnes of CO_2 a year and are subject to stricter requirements in terms of MRV.

Emissions of nitrous oxide generated by the production of nitric acid must be calculated by continuous measurement using the method specified by the European Commission (2008). Operators must measure the flow of gaseous waste and the hourly concentration of N_2O, in order to calculate annual N_2O emissions. N_2O emissions are converted into CO_2 equivalent using nitrous oxide's global-warming potential (GWP) published by the IPCC in 1995, or 310 $tCO_2e/t\ N_2O$.

B. Compliance management

Following declaration of their CO_2 emissions, operators must surrender carbon assets equivalent to their liabilities, i.e. their emissions, by 30 April at the latest in order to comply with regulations. Two types of assets can be used: allowances – European Union Allowances (EUAs) – and credits – Certified Emissions Reductions (CERs) and Emissions Reduction Unit (ERUs) – from CDMs and JIs respectively[4].

Surrender of allowances (EUAs)

In phases I and II, the main source of EUAs for each installation has been the free allocation it receives on February 28th for the coming year. If this allocation is insufficient to cover the installation's needs, it has three ways of increasing its allowances:

- **borrowing**. Allowances are to be surrendered by April 30th of year *n* for verified emissions in year *n-1*, with the period between February 28th and April 30th representing a dual allocation period since

[1] European Commission, "Commission Regulation on the Monitoring and Reporting of Greenhouse Gas Emissions Pursuant to Directive 2003/87/EC of the European Parliament and of the Council Text with EEA Relevance", 2012.

[2] European Commission, "Commission Regulation on the Verification of Greenhouse Gas Emission Reports and Tonne-kilometre Reports and the Accreditation of Verifiers Pursuant to Directive 2003/87/EC of the European Parliament and of the Council Text EEA Relevance", 2012.

[3] For the calculation, levels of accuracy are specified for the different variables.

[4] The Clean Development Mechanism (CDM) is a way of creating value from emissions reductions indeveloping countries in the form of CERs. Joint Implementation (JI) is a way of creating value from emissions reductions in industrialised countries outside the scope of the EU ETS.

installations still have their allowances for year *n-1* as well as their allowances for year *n*. This allows them to borrow allowances from their allocation for year *n*, for example to cover an exceptional spike in activity during the year *n-1*. Conversely, all allowances can be saved and carried over (allowance banking) from one year to the next, if their emissions are lower than the quantity of allocated allowances.

- **purchase on the secondary market**. Operators may also purchase EUAs from other operators with a surplus of allowances. This principle is known as "cap-and–trade", whereby installations able to achieve low-cost emissions reductions sell their allowances to installations with less ability to reduce their emissions. This can be negotiated directly, on an exchange or via brokers.
- **purchase on the primary market**. This involves purchasing allowances "at source", i.e. from member states participating in one of the regular auctions which are held. During the second period, bids were limited to 10% of allocations and states were not obliged to take part. Only 3.6% of Europe's primary allocation was eventually auctioned during phase 2, representing just under 400 million allowances[1], the rest being allocated free of charge. Auctions will account for an increasing share from 2013, however, reaching an annual total of 1 billion allowances by 2020, or 56% of available EUAs.

Finally, while banking of unused allowances from phase I and II was left to the discretion of states, which unanimously banned it following the belated ban in France and Poland, carrying over allowances from phase II to phase III is mandatory. Therefore any allowance surplus at the end of phase II may be used by installations after 2013 (See part III.A on phase II allowance surpluses).

Use of Kyoto credits (CERs and ERUs)

Installations may also achieve compliance by using credits from Kyoto projects. Authorisation for use of these international credits is limited however. The average limit, which is specific to each country, is 13.5% of the total allocation under phase II or 1.4 billion credits. At the time this study was carried out, installations had surrendered just under half of the authorised threshold (555 billion CERs and ERUs surrendered since 2008). This quantitative limit is more restrictive for phase III:

- for installations which were already covered under phase II, the quantity of usable credits has not been increased. This means they can only surrender credits if they did not use up their limit during the period 2008-2012[2];
- for new entrants covered in phase III, the quantity of usable credits is limited to 4.5% of their verified emissions between 2013 and 2020.

Including credits potentially usable by the aviation sector, the maximum number of credits which could be surrendered between 2008 and 2020 is approximately 1.65 billion.

The quantitative limit will also be combined with qualitative restrictions from 2013:

- credits must come from projects registered by December 31st, 2012 at the latest, unless these projects are being carried out in countries with which the European Union has signed bilateral agreements or developing countries;
- from May 1st, 2013, use of credits from HFC-23 and N_2O (adipic acid) projects will be banned.

[1] 395.6 million allowances were sold in 10 countries, raising 5.234 billion euros

[2] In countries where the limit was below 11% of the allocation in 2008-2012, installations will have their limit raised to this level for the whole period 2008-2020.

C. EU ETS transaction costs: 30 million euros for the agricultural industry for the period 2008-2011

The two requirements of MRV and compliance management are reflected in transaction costs. Installations also incur costs for establishing an emissions reduction strategy (information gathering, innovation, investment, etc.) as well as costs linked to preparing free allowance applications.

According to two studies making an empirical estimate of transaction costs for installations in the UK and Germany (King & Davison, 2010) and (Heindl, 2012), total transaction costs increase according to the size of the installation. Due to economies of scale, however, they fall with the volume of verified emissions when averaged per ton of CO_2 produced. Smaller installations may have transaction costs of more than €1/tCO_2/year, but this cost falls to €0.4/tCO_2/year for installations releasing 25 ktCO_2/year and €0.2/tCO_2/year for installations releasing 50 ktCO_2/year. In other words, transaction costs penalise smaller installations and distort the price signal generated by the market. This gives smaller installations a stronger incentive to reduce their emissions than in an optimal situation, without transaction costs. They can also encourage smaller installations to invoke article 27, excluding them from the EU ETS.

The German study broke down the various constraints by their share of total transaction costs. The largest item was MRV, representing 69% of transaction costs, followed by administrative costs linked to the sale and purchase of carbon assets, at 20%, and finally the establishment of an emissions reduction strategy, at 11%. The study also identified a fourth item: preparation of installations' free allowance application. However, this item was not included in the estimate of transaction costs, since it eventually leads to a gain: the allocation of free allowances.

By applying the results of this German study to all installations in the agricultural industry, transaction costs can be estimated at around 30 million euros for the period 2008-2011 (APPENDIX IV).

