PANORAMA 2016

a look at ...

Overview of the refining industry in the European Union Emissions Trading System (EU ETS)

Inclusion of the refining sector in the EU ETS

In 2007, the European Council announced three binding targets for 2020[1] in the Climate and Energy Package: 20% of renewable energy in total energy consumption, 20% improvement in energy efficiency and a 20% reduction in greenhouse gas (GHG) emissions. By 2013, European GHG emissions had already fallen by 19%[2] compared with 1990, making it likely that the European target of –20% by 2020 will be achieved.

In October 2014 the European Council adopted the 2030[3] Climate and Energy Package (CEP) which moved the target for European GHG emission reduction to –40% by 2030[4], and includes targets to achieve a minimum 27% share for renewable energy in primary energy consumption, and at least a 27% improvement in energy efficiency.

Total 2012 GHG emissions for the EU-28 (excluding LULUCF[5] and including the aviation sector) were 4,682.9 $MtCO_2e$[6,7].

At the same time, Europe opted for an Emissions Trading System (EU ETS) as its key tool for reducing industrial GHG emissions. Thus, European objectives in the 2020 and 2030 CEP are incorporated into the EU ETS through two objectives – one aiming to lower GHG emissions by 21% by 2020 (compared with 1990 levels) and the second[8] aiming to lower GHG by 43% by 2030 (compared with 2005 levels).

European directive no. 2003/87/EC of October 13, 2003 established the EU ETS. Legal entities within various industries (production of heating and electricity, steel, cement, glass, paper and refining, and any combustion installations with a rated thermal input exceeding 20 MW would, until 2012, receive some or all of the free GHG emission allowances known as EUAs[9]. These allowances are permits to emit the equivalent of one metric ton of CO_2e[10].

Since 2013, a significant change was implemented in the EU ETS: allowances allocated free of charge in the past, is no longer the rule. From now on, free allowances must satisfy various conditions established by the EC[11], which essentially strip back the permits to emit industrial GHG.

The European Commission (EC) set the 2013 cap on industrial emissions under the EU ETS at 2,084 $MtCO_2e$.

This cap will decrease each year by 1.74% during phase 3 of the EU ETS (2013-2020). In absolute terms, this means that the average quantity of allowances will be reduced annually by 38.2 $MtCO_2e$.

To date, nearly 16,400 installations in Europe are required to measure and report[12] their GHG emissions and achieve compliance. Nearly 41% of European GHG emissions are included in the EU ETS.

To achieve the target of a 40% reduction in EU GHG emissions by 2030 (compared with 1990 levels), the cap will need to be lowered by 2.2% per year from 2021. This would reduce allowed emissions from fixed installations to around 43% below 2005 levels by 2030.

(1) Compared with 1990
(2) http://ec.europa.eu/clima/policies/strategies/progress/index_fr.htm
(3) To be put to a vote by the EC in 2016
(4) Compared with 1990
(5) LULUCF: Land Use, Land-Use Change and Forestry
(6) EEA. Technical report No. 09/2014. Annual European Union Greenhouse Gas Inventory 1990-2012 and Inventory Report 2014. Submission to the UNFCCC Secretariat
(7) Eurostat Statistical Books, ISSN 2363-2372, Energy, Transport and Environment Indicators 2015
(8) To be voted on by the end of 2016

(9) EUAs: European Union Allowances
(10) CO_2e: CO_2 equivalent. In addition to CO_2, N_2O and SF6 have been included in the EU ETS
(11) Linked to the sector benchmark, the cross-sectoral correction factor and the correction coefficient for the risk of carbon leakage, further discussed in page 6
(12) "Communiquer" in French

