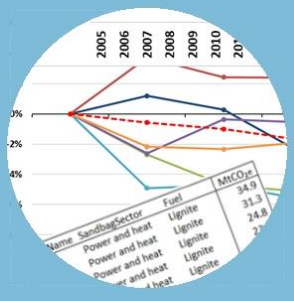
State of the EU Emissions Trading System 2017

Asking questions of the numbers: leaders and laggards



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KEY FINDINGS

- **The two highest emitting member states under the EU Emissions Trading System (ETS), Germany and Poland, also have some of the slowest rates of emissions reductions.** This is driven by the dominance of coal in their power and heat sector.
    - 15 of the 20 highest-emitting installations in the EU are coal and lignite plants.
    - 10 of these are in Germany and Poland.

- Overall power emissions have been decreasing, mainly due to declining coal use elsewhere in Europe, particularly the UK.
    - **Coal power still accounts for 39% of total EU ETS emissions** - so there is a lot of further reduction potential available.

- **Industry emissions have been stable in the current ETS phase, after declining during the economic crash in Phase 2 (2008-2012).**
    - Data available suggests reductions have been mainly achieved by lower production, not by reduced emissions intensity, although there are some exceptions (e.g. paper and paperboard and chemicals).
    - We risk running out of time to reach carbon neutrality in heavy industry sectors before our carbon budget is used up. Additional efforts are needed to stimulate abatement to meet even the lower range of the current long-term targets.

- **Aviation emissions under the ETS scope are currently relatively small but they are increasing very rapidly**. Net demand for EUAs from aviation will continue to increase.

- Total surplus of emissions permits has decreased in recent years but **at the end of 2016 there is still a huge 1.5 billion[1] surplus**.

- Industry's total potential to monetise oversupply has likely reached a cumulative level of **more than €9 billion** (2008-2016).
    - However, all highly emitting sectors except cement and lime now receive fewer allowances per year than required for compliance and their surpluses will decline in the remaining years of the current phase.

- **Phase 4 reform measures are insufficient to match supply to demand in the short to medium term.** The ongoing approach for protecting industry sectors from carbon leakage risk continues to dilute the effectiveness of the ETS as a tool to stimulate allowance trading to identify rapid least cost abatement.
    - A subsequent report will consider solutions in-depth.

[1] This figure differs from the Commission's May 2017 figure of 1.67 billion for market surplus (available here) because it uses more complete 2016 emissions data downloaded from the EUTL in August and includes net demand from aviation.

About this report

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1. Introduction

This report builds on our commentary (April 2017) on the release of the preliminary 2016 EU Emissions Trading System (ETS) compliance data by the Commission. It looks at the state of the ETS in 2017 by applying more complete data downloaded from the Union Registry EU Transaction Log (EUTL) in August, data from the Commission website on offsets, data from the appointed auctioning platforms on auctioned allowances, data from Eurostat on GDP per capita data and total sold production, and data from Eurostat on power generation.

Beginning with a brief look at overall EU ETS and Effort Sharing Directive (ESD) emissions combined to put the ETS emissions into context, this data review then focuses in more detail on fastest changing areas within just the ETS scope. It looks at emission trends, the drivers of those trends, the overall market balance, the balance of allocations and emissions in the various industrial sectors and the distribution of auctioning revenues and their use. It concludes with a brief overview of the changes recently agreed for ETS reform and their expected impact.

Sandbag will be publishing a more wide-ranging and forward-looking report on the state of ETS policy development later this month.

2. For the ETS and ESD combined, which EU28 countries emit most and which are reducing emissions fastest?

Overall EU emissions are declining, but not fast enough to meet our long-term targets of 80 to 95% emissions reductions compared to 1990. The pace of reduction varies from member state to member state. Unfortunately, the most highly emitting member state, Germany, is reducing emissions most slowly and increasing its share of the total emissions.

Before reviewing the ETS numbers, it is worthwhile to take a look at the overall ETS plus ESD stationary emissions[2] and where these are situated. Charts 1 and 2 below show the split of emissions across the member states for 2008 and 2015. Germany remains, by far, the highest emitter and is growing its share of overall emissions. Poland's and France's shares have also increased slightly whereas the UK's and Italy's shares have decreased.

Chart 1. Split of 2008 emissions (5,016 $MtCO_2e$)

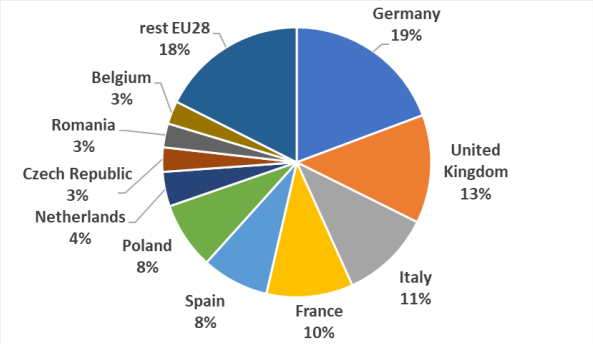
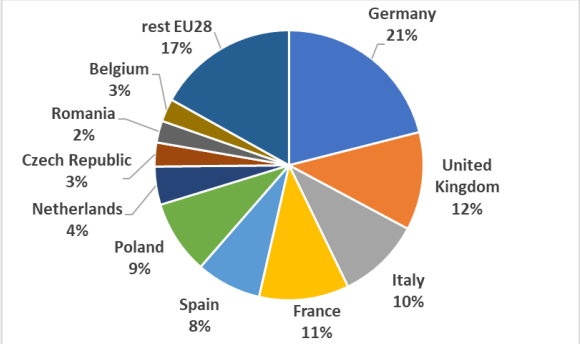


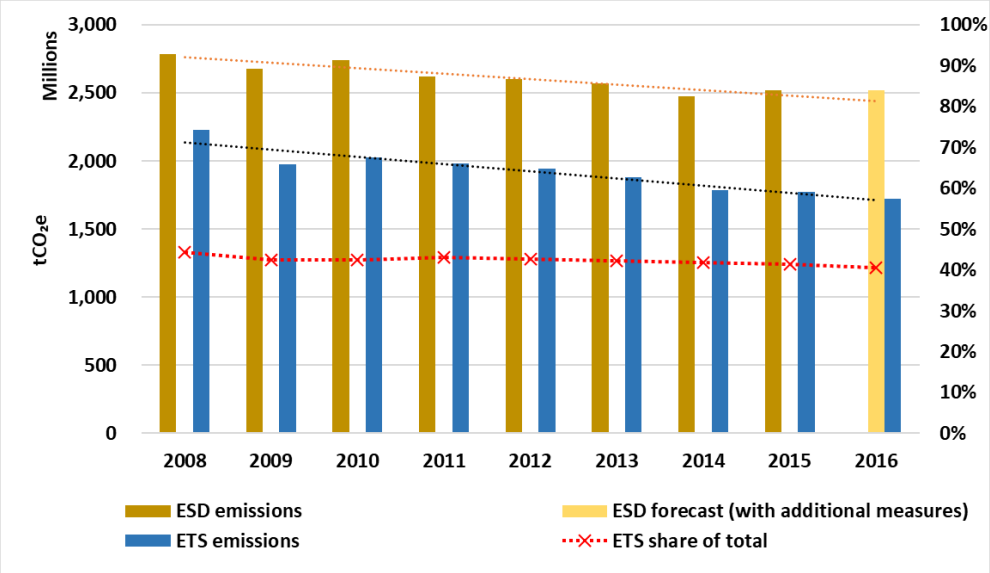
Chart 2. Split of 2015 emissions (4,296 $MtCO_2e$)



[2] *ETS emissions data for 2005 to 2016 was downloaded from the ETS Union Registry EU Transaction Log in Aug 2017: available here. These figures have been adjusted for scope change using data downloaded from the European Environment Agency: dataset last modified Aug 2017, available here. ESD emissions data for 2005 to 2015 was downloaded from the European Environment Agency: dataset last modified Jun 2017, available here. ESD data excludes Land Use, Land Use Change and Forestry (LULUCF) and excludes aviation. ESD projected emissions data for 2016, with additional measures, was downloaded from the European Environment Agency: dataset last modified Apr 2017, available here. For more details on ETS scope change see appendices.*

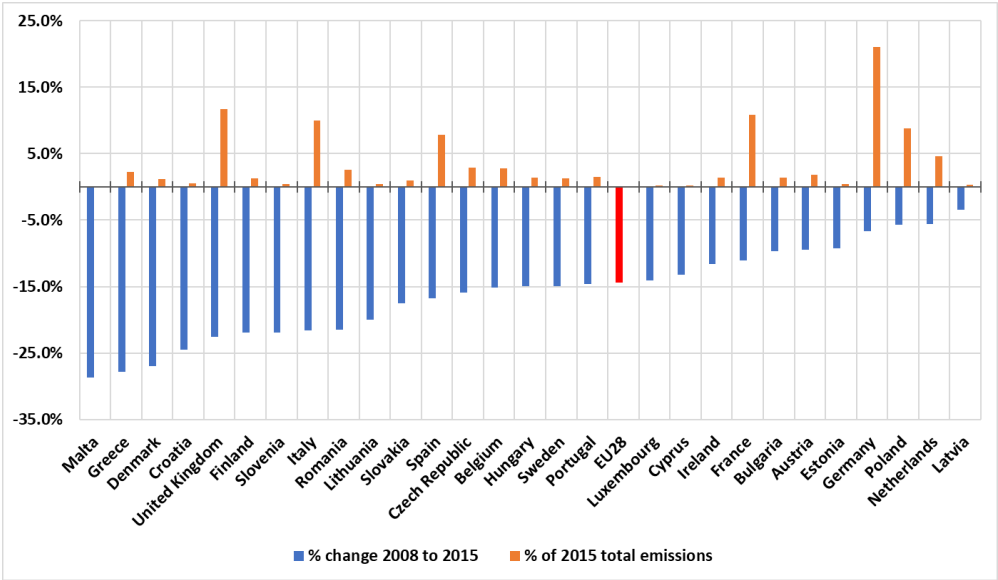
Overall, EU28 ETS plus ESD[3] emissions have been reducing by approximately 2.2% per year since 2008. This rate needs to be sustained right out to 2050 to achieve an 80% reduction compared to 1990 baseline[4], and increased to 2.7% to achieve a 95% reduction. Emissions from both the traded sector (ETS) and the non-traded sector (ESD) have declined in the EU28 as can be seen in Chart 3 below.

Chart 3: ESD and ETS emissions trends (scope adjusted, excl. LULUCF & excl. aviation)



The pace of emissions reduction varies considerably from member state to member state as can be seen in Chart 4 below. The blue bars show the percentage change in emissions from 2008 to 2015 (ETS plus ESD) sorted left to right by most reduction to least reduction (or even growth). The orange bars show the member states' share of the total EU28 2015 emissions. The chart illustrates how highly emitting member states, such as Germany, France, Poland and the Netherlands, have been reducing much more slowly than the EU total. In contrast, other highly emitting member states such as the UK, Italy, and Spain, have reduced faster than the EU overall.

Chart 4. Percentage change in emissions per member state from 2008 to 2015 (ESD plus ETS)



[3] *ETS stationary emissions scope adjusted, ESD without LULUCF or aviation*

[4] *Baseline for 1990 emissions for relative reductions calculations is 5,633 $MtCO_2e$, based on latest GHG reporting, excluding Land Use, Land Use Change and Forestry (LULUCF) and aviation, available here.*

3. Stationary ETS emissions: are they decoupling from GDP?

A success story at first glance but there are wide differences from member state to member state.

The previous section saw that the pace of overall emission reductions varies considerably between member states. This section looks at differences for just ETS emission reductions. It also explores to what extent the EU member states have been able to decouple ETS emissions from GDP.

Chart 5 below shows stationary ETS emissions split by member state (scope adjusted[5]). Germany has the highest emissions followed by Poland, Italy and the UK. These four member states together accounted for more than half of the 2016 emissions. Chart 6 illustrates which of the top eight emitting member states in 2016 have been reducing fastest. The two highest emitting member states, Germany and Poland, are also the member states with the lowest emissions reduction rates.

Chart 5. ETS emissions by member state (scope adjusted)

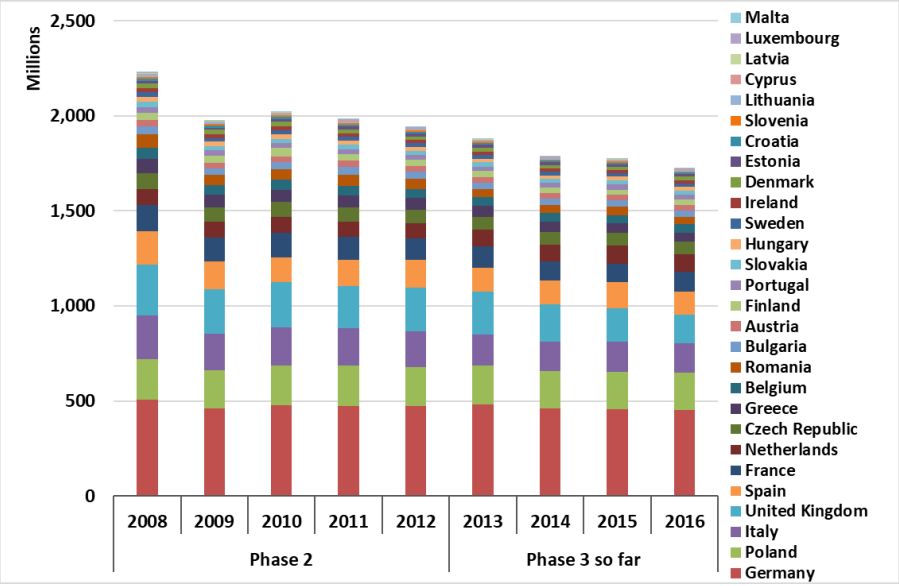
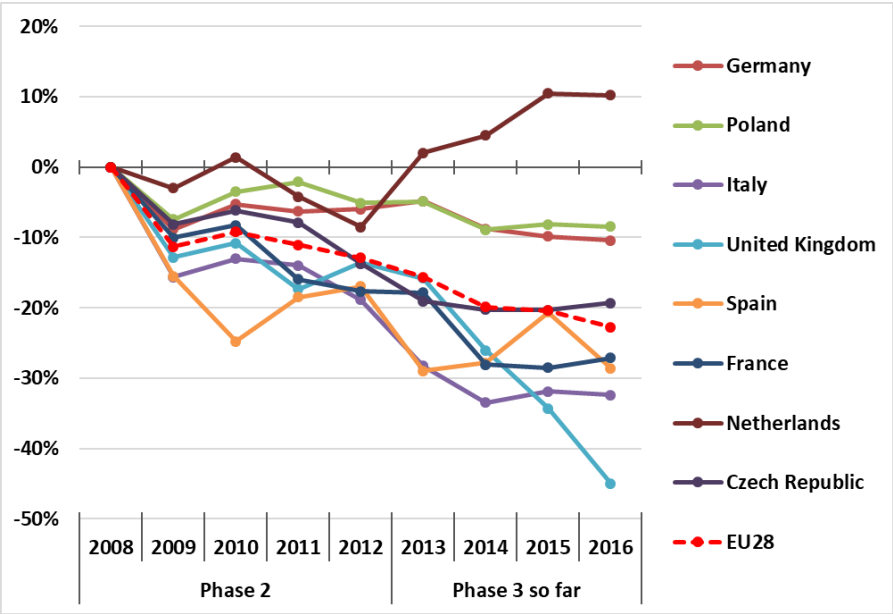


Chart 6. Percentage change in ETS emissions compared to 2008 emissions (scope adjusted)

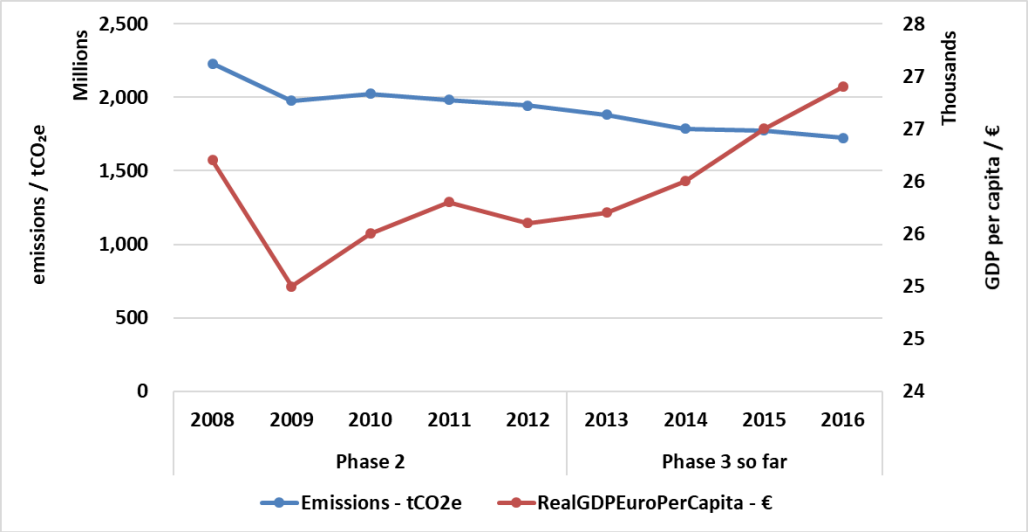


[5] *Scope adjusted using data downloaded from the European Environment Agency: dataset last modified Aug 2017, available here.*

As will be illustrated later in this report, the increase in ETS emissions in the Netherlands and the lower than overall EU28 reductions in Germany and Poland are strongly influenced by those member states' fuel mixes for power generation. The fast reductions in UK emissions have also been driven to a large extent by power sector reductions related to decreasing coal and other fossil fuel generation. Other high emitters, Italy, Spain and France, have also been reducing emissions faster than the overall EU28 rate.

Chart 7 below looks at the overall EU28 stationary emissions trend and tracks it with GDP per capita[6] recovery since the deep recession of the late 2000s. Emissions have indeed been falling at the same time as GDP has been increasing[7] which indicates some degree of decoupling.