III. ALLOWANCE SURRENDER: THUS FAR, AN OPPORTUNITY FOR THE AGRICULTURAL SECTOR

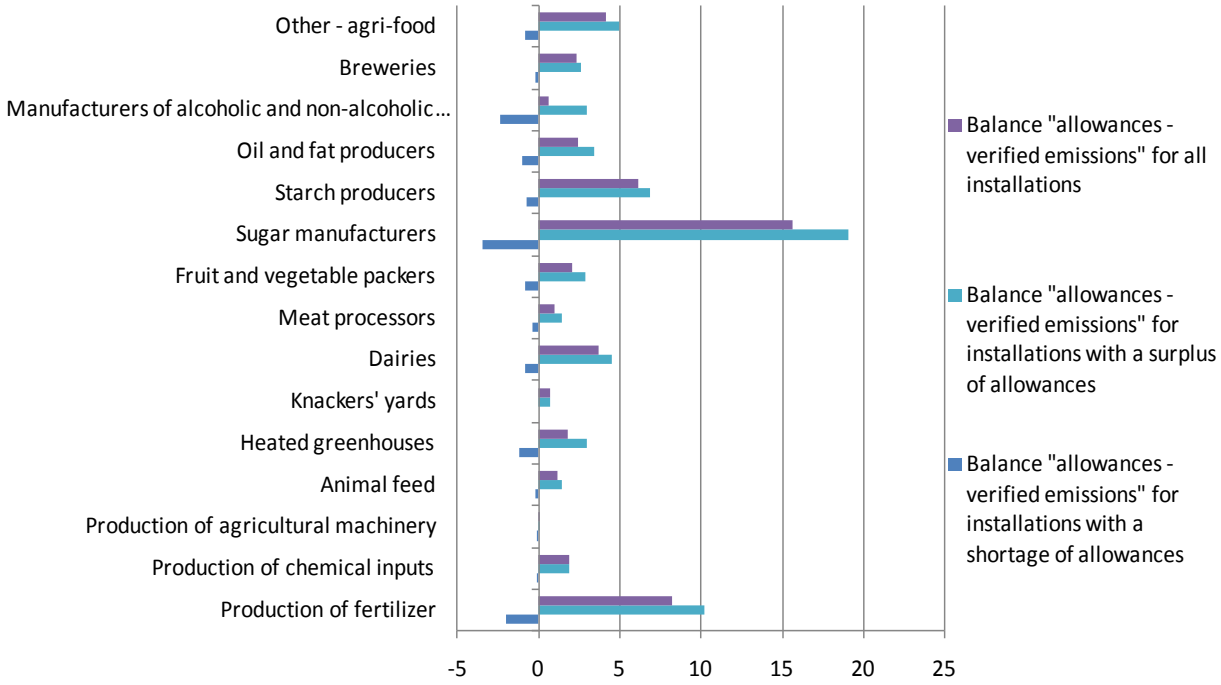
Like any "cap-and-trade" system, the EU ETS may be seen as an inter-sectoral redistribution mechanism: some sectors of the economy will naturally find themselves short of allowances – due to rigorous allocation or the prohibitive cost of reductions in those sectors – and buy allowances from sectors with a surplus following generous allocation or the implementation of emission-reduction technologies. It therefore gives certain sectors an additional source of revenue. This has particularly been the case in the agricultural and agri-food sectors which received more allowances than the greenhouse gas emissions they produced during the first two phases.

A. A positive balance of 495 million euros for the agricultural sector after phase II (2008-2011)

A surplus of 33 million allowances for the agricultural industry for the period 2008-2011

As for most sectors subject to the EU ETS, the agricultural industry had a surplus of allowances during the period 2008-2011 (Figure 3). Some installations were therefore able to generate revenue by selling some of their EUAs to industries with a shortage, such as electricity producers. Others held onto them in anticipation of a reduction in free allocations in phase III. The agricultural industry recorded a total surplus of 33 million allowances, or 21% of its allocation. Sugar manufacturers and producers of nitrogen fertilizers were the main beneficiaries of this surplus, with 8 million and 6 million excess allowances respectively. When the surplus is compared with the initial allocation, animal feed producers come out on top with 31%. Other sectors have a surplus of between 15% and 27% of their initial allowance allocation.

Figure 3 – Balance allocation / verified emissions for the period 2008-2011 ($MtCO_2$)



Source: CDC Climat based on CITL data

Based on the average annual cash price of EUAs affected to the corresponding annual surplus, this excess can be estimated at 495 million euros (see Table 2). However, it is currently impossible to know whether installations have sold this asset to installations with a shortage of allowances, particularly in the electricity sector, or banked it in anticipation of phase III.

Table 2 – Estimated value of the asset constituted by excess allowances

	2008	2009	2010	2011	2008-2011 balance
Surplus of allowances (million allowances)	5,8	10	8,7	8,3	32,8
Average price of EUA (euros)	22,34	13,18	14,34	12,96	
Value of the asset (million euros)	131	132	125	107	495