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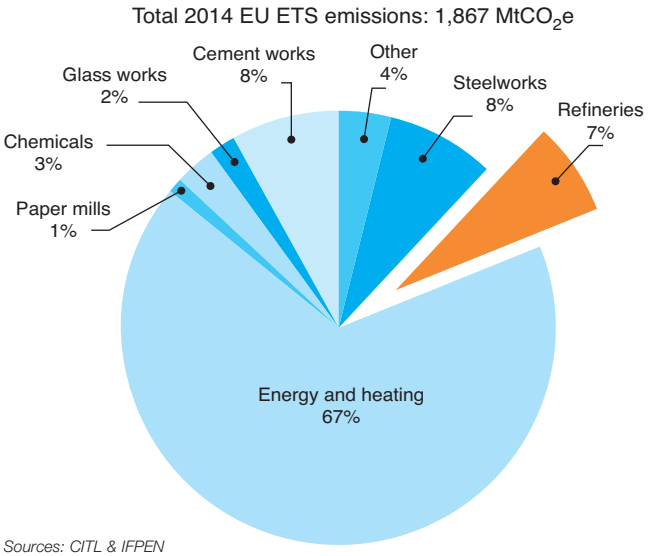
The EC estimates that, during phase 3 of the EU ETS (2013-2020), nearly 48% of allowances will be auctioned. This estimate takes into account all allowances allocated free of charge, as well as sectors on the carbon leakage list[13].

European refining has been included in the EU ETS[14] since its 2005 launch. Out of 1,867 $MtCO_2e$ total emissions recorded in 2014 in the EU ETS, refining emissions represented 7% of total emissions (Fig. 1).

Fig. 1 – GHG emissions by sector in the EU ETS for 2014



Sources: CITL & IFPEN

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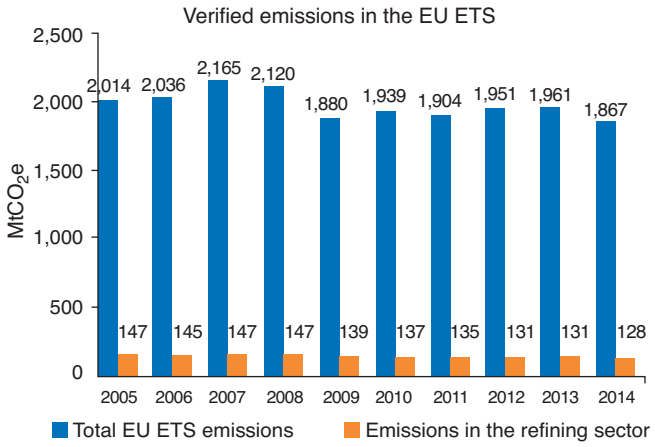
Since 2005, total CO_2e emissions reported and verified in the EU ETS fell by more than 7%, from 2,014 $MtCO_2e$ in 2005 to 1,867 $MtCO_2e$ in 2014. They peaked in 2007 at 2,165 $MtCO_2e$ before the economic crisis.

During this time, after experiencing relative stability from 2005 to 2008 at around 147 $MtCO_2e$, emissions from refining fell by more than 12%, reaching 128 $MtCO_2e$ in 2014 (Fig. 2).

Out of 30 countries included in the EU ETS in 2014, only 24 have refining or similar units. During the 2005-2014 period, Germany remained the largest emitter of CO_2e in the refining sector in the EU ETS. This is the case notwithstanding the fall in emissions from 29 $MtCO_2e$ to 24 $MtCO_2e$ between 2005 and 2014. In 2014, German emissions totaled 18.4% of total emissions in the European refining sector.

Fig. 2 – Change in total emissions and emissions from refining in the EU ETS



Sources: EUTL[15], Bloomberg DataBase[16] & IFPEN

Other countries generate significant emissions in this sector. Italy (19.3 $MtCO_2e$), Spain (14.1 $MtCO_2e$), the United Kingdom (11.2 $MtCO_2e$) and France (11.4 $MtCO_2e$) were the other four countries with the highest emissions in 2014. Note that since 2012, Spain has emitted more CO_2e than France or the United Kingdom (Fig. 3).

In 2014, six European countries accounted for 71% of refining sector emissions in the EU ETS: Germany, Italy, Spain, United Kingdom, France and the Netherlands. In 2005 – before Eastern European countries and Norway joined the EU ETS – these same countries accounted for 79% of emissions in the sector.

The number of refining sites covered by the EU ETS has continued to change since 2005 in response to closings and restructurings as well as the inclusion of new European members with refining sites such as Bulgaria and Romania in 2007, Norway in 2008 and Croatia in 2013.

Due to the inclusion of these new members, the refining sector has gained some twenty sites, mainly in Bulgaria and Romania. The sector reached a peak in 2007 with 152 sites covered by the allowance system, falling to 139 sites in 2014 (Fig. 4).