Chart 7. Trend in EU28 ETS emissions (scope adjusted) compared to trend in GDP per capita



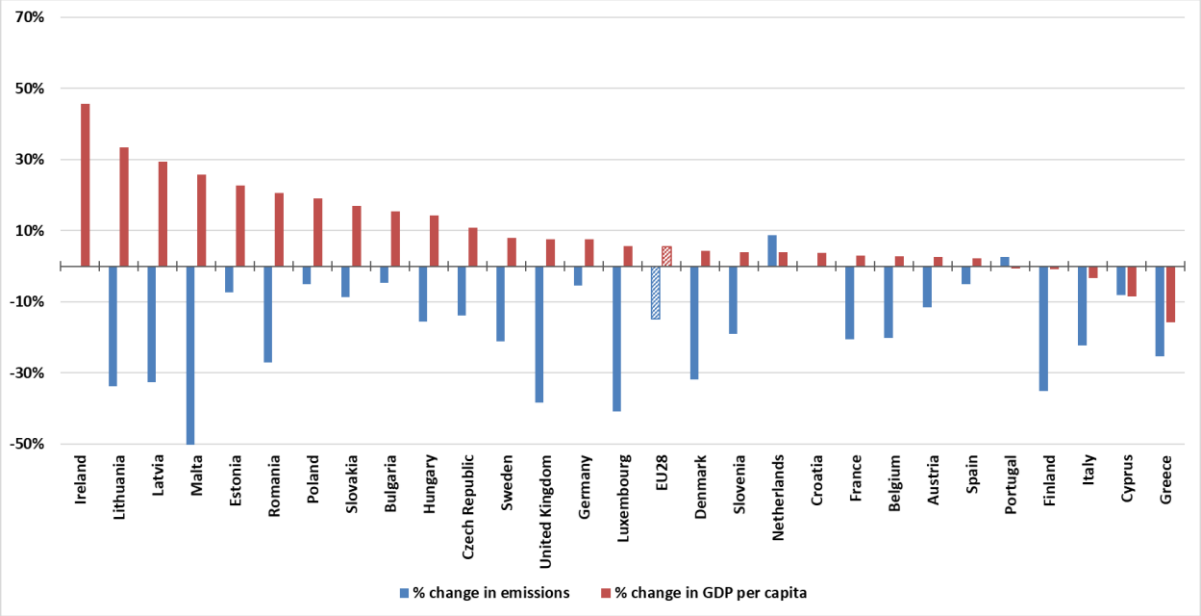
Focusing on the post-recession time period, Chart 8 below compares the change in ETS emissions per member state between 2010 and 2016 (blue column) with their change in real GDP per capita (red column). The member states are sorted left to right in descending order of GDP per capita change.

The good news is that many countries have significantly grown GDP per capita whilst at the same achieving large reductions in stationary emissions. Amongst the higher emitters, these include the UK, the Czech Republic and, to a lesser extent, France. Many Central and Eastern European member states have also seen double-digit emissions reductions whilst successfully growing their economies. By contrast, with a smaller increase in GDP, the highest emitter Germany, has decreased emissions far less than the EU28 as a whole. Poland has seen a higher increase in GDP for a similar emissions decrease. The Netherlands has seen emissions increases alongside its modest increase in GDP. Portugal has also seen a small emissions increase but with a small decrease in GDP.

[6] *Data downloaded from Eurostat 20170816 (ChainLinkedVolumes, 2010): available here.*

[7] *Chart X shows the evolution of GDP per capita between 2008 and 2016. In the same period, the population in the EU has increased slightly (+2%), which implies that the decoupling is even stronger when comparing emissions with absolute GDP.*

Chart 8. 2010 to 2016 % change in stationary emissions (scope adjusted) and GDP per capita



However, we should be cautious in our interpretation of these positive signs of decoupling. Emissions decreases could also be reflecting shifts from industrial to service-based economies. It should also be born in mind that consumption-based emissions may be on the rise in some member states[8].

4. What's happening to the overall balance of ETS supply to demand?

Despite reduced auctioning in 2014, 2015 and 2016, the total market surplus still exceeds 1.5 billion allowances – close to a year's worth of current demand.

So far, many more allowances have been released to market in total than have been required for emissions compliance under the scope of the trading system. The oversupply has been made worse by the augmentation of the ETS cap via the Linking Directive[9] which allows the use of around 1.6 billion offsets for ETS compliance between 2008 and 2020. Most of this offset entitlement[10] has been used up already. Less than 50 million remain to be used by the end of the phase.

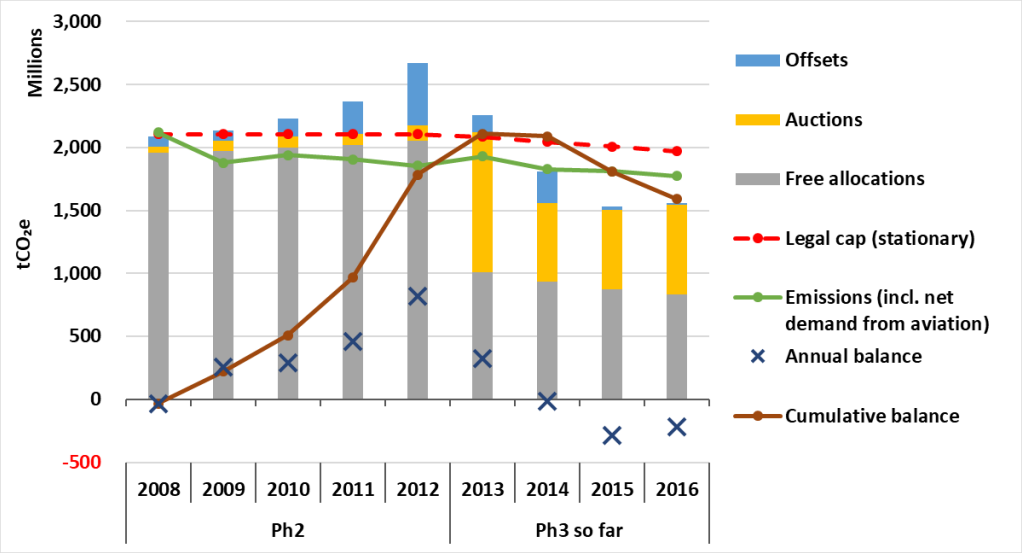
Chart 9 below illustrates the development of the overall market supply balance since 2008 in terms of supply via free allocation, supply via auctioning and via additional offset use, minus the demand needed to cover emissions (stationary emissions plus net demand from the aviation sector).

[8] This report is focussed on production-based emissions. Analysis of the extent of offshoring of emissions and on consumption-based emissions is beyond its scope.

[9] DIRECTIVE 2004/101/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, available here.

[10] Offset entitlement figures downloaded from EUTL together with emissions and free allocation data.

Chart 9. Free allocation, auction and offset supply, emissions demand, and build up of surplus since 2008



The chart illustrates how the introduction of offsets as a result of the Linking Directive has resulted in the overall annual supply (stacked column) exceeding the legal cap during Phase 2 and in 2013. The chart also illustrates the Phase 2 to Phase 3 change in how allowances reach the market. Since the start of Phase 3, auctioning is intended to be the default method of releasing allowances. Power sector participants no longer receive free allocations unless by derogation from auctioning in accordance with Article 10c of the ETS Directive. This limited derogation is restricted to certain member states with power sectors in transition[11].

Following an amendment to the Auctioning Regulation[12], auction levels in 2014, 2015 and 2016 were lower than originally planned for the phase. The amendment allows a temporary backloading of Phase 3 auctions from 2014, 2015 and 2016 (400 million, 300 million and 200 million allowances respectively) to 2019 and 2020 (300 million and 600 million respectively). The backloading was agreed at the start of 2014 as a temporary measure to address the large build-up of surplus allowances in the market before establishing a more permanent solution to the problem of market imbalance.

The Market Stability Reserve (MSR) Decision was agreed in 2015 to provide a more permanent measure for addressing market imbalance. Starting in 2019, the MSR will withdraw a certain proportion of the allowances due to come to auction if the cumulative balance of allowances in circulation exceeds a specified upper threshold value considered to be necessary for adequate market functioning. It will return allowances to the market, above the normal auctioning amounts, in the event of market tightness below a specified lower threshold value[13]. The MSR Decision also established that the 900 million backloaded allowances due to return to market in 2019 and 2020 will instead be placed directly in the MSR. Unused Phase 3 New Entrants Reserve (NER) allowances

[11] Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania, Latvia and Malta.

[12] Backloading is implemented via COMMISSION REGULATION (EU) No 176/2014 of 25 February 2014 amending Regulation (EU) No 1031/2010 in particular to determine the volumes of greenhouse gas emission allowances to be auctioned in 2013-20, available here.

[13] DECISION (EU) 2015/1814 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 October 2015 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC, available here.

and allowances freed up via installation activity cessations, partial cessations or significant capacity reductions[14] are also destined for the MSR[15].

Despite three consecutive years of restricted auctioning as a result of backloading, the overall cumulative balance at the end of 2016 stands at just over 1.5 billion[16] surplus allowances. This is close to a whole year's worth of demand.

5. How do power and heat emissions compare to industry and aviation emissions?

Significant steady progress has been made in reducing ETS emissions from power and heat (24% reduction compared to 2008). Emissions from industry sectors also dropped significantly over the period (20% reduction compared to 2008) but most of this reduction was achieved during Phase 2 and industrial emissions have remained stubbornly more or less flat in recent years. Aviation emissions under the scope of the ETS are currently relatively low but are growing rapidly (16% increase from the start of this phase)[17].

Section 3 has shown how total ETS emissions have been decreasing since 2008 and have decoupled, to varying degrees, from GDP in most member states. This section compares the relative contributions of power and heat, industry and aviation to the ETS emissions. This is followed by a deeper dive into the numbers for each of these main sectors.

Chart 10 below illustrates the relative contributions of power and heat, industry and aviation to EU28 ETS emissions in Phase 2 and 3 so far under the ETS (scope adjusted[18]). Power and heat emissions continue to dominate but they are falling fast as can be seen in the following chart.

Chart 11 compares the rates of emissions change for power and heat, for industry and for aviation. Following a relatively flat period during Phase 2, which was preceded by a rapid decrease related to the recession, power emissions have been declining fast during Phase 3 so far. After a similar rapid decrease at the start of Phase 2, industry emissions reductions more or less flattened out. Most EU aviation sector emissions remain outside the scope of the ETS[19] but even those within the scope of the ETS are growing rapidly.

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[14] Under the current phase's rules on activity adjustment. See Section 7.2 for commentary on the inadequacy of the current activity adjustment rules.

[15] Sandbag estimates that there are likely to be approximately 305 million left-over Phase 3 NER allowances and approximately 775 million other allowances under the Phase 3 cap that are not auctioned, not backloaded (to go to MSR), not freely allocated and not unused Article 10c allowances.

[16] This figure differs from the Commission's May 2017 figure of 1.67 billion for market surplus (available here) because it uses more complete 2016 emissions data downloaded from the EUTL in August and includes net demand from aviation.

[17] Aviation emissions have not been adjusted for scope change between 2012 and 2013 so the comparison here is from 2013. See Commission website here for further information on the 'Stop the Clock' decision for aviation under the EU ETS.

[18] Data from EUTL, downloaded Aug 2017. Stationary emissions adjusted for scope change using data downloaded from the European Environment Agency: dataset last modified Aug 2017, available here. See appendix for further details on estimations for scope change by member state and sector.

[19] Please refer to the Commission website here for further information on EU policy to reduce emissions from aviation.

Chart 10. Comparing power and heat , industry and aviation emissions since 2008 (scope adjusted)

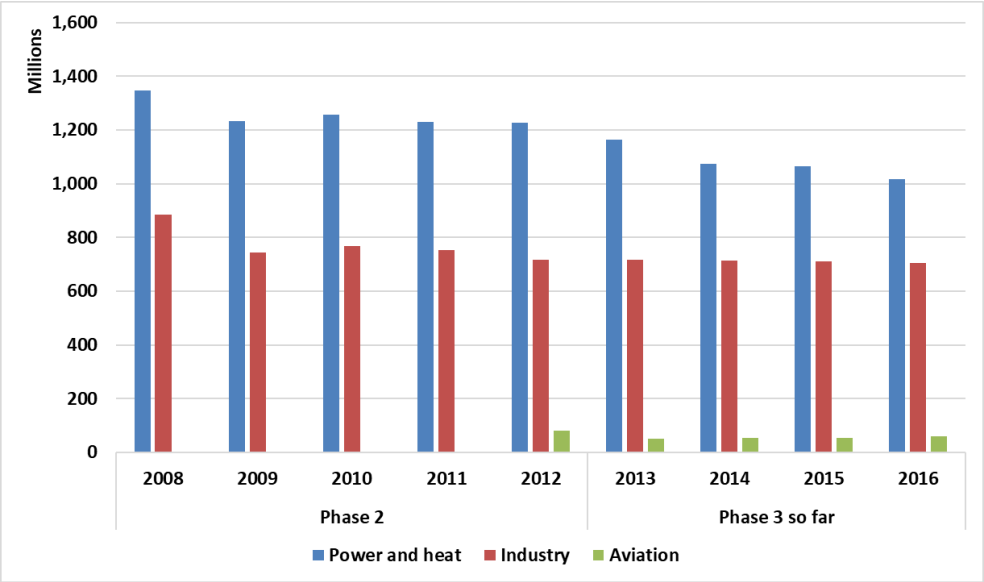
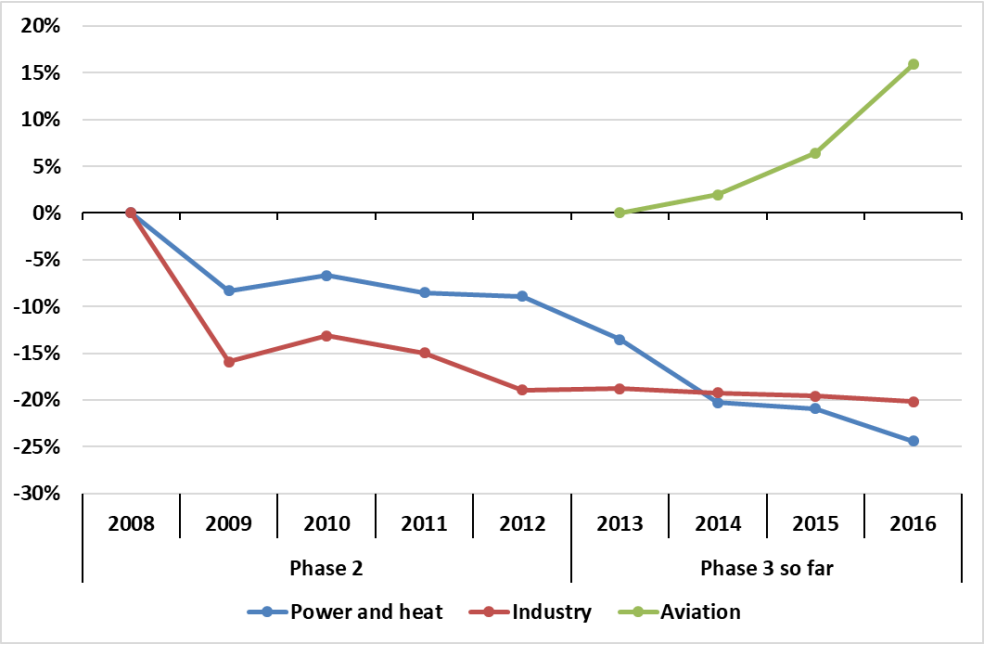


Chart 11. Percentage change in emissions (scope adjusted) compared to 2008 levels (2013 for aviation)



11 of the top 20 emitting ETS installations in 2016 are lignite fired power plants

The importance of focusing on phasing out coal for power generation, particularly the dirtiest lignite coal, is illustrated very clearly by the list of the top 20 emitting ETS installations shown in Table 1 below. The 11 lignite power stations included in this top 20 together accounted for 11% of the total ETS emissions in 2016.

Just three industrial installations reach the top 20 emitters list. All are iron and steel installations. Airline operator Ryanair also makes the top twenty.

Table 1. Top 20 emitting ETS installations in 2016

InstallationName	RegCtryName	SandbagSector	Fuel	$MtCO_2e$
PGE GiEK S.A. Oddział Elektrownia Bełchatów	Poland	Power and heat	Lignite	34.9
Kraftwerk Neurath	Germany	Power and heat	Lignite	31.3
Kraftwerk Niederaußem	Germany	Power and heat	Lignite	24.8
Kraftwerk Jänschwalde	Germany	Power and heat	Lignite	23.8
Kraftwerk Weisweiler	Germany	Power and heat	Lignite	18.7
Kraftwerk Schwarze Pumpe	Germany	Power and heat	Lignite	12.2
ELEKTROWNIA KOZIENICE	Poland	Power and heat	Hard coal	12.0
Kraftwerk Lippendorf	Germany	Power and heat	Lignite	10.8
CENTRALE TERMOELETTRICA DI TORREVALDALIGA NORD	Italy	Power and heat	Hard coal	10.2
Kraftwerk Boxberg Werk IV	Germany	Power and heat	Lignite	9.7
TPP MARITSA EAST 2 EAD	Bulgaria	Power and heat	Lignite	9.6
ΑΤΜΟΗΛΕΚΤΡΙΚΟΣ ΣΤΑΘΜΟΣ ΑΗΣ ΑΓΙΟΥ ΔΗΜΗΤΡΙΟΥ	Greece	Power and heat	Lignite	9.1
Kraftwerk Boxberg Werk III	Germany	Power and heat	Lignite	8.9
U. S. Steel Košice, s.r.o.	Slovakia	Iron and steel		8.9
Voestalpine Stahl Linz	Austria	Iron and steel		8.7
Integriertes Hüttenwerk Duisburg	Germany	Iron and steel		8.4
Ryanair Limited	Ireland	Aviation		8.4
RWE Eemshaven Centrale	Netherlands	Power and heat	Hard coal	8.3
CENTRALE TERMOELETTRICA DI BRINDISI SUD	Italy	Power and heat	Hard coal	8.3
Eesti Elektrijaam	Estonia	Power and heat	Other	7.9
rest				1,507.5
EU28 total				1,782.4

Coal power installations accounted for 39% of all ETS emissions in 2016

6. Which member states are reducing power and heat emissions most rapidly?

Nearly half of all current power and heat emissions come from just two member states: Germany and Poland. Both are reducing power emissions more slowly than other member states with high power emissions. Power emissions from the Netherlands are increasing. By contrast, power emissions from the UK, Spain and Italy are decreasing rapidly.

Sandbag has combined forces with several other NGOs and thinktanks to highlight the crucial role of coal phase-out for achieving rapid power sector emissions reductions. Please refer to our recent reports, *'Carbon Haven: German lignite is fuelling electricity exports'* and *'Energy Transition in the Power Sector in Europe: State of Affairs in 2016'* and to the Europe Beyond Coal website for a more comprehensive review of power emissions.

As we have seen in Section 5 above, the power sector has been the primary driver of ETS emissions reductions so far. With 16 of the top 20 emitting installations coming from the power sector and 39% of 2016 emissions coming from coal power stations, there is still much potential for further rapid abatement.

Chart 12 below shows the split of power emissions per year by member state[20] and Chart 13 shows which of the top six emitting member states are changing most rapidly. The Netherlands is alone in increasing its power and heat emissions over the period. However, the new Dutch government has announced the closure of all coal fired power stations by 2030. Subsidies for cofiring biomass with coal will be stopped by 2024[21].