Source: CDC Climat Research, CITL, ICE Futures Europe

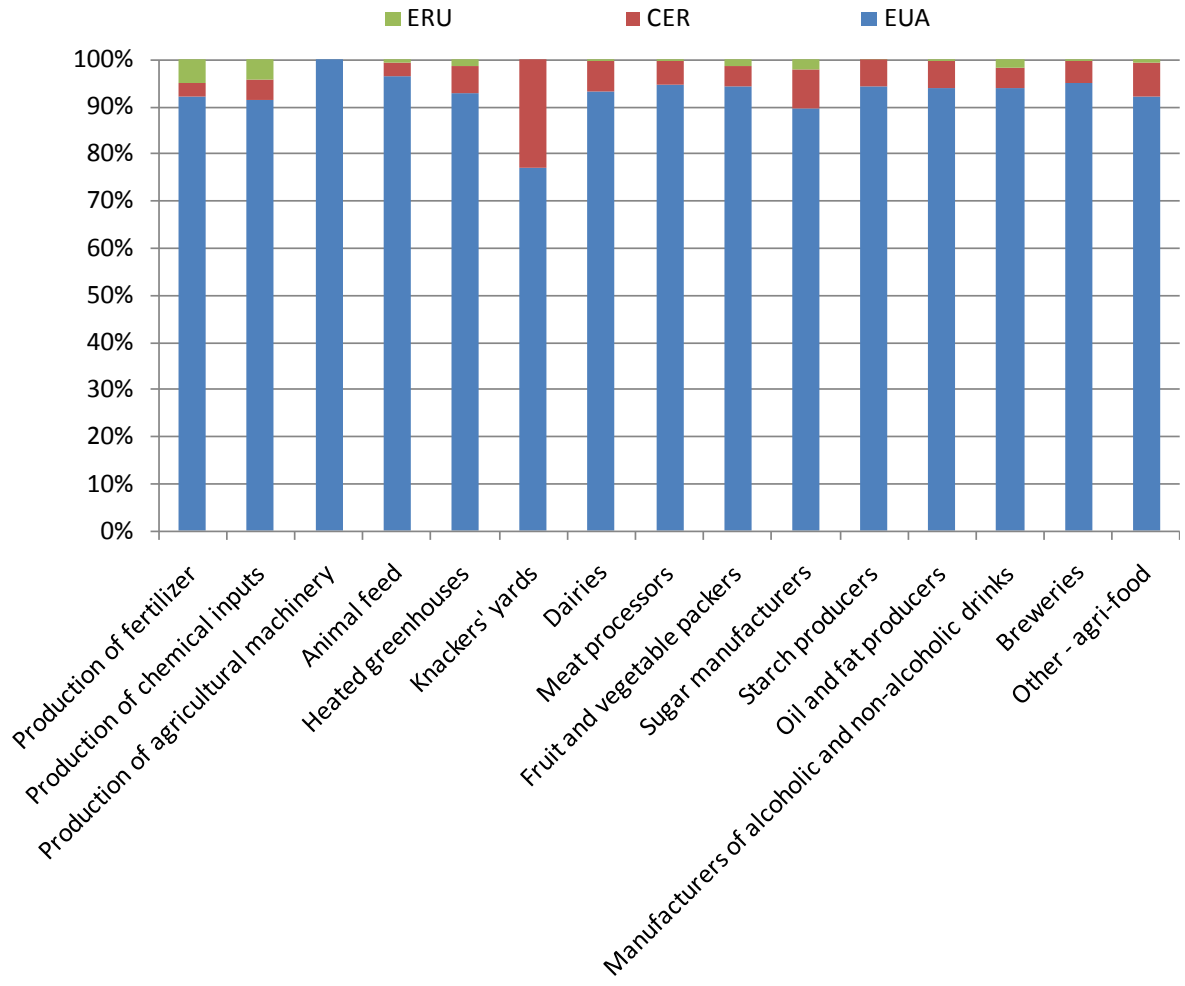
A €23 million boost to the balance through the use of credits

Despite a surplus of allowances, installations surrendered CER and ERU credits as well as EUAs (Figure 4). The surrender of Kyoto credits by the agricultural industry represents around 6% of the allocation over the period 2008-2011. All sectors surrendered Kyoto credits at some point during the period, except for manufacturers of agricultural machinery. Knackers' yards made the most use of credits, with 22% of their surrendered allowances taking the form of CERs over the period 2008-2011, while 10% of sugar manufacturers' surrendered allowances were Kyoto credits. The figure was between 6% and 8% for other categories of installations, except for producers of animal feed and breweries, for which credits accounted for 4% to 5%.

There are two benefits to operators of using these flexibility mechanisms. Firstly, they allow industrial companies to make a profit from the price difference between EUAs and CERs/ERUs. Operators buy

CERs or ERUs (whose prices fell to a few euro cents in December 2012) to meet their obligations and resell excess EUAs (whose price was around 6 euros in December 2012). This price difference can be explained by the limit on the number of credits that can be used, which poses a risk to intermediaries since once all industrial companies have reached that limit, the credits held by intermediaries no longer have any value[1]. Furthermore it allows operators to make internal use of emissions reductions achieved at other sites. These may be sites outside the European Union or sites not subject to the EU ETS, for example because they are below the threshold for inclusion or because some of their activities are not covered by the EU ETS. For example, this is the case for nitrogen fertilizer producers, whose inclusion until 2012 was mandatory for their combustion activity but non-mandatory for the N_2O emissions produced by their industrial processes. There are just over 50 JI projects to reduce N_2O emissions carried out by producers of nitrogen fertilizers and most ERUs surrendered in this sector come from these projects.

Figure 4 – Surrendering 2008-2011



Source: CDC Climat based on CITL data

Use of international credits improves the balance of the agricultural industry which had previously been valued at 395 million euros. The saving achieved by the sector since 2008 is estimated at 23 million euros, based on the difference between the prices of EUAs and prices of CERs/ERUs (see APPENDIX III). Again, this is an estimate based on the respective market values of these assets.

So, even including estimated transaction costs of €30 million over the period 2008-2011, the agricultural industry still significantly benefits over this period.

[1] See Bellassen et al., 2012, Climate Brief no.13

Box 2 – EU ETS or domestic projects:
the experience of alfalfa producers and producers of nitrogen fertilizers

Alfalfa producers

Alfalfa producers asked to opt out the EU ETS under article 27 of the directive (see Box 1). This request was made to avoid having a shortage of EUAs while at the same time profiting from emissions reductions through the establishment of domestic projects. The anticipated shortage did not eventually materialise for most of the sector's installations. Furthermore, given the increasing price discrepancy between EUAs and ERUs, combined with higher transaction costs for a domestic project than for compliance management, the profit generated by emissions reductions is far lower via the domestic projects route than through direct participation in the EU ETS. However, a number of sites used electricity during the reference years and have since moved to coal. This electricity was purchased at preferential prices, raising competitiveness problems. These preferential contracts were ended following a European ruling. The differential in terms of greenhouse gas emissions for these sites was therefore very high, which is why the sector wanted to opt out of the EU ETS in the second phase.

Producers of nitrogen fertilizers

Conversely some countries have chosen to include N_2O emissions from nitric acid production plants, on a voluntary basis, pursuant to article 24 of the directive. This sector's unilateral inclusion enables countries to encourage the relevant installations to reduce N_2O emissions generated by the industrial process and profit from any emissions reductions through the sale of surplus allowances. In countries which have not decided to use article 24, JI projects have been set up to profit from emissions reductions created through the generation of ERUs.

B. Phase III: the sector appears to be heading for an allowance deficit

Tighter restrictions due

The third phase of the EU ETS introduces three major changes compared with the first two phases. The first is the lowering of the emissions cap, guaranteeing a 21% reduction in emissions covered by the EU ETS in 2020 compared with 2005. The second is the generalisation of auctions for allowances. In general terms, the free allocation of allowances – which accounted for most allowances in phases 1 and 2 – will become the exception during phase 3 and is set to be phased out by 2027. While the electricity sector will receive no free allowances from 2013, free allowances to other sectors will gradually fall, from 80% in 2013 to 30% in 2020[1]. Finally, the third change is a switch from grandfathering (allocation based on historic emissions) to benchmarking (allocation based on performance criteria).