At least four major refineries closed[17] in Europe between 2005 and 2014. Two in France: the Petroplus Petit-Couronne refinery in 2013 (it issued 1,417 $ktCO_2e$ in 2005) and the Flandres refinery in 2014 (1,300 $ktCO_2e$ in 2005). Two in Germany: Karlsruhe in 2012 (1,625 $ktCO_2e$ in 2005) and the PCK Raffinerie GmbH refinery in 2013 (1,625 $ktCO_2e$ in 2005).

(13) http://ec.europa.eu/clima/policies/ets/cap/index_en.htm
(14) In EUTL sector codes no. 2 (Mineral oil refineries) and no. 21 (Refining of mineral oil)
(15) http://ec.europa.eu/environment/ets/napMgt.do;EUROPA_JSESSIONID=UTX8Ad-ZFY5JKKMnWkwr4A5eJ3GdQO_JtneQn3x5h269LSgcto4d!599595921
(16) Bloomberg DataBase as of 10/06/15
(17) The list is not exhaustive

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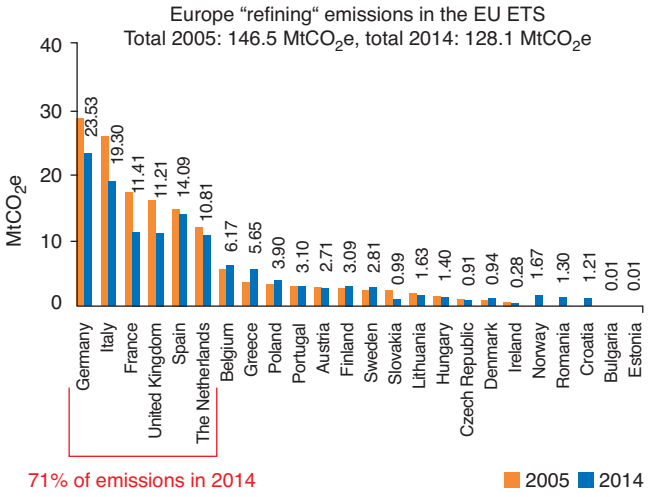
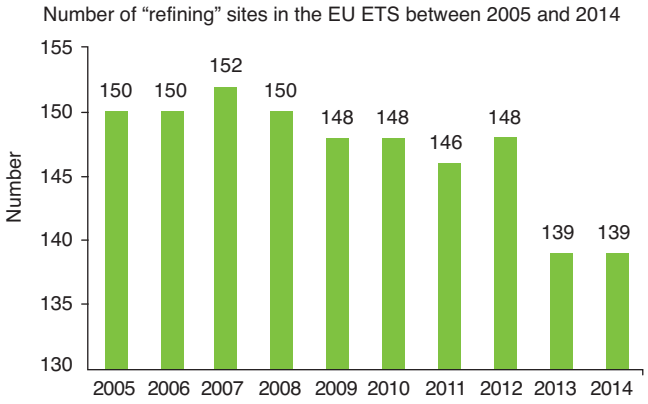
Fig. 3 – European emissions in the refining sector in the EU ETS – 2005 and 2014



Sources: EUTL, Bloomberg DataBase & IFPEN

Fig. 4 – Change in the number of refining sites in the EU ETS – 2005 and 2014



Sources: EUTL, Bloomberg DataBase[18] & IFPEN

Emissions at other sites more than doubled following reorganizations or reinvestments. This was the case for two refineries in Germany: Mineralölraffinerie Oberrhein GmbH, with a five-fold increase in emissions between 2005 and 2014, and PCK Raffinerie Glocke Schwedt, where emissions more than doubled from 2005 to 2014.

In Spain, emissions from the Repsol Petróleo SA refinery rose from 702 $ktCO_2e$ in 2005 to 2,413 $ktCO_2e$ in 2014 following restructuring. Finally, in Poland, emissions at the Instalacje Rafineryjne refinery rose from 694 $ktCO_2e$ in 2005 to 1,510 $ktCO_2e$ in 2014.