[20] *Important: As Croatia's emissions are relatively small, estimates to account for scope change as a result of this member state joining in 2013 have not been taken into account in this section.*

[21] *See p.38 of 10th October 2017 Regeerakkoord 2017 – 2021 available here*

Chart 12. Power and heat sector emissions per year per member state

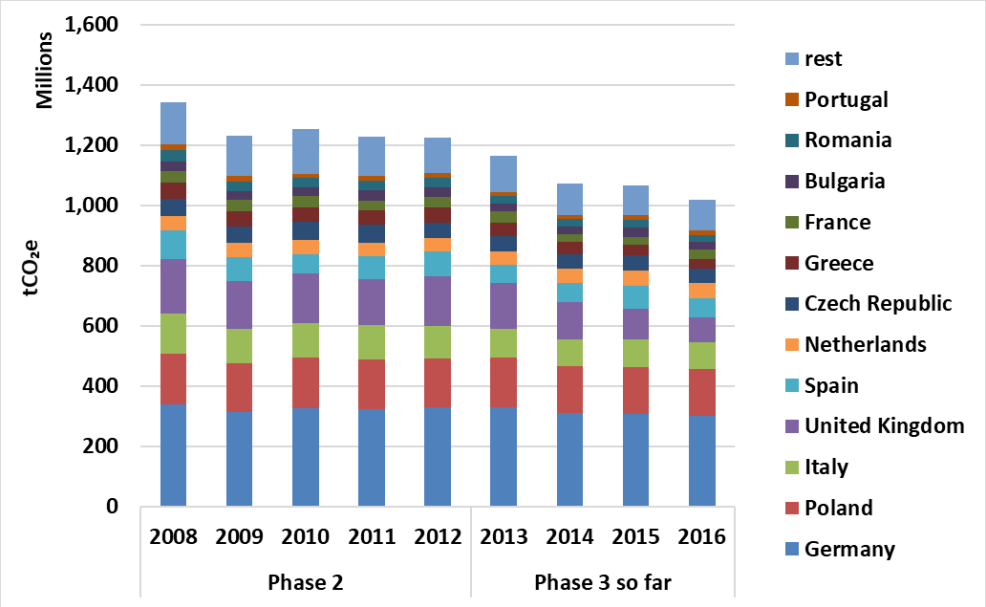
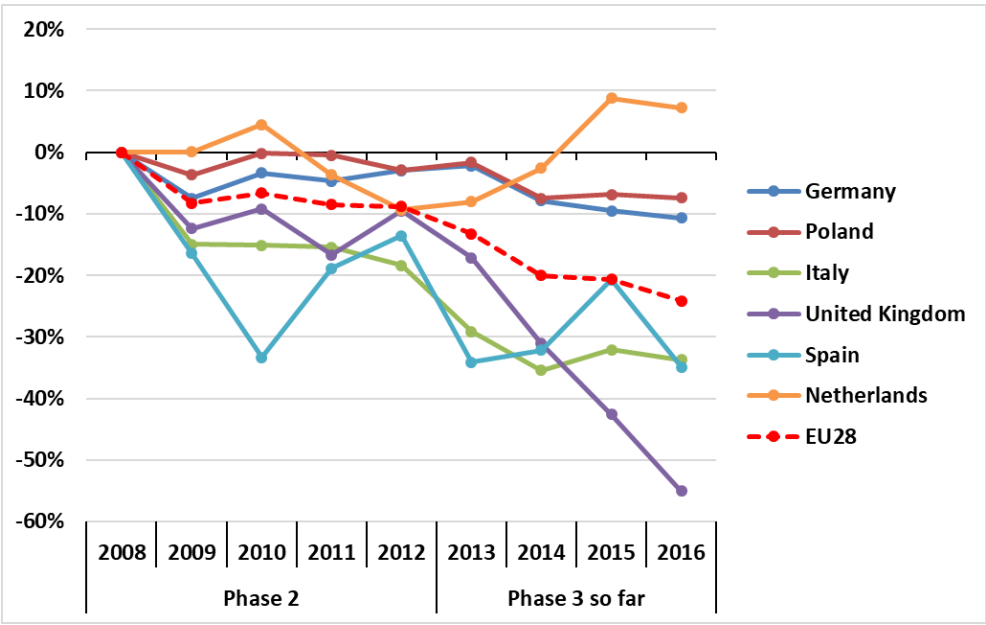


Chart 13. Percentage change in power and heat emissions compared to 2008



Germany and Poland are decreasing power emissions but at a far slower rate than the EU28 total. Italy, Spain and the UK are all reducing power emissions faster than the EU28 overall. The Netherlands is alone in increasing power emissions but, as mentioned above, this is expected to change following recent announcements by the new Dutch government.

6.1 Where are the highest emitting power sector installations?

Power and heat sector emissions are concentrated at just a handful of installations. Most of these are in Germany.

Over half of the power sector's emissions in 2016 come from just 2% of the sector's installations, and a quarter of the emissions come from the top 18 installations. These are listed in Table 2 below and are mainly in Germany and Poland. Many of these installations have been increasing their emissions compared to 2008. On the other hand, emissions reductions in other member states show

that rapid abatement can be achieved. There is much abatement potential to be tapped via action at just a few installations

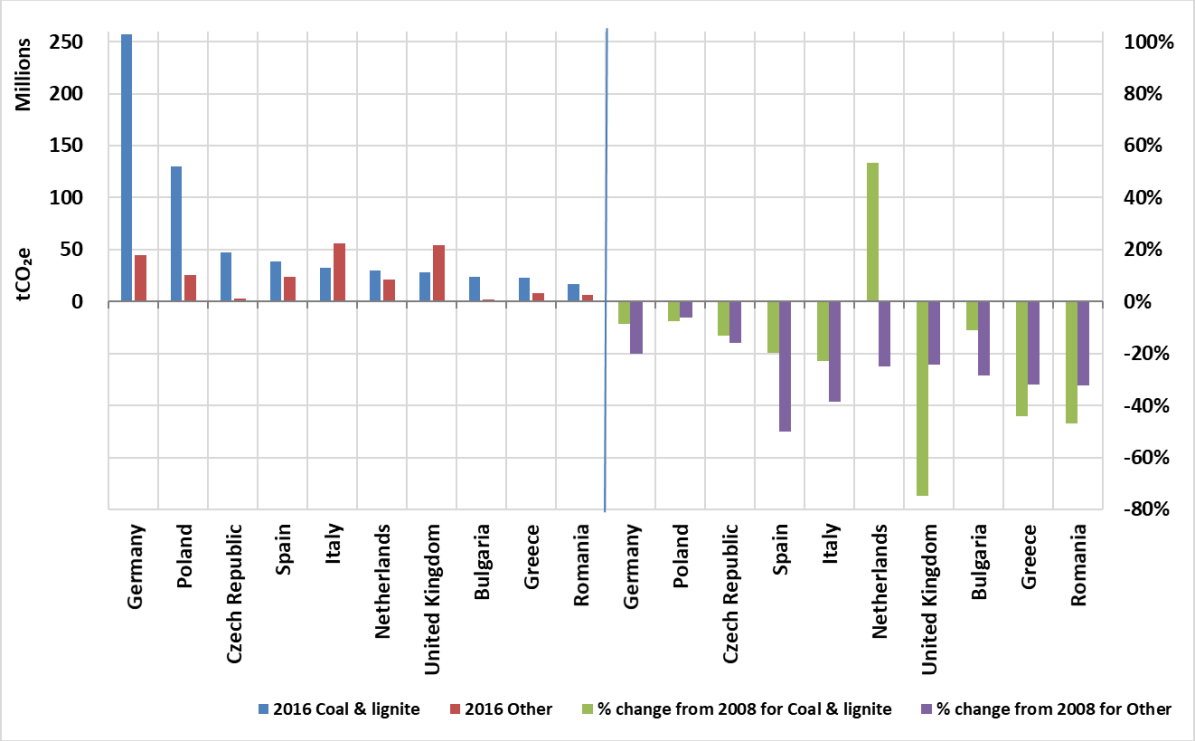
Table 2. List of top 18 emitting installations

MtCO2e emissions	RegCtryName	2008	2016	% of 2016 total	% change 2008 to 2016
PGE GiEK S.A. Oddział Elektrownia Bełchatów	Poland	31	35	3%	13%
Kraftwerk Neurath	Germany	18	31	3%	74%
Kraftwerk Niederaußem	Germany	25	25	2%	0%
Kraftwerk Jänschwalde	Germany	23	24	2%	1%
Kraftwerk Weisweiler	Germany	21	19	2%	-13%
Kraftwerk Schwarze Pumpe	Germany	12	12	1%	-2%
ELEKTROWNIA KOZIENICE	Poland	10	12	1%	20%
Kraftwerk Lippendorf	Germany	11	11	1%	-5%
CENTRALE TERMOELETTRICA DI TORREVALDALIGA NORD	Italy	0	10	1%	new
Kraftwerk Boxberg Werk IV	Germany	6	10	1%	58%
TPP MARITSA EAST 2 EAD	Bulgaria	9	10	1%	6%
ΑΤΜΟΗΛΕΚΤΡΙΚΟΣ ΣΤΑΘΜΟΣ ΑΗΣ ΑΓΙΟΥ ΔΗΜΗΤΡΙΟΥ	Greece	12	9	1%	-23%
Kraftwerk Boxberg Werk III	Germany	9	9	1%	-5%
RWE Eemshaven Centrale	Netherlands	0	8	1%	new
CENTRALE TERMOELETTRICA DI BRINDISI SUD	Italy	15	8	1%	-45%
Eesti Elektrijaam	Estonia	8	8	1%	-4%
Grosskraftwerk Mannheim	Germany	7	8	1%	11%
PGE GiEK S.A. Oddział Elektrownia Turów	Poland	13	8	1%	-39%
rest		1,109	761	75%	-31%
total		1,341	1,017	100%	-24%

6.2 Which countries have highest power emissions from coal and lignite and which are reducing coal and lignite burning most rapidly?

Chart 14 below shows the 10 member states with most coal and lignite power emissions in 2016 (ranked top down). It also compares their percentage change in emissions from 2008 to 2016 for coal and lignite burning and from other generation sources. The blue columns show the power emissions from coal and lignite burning in 2016, and the red columns show the power emissions from all other fuels e.g. natural gas and biomass etc. The green columns show the percentage reduction in power emissions from coal and lignite since 2008 and the purple columns show the percentage reduction in power emissions from all other fuels.

Chart 14. Member states with most power emissions from coal and lignite in 2016 (left hand side) and the percentage change in power emissions reductions from 2008 to 2016 (right hand side) – coal and lignite compared to all other fuels



With the exception of the Netherlands, power emissions from all fuels have decreased in all of these member states since 2008. In the Netherlands, increases in power emissions from coal and lignite burning have outstripped the emissions reductions from other fuels.

Germany and Poland, together with Bulgaria, have had the lowest percentage changes in emissions since 2008 for coal and lignite burning. Over the same time period, other member states such as Spain, Greece, Romania and the UK have significantly decreased their coal and lignite power emissions. The UK's coal and lignite emissions have decreased hugely.

The following section digs further into power generation fuel mixes and helps to explain member states' differing rates of emissions reductions.

6.3 Are the countries with declining power emissions simply generating less? And how do country fuel mixes track emissions reductions?

Yes, to a certain extent countries with the most rapidly declining power and heat sector emissions are reducing generation. This is likely to also be linked to higher imports of power from other member states[22]. Differences in emissions reductions from member state to member state are driven by the different generation fuel mixes. Clearly, regardless of where the power is consumed, more needs to be done to tackle Germany's huge appetite for coal generation and to accelerate diversification away from coal in Poland.

Chart 15 below uses data from the nrg_105a Eurostat dataset[23] to illustrate the trend in gross electricity generation (including autoproducers) from 2005 to 2015 for the member states with the highest ETS power and heat sector emissions plus the rest of the EU28. Chart 16 shows the

[22] *This report is focussed on member states' emissions and power generation rather than their consumption. Analysis on power exports and imports is outside the scope of this report.*

[23] *Available here; last updated 31 May 2017.*

percentage change in generation compared to 2005 for the top 6 power and heat sector emitting member states.

Chart 15. Comparing member states' gross electricity generation trends

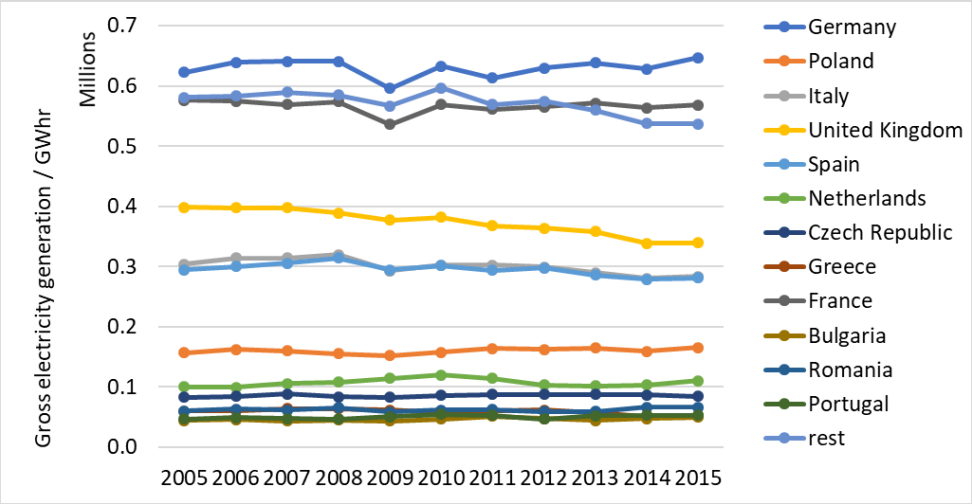


Chart 16. Percentage change in gross generation for the member states with highest power and heat sector emissions

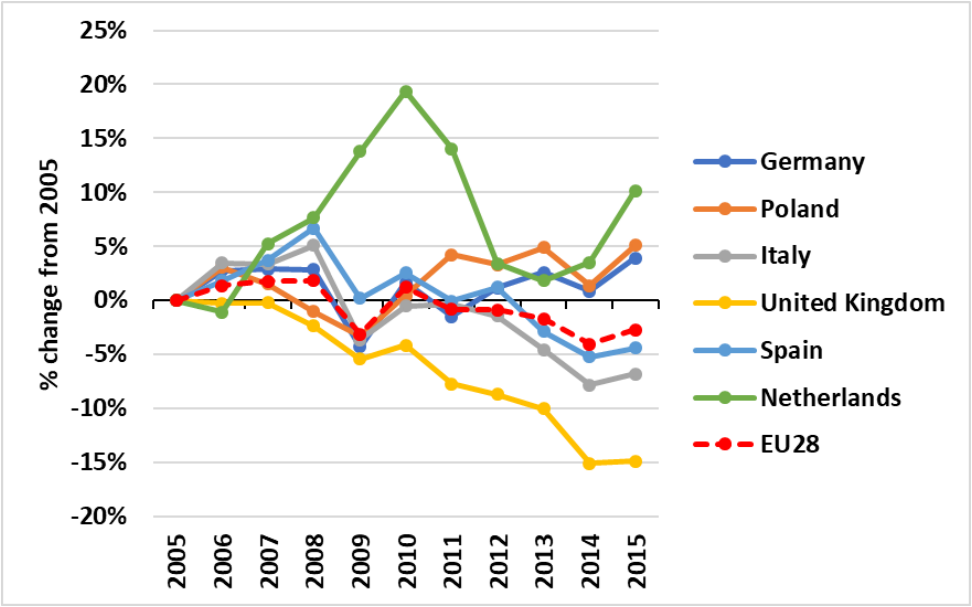
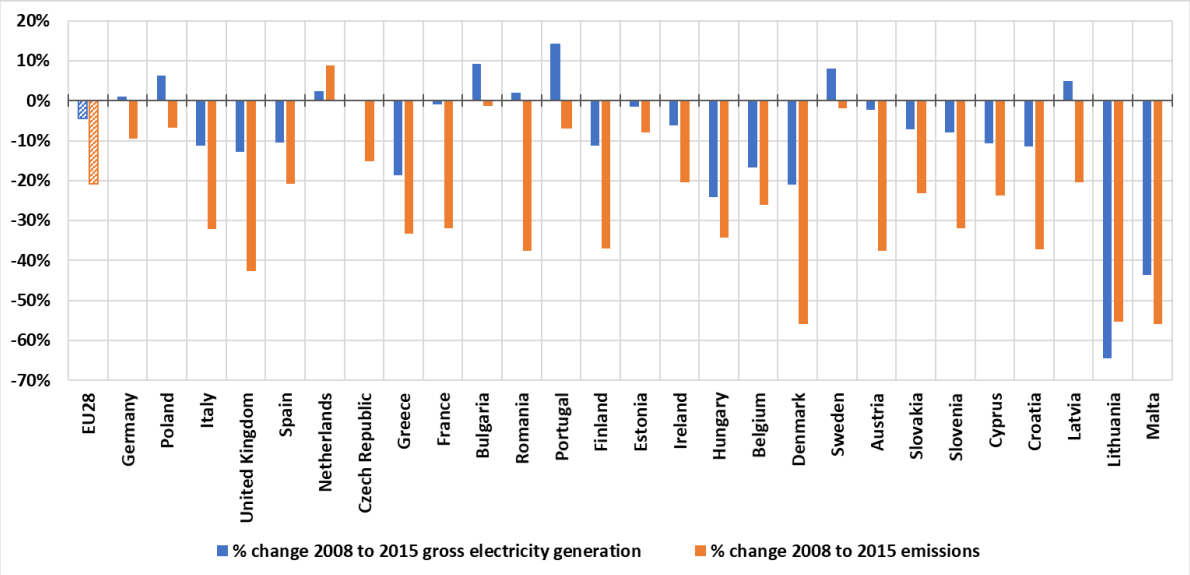


Chart 17 below compares the change in gross electricity generation per member state (blue columns) to the change in ETS power installation emissions (orange columns). The time period chosen to be plotted is 2008 to 2016 rather than 2005 to 2016 in order to avoid scope change adjustments for Bulgaria and Romania[24]. The member states are sorted from left to right in descending order of 2016 emissions. The chart illustrates that the most highly emitting member states have amongst the lowest changes in their emissions – lower than the EU overall. It also shows that some member states have increased power generation whilst also reducing emissions. The fuel mixes driving these changes are further explored below.

[24] Power generation data is available for all member states from 2005 but power sector ETS emissions data does not cover new member states Bulgaria and Romania until 2008 and does not cover Croatia until 2013. As mentioned in footnote 18, Croatia's emissions are relatively small so estimates to account for scope change as a result of this member state joining in 2013 have not been taken into account for the period 2008 to 2012.

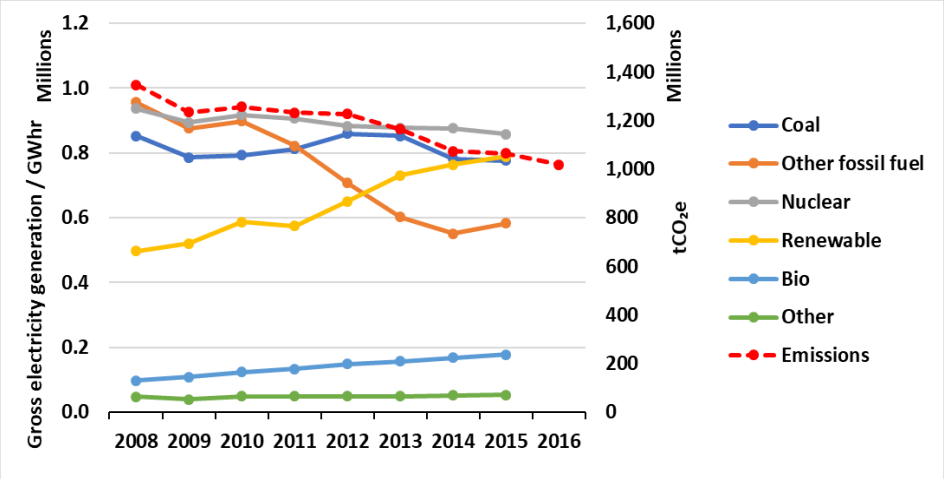
Chart 17. Comparing percentage change in gross electricity generation per member state to percentage change in power emissions



EU28 power generation fuel mix

If we look at the generation type mix across the EU28, as shown in Chart 18 below, it is easy to see how the decrease in other fossil fuel and, more recently, coal[25] generation is tracking the decrease in emissions for power and heat[26].