The total quantity of allowances to be allocated freely to installations covered by the EU ETS during the third phase is currently unknown. It will only be known once all Member States have submitted their preliminary allowance applications and these requests have been adjusted, if necessary, to the maximum amount of free allowances previously set by the European Commission. The method used to allocate allowances in phase 3 is set out in APPENDIX I.

Carbon leakage is a major risk in the agricultural industry

The European Commission has drawn up a list of sectors and sub-sectors in which there is a risk of carbon leakage. These are sectors in which the direct and indirect costs linked to emissions imposed by the EU ETS would have a major impact on competitiveness. Installations subject to the EU ETS would therefore risk losing market share if the free allowance reduction rules were applied to them. These sectors' activities would move to regions with less onerous emissions restrictions, leading to an increase in greenhouse gas emissions in those regions. This transfer of emissions out of the European Union is precisely what is meant by "carbon leakage". For sectors and sub-sectors presenting a risk of carbon

[1] Exceptions to this rule are explained in Appendix 1.

leakage, the installations will receive a free allocation equal to 100% of their reference emissions[1]. At a European level, industrial sectors considered as presenting a risk of carbon leakage represent 90% of emissions subject to the EU ETS, excluding electricity production (45% of all EU ETS emissions, including electricity production). Several criteria are taken into account when drawing up this list, including direct and indirect costs linked to application of the EU ETS directive, intensity of exchanges with third countries, capacity to reduce emissions and associated costs, as well as the extent to which third countries have committed to reducing their emissions. The precise rules used to define the list of sectors and sub-sectors presenting a risk of carbon leakage, as well as the list of agricultural and agri-food sectors concerned are set out in APPENDIX V.

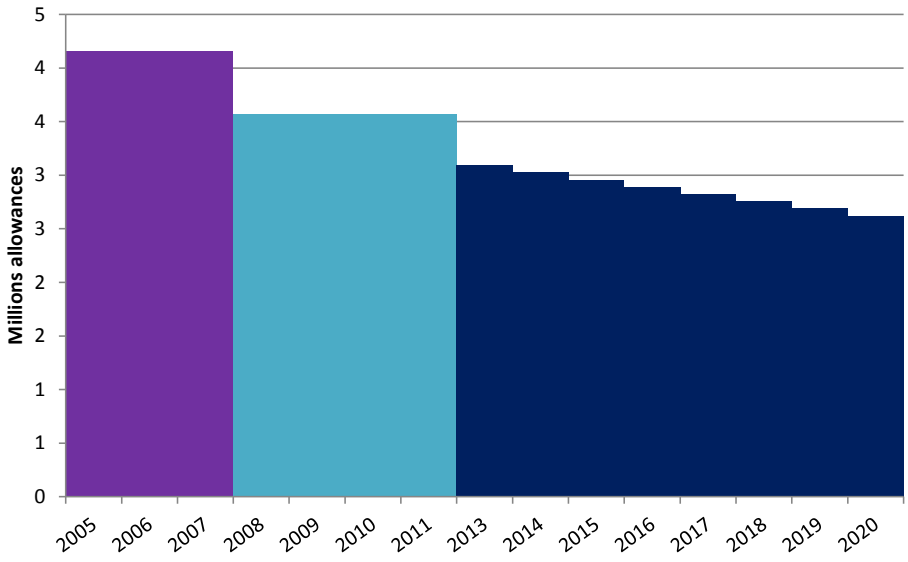
For some sub-sectors, only part of their production is considered at risk of carbon leakage. This is the case for canning plants, for example, with only their production of tomato concentrate considered to present a risk. The sugar industry is considered as presenting a risk of carbon leakage and will receive 100% of its allocations free, except for emissions linked to combined heat and power (CHP) production, which is not considered as presenting risks of carbon leakage (See Box 3).

Concerning the sub-sectors defined for this study, fodder dehydrators, dryers, knackers' yards, transformers of fruit and vegetables and other agri-food productions are considered not to present a risk of carbon leakage and will therefore have their free allocation reduced each year, from 80% of their reference emissions in 2013 to 30% in 2020[2]. Dehydrators of sugar beet pulp, as a sugar coproduct, are considered as presenting a risk of carbon leakage and will therefore receive 100% of their allocations.

The case of France

On a like-for-like basis, free allocations will fall by 26% in 2013 compared with the first phase and 14% compared with the second phase. Allocations will then fall by 67,500 allowances a year until 2020 (Figure 5).

Figure 5 – Change in quantities of free allowances in France for the agricultural and agri-food sectors on a like-for-like basis



Source: CDC Climat based on CITL and MEDDE data

Generally speaking, all classes will have their allocations reduced due to the switch from a calculation based on grandfathering to one using benchmarking. Depending on their efficiency, however, varying

[1] Reference emissions are calculated based on a benchmark and the median quantity produced by the site between 2005 and 2008 or between 2008 and 2009 (details in Appendix II).

[2] The list is subject to change, meaning some activities may be considered to pose a risk of carbon leakage from April 2013.

degrees of effort will be required for installations to achieve compliance. French producers of nitrogen fertilizers are the exception, since they will experience a sharp increase in their free-allowance allocation in the third period, from 54 $ktCO_2$ per year per installation during the 2008-2011 period to 230 $ktCO_2$ on average during phase III. This is due to the inclusion in the EU ETS of new installations producing high levels of emissions and by the obligatory inclusion from 2013 of N_2O emissions generated during the manufacture of nitric acid. Producers of drinks, as well as oils and fats, will see a slight increase in their free-allowance allocation. French installations in these sectors are certainly more efficient in terms of their emissions than their counterparts in other European countries, so appear to have benefited from the move to benchmarking. This is because the benchmarks are produced based on the top 10% of installations covered by the EU ETS in terms of carbon efficiency. This increases the competitiveness of the most efficient installations by type of activity on an intra-European level, while the grandfathering method used in the first two phases favoured the installations with the highest emissions.

Box 2 – Implications of the EU ETS for the French sugar manufacturing sector

The sugar sector produces a number of coproducts including ethanol, sugar beet pulp, molasses, etc. It is not possible to break down emissions between these productions, making it difficult to use a product benchmark. The benchmark selected is therefore a heating benchmark.