(18) Bloomberg DataBase as of 12/9/15

Compliance of a site or group of sites in the EU ETS

The EU ETS requires the covered installations (including refineries) surrenders to national registries a number of emissions permits[19] equal to the amount of their verified GHG emissions. In other words, an installation is deemed in compliance when the number of EUAs and carbon credits[20] surrendered is equal to its CO_2e emissions. The EU ETS operates in multi-year periods known as "phases". Installations must be in compliance every year and at the end of each trading period[21].

In the EU ETS during 2005-2007 (which corresponds to phase 1), free allowances were used to achieve site compliance until 2007 at the latest. Free allowances or those acquired *via* auction since 2008 will be used to achieve site compliance until at least 2020.

To determine if a sector or industrial site has a surplus or deficit under the EU ETS[22], actual emissions are subtracted from free allowances (EUAs) and used carbon credits (CERs and ERUs, see note 20), all for the same annual period or covering one or more trading periods.

Compliance of a site α, during period t, can be expressed as follows:

$C\alpha_t = ED\ \alpha_t - EUAsG\ \alpha_t - EUAsE\ \alpha_t - CERs\ \alpha_t - ERUs\ \alpha_t$

With:

- $C\alpha t$: compliance of a site α during period t,
- ED αt: reported emissions for site α during period t,
- EUAsG αt: free allowances for site α surrendered to the authority during period t,
- EUAsE αt: allowances purchased at auction and surrendered to the authority during period t,
- CERs αt: CER credits used during period t,
- ERUs αt: ERU credits used during period t,

If $C\alpha t \leq 0$, site α is in compliance in the EU ETS for period t.

If $C\alpha t \geq 0$, it is not in compliance and must trade on the market to offset its emissions.

(19) EUAs, CERs and ERUs

(20) CER (Certified Emissions Reductions) units via Clean Development Mechanism (CDM) projects excluding countries in Annex I of the Kyoto Protocol or ERU (Emission Reduction Units) units via Joint Implementation projects (JI) between countries in Annex I of the Kyoto Protocol

(21) The phases of the EU ETS are: phase 1: 2005-2007, phase 2: 2008-2012, phase 3: 2013-2020 and phase 4: 2021-2030

(22) That is, if the sector received more emission permits than needed or conversely, fewer allocated permits

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The sites' verified emissions are known from 2005 to 2014. Free allowances per site are established until 2020, as well as import authorizations for CER and ERU credits.

Method for defining the benchmark and allocating free allowances for the refining sector

Free allowances are established based on emissions levels of the 10% most efficient installations within the same sector (top decile benchmark). This method requires less efficient installations to purchase the allowances needed to cover their emissions that exceed the free allowances. Free allowances are defined based on historical production levels for each refinery. To this, the European Commission applies a cross-sectoral correction factor (CSCF)[23] that reduces the total amount of free allowances, all sectors combined, by 11.6% on average over phase 3 (2013-2020). Finally, these free allowances are corrected by a risk of carbon leakage coefficient, depending on whether the industry is considered exposed to international competition. Because the refining sector is considered exposed, its coefficient is equal to 1 (the coefficient is less than 1 if the sector has little exposure).

Refinery production processes are complex and give rise to numerous co-products including Liquefied Petroleum Gas (LPG), naphtha, gasoline, kerosene, diesel, and heavy and light fuels. Different units for processing crude interact within a refinery, and their carbon performance is interdependent. Metric tons of CO_2e emitted per ton of refined crude is not a relevant indicator of performance for the processes used, since they largely depend on the refinery scheme. It therefore elected to implement a common parameter to measure activity, the Complexity Weighted Tonne (CWT), in order to compare carbon efficiency across refineries on an equal footing. The European Commission calculated the benchmark of the top 10% of European refineries in terms of efficiency at 0.0295 tCO_2e/CWT.

The average efficiency of all European refineries equals 120% of the benchmark value. The distribution of refinery efficiency is relatively far from the benchmark when compared with other sectors such as cement, where this value was 106%. In addition, the aggregate refinery production level fell by only 8% compared with the historical baseline used to calculate allowances, compared with over 25% for cement. This contributed to a lower free allowance rate for refineries, on the order of 80%, compared to 120% for the cement sector in 2013.