Chart 18. EU28 power generation fuel mix and emissions trends since 2008



This picture varies considerably from member state to member state[27], as described in more detail below.

Amongst the high power emitters with increasing generation, the Netherlands is increasing power emissions by displacing the currently dominant other fossil fuel generation[28] with coal generation. Germany and Poland are both increasing generation whilst decreasing emissions. Italy and Spain are

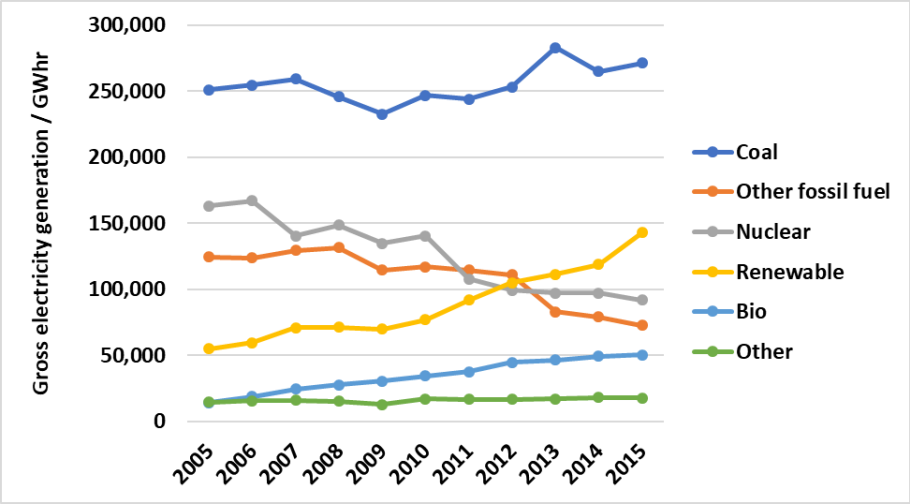
[25] The coal generation category includes hard coal, lignite/brown coal, other bituminous and sub-bituminous coal and BKB.
[26] This chart covers just the post 2008 period. Power and heat sector scope adjustments for the new Central and Eastern European member states prior to 2008 have not been estimated and estimates for Croatia prior to 2013 have not been included in this section.
[27] A longer time period can be used for these member states as there has been no change in the scope of their power and heat emissions.
[28] Detailed other fossil fuel breakdown data was not collected for this report but in NL this is likely to be mainly natural gas which is both domestically sourced and imported.

decreasing generation slightly, but emissions are decreasing much faster than generation. The member state with the fastest declining power emissions, the UK, also has the most generation reduction, but emissions are decreasing much faster than generation.

Germany

Germany has realised a ~5% increase in overall electricity generation and a ~13% decrease in ETS power sector emissions since 2005. The rollout of renewables has not been able to cover the generation gap left by its nuclear power plant closures[29]. Rather than displacing coal, renewables look to be displacing other fossil fuels. Germany still has a dominant and even growing share of coal in its generation mix.

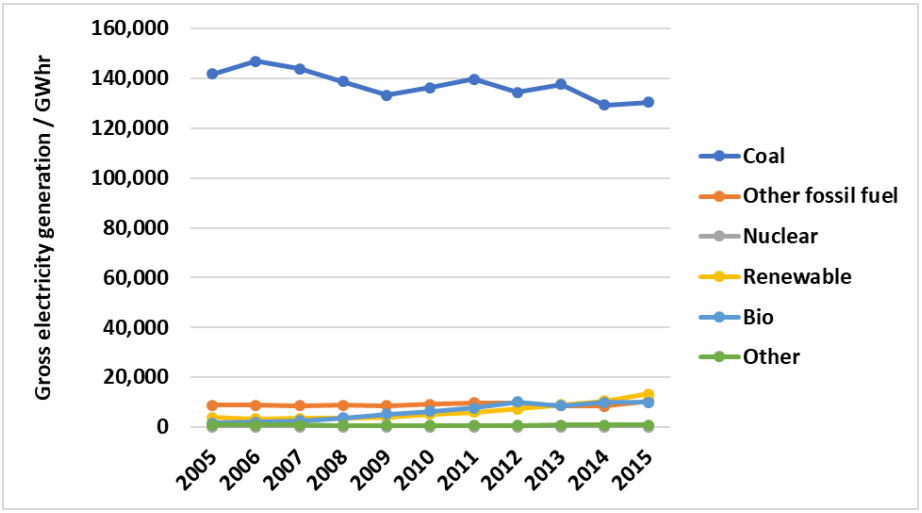
Chart 19. Gross electricity generation fuel mix in Germany



Poland

With a similar ~5% increase in overall generation to Germany but with a ~10% decrease in ETS power sector emissions since 2005, Poland has dominant but declining coal generation. Poland has not been able to match Germany's emissions reductions despite reducing coal generation because it is still so reliant on just one fuel – coal.

Chart 20. Gross electricity generation fuel mix in Poland



Poland's small but growing renewables and biofuel generation is starting to displace its dominant coal generation. However, as Sandbag's recent report *'Something nasty in the woodshed: How*

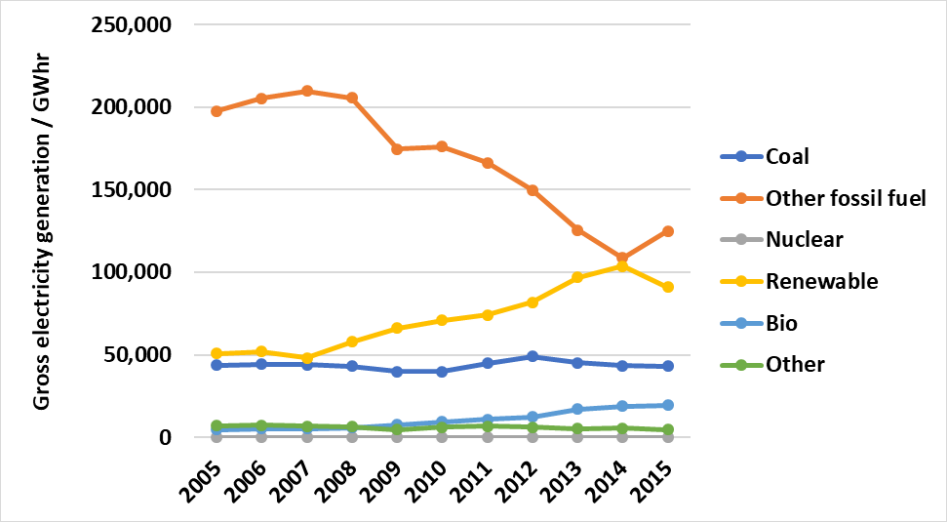
[29] *Germany announced accelerated phase-out of nuclear power following the 2011 Fukushima power plant disaster.*

biomass subsidies are secretly funding coal' reveals, we need to stay alert to the risk of cofiring risks maintaining high levels of coal burning for power.

Italy

With a ~7% decrease in generation and a ~35% decrease in ETS power sector emissions since 2005, Italy's coal generation has remained flat whilst other fossil fuel generation declines. The reduction trends is mainly driven by renewables which are driving out other fossil fuel generation besides coal.

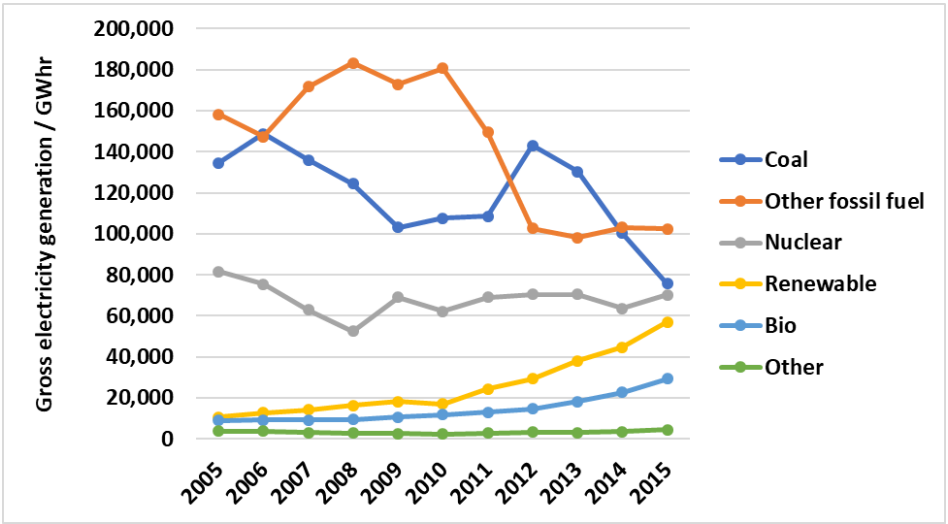
Chart 21. Gross electricity generation fuel mix in Italy



United Kingdom

The UK's ~15% decrease in generation and ~55% decrease in ETS power sector emissions since 2005 has been achieved via rapidly declining coal and other fossil fuel generation which has been replaced in a large part by renewables (offshore wind and solar PV).

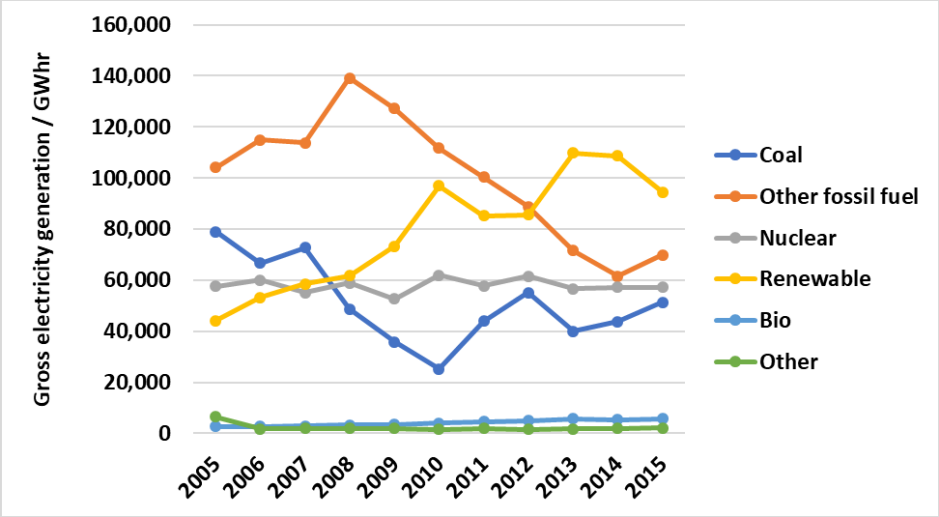
Chart 22. Gross electricity generation fuel mix in UK



Spain

With a just under 5% decrease in overall generation and a ~45% decrease in ETS power sector emissions, Spain's coal generation is on the rise again although significantly less dominant than in Germany or Poland. Renewables have mainly pushed out other fossil fuels out of the generation mix.

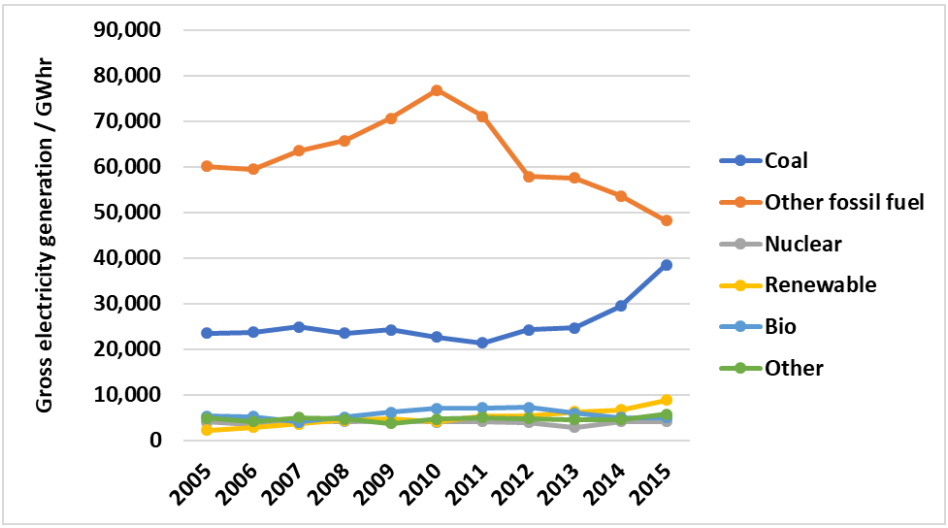
Chart 23. Gross electricity generation fuel mix in Spain



Netherlands

The Netherlands had been increasing generation via non-coal fossil fuel burning but from around 2010/2011 this changed to increasing coal and decreasing other fossil fuel generation. The ~10% increase in overall generation since 2005 has been accompanied by an ~8% increase in ETS power sector emissions.

Chart 24. Gross electricity generation fuel mix in the Netherlands

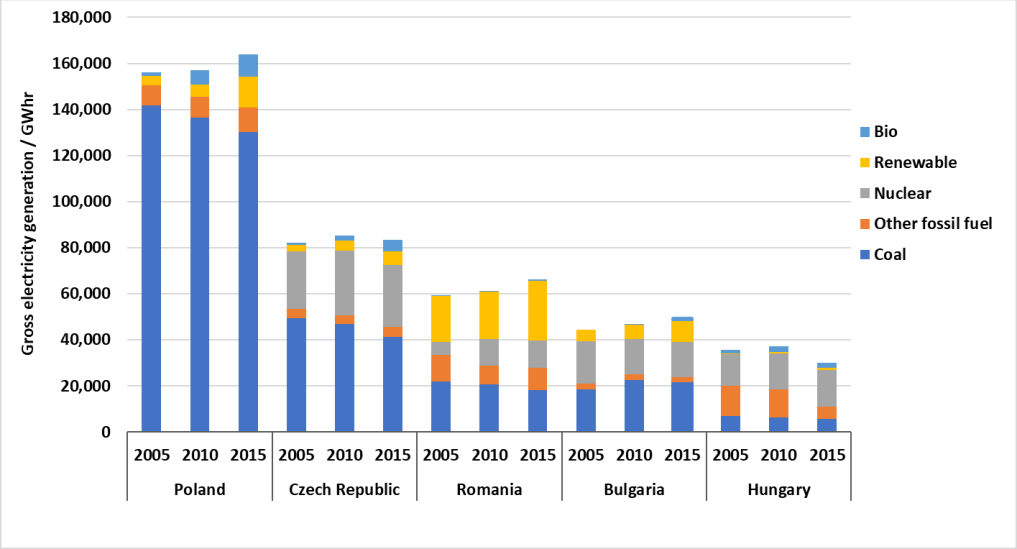


6.4 Poland's potential: are Article 10c allowances being used for maximum abatement?

Chart 25 below compares the changes in generation mix for five of the member states eligible for Article 10c[30] support for transitioning their power sectors. This illustrates the huge potential for rapid emissions decreases in Poland if ongoing Article 10c and Modernisation Fund support is focussed on transitioning from coal power.

[30] *Article 10c of the ETS Directive allows 8 member states with electricity sectors in transition to opt for transitional free allocation to power sector installations, provided certain criteria are met. These member states may opt to freely allocate a limited number of allowances from their auction share. See here for the Commission's Guidance Document on current Article 10c rules.*

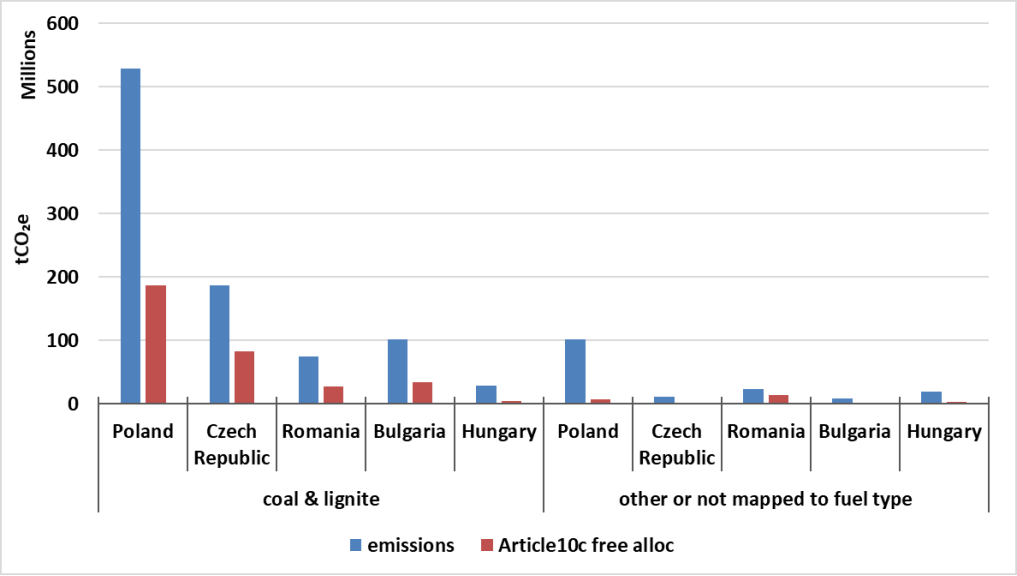
Chart 25. Comparing gross electricity generation fuel mix for member states with most Article 10c use



Nearly all of Poland's Article 10c allowances so far have been allocated to coal and lignite plants - thus removing compliance cost for over a third of Poland's coal and lignite emissions.

Chart 26 below shows how the Article 10c allowances were allocated to the above five member states between 2013 and 2016. The blue columns show emissions split by emissions for coal and lignite installations and emissions for other fuel type installations. The red columns show the Article 10c free allocations, again split by emissions for coal and lignite installations and other power installations. It is clear to see that most of the Article 10c allowances allocated between 2013 and 2016 (386 million in total) have gone to coal and lignite installations. Unfortunately, there is little detail available publicly on the projects receiving the allowances so it is difficult to assess to what extent this free allocation has supported emissions reductions. However, it is very likely that Article 10c free allocation is extending the lifetimes of old coal and lignite power plants in Poland and thus potentially blocking market entry of cleaner alternatives.

Chart 26. 2013 to 2016 power emissions and Article 10c allocations



For more information on Article 10c implementation, please refer to Carbon Market Watch's 2016 policy briefing, "Fossil fuel subsidies from Europe's carbon market: The lessons learnt with Article 10c of the EU ETS Directive and recommendations for the post-2020 period".