However, sugar manufacturers have set up combined heat and power plants allowing them to generate electricity as well as producing heat. This electricity is mostly used in the sugar manufacturing process, although if production exceeds needs, the surplus can be sold to the power grid. Conversely, sugar manufacturing installations may sometimes need to purchase electricity. As for any combined heat and power plant, this makes calculation of the free allocation more complicated, since it is necessary to separate emissions linked to the production of heat, which will receive free allowances for 100% of the heating benchmark, from emissions linked to the generation of power, which no longer receive free allowances from 2013. A combined heat and power plant may therefore receive fewer free allowances than a simple heating plant of the same capacity.

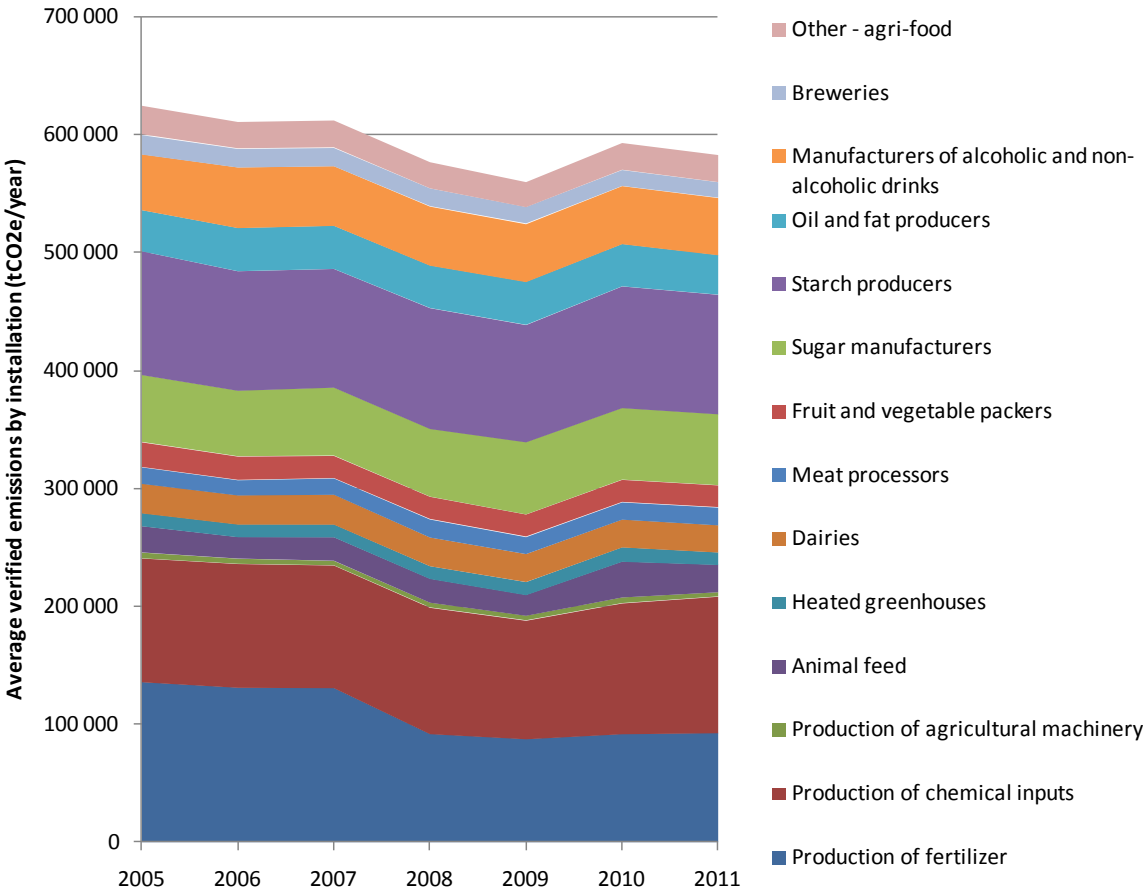
The activity of the sugar manufacturing sector, like other agricultural sectors (e.g. dryers and dehydrators), is also seasonal. So although a sugar manufacturing year lasts on average around 100 days, the actual duration varies according to sugar beet production. Under the current EU ETS system, however, no adjustment mechanism exists for sectors with significant fluctuations in their production from one year to the next.

IV. LOWER EMISSIONS DESPITE AN INCREASE IN PRODUCTION

The primary objective of the European emission trading scheme is to reduce the emissions of the most polluting installations. To achieve compliance, installations may therefore change their practices or implement new technologies to reduce their emissions. Given the change in verified emissions across all installations included in the EU ETS, it is difficult to determine what proportion can be attributed to a real effort to reduce emissions and how much is due to a fall in activity.

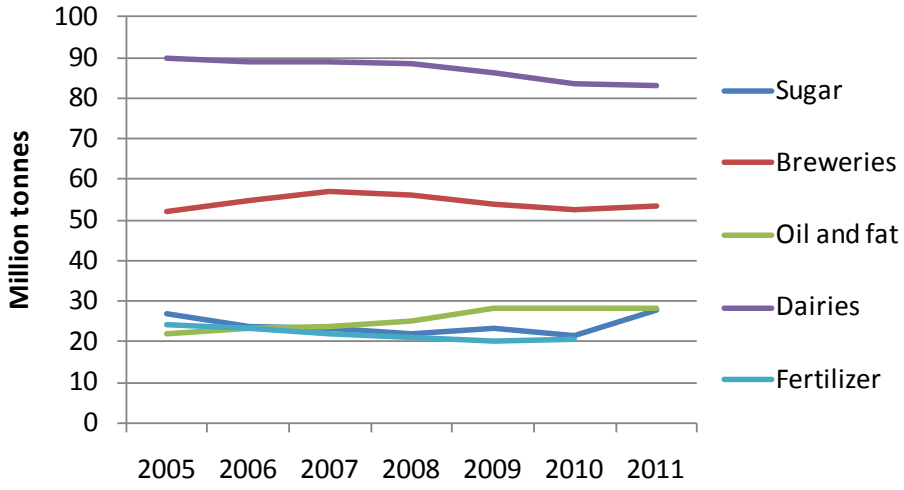
Concerning the agricultural industry, average emissions by installation on a like-for-like basis – i.e. only for installations covered by the EU ETS throughout the period 2005-2011 – fell slightly, from 45 $ktCO_2$ in 2005 to 42 $ktCO_2$ in 2011. This fall accelerated at the start of the second phase, mainly due to the introduction of new manufacturing processes such as high-temperature catalysis in fertilizer production installations. Average emissions from these installations has fallen from 136 $ktCO_2$/year in 2005 to 93 $ktCO_2$ in 2011 (Figure 6), despite relatively consistent production since 2005 (Figure 7). Average emissions by installation remained relatively stable for other sectors, except for producers of chemical inputs and animal feed, for which emissions have increased slightly since 2009. This can be attributed to two factors: *i)* an increase in production, principally in the animal feed sector *ii)* restructuring of industrial sites favouring a higher concentration.