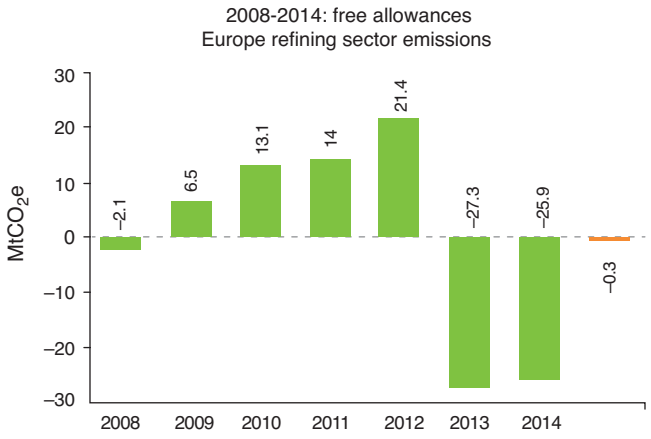
With respect to the EU ETS trading rules adopted since 2013, the total number of free allowances will be lowered by –1.74% per year until 2020, then by –2.20% per year until 2030. Free allowances by sector in phase 4 (2021-2030) are under discussion.

It is clear that the European Commission (or the DG CLIMA) is attempting to reduce surplus carbon allowances in the EU ETS market through a policy of lowering the cap each year, through the reduction of free allowances and adoption of the market stability reserve[24]. On top of this, CER and ERU credit imports to the EU ETS[25] will be prohibited as from 2021.

Refining sector compliance in the EU ETS from 2008 to 2014

Between 2008 and 2014, verified emissions in the refining industry were nearly equal to its free allowances alone (deficit of 0.3 $MtCO_2e$ for the period) (Fig. 5). Free allowances have fallen sharply since the start of phase 3 of the EU ETS (2013-2020).

Fig. 5 – Free allowances and verified emissions in the EU ETS for the refining sector



Sources: EUTL, Bloomberg DataBase & IFPEN

By adding the use of CERs and ERUs, the refining sector is in compliance and had a surplus of 74 $MtCO_2e$ over the 2008-2014 period (Fig. 6). However, it should be noted that since 2013 (phase 3), due to the drop in allocated allowances, there has been an annual deficit with respect to actual emissions of –23.7 $MtCO_2e$ in 2013 and of –17.3 $MtCO_2e$ in 2014.

(23) CSCF: Cross Sectoral Correction Factor

(24) MSR: Market Stability Reserve

(25) Corresponds to the end of the Kyoto protocol period (2008-2012)

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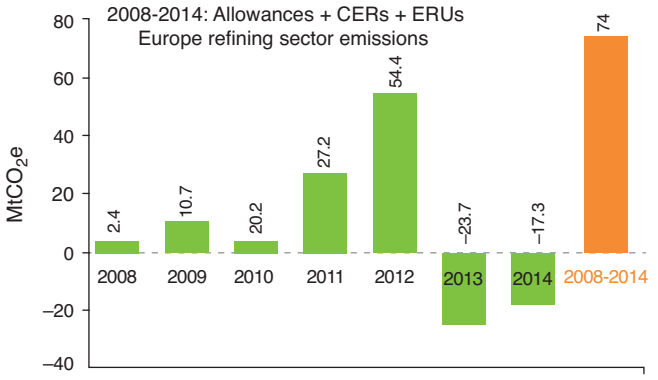
Fig. 6 – Allowances, use of CER and ERU credits and verified emissions of the refining industry in the EU ETS



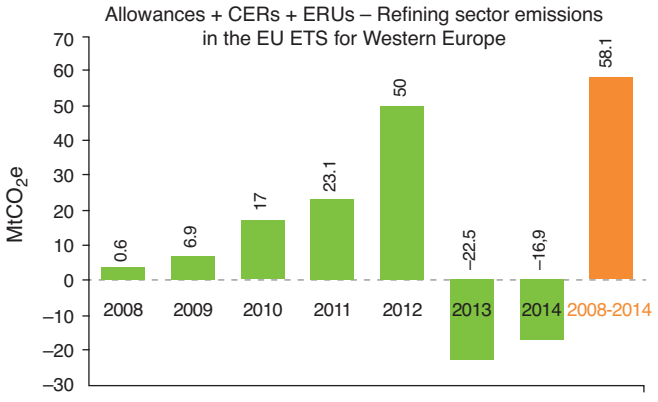
Sources: EUTL, Bloomberg DataBase & IFPEN

What is the overall position of the refining sector in Western European countries?