7. Which industry sectors emit the most and which are reducing emissions fastest?

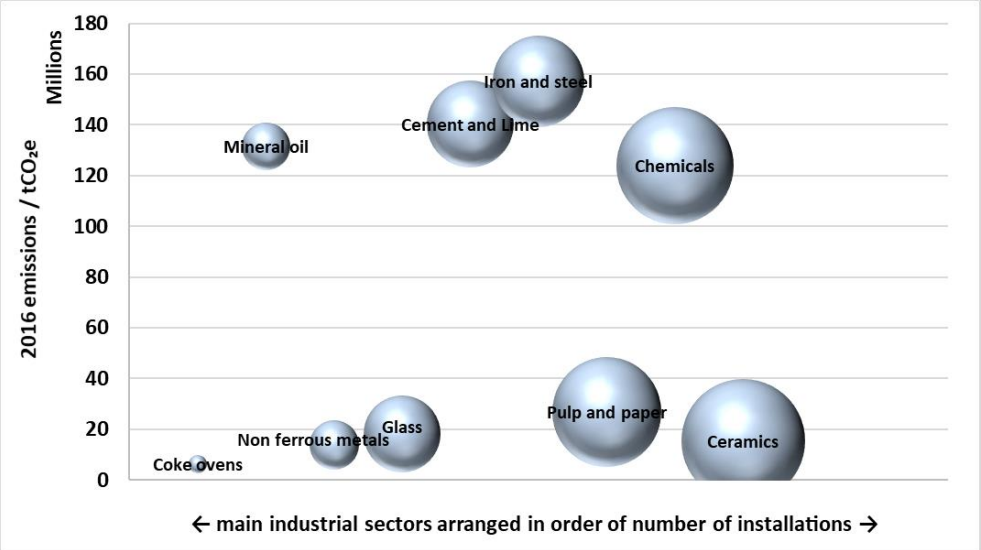
Industrial emissions decreased rapidly during the 2008 to 2012 recession period but have remained stubbornly flat in recent years. All is not equal across the various industries. Some sectors, chemicals and pulp and paper, have continued to reduce emissions but there is no, or little, ongoing reduction in emissions for cement and lime, mineral oil and iron and steel. Some sectors have very many lower emitting installations. For others, emissions are concentrated at fewer highly emitting installations.

As seen in Section 5, industrial emissions decreased rapidly during Phase 2, a period characterized by an economic recession in the EU. The reduction trend seems to have stopped since the start of Phase 3 and emissions have remained more or less stable. This section takes a closer look at the differences between the different industrial sectors.

Which sectors have most installations and highest emissions?

Chart 27 below plots 2016 emissions per main industrial sector. The bubble sizes reflect the number of installations in each sector. Sectors such as ceramics and pulp and paper have many more lower emitting installations compared to sectors such as mineral oil, where a high amount of emissions is concentrated in a relatively small number of installations[31].

Chart 27. 2016 emissions per main industrial sector



A few highly emitting sectors dominate ETS emissions, so the rest of this section focuses on these sectors with all other sectors grouped together.

Which industrial sectors are reducing emissions fastest?

Chart 28 below shows the trend in emissions for the top five sectors since 2008.

Important:

As seen in the sections above, ideally we need to take the impact of scope extension into account when looking at emissions trends across different ETS phases. However, while the European Environment Agency has shared figures on aggregate scope extension per member state, there is no publicly available data to divide this accurately across the

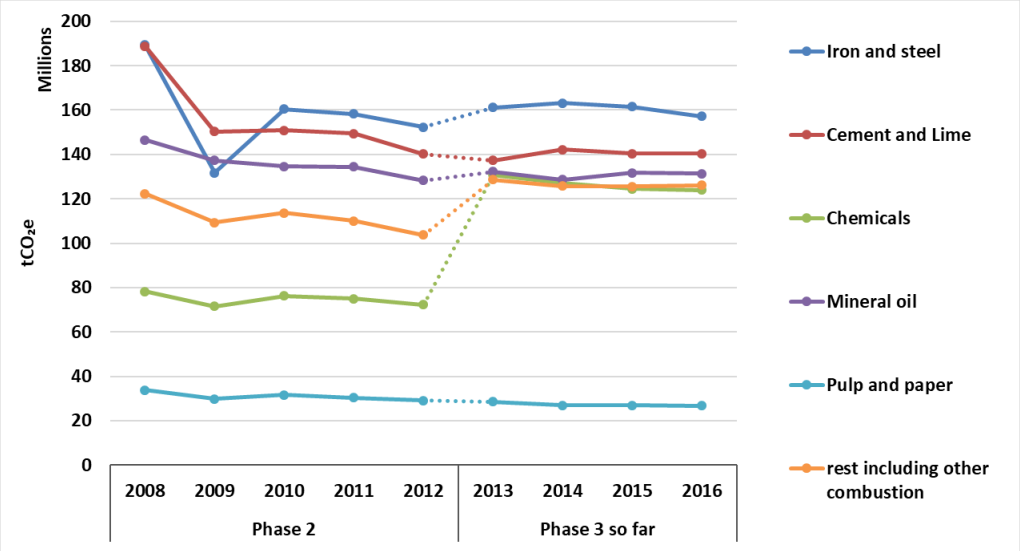
[31] *Other sectors not shown in the chart include extraction of crude petroleum and natural gas and their transportation; food processing and manufacture; and others such as tyre manufacture and manufacture of motor vehicles.*

different industry sectors. The sectors most significantly affected are chemicals and non-ferrous metals.

With these scope change limitations in mind, we have shown a break in the trends between 2012 to 2013.

There is no clear ongoing emission reduction trend in recent years for iron and steel, cement and lime, and mineral oil – the three largest industrial emitting sectors under the EU ETS. After a significant drop in 2009, emissions in the iron and steel sector were partially restored in 2010 and have been going slightly up and down since then without a clear reduction trend[32]. Emissions from cement and lime also dropped steadily until 2013 but have been stabilizing or even increasing emissions so far during the current phase. Reductions in mineral oil emissions also look to have stopped since the end of Phase 2.

Chart 28. Emissions per main industry sector since 2008 (no scope change adjustment)



Looking at relative, rather than absolute, changes in industrial emissions helps to more sharply illustrate which main industry sectors have been reducing their emissions fastest. Charts 29 and 30 below show the trends in emissions changes for the top five emitting sectors from 2008 to 2012 compared to 2008 levels and again from 2013 onwards compared to 2013 levels.

[32] *It should be noted that some emissions resulting from the iron and steel sector are reported under the power sector as some waste gases are transferred for combustion to generate power. Increased uptake of this 'circular economy' type approach could be accounting some of the reported emissions reductions from the iron and steel sector. Unfortunately, detailed data on waste gas transfers is not publicly available.*

Chart 29. Percentage change in emissions during Phase 2 compared to 2008 (no scope change adjustment)

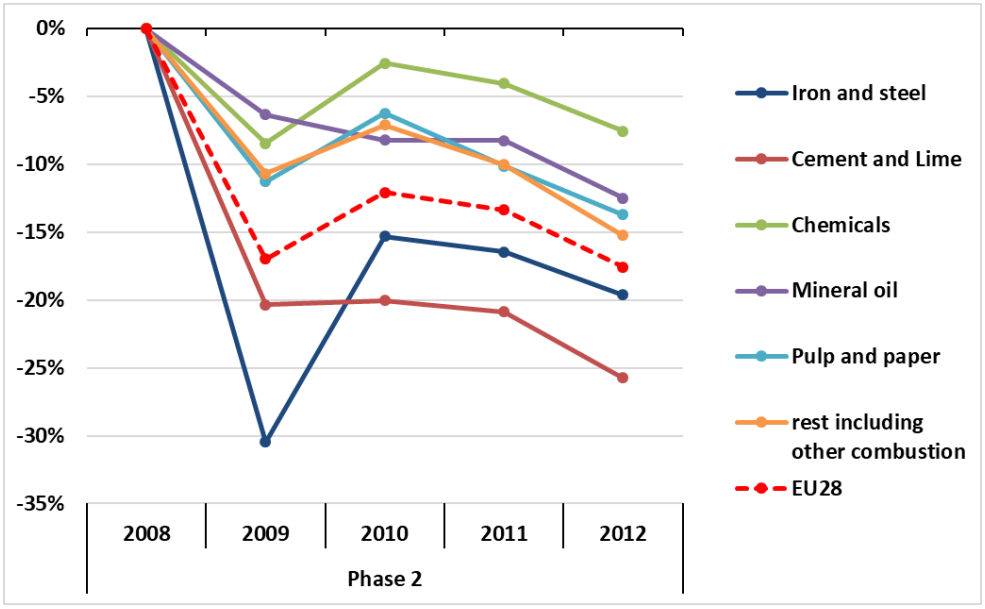
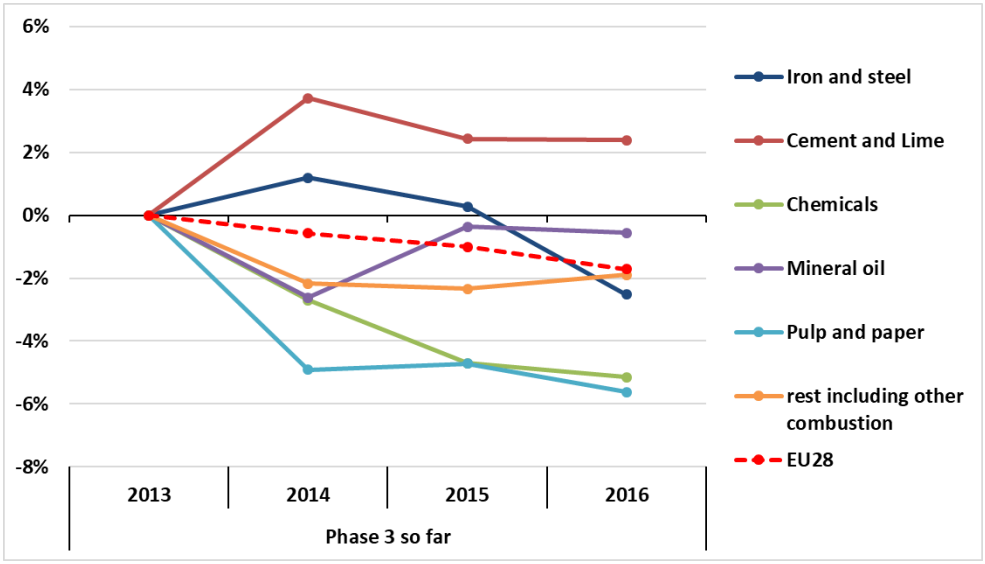


Chart 30. Percentage change in emissions during Phase 3 so far compared to 2013



The cement and lime and the iron and steel sectors both reduced emissions during Phase 2 faster than the EU28 overall but, while iron and steel is continuing to reduce emissions in Phase 3 (after an increase at the start of the phase), cement and lime is now the only sector with an overall increase in emissions during the current phase.

The chemicals sector decreased more slowly than the EU overall in Phase 2 but its rate of reduction has overtaken the other sectors in Phase 3 after additional gases come under the scope of the ETS. Major reductions have been achieved due the reduction of N_2O emissions from the production of nitric and adipic acid. Based on EU GHG inventories as reported under the United Nations Framework Convention on Climate Change (UNFCCC), these efforts have led to a reduction of approximately 46.9 $MtCO_2e$ between 2008 and 2015. However, this reduction potential may be nearly exhausted.

Similar to cement and lime, mineral oil has not maintained its rate of emissions reduction.

With smaller overall impact, the pulp and paper sector has become the leader (in terms of fastest rate of reduction) with ongoing emissions reductions in Phase 3 following on from reductions in Phase 2.

This analysis indicates that whilst industry emissions decreased significantly between 2008 and 2012, the trend in emissions reductions has now slowed or even stopped for some sectors. This is likely to be due to the economic recovery and the exhaustion of low-hanging fruit (such as N_2O reductions in the chemicals sector). A lot more abatement progress is needed from all main industrial sectors if we are to reach our Paris Agreement objective of *"achieving a balance between anthropogenic emissions by sources and removals by sinks of GHG ('net zero emissions') in the second half of this century"*[33].

7.1 Getting smarter or just doing less?

Trends in approximated emissions intensities for highly emitting industry sectors suggest that the EU's flagship emissions trading policy has not been accelerating widespread progress towards industrial decarbonisation. Some highly emitting industry sectors do not appear to be getting significantly smarter in terms of emissions although it may be that production level reductions have led to lowered process efficiencies and hence intensity increases.

The previous section has indicated that emissions reductions for the industrial sectors have mainly happened during a time of economic recession and have slowed during a period of economic recovery. It is useful to dig deeper into this to assess to what extent emissions trends in the various industrial sectors are being driven by changes in productions levels. Unfortunately, data on production levels by ETS installations is not shared publicly and there is no regular mapping of ETS installations into categories also used to report production levels elsewhere. The analysis below is therefore based on approximations from the data available.

Production data is available from Eurostat following NACERev2 industry classifications[34] and for production of total petroleum products from Eurostat in the nrg_110a dataset[35]. By building on a file mapping installations to NACE codes that was shared by the Commission in 2014 as part of the preparatory work when establishing the current 2015 to 2019 carbon leakage list[36], it is possible to combine these datasets to get an approximation of the change in carbon intensity of an industry sector over time[37].

The series of charts below show changes in EU28 total production levels (blue lines), emissions (orange lines) and approximated emissions intensity (grey lines) over the last few years for NACE codes 24.10 Iron and Steel, 23.51 Cement, 23.52 Lime, 17.12 Paper and Paperboard, 24.42 Aluminium, and 19.20 Refined Petroleum Products. Due to the diverse nature of the chemical sector and the significant scope change impact on ETS emissions, we have not been able to assess trends for this sector.

[33] *Point 13, European Parliament resolution of 4 October 2017 on the 2017 UN Climate Change Conference in Bonn, Germany (COP23) (2017/2620(RSP))*
[34] *Available here*
[35] *Available here*
[36] *Available here*
[37] *This should only be considered as an approximation of the direction of travel as it does not exactly compare like with like. If anything, the emissions intensity will be slightly underestimated following this approach as not all emissions for each NACE code are included under the scope of the ETS.*

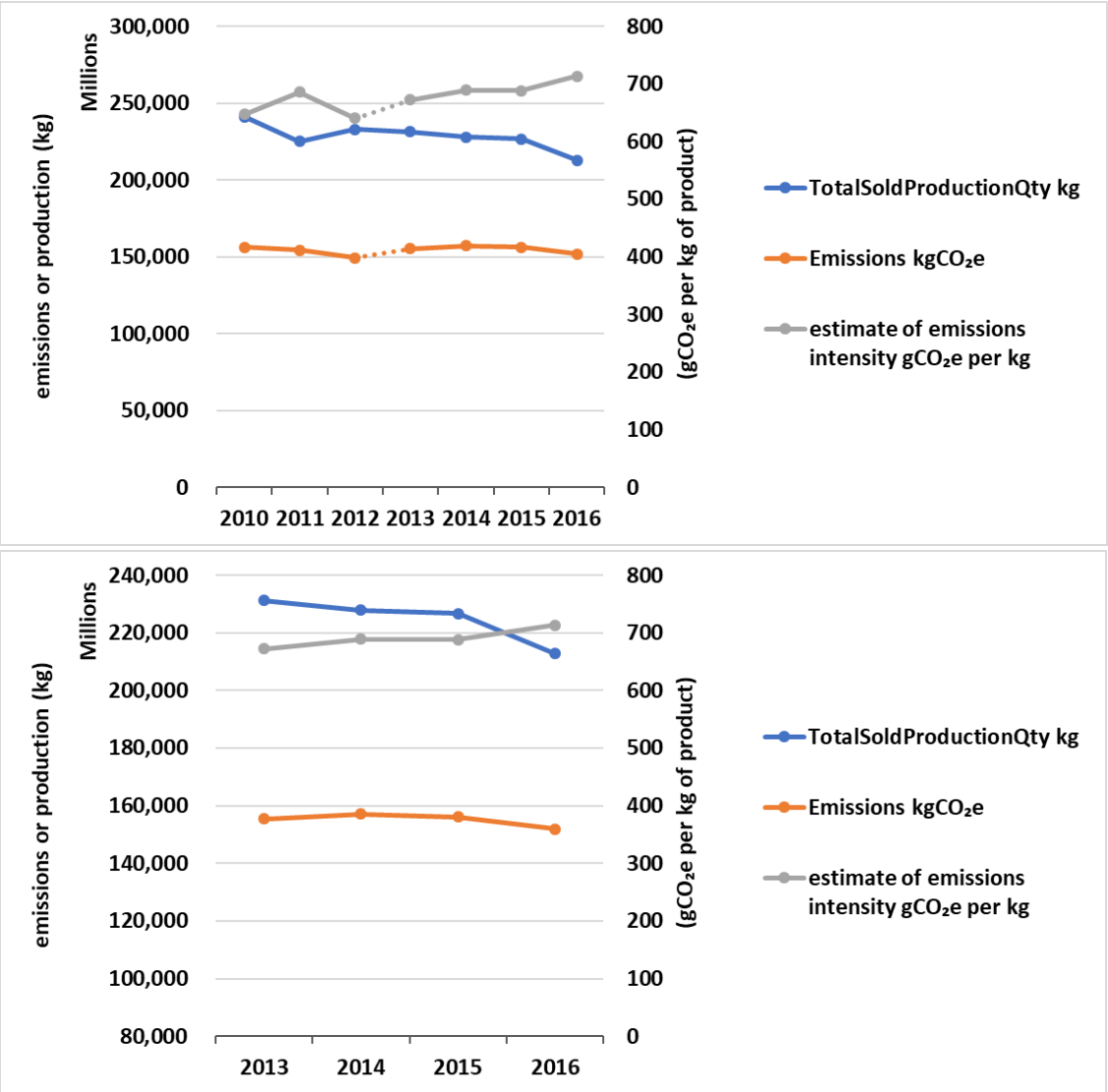
Important:

- The emissions values in this series of charts have not been adjusted for scope change, so the emissions (and hence the estimated emissions intensities) for 2010, 2011 and 2012 might be understated for some sectors.
- Emissions for the iron and steel sector are as reported by installations in the sector, i.e. not including emissions from waste gases combusted at third party power sector installations.
- The 2010-2016 period was chosen in an attempt to reflect post-recession trends. The plots have also been repeated for just the 2013-2016 period during which there was no scope change. Only the 2013-2016 period was plotted for NACE code 24.42 Aluminium as the post-2012 scope change did have a significant impact on reported emissions from this sector.
- The observations are based on approximations from the data available. Sandbag has not contacted the industry associations for comment prior to the publication of this report. This will be addressed in the coming period. Please refer to our website for updates.

Iron and steel (NACE code 24.10)

The charts below indicate that even the small reduction in emissions for this sector in recent years is driven by lower production levels rather than increased efficiency. Indeed, the charts suggest that the emissions intensity of steel production may have increased in recent years. Even if we look at just the post-2012 period to remove any influence of scope change, these charts indicate that this sector is not on the right track. Further policy levers are required to turn around emissions intensity for this highly emitting sector.