Figure 6 – Change in average annual verified emissions by installation



Source: CDC Climat based on CITL data

Figure 7 – Change in volumes produced



Source: CDC Climat based on FAOSTAT data

Although the fall in emissions is currently most visible for fertilizer producers, a number of other sectors are implementing or planning to implement reduction strategies. This is the case with agri-food industries, for instance, which have reduced their emissions by setting up CHP plants for example. This phenomenon is accelerating in anticipation of a restriction on the allocation of free allowances and the possible use of

carbon credits in phase III. However, the phase III allocation rules, which are not very favourable to CHP (see Box 3), may hamper this growth.

One way of reducing the balance of emissions is to replace fossil fuels with biomass. Bioenergies are controversial, particularly due to the risk of indirect emissions linked to land conversion, deforestation or turning over grazing land to crops. The European Union nevertheless considers that the sustainability criteria established for biomass produced in Europe – PEFC certification of almost all European forests, significant legal obstacles to deforestation, etc. – and for imported biofuels – cancels out most of this risk. The emission factor of biomass is therefore deemed to be nil under the EU ETS.

In addition, new technologies, that are either more energy efficient or reduce emissions generated during industrial processes, are appearing in a wide range of business sectors:

Production of fertilizer: production of nitrogen fertilizer produces high levels of CO_2 and N_2O. Improving energy efficiency is this sector's main lever for reducing CO_2 emissions. A technology also exists for reducing N_2O emissions during the manufacture of nitric acid from ammonia. This is high-temperature catalysis which, according to UNIFA, reduces nitrous oxide emissions by 70%-85%. This technique breaks down the N_2O molecules into nitrogen (N_2) and oxygen (O_2). Several CDM projects use this technology to reduce their emissions[1]. There are also 44 JI projects of this type registered in countries which did not decide to voluntarily include N_2O emissions from production of nitric acid in the EU ETS from 2008, 12 of which are located in France.

Alfalfa dehydration: Coop de France Déshydratation has developed a technique for pre-wilting alfalfa (see Box 1) reducing energy consumption by around 20% without any impact on the quality of the fodder. It has been necessary to invest in new agricultural equipment however (swather adapted to alfalfa) and to develop complex management of harvesting.

Grain dryers: in order to conserve grain during storage, it must first be dried. Current drying methods involve drying grain at a very high temperature and immediately cooling it. As well as requiring large amounts of energy, this technique increases the risk of the grain splitting. A new method, called dryeration, involves drying the grain at a temperature of between 45°C and 50°C, leaving it in a non-aerated space so that the grain's internal humidity moves to the outside, then placing it in a ventilated space to finish drying. This procedure preserves the quality of the grain more effectively. According to ADEME (2011), dryeration reduces fuel consumption by around 30% compared with traditional drying of corn. However, this technique requires a high initial investment since, on average, the dryer costs twice as much.

Sugar manufacturers: since energy consumption is their second biggest expense, sugar manufacturers have set up CHP installations. CHP allows some of the steam produced when dehydrating sugar beet to be used to generate the electricity required in the sugar manufacturing process, the remaining steam being used directly in the sugar manufacturing process. An analysis carried out by SNFS (*Syndicat National des Fabricants de Sucre*) estimates that this system has reduced the French sugar industry's emissions by 30%.

[1] They use AM 0034 methodology: Catalytic reduction of N2O inside the ammonia burner of nitric acid plants

CONCLUSION

The EU ETS covers more than 800 installations in the agricultural and agri-food sectors, either for their combustion, their nitric acid production or their ammonia production activities. The industry is among the net beneficiaries of the EU ETS in the first two phases (2005-2012), with a surplus of 33 million allowances over the period 2008-2011. This surplus, combined with the trade-off between allowances and credits, represents an estimated asset of 395 million euros. Although this asset has not been fully sold on the market, it largely exceeds the cost of transactions associated with emissions monitoring, reporting and verification (MRV) procedures and compliance work, estimated at 30 million euros over the same period. This net profit is due to generous free allocations combined with emissions reduction efforts.

This situation could change from 2013. The third phase of the EU ETS will be much more restrictive in terms of free allocation of allowances. The implementation of an allocation method using benchmarks and a gradual reduction in the quantity of free allowances, replaced by auctions, will mark a major turning point for the EU ETS. The reduction in the free allocation will force installations to buy allowances, either at auction or on the secondary market, and so pay for some of their CO_2e emissions. As well as these changes to the rules, the third phase features the inclusion of a number of agricultural installations in the EU ETS. In France, for instance, around 50 dryers and 20 alfalfa dehydration facilities will join the EU system in 2013. The new installations are therefore located more upstream of the agricultural industry as defined in this study, with strong roots in agriculture in the strict sense of the term.

To avoid risks of carbon leakage, some installations in the industry will not be affected by the annual reduction in free allowances. They will therefore receive all of their allocation free of charge. However, since the allocation method has changed from grandfathering to benchmarking, a number of installations with a risk of carbon leakage will still have their free allocation cut if they are not among the top 10% in terms of efficiency.

This means the EU ETS will no longer offer a source of revenue for the sector in phase III. However, this should not significantly affect the sector's competitiveness due to the free allocation to sectors at risk of carbon leakage. Furthermore, the EU ETS may marginally reinforce the intra-European competitiveness of the most efficient installations. This is particularly true of producers of drinks, oils and fats in France.

It is currently hard to say whether the changes anticipated in 2013 will favour investment in low-carbon technologies in the agricultural industry and to what extent they will impact the sector's emissions. However, emissions reduction actions have already been initiated in the installations concerned, particularly among fertilizer producers.

Appendix I – Method for determining free allocation of allowances in phase III

The allocation of free allowances is much more centralised than in the first two phases. The allocation involves four stages and concerns all installations covered by the EU ETS, with the exception of the electricity sector.

- **Determination of the total quantity of allowances for the EU ETS**

The average annual total of allowances issued over the period 2008-2012 (2,037,227,209 allowances) is used to calculate the quantity of allowances allocated in 2013, on a like-for-like basis. The quantity is reduced by a linear factor of 1.74%from 2010.