In Western Europe, the refining industry had an overall surplus for the 2008-2014 period of 58.1 $MtCO_2e$ (Fig. 7), corresponding to nearly six months of refining emissions in Western Europe. This surplus arose primarily between 2008 and 2012 (phase 2 of EU ETS trading), when emissions fell below the allocated allowances.

However, since 2013 and at the start of phase 3, the Western European refining sector had a deficit of –22.5 $MtCO_2e$ for 2013 and –16.9 $MtCO_2e$ for 2014.

Fig. 7 – Net position of the refining sector in Western Europe



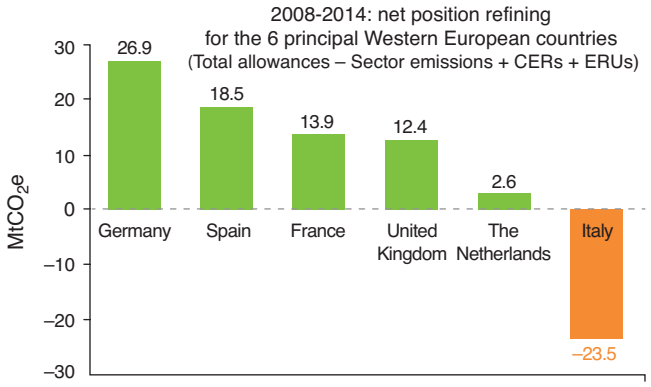
Sources: EUTL, Bloomberg DataBase & IFPEN

One exception: Italy!

The six leading Western European countries in terms of refining are Germany, Spain, France, United Kingdom, the Netherlands and Italy.

From 2008 to 2014, all of these countries maintained a surplus, with more authorizations to emit than actual reported emissions, except for Italy which reported a net deficit of –23.5 $MtCO_2e$ for the 2008-2014 period (Fig. 8).

Fig. 8 – Net position of the refining sector in the principal Western European refining countries



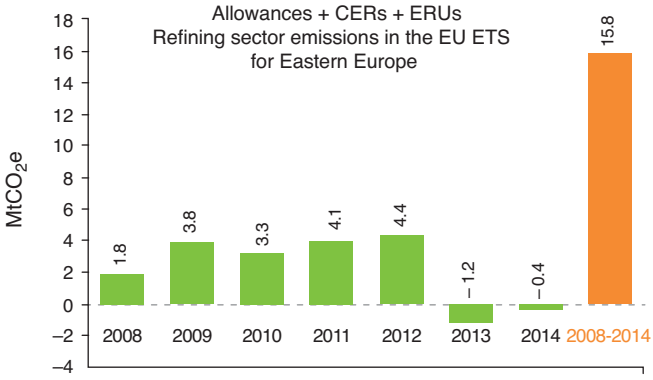
Sources: EUTL, Bloomberg DataBase & IFPEN

What is the overall position of the refining sector in Eastern European countries[26]?

Emissions from refining in Eastern European countries represented only 11% (14.1 $MtCO_2e$) of total emissions from European refining. Eastern countries reported an overall positive position in the refining sector during the 2008-2014 period. This overall surplus was equal to nearly one year of emissions from the sector (Fig. 9).

Of all Eastern European nations, Poland is the country with the largest refining industry. Polish emissions from refining equaled 3.9 $MtCO_2e$ in 2014 and achieved a surplus of 3.2 $MtCO_2e$ in emissions allowances over the 2008-2014 period.

Fig. 9 – Net position of the refining sector in Eastern Europe



Sources: EUTL, Bloomberg DataBase & IFPEN

(26) Austria, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania and Slovakia

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Net position in other sectors: cement manufacturers, energy and heating producers, aluminum and chemical production

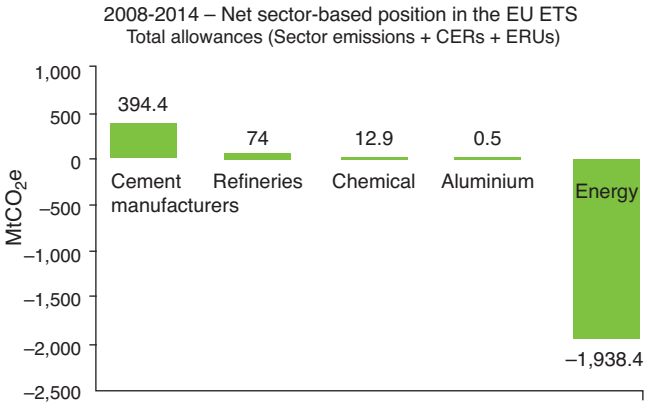
A broad disparity exists between sectors in terms of the net balance between verified emissions and total allowances (EUAs, CERs and ERUs).