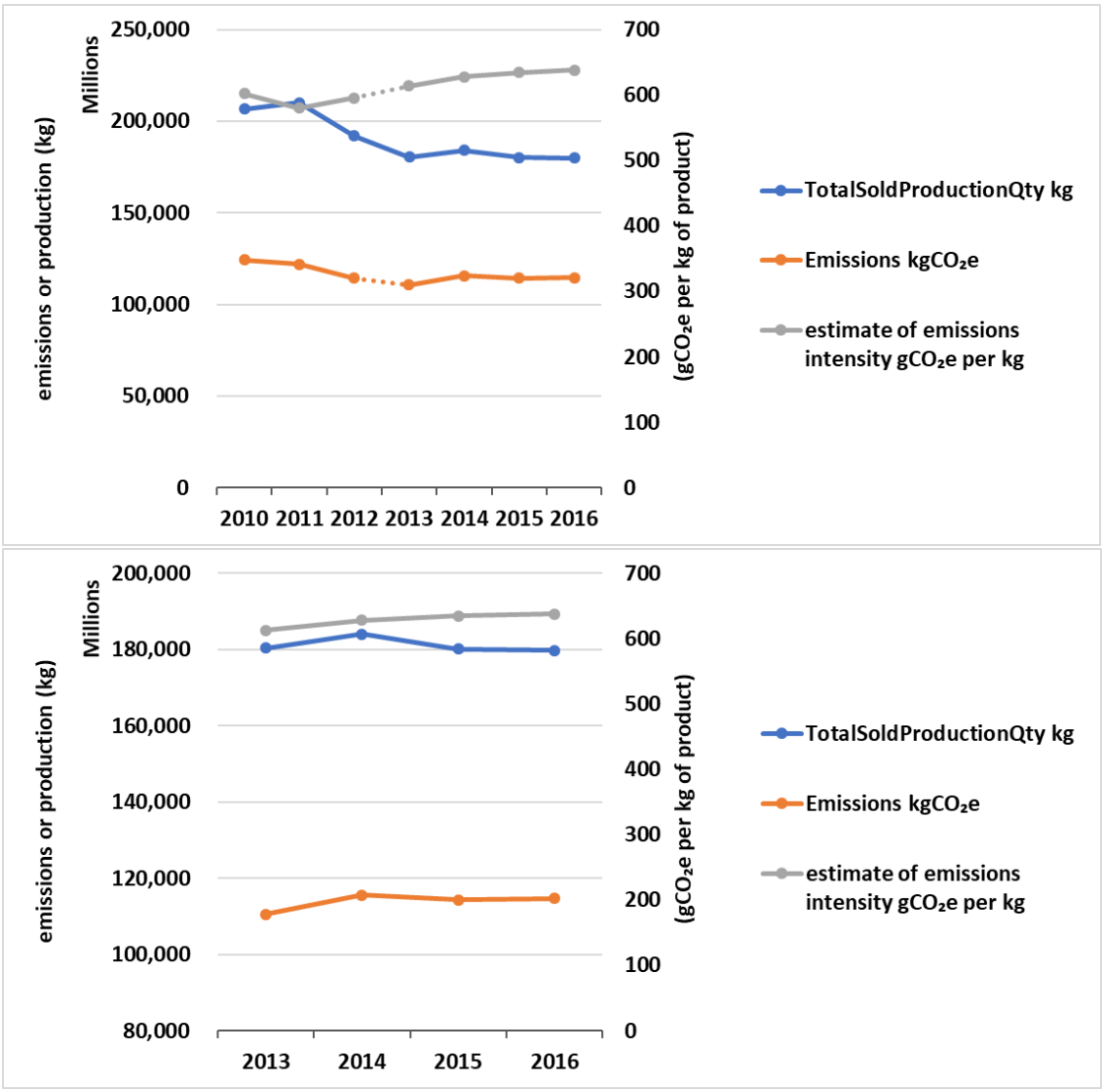
Charts 31 & 32. NACE code 24.10, 2010-2016 and 2013-2016



Cement (NACE code 23.51)

A similar conclusion can be drawn for the cement sector. Emission reductions for 2010 to 2013 appear to track production decreases over the same period. The charts indicate that the emissions intensity of cement has been increasing. Further policy levers are required for abatement for this highly emitting sector.

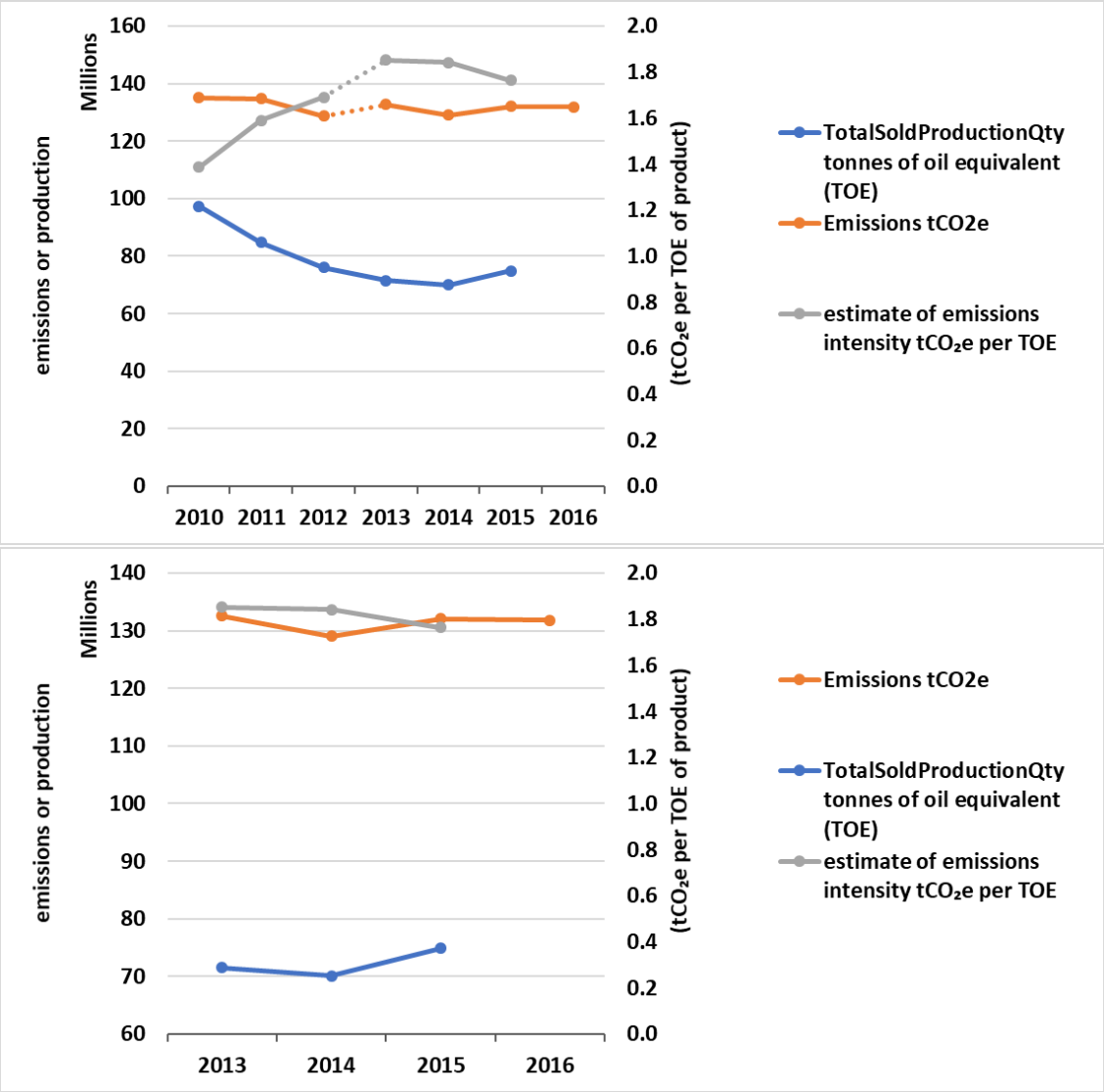
Charts 33 & 34. NACE code 23.51, 2010-2016 and 2013-2016



Refined petroleum products (NACE code 19.20)

The chart below suggests that the situation may be even worse for the mineral oil sector. Declining production levels combined with more or less flat emissions levels suggest that there has been a significant increase in emissions intensity, although it may be that a corner is being turned in recent years. Unfortunately, the data sourced used for production data for petroleum did not extend to 2016.

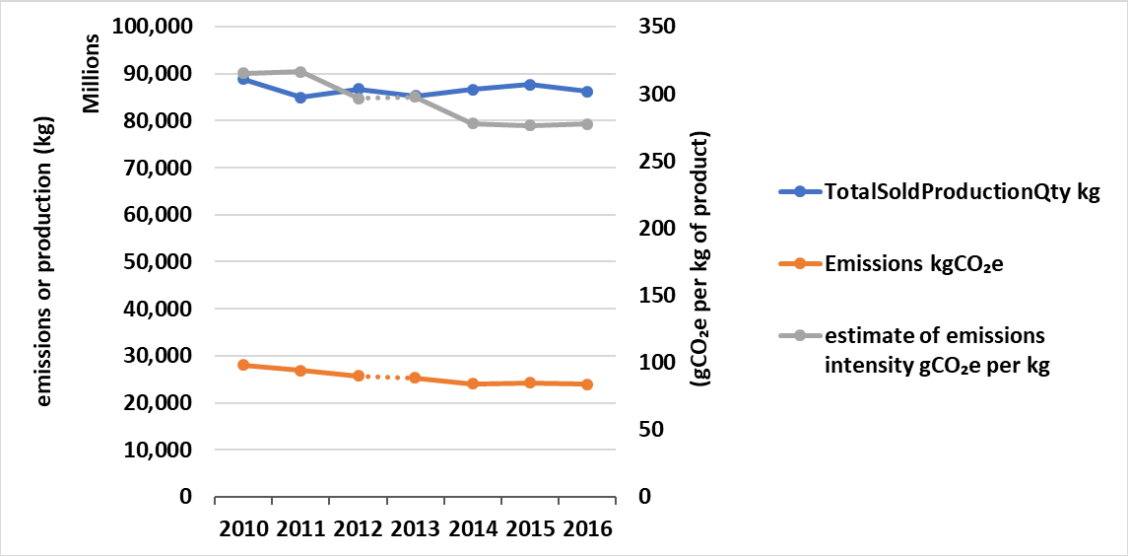
Charts 35 & 36. NACE code 19.20, 2010-2016 and 2013-2016

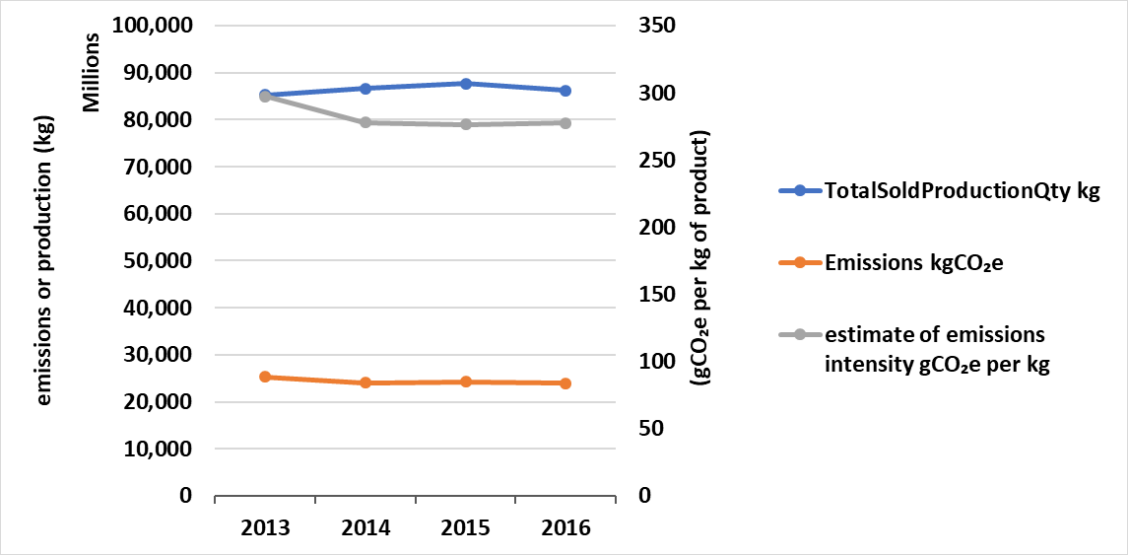


Paper and paperboard (NACE code 17.12)

This already lower-emitting sector does look to be decreasing emissions intensity slightly. Despite a slight increase in production, emissions have been decreasing since 2010. However, even this progress falls short of the deep reduction pathway required to meet our long-term targets.

Charts 37 & 38. NACE code 17.12, 2010-2016 and 2013-2016

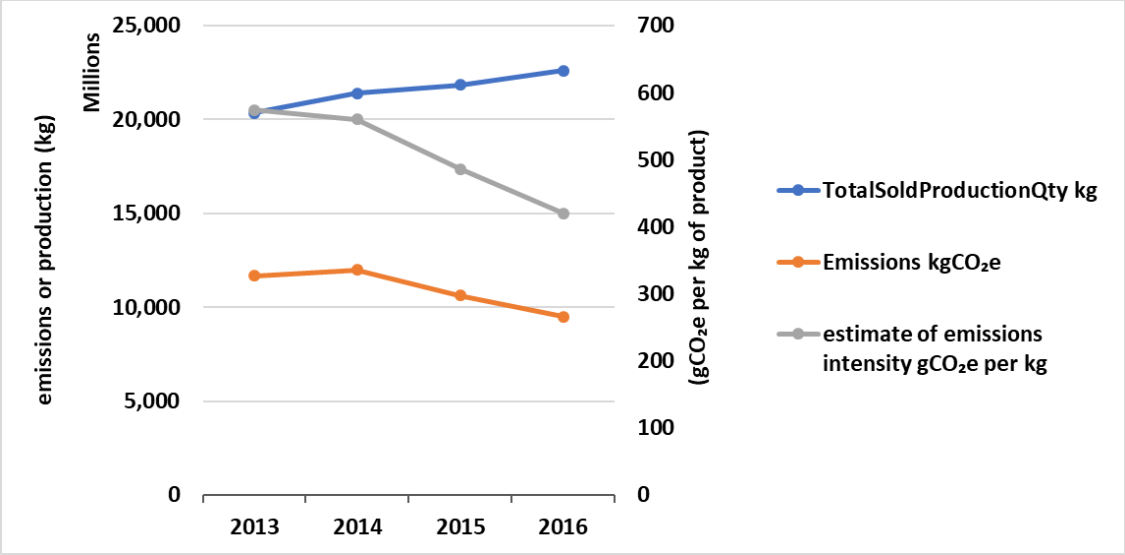




Aluminium (NACE code 24.42)

The chart below indicates that this sector is indeed significantly reducing emissions intensity. Similar to the power and heat sector, relatively low-cost abatement options are already available for this sector. PFC (perfluorocarbon) emissions related to anode effects in the electrolysis process can be significantly reduced via improved process control[38].

Chart 39. NACE code 24.42, 2013-2016



7.2 Which industries have highest allowance balances? Who's fattest now?

At the close of 2016, the cement sector is still, by far, the most overallocated sector in the ETS. Once allowance transfers are taken into consideration, cement is now the only highly emitting sector still receiving significantly more allowances than required for compliance. Of the other highly emitting sectors, only the mineral oil sector closes 2016 with fewer allowances in aggregate than needed for compliance. Iron and steel, chemicals and pulp and paper all close 2016 with a cumulative surplus carried over from Phase 2, but they will be consuming that surplus during the rest of the current phase.

The laudable approach of using emissions trading as a market mechanism to identify and achieve lowest cost industry abatement has been undermined by the method employed to protect EU industry from competitors outside the EU region who do not face equivalent carbon cost. Installations in industry sectors considered to be at risk of carbon leakage receive free allocations of emissions allowances.

Unfortunately, the allocation approach followed in Phase 2 did not respond to the significant drop in industrial activity during the recession of the late 2000s. This resulted in significant overallocations. Phase 3 provided just a partial solution as free allocations are only adjusted downwards when an installation's activity level drops by more than 50% or if there are significant capacity reductions[39]. These shortcomings in the allocation rules have contributed to a huge build-up of surplus allowances.

Sandbag has been instrumental in raising awareness of oversupply to industry sectors and first coined the expression *'Carbon Fat Cats'* in its 2011 report on the ETS of that name[40]. We reported on excessive free allocations again in our 2012 state of the ETS report *'Losing the lead?: Europe's*

[38] See IPCC report 'PFC Emissions from primary aluminium production', available here, date unknown.
[39] See Articles 23 and 21 of the Benchmarking Decision (2011/278/EU) on partial cessations, available here..
[40] Carbon Fat Cats 2011: The Companies Profiting from the EU Emissions trading Scheme, available here.

Flagging Carbon Market', and again in 2013 with *'Drifting toward disaster?: The ETS adrift in Europe's climate efforts'* and in again 2014 with *'Slaying the dragon: Vanquish the surplus and rescue the ETS'*[41]. Highlighting ETS surpluses has been a constant theme in our work. Our report on carbon leakage earlier this year, *'The Carbon Leakage Conundrum: Getting the EU ETS abatement investment signals right'*[42] explored problems with free allocation and advocated alternative approaches to protect industry sectors and encourage innovation.

Changes in the rules for free allocation from Phase 2 to Phase 3, combined with activity recovery from the late 2000 recession, have meant that industrial participants are now having to purchase more allowances for compliance than in earlier years.

The list of sectors and subsectors considered at risk of carbon leakage, and hence able to apply for 100% of benchmarked free allocation for their historical activity level, has been very extensive. This, combined with continued free allocation to sectors not considered to be at risk of carbon leakage (80% of benchmark in 2013 declining to 30% of benchmark in 2020), has meant that benchmarked free allocation applications exceed the maximum available under the free allocation share of the cap. This has resulted in the application of a uniform cross-sectoral correction factor (CSCF), in accordance with Article 10a(5) of the current Directive, across the whole phase. The CSCF has prevented a further build-up of surplus free allocation in certain sectors, although in a non-targeted manner and without taking into account the different levels of exposure to carbon leakage risk.

So, who's fattest now at the end of 2016? As our analysis shows, there are still significant differences in allowance balances between sectors.

Allowance balances before accounting for allowance transfers

Table 3 below shows the cumulative balance between free allocations received and verified emissions per main industry sector between 2008 and 2012 and again between 2013 and 2016. Darker green shading means more negative balances (i.e. more price signal to abate) and darker red shading means more positive balances (i.e. more potential for windfall profit via overallocation).

Table 3. Cumulative balance between free allocations received and verified emissions

main industry sectors sorted by 2016 emissions (desc)	free allocation minus emissions /MtCO2e		balance as % of emissions	
	2008to2012	2013to2016	2008to2012	2013to2016
Iron and steel	405	114	51%	18%
Cement and Lime	282	61	36%	11%
Mineral oil	57	-103	8%	-20%
Chemicals	89	-8	24%	-2%
Pulp and paper	59	16	38%	15%
Glass	22	-10	23%	-13%
Ceramics	48	3	74%	5%
Non ferrous metals	6	-3	49%	-5%
Coke ovens	0	-6	0%	-23%
rest	111	-50	31%	-17%
Subtotal industry	1,078	15	32%	1%

Allowance balances after estimating allowance transfers

However, it's important to bear in mind that waste gases generated during the iron and steel making process can be used to generate power. Some of the waste gas is consumed within the iron and steel sector installations themselves as power to be consumed on-site. Some is transferred to third

[41] *'Losing the lead?: Europe's Flagging Carbon Market', available here. 'Drifting toward disaster?: The ETS adrift in Europe's climate efforts', available here. 'Slaying the dragon: Vanquish the surplus and rescue the ETS', available here.*
[42] *'The Carbon Leakage Conundrum: Getting the EU ETS abatement investment signals right', available here.*

party power generators. It is common practice for iron and steel producers to transfer some of their freely allocated allowances to the power producers as part of the transfer arrangements. These allowance transfers mean that the allowance balance for this sector is likely to be less positive than shown above. Information on waste gas transfers is not shared for public scrutiny via the EU Transaction Log.