A = Quantity of allowances in 2013 on a like-for-like basis = 2,037,227 209 – 0.0174 × 3 = 1,930,883,949 allowances

We must then add the average total of allowances issued over the period 2008-2012 for installations voluntarily included pursuant to article 24 of the EU ETS directive (1,401,369 allowances). This amount is also adjusted by a linear factor of 1.74%:

B = Quantity of allowances in 2013 for article 24 installations = 1,401,369 – 0.0174 × 3 = 1,328,218 allowances

We must also add the quantity of allowances allocated to newcomers, adjusted by the linear factor of 1.74%, i.e. *C = 106,940,715 allowances*.

This gives a total quantity of allowances in 2013 of 2,039,152,882.

To calculate the total quantity for the rest of phase 3, an annual linear reduction of 1.74% should continue to be applied to the average annual total of allowances issued for the period 2008-2012, i.e. a reduction of 37,435,387 allowances each year.

- **Calculation of the total maximum quantity of free allowances in the EU ETS**

The maximum quantity of allowances can be determined by multiplying the total quantity of allowances in 2013, excluding those for newcomers (= A + B) by the share of the non-electricity sectors in phase 1 (estimated at 35.5%) and adding the quantity of allowances to be allocated to newcomers (= C).

Maximum quantity of free allowances in 2013 = 1932 × 0.355 + 107 = 793 million.

It is then necessary to apply the linear factor of 1.74% to calculate the maximum quantities of free allowances for the whole period.

- **Preliminary demand for free allowances by installation in 2013**

Each installation submits an application for free allowances using the following formula:

Preliminary allocation application by installation = benchmark × level of historic activity

Benchmarking: there are 52 "product" benchmarks covering more than 75% of the non-electricity sectors. These are calculated by taking the average of the top 10% of installations in terms of efficiency over the period 2007-2008. Sectors where no product benchmark exists can use, in order of priority and subject to feasibility: a heating benchmark, a fuel benchmark or a process benchmark.

Historic level of activity: this corresponds to the median annual level of production for the period 2005-2008 except when the median annual level of production is higher for the period 2009-2010, in which case that period is used.

At the time this study was published, not all states had submitted their preliminary free allowance application. The total amount is therefore still unknown.

- **Readjustment by application of a standard trans-sectoral factor**

If the preliminary free allowance application is higher than the maximum number of free allowances predetermined by the European Commission, a standard trans-sectoral correction factor will be applied to equalise the two values.

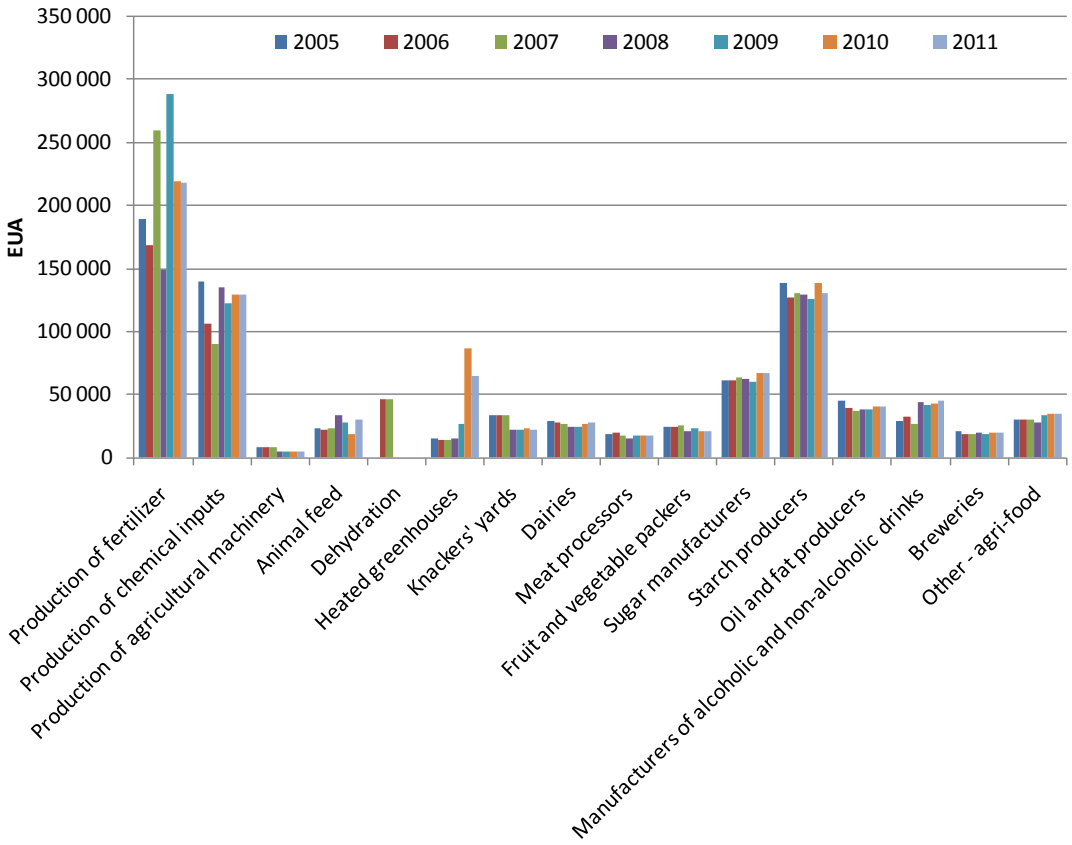
Since not all countries have submitted an application, it is hard to tell whether demand will be higher than the maximum quantity. It could be lower, in which case the difference will be auctioned and this correction factor will not be needed.

Application of a progressive elimination factor (PEF)

Then share of free allowances in 2013 will be 80% for the non-electricity sectors (PEF = 0.8) and will gradually fall to 30% in 2020 before being totally phased out in 2027. An exception is made, however, for 164 sectors exposed to risks of carbon leakage which will have a PEF of 1. In order to facilitate the modernisation of their production technologies, some electrical installations in Eastern Europe will receive exceptional free allocations, which will fall gradually until they are phased out in 2020.

Following these stages, the quantity of allowances to be allocated to installations free of charge will be known for the third phase of the EU ETS.

Appendix II – Change in average allocations by installation, class and year



Source: CDC Climat based on CITL data

Appendix III – Method for calculating savings made by the agricultural industry over the period 2008-2011 through the surrender of international credits

The savings made by the agricultural industry have been estimated by taking the average annual spread between EUAs and CERs in the year of surrender of international credits and multiplying it by the volume of international credits surrendered by the sector each year since 2008. The average annual EUA-CER variance is obtained by weighting the average daily price variance between the EUAs and CERs by the volume of CERs traded that day.