Thus, the cement production industry had a net surplus of 394 $MtCO_2e$ in allowances over the 2008-2014 period (Fig. 10). 2014 emissions in the cement production industry totaled 124 $MtCO_2e$, a surplus equal to three years of emissions in the sector[27].

The chemical and aluminum production sectors are approaching equilibrium, with 13 $MtCO_2e$ and 0.5 $MtCO_2e$ in surplus emissions permits respectively.

In contrast, and due to the allocation method used since phase 2 of the EU ETS, the energy sector runs a structural deficit since it must purchase nearly all of its EUA allowances at auction. During 2008-2014, the energy sector purchased nearly 1,938 $MtCO_2e$ in allowances on the market. The European power market is fully included in the EU ETS and is not considered exposed to international competition. The cost of EUA allowances purchased at auction is entirely carried over to consumers' electric bills. Such cost carrying over is more difficult for industries which, like the refining sector, have to face imports of petroleum products from countries without carbon constraints.

Fig. 10 – Net sector-based position in the EU ETS. 2008-2014 period



Sources: EUTL, Bloomberg DataBase & IFPEN

(27) To iso-emissions

Declining growth projected for the European refining sector

Over the 2010-2035 period, projections for the processing of crude in the European refining industry are expected to fall by nearly 30%. Falling from 660 Mt/yr of processed crude to 500 Mt/yr by 2035[28]. Consequently, over the same period, this is expected to result in a 20 to 25% drop in CO_2e emissions, given the emergence of a new requirement for desulphurization of bunker fuels. In 2014, for 128.1 $MtCO_2e$ emitted, 102.2 million free allowances were allocated, i.e. 80% of free allowances. By 2020, only 90 $MtCO_2e$ in free allowances will be allocated to the refining sector. A 10% decline compared with 2014. It is estimated that by 2020, emissions from the European refining sector should be approximately 120 $MtCO_2e$[29]. The refining sector is therefore expected to be allocated nearly 75% of free allowances in 2020.

For a CO_2 price estimated at €20/t in 2020[30] the sector's compliance costs could reach nearly €600 million[31] for 2020 alone.

Conclusion

Since 2008, emissions from the refining sector have fallen by more than 12%, reaching 128 $MtCO_2e$ in 2014. Germany was the largest emitter of CO_2e for the 2005-2014 period. With Italy, Spain, the United Kingdom, France and the Netherlands, these six countries accounted for 71% of the industry's emissions in the EU ETS for 2014.

During the 2008-2014 period, the European refining sector had a surplus of 74 $MtCO_2e$, but since 2013 has had an annual deficit. Estimates show that the overall surplus of 74 $MtCO_2e$ should vanish by 2015.

In the future, European demand for petroleum products will drop, and forecasts for crude processing are expected to decline. IFPEN estimates that, by 2035, this decline should reach 30%, leading to a 20% drop in the sector's emissions. Against this background, the amount of free allowances in the refining sector will fall, from 80% in 2014 to nearly 75% in 2020, leading to

(28) See Panorama article "Refining outlook for 2035". IFPEN study
(29) IFPEN study
(30) Thomson Reuters. 11/27/2015
(31) (120 $MtCO_2e$ – 90 $MtCO_2$)€20/tCO_2e = €600 million*

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compliance costs for the European refining sector of approximately €600 million for 2020 alone, compared with the $6 billion needed for investment in Europe by 2035[32].

Due to the great disparity in efficiency among European refineries (difference when compared with the benchmark), it is clear that it will be extremely costly for certain refineries to remain in operation. This will lead to the likely closure of refineries that are less efficient in terms of GHG emissions.

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Final draft submitted in December 2015

(32) See Panorama article "Refining outlook for 2035"