Sandbag has been informed, by industry representatives, of an approach for estimating waste gas transfers from the iron and steel sector. We have also been made aware, by industry association representatives, of allowances transfers to the power and heat sector from pulp and paper installations following the Benchmarking Decision (hence impacting the post 2012 time period only).

After applying approximated corrections for allowance transfers in line with suggestions from industry, new balances may be estimated as follows in Table 4.

Table 4. Cumulative balance between free allocations received and verified emissions after accounting for allowance transfers

main industry sectors sorted by 2016 emissions (desc)	free allocation minus emissions (after estimated allowance transfers*) /MtCO2e		balance as % of emissions	
	2008to2012	2013to2016	2008to2012	2013to2016
Iron and steel*	158	-86	20%	-13%
Cement and Lime	282	61	36%	11%
Mineral oil	57	-103	8%	-20%
Chemicals	89	-8	24%	-2%
Pulp and paper*	59	4	38%	4%
Glass	22	-10	23%	-13%
Ceramics	48	3	74%	5%
Non ferrous metals	6	-3	49%	-5%
Coke ovens	0	-6	0%	-23%
rest	111	-50	31%	-17%
Subtotal industry	831	-197	25%	-7%

Allowance balances have tightened for all sectors during Phase 3 so far but there are large differences in the extent of tightening from sector to sector.

Once allowance transfers are taken into account, the iron and steel sector is no longer the fattest 'Fat Cat'. Indeed, cumulative emissions for this sector in Phase 3 already exceed cumulative free allocation. Like the mineral oil sector, this sector has a negative balance for just Phase 3 but unlike the mineral oil sector, if it had held on to all its surplus allowances, this sector would not yet need to buy allowances for compliance as it has a significant layer of surplus to get through left over from Phase 2.

The mineral oil sector has the tightest supply compared to its demand and in 2016. Cement is the only highly emitting sector still receiving significantly more allowances than required for compliance. Cement remains the fattest 'Fat Cat' in 2016. It has received upwards of 340 million allowances more than required for compliance since 2008. That's equivalent to more than two years' worth of emissions at current rates.

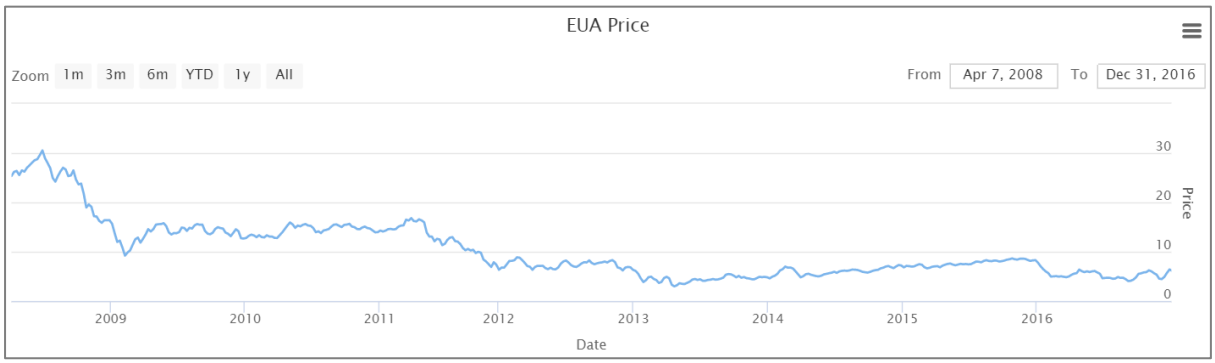
Estimating spare allowance monetisation potential

Even though free allocation has tightened during Phase 3, most of the highly emitting industry sectors (with the notable exception of mineral oil) have still received more allowances in aggregate over the whole period between 2008 to 2016 than they have needed to cover their emissions. This overallocation has effectively provided free assets to the companies involved. Table 5 below

summarises what the total value of these free assets could have been per sector at different market prices.

Price information is available at the various auction exchanges. The simple overview of EUA price changes over time seen in Chart 40 below has been copied from the Sandbag website[43].

Chart 40. EUA price changes over time



A limited number of Kyoto Protocol offsets, certified emission reductions (CERs) and emission reduction units (ERUs) can also be used between 2008 and 2020 as a result of the Linking Directive[44] so, Table 5 also illustrates the potential for further financial gain via surrendering or exchanging offsets for compliance rather than ETS allowances. Based on observed price evolutions, one can estimate that the potential gains are likely to be somewhere between the values calculated for 5 €/t and 10 €/t.

Table 5. Estimation of potential financial gain as a result of oversupply to industry sectors

main industry sectors sorted by 2016 emissions (desc)	2008to2016 free allocation minus emissions (after estimated allowance transfers*) /MtCO2e	estimate of potential financial gain (million Euros) if spare allowances all sold at EUA price /t			2008to2020 offset entitlement /MtCO2e	estimate of potential financial gain (million Euros) if spare allowances all sold and total offset entitlement already used with offset prices at half the level of EUA price /t		
		5	10	15		5	10	15
Cement and Lime	343	1,713	3,426	5,140	135	2,050	4,101	6,151
Iron and steel*	72	359	719	1,078	168	779	1,559	2,338
Chemicals	81	405	809	1,214	67	572	1,144	1,716
rest	61	304	608	913	54	440	881	1,321
Pulp and paper*	63	316	631	947	28	384	769	1,153
Ceramics	51	254	507	761	12	283	567	850
Glass	12	60	121	181	15	98	197	295
Non ferrous metals	3	17	33	50	4	26	52	79
Mineral oil	-46	-230	-460	-690	98	15	30	45
Coke ovens	-6	-28	-55	-83	5	-16	-31	-47
Subtotal industry	634	3,170	6,341	9,511	585	4,634	9,268	13,901

Important:

This table shows hugely oversimplified estimates. The 15 €/t price financial gains could not have been fully achieved because prices have not been sustained across the whole period at this level. However, for much of Phase 2 EUA prices hovered over the 10 €/t mark and for Phase 3 so far they have averaged at just above 5 €/t as can be seen in Chart 40 above.

[43] Closing ECX EUA Futures prices, Continuous Contract #1. Non-adjusted price based on spot-month continuous contract calculations. Raw data from ICE via Quandy.

[44] DIRECTIVE 2004/101/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, available here.

Despite the limitations of the approximation approach, the clear 'winner', with potential cumulative windfall profit of between €2 to 4 billion, is the cement and lime sector. By contrast, without the availability of cheap offsets for compliance, the mineral oil sector would already have faced compliance costs ranging from ~€0.25 to 0.5 billion since 2008.

7.3 Which countries have most free allocation change as a result of activity level change (new entrants, significant capacity expansions, closures, partial cessations or significant capacity reductions)?

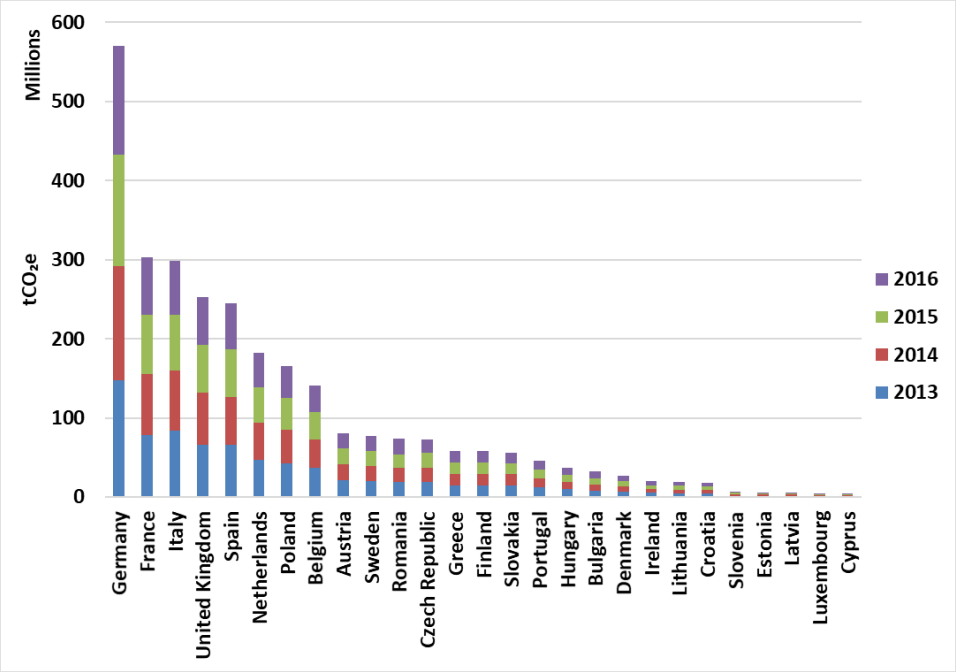
Italy has seen most net decrease in free allocations due to industry activity level change since the start of Phase 3. Germany still receives, by far, the majority of the free allocations.

As mentioned earlier in this report, data on production levels by ETS installations is not shared publicly so it is not possible to see directly to what extent emissions changes are due to emissions intensity changes. However, the reporting required from member states under Article 21 of the ETS Directive does shares information on free allocation changes across the whole phase for new entrants, significant capacity expansion, closures, partial cessations or significant capacity reductions at the member state level.

Sandbag has collected this data from the EIONET Reporting Obligations Database (ROD)[45] to gain an understanding of which countries are experiencing the most change.

Chart 41 (landscape orientation) ranks the EU28 countries in order of most reduction in free allocation across the whole phase and compares the net change for each member state to the current total phase free allocation for each member state and Chart 42 below shows the split of the current free allocations to industry sectors for 2013, 2014, 2015 and 2016 across the member states.

Chart 42. Current free allocations to industry sectors for 2013, 2014, 2015 and 2016 by member state



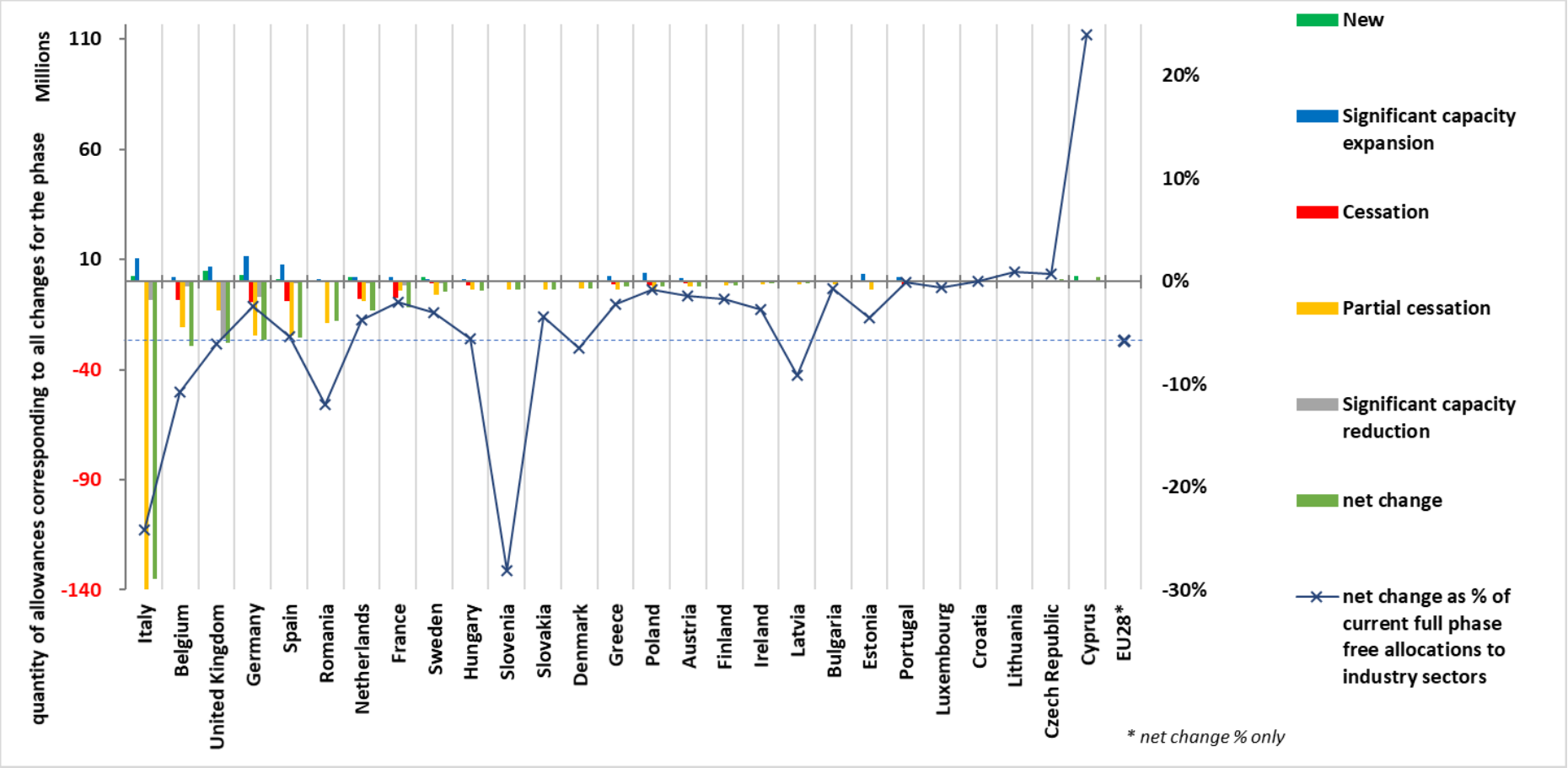
[45] *Available here. Not broken down by sector but new entrants and significant capacity expansions should just be industrial as power sector installations are not entitled to receive free allocations from the Phase 3 New Entrants Reserve.*

Italy's installation closures, partial closures and capacity reductions exceed the new entrant installations and capacity expansions, by far. Further investigation into emissions and free allocations trends for Italy suggests that the sectors most likely to be involved in these installation closures, partial closures and capacity reductions are cement and lime and mineral oil. Industry association analysis for the cement industry indicates that construction projects in Italy since the recession have been focussed on restoration rather than new build. Contrary to Spain, which has also seen a huge drop in its domestic construction market and a shift to restoration projects, Italy has not maintained cement production for export[46]. The second largest Italian mineral oil installation, Raffineria di Gela, is being converted to a bio-refinery[47].

[46] Analysis from 'Changing patterns of cement consumption in southern Europe', by David Perilli, Global Cement June 2017, available here.

[47] See ENI website here.

Chart 41. Member state free allocation changes for new entrants, significant capacity expansion, closures, partial cessations and significant capacity reductions and net change as percentage of total free allocation for industry (full phase)



Whilst overall across the EU28 member states the reduction in free allocation is relatively low (-6%, dotted blue line, secondary Y axis), there are significant differences between member states.

8. What's happening with aviation emissions under the ETS?

There has been net demand for stationary allowances from aviation participants each year so far this phase. Just six companies together account for over half of the aviation emissions.

No ETS overview would be complete without a brief look at aviation emissions. The 2008 legislation bringing the aviation sector under the ETS originally intended to include emissions from all flights from, to and within the European Economic Area (EEA) i.e. EU28 plus Iceland, Liechtenstein and Norway[48]. However, following the 2012 'Stop the Clock' Decision[49], ETS coverage of aviation emissions is currently confined to just emissions from flights within the European Economic Area (EEA).

Overall balance

Aviation emissions covered by the ETS have been higher than the combined number of issued aviation allowances (EUAAs) plus offset use by aviation. Aviation sector participants therefore make up the difference by stationary allowances (EUAs) in addition to their aviation allowances. Each year so far, there has been a small net additional demand for stationary allowances from the aviation sector. Table 6 below shows how Sandbag has calculated the size of this net demand. (NB: offsets cover 2012 only as there is no visibility of offset exchanges for allowances for compliance by sector since the start of Phase 3.)

Table 6. Sandbag calculation of net demand for stationary allowances (EUAs) by aviation operators[50]

$MtCO_2e$	2012	2013	2014	2015	2016
Auctioned	3		9	16	5
FreeAllocation	71	32	32	32	32
Offsets	11				
Emissions	84	53	55	57	61
net demand = (auctioned + free alloc + offsets) - emissions	0	-21	-13	-9	-24

As seen in Section 5 above, whilst small now, aviation emissions are growing rapidly. It is expected that the net demand for stationary allowances from the aviation sector will continue to grow in the coming years.

Top emitters/buyers

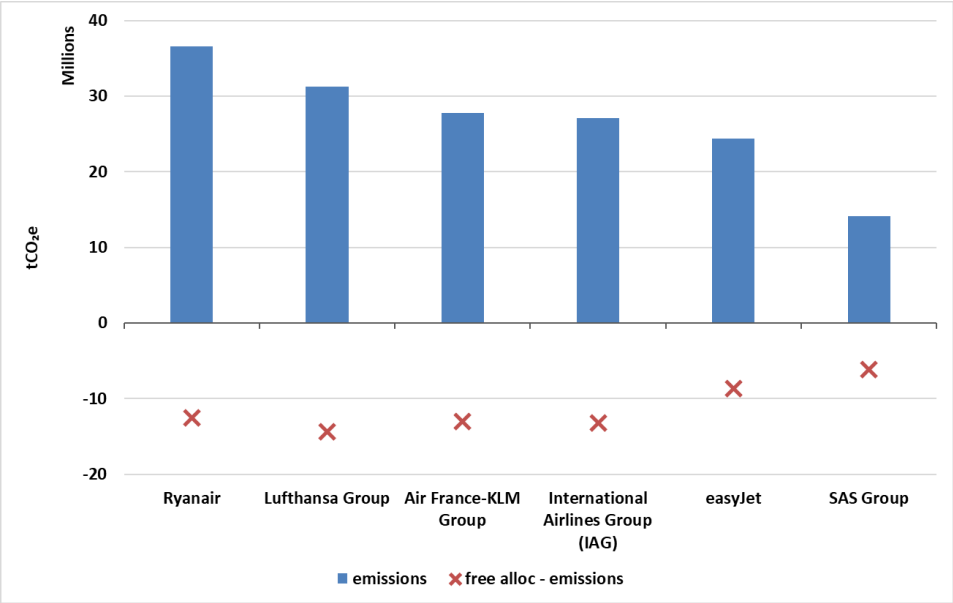
Sandbag has attempted to group together aviation sector account holders into parent companies to see which companies have needed to buy most allowances so far. Chart 43 below shows the emissions and number of allowances to buy (free allocations minus emissions) for the top six companies for the period 2012 to 2016. These companies together account for over half of the aviation emissions.