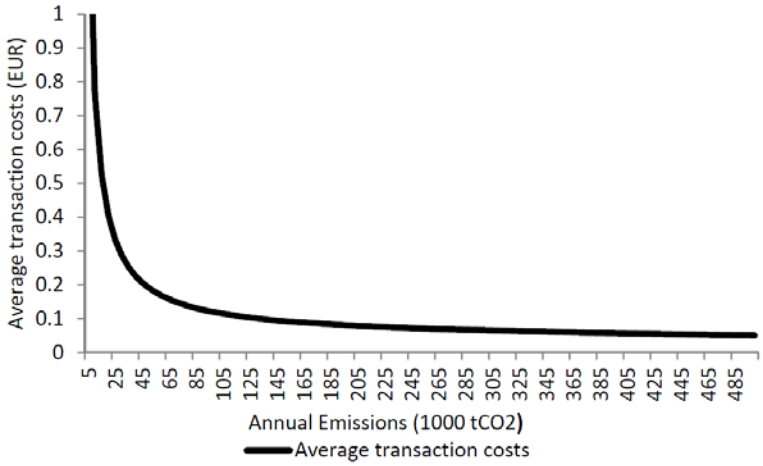
Year	EUA-CER spread	CER surrended (Mt)	ERU surrended (Mt)	International credits surrended	Savings (M€)
2008	3,9	1,155	0	1,155	**4,505**
2009	1,5	1,153	0,004	1,157	**1,736**
2010	1	2,036	0,736	2,772	**2,772**
2011	3,3	2,731	1,414	4,145	**13,679**
2008-2011					**22,6905**

Source: CDC Climat Research, CITL, ICE Futures Europe

Savings can therefore be estimated at 23 million euros over the period 2008-2011.

Appendix IV – Estimation of transaction costs

The agricultural industry's transaction costs have been estimated using the results of the ZEW study (Heindl, 2012). This study is based on data gathered from 150 German installations through two surveys conducted in 2010 and 2011. Average annual transaction costs per installation according to their annual emissions are presented in the graphic below.



Source: (Heindl, 2012)

This curve follows the following model:

ATCi (euros/year) = 7162.887 + 48.78564 × VEi ($ktCO_2$/year) – 0.0246899 × VEi^2 + εi

With:

ATCi: Annual Transaction Costs for the installation i

VEi: Verified Emissions for the installation

By applying this model to all installations in the agricultural industry for the period 2008-2011, we can estimate transaction costs for this period at 30 million euros.

This amount is probably overestimated: part of the calculation is based on the average cost of labour in the German industrial sector, which is not representative of Europe as a whole. Brokerage costs are also included in this estimation, which are minimal for the agricultural industry since it enjoyed a surplus of allowances and so did not need to buy additional allowances to meet its obligations.

Transaction costs are also likely to change significantly from 2013. This is because from the third period, marked by a progressive fall in allocation of free allowances, costs incurred to buy and sell allowances are set to increase. Conversely, relaxing of MRV requirements for the smallest installations will reduce associated costs.

Appendix V – Sectors concerned by risk of carbon leakage

This appendix sets out the criteria defined by the EU ETS directive used to draw up a list of sectors and sub-sectors posing a risk of carbon leakage as well as a list of agricultural and agri-food sectors and sub-sectors responding to each of these criteria. It is important to remember, however, that these criteria give the European Commission scope for discretion and therefore offer the various industries a lobbying window.

To establish this list, the European Commission has assessed risks based on a four-figure classification system for economic activities in the EU (NACE). However, in some cases it was necessary to subdivide sectors into sub-sectors when not all of the sector's branches were concerned by risks of carbon leakage. Prodcom codes were then used. The Prodcom list sets out a product nomenclature.

Criteria

The quantitative criteria defined by article 10a paragraphs 15 and 16 of the directive are:

i) total additional direct and indirect costs incurred as a result of implementing the directive lead to a significant increase in production costs, calculated as a proportion of gross value-added, of at least 5% and if the intensity of exchanges with third countries, defined as the ratio between total value of exports to third countries plus the value of imports from third countries and the total size of the market for the EU, is greater than 10%;

ii) a) total additional direct and indirect costs incurred as a result of implementing this directive lead to a particularly sharp increase in production costs, calculated as a proportion of gross value-added, of at least 30% or b) the intensity of exchanges with third countries, defined as the ratio between total value of exports to third countries plus the value of imports from third countries and the total size of the market for the EU, is greater than 30%;

The qualitative criteria defined by article 10a paragraph 17 of the directive are:

iii) according to the extent to which installations in the sector or sub-sector concerned are able to reduce their emissions or electricity consumption, including, where relevant the increase in production costs this investment may entail, for example by using the most efficient technologies; according to current and projected market characteristics, including when the intensity of exchanges or rates of increase in direct and indirect costs are approaching than 30%; according to profit margins as potential indicators of long-term investment or relocation decisions.

The list must also take account of *"the extent to which third countries, representing a decisive share of world production of products in sectors deemed to be at risk of carbon leakage, firmly commit to reducing greenhouse gas emissions in the relevant sectors and within the same time frame to an extent comparable to that of the EU and the extent to which carbon efficiency of installations located in these countries is comparable to that of the EU."*

Sectors and sub-sectors concerned

Sectors and sub-sectors	NACE and Prodcom code	Criteria concerned
Mining of minerals for the chemicals and natural fertilizer industries	1430	i and ii
Manufacture of nitrogen and fertilizer products	2415	i and ii
Manufacture of agro-chemical products	2420	ii b.
Manufacture of agricultural machinery	2931 and 2932	ii b.
Manufacture of machinery for the agri-food industry	2953	ii b.
Malt houses	1597	i and ii
Manufacture of sugar	1583	i
Production of distilled alcoholic beverages	1591	ii b.
Production of ethyl alcohol from fermented materials	1592	i
Production of wine	1593	ii b.
Production of other fermented beverages	1595	i
Fish industry	1520	ii b.
Manufacture of crude oils and fats	1541	ii b.
Manufacture of tomato concentrate	15331427	i and ii
Manufacture of whole milk powder or full cream powder (milk and cream in solid forms)	155120	i and ii
Production of casein	155153	i and ii
Production of lactose and lactose syrup	155154	i and ii
Production of cocoa paste (excluding paste with added sugaror othersweeteners)	15841100	i and ii
Production of cocoa butter, fat and oil	15841200	i and ii
Production of cocoa powder, without added sugar or other sweeteners	15841300	i and ii
Production of dried baker's yeast	15891333	i and ii
Manufacture of starches and starch products	1562	i

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