[48] See Directive 2008/101/EC, available here.

[49] See 2012 Commission Memo 'Stopping the clock of ETS and aviation emissions following last week's International Civil Aviation Organisation (ICAO) Council', available here.

[50] A number of free allocations issued in 2012 were returned as a result of the 2013 Stop the Clock decision. Sandbag has subtracted these returns off the original 2012 aviation free allocations for the relevant aircraft operator codes.

Chart 43. Emissions and allowances to buy for 2012 to 2016 period



9. Which countries have received most allowances for auctioning?

Germany has received, by far, the largest share of allowances for auctioning and will continue to receive the lion's share in Phase 4.

Having reviewed emissions trends and changes in free allocation, the following section looks at differences in auctioned allowances from member state to member state.

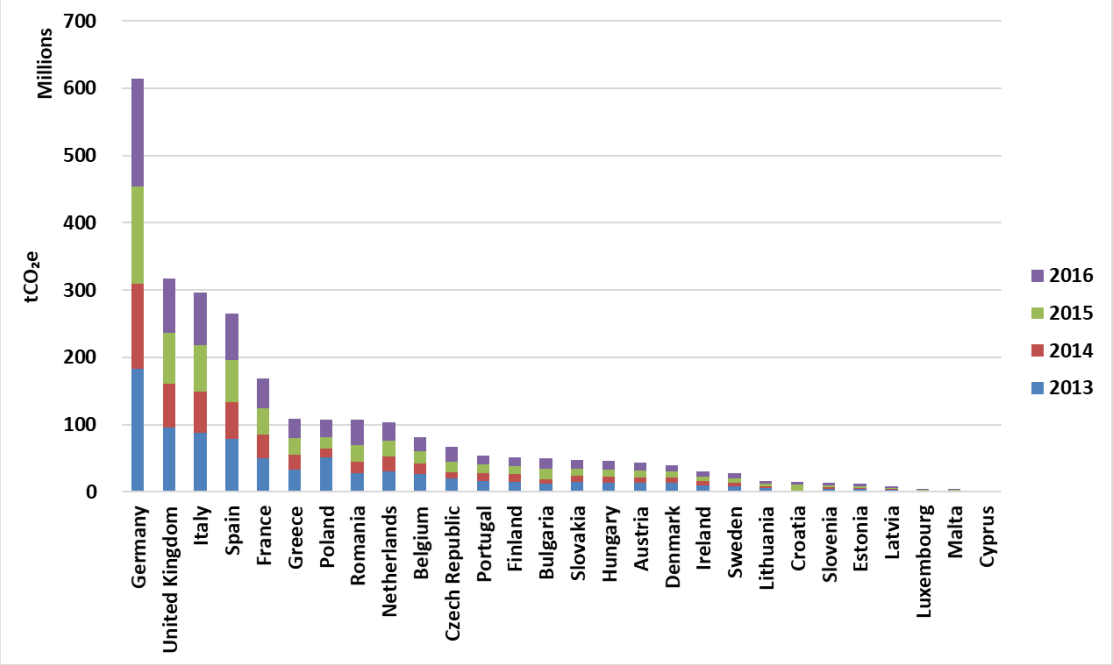
Auctioning is intended to be the default method of allocating allowances within the ETS and indeed, as seen in Section 4 above, as electricity generators no longer receive free allocations (unless under the Article 10c derogation from auctioning), the share of allowances reaching the market via auctioning rather than via free allocation has increased hugely in Phase 3.

Distribution of allowances for auctioning

The split of the allowances for auctioning across the member states is determined under Article 10(2). In Phase 3, under Article 10(2)(a), 88% of the auction share of the allowances is split across the member states in proportions related to their share of verified emissions in 2005 (or the average of the period from 2005 to 2007, whichever one is the highest). A further 10% is distributed across specific member states meeting the criteria for solidarity and growth support under Article 10(2)(b), and the remaining 2% is distributed under Article 10(2)(c) across specific member states with early action under the Kyoto Protocol.

Chart 44 below illustrates how, because of the high emissions in Germany over a decade ago, Germany receives, by far, the most allowances for auctioning each year. Perhaps oddly, the distribution of the Article 10(2)(a) allowances was not a subject of significant civil society debate during the Phase 4 reform process. However, it was reviewed during the 2013-2014 negotiations on the overall EU Climate and Energy Framework for 2030. EU Heads of State agreed to maintain the split of Article 10(2)(a) allowances across the member states. In Phase 4, 90% of the auction share is distributed under Article 10(2)(a). Consequently, right through to 2030, Germany will continue to receive the lion's share of auction allowances based on emissions data from more than 15 years ago.

Chart 44. Auctioned allowances for 2013, 2014, 2015 and 2016 split by member state



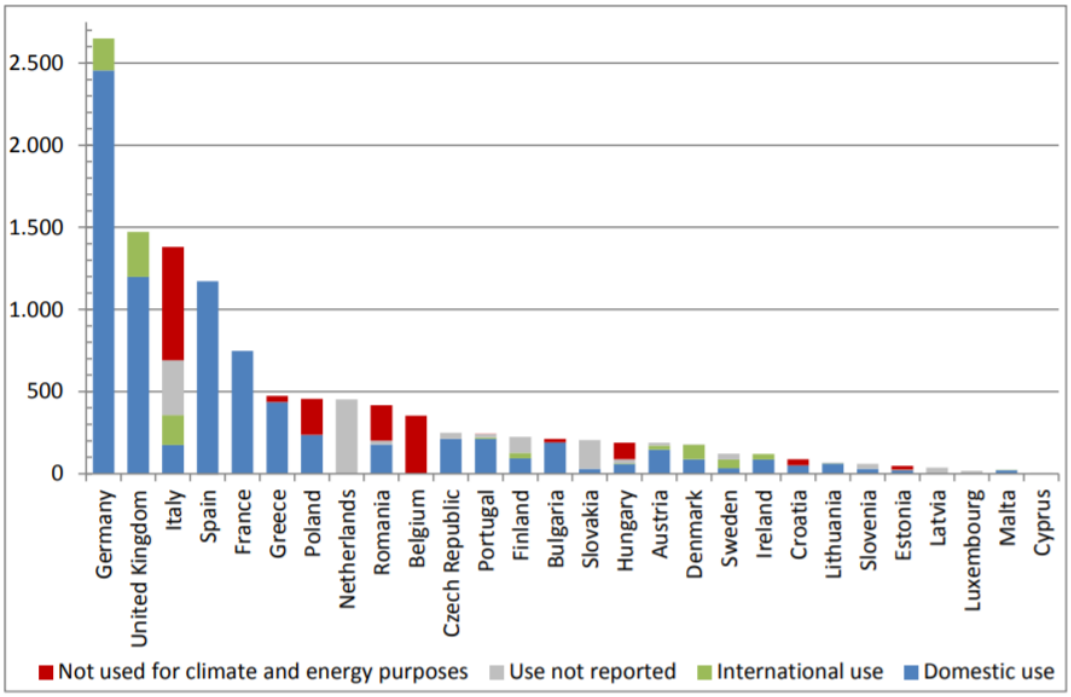
Use of auctioning revenues

Member states report the use of revenues (and the actions taken) to the Commission under the Monitoring Mechanism Decision (280/2004/EC). At least 50% of the Article 10(2)(a) auctioning revenues are intended to be spend on measures to reduce greenhouse gas emissions.

Chart 45 below has been taken from the Commission's Mar 2017 report on use of auction revenues[51]. It provides an overview of the use of auctioning revenues per member state for 2013 to 2015 and illustrates how much more ETS related finance is available to Germany compared to other member states. It also illustrates how Germany uses the majority of this auction revenue for domestic climate and energy purposes. The report concluded, "*The auction revenues are an important source of finance for climate and energy projects in the national context*"[52]; it also pointed out that in 2014-2015 Germany used €237.3 million of this to compensate energy intensive companies for increases in energy prices due to emission trading[53]. Given its high and increasing share of coal-fired power generation (see Section 6.3), it is to be hoped that in the future, more of the revenues will used to support an accelerated coal phase-out.

[51] *Figure 2, p.18 'Analysis of the use of Auction Revenues by the Member States' available here.*
[52] *p.36 'Analysis of the use of Auction Revenues by the Member States' available here.*
[53] *p.19 'Analysis of the use of Auction Revenues by the Member States' available here.*

Chart 45. Use of auctioning revenues per member state for 2013 to 2015 (000 €)



10. Looking forward, what does the Phase 4 reform bring?

The reform agreed at the final Trialogue earlier this month brings some progress to balance the market and improve allocation rules but it does not go far enough. It doesn't adequately address the surplus of allowance surplus in the short to medium term, it doesn't respond quickly enough to emissions reducing faster than the linear reduction rate and it doesn't ensure a steadily increasing cost of carbon for all participants to encourage identification of least cost abatement.

So far this report has looked backwards across Phase 2 and Phase 3. We have seen which countries and sectors emit the most and are changing most rapidly; and we have seen that while free allocation to industry sectors is getting tighter during Phase 3 (primarily due to the need for a uniform CSCF), even the Backloading Decision has failed to address the overall imbalance of supply to demand for compliance.

We will now look briefly at the Phase 4 reform. Sandbag will be publishing a second more wide ranging and forward-looking report on the state of the ETS later this month.

Ideally, the Phase 4 ETS reform should have rebalanced supply to demand short-term and clearly established additional flexibilities for ratcheting the cap in line with ongoing 'Paris Agreement'-style increases in abatement ambition. It should also have ensured that ongoing free allocation, a temporary exception from the principle of auctioning being the default method of allowance distribution, could be phased out more rapidly whilst at the same time introducing more appropriate measures to avoid displacement of industrial activities to regions outside the scope of the ETS. A further aim of the reform was to tighten up the criteria for use of auction revenues and for ongoing free allocation to power installations under the Article 10c derogation.

The reform agreed at the final Trialogue either this month does bring some progress on these issues but it does not go far enough.

With a steadily decreasing cap, the ETS is supposed to identify least cost abatement while increasing ambition over time. In this ever more carbon constrained world, encouraging a race to the top on industrial carbon neutrality within the EU could have given European industry strategic advantage and encouraged inwards investment. Instead, policy makers have failed to adequately address the problem of the surplus in the short and medium term. The cost pressure required to stimulate investment in abatement measures higher up the marginal abatement cost curve (MACC)[54] is being delayed. Yet, particularly when considering long industrial investment cycles, we need to be stimulating additional process and material innovation now.

In addition, the approach being followed to protect EU industry from the risk of activity displacement to other regions outside the scope of the ETS means that many of the most highly emitting sectors will continue to receive full allocation to benchmarks established by their *current* most carbon efficient installations. High levels of free allocation delay the pressure to break through into abatement options further up the MACC curve. We risk running out of time to reach carbon neutrality in heavy industry sectors before our carbon budget runs out.

High levels of free allocation, together with the unwillingness of some member states to give up more of the allowances available for their auctioning revenues, has ensured resistance to tightening the overall cap. Instead, we rely on the mopping up effect of the MSR and on voluntary action to cancel auction share allowances by more ambitious member states.

On a more positive note, changes to Article 11 of the Directive will ensure that more comprehensive data on transfers of heat and gases must be provided to the Commission as part of members states' reporting obligations, although it is not yet clear to what extent such information will be available for public scrutiny.

Persistent market surplus, even by the end of Phase 4

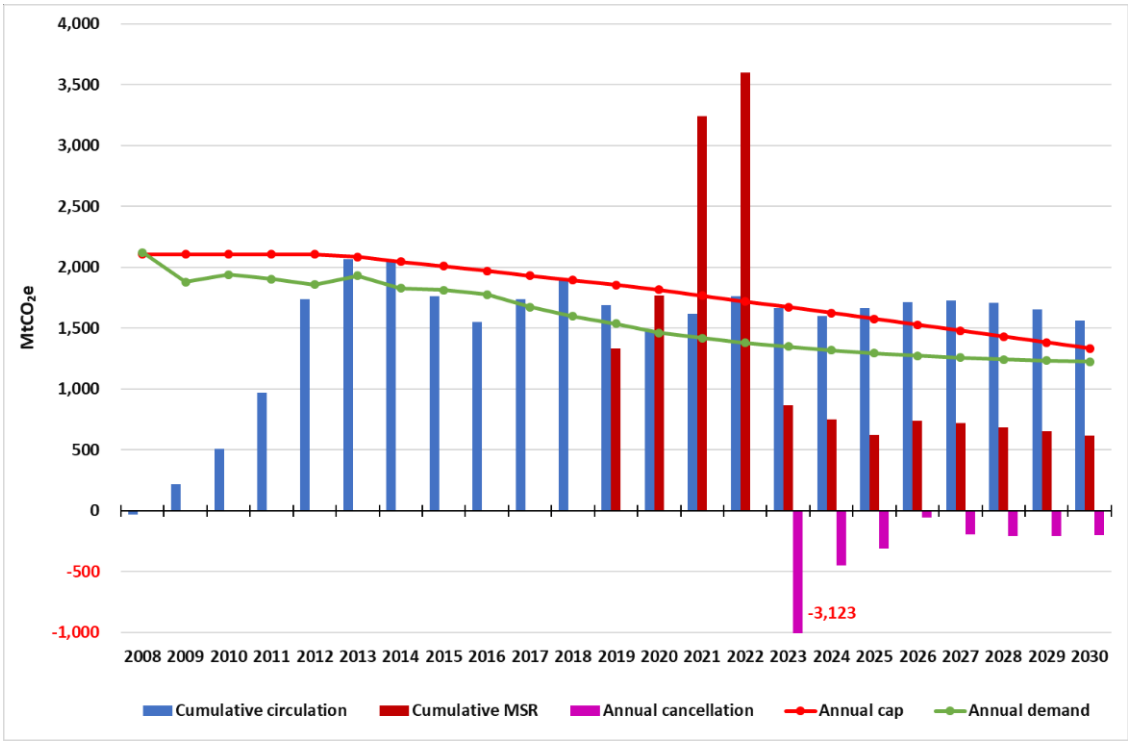
The rate of allowance withdrawals into the MSR will be doubled up to and including 2023 and, from 2023, the number of allowances to be held in the MSR will be restricted to the previous year's auctioned amount. Allowances above that amount will be cancelled from the MSR.

These reforms are very welcome but, as illustrated in Chart 46 below, insufficient to keep pace with ongoing emissions projections[55]. Sandbag calculates that the reform measures are not likely reduce the market surplus significantly before the 2030s.

[54] McKinsey 'Pathways to a low-carbon economy: version 2 of the global greenhouse gas abatement cost curve' is available here.

[55] Emissions under the ETS have fallen on average 2.9% from 2005-2010, and 2.6% from 2010-2016 (taking into account scope corrections). Sandbag's emissions projections assume ongoing average reductions of 2.8%/year. This assumes some acceleration of coal phase-out and some industrial emissions reductions.

Chart 46. Cumulative surplus development to 2030 under the reforms agreed for Phase 4[56]

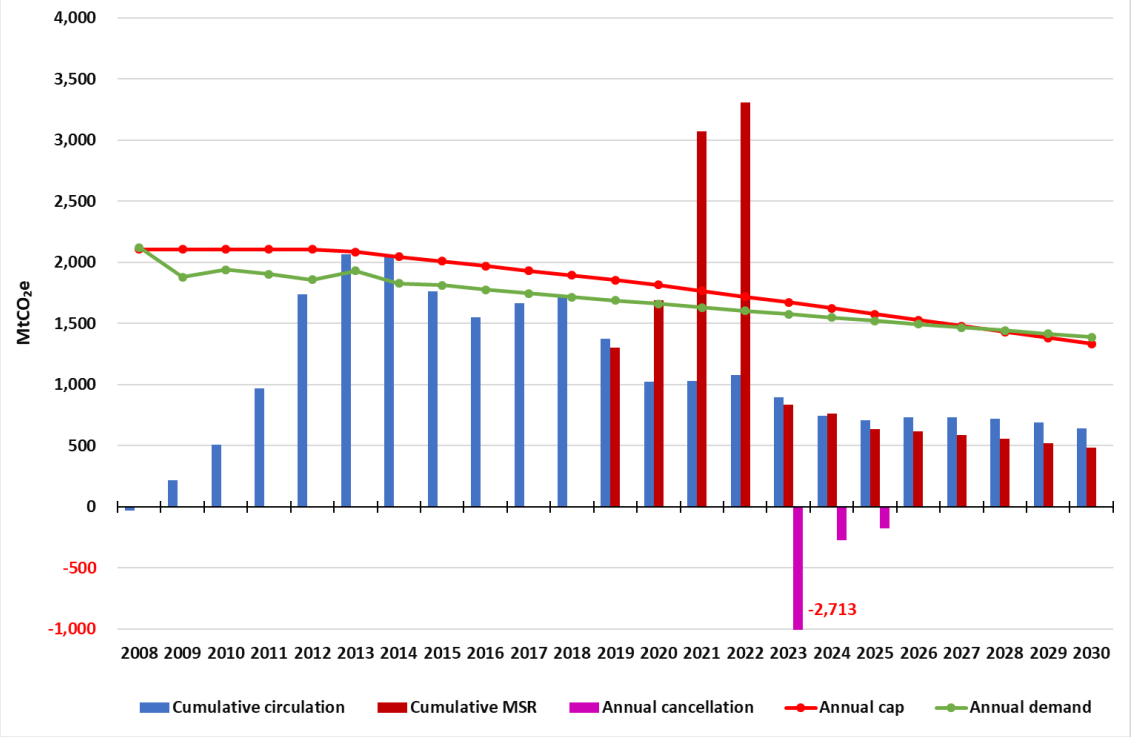


By the end of Phase 4, the cumulative circulation in the market (i.e. the supply demand surplus) is likely to still be about the same as it is at the close of 2016 – equal to more than a year's worth of emissions and even above the cap.

Even if we assume the unlikely scenario of linear emissions reductions down to the -43% target for 2030 compared to 2005 baseline, there will still be a supply surplus of near half a year's worth of emissions by the end of the phase. Given the current rate of emissions reductions and the potential for further rapid drops due to coal phase-out, this second scenario, as seen in Chart 47 below, seems very conservative.

[56] *Assumptions: no cap flexibility i.e. 2.2% LRF continuing from 2020; ongoing net demand from aviation for emissions increases of 2.5% per year; max increased Article 10c derogation; doubling MSR withdrawals until (&incl) 2023; 25 million from MSR to Greece; MSR cancellations from 2023; max 3% auction share reduction to avoid CSCF; 2% Modernisation Fund; 350 million NER from MSR; 450 Innovation Fund (400 from FA share & 50 from MSR)*

Chart 47. Cumulative surplus development to 2030 under the reforms agreed for Phase 4[57]



Continuing binary approach to assessing carbon leakage risk (on list or off list for 100% allocation to benchmarked level); auction share will be reduced to delay or even avoid a CSCF

A significant focus of the reform has been to ensure that sectors considered at risk of carbon leakage can receive full benchmarked free allocation without applying a uniform cross-sectoral correction factor (CSCF) across all sectors.

Despite pressure from climate campaigners to differentiate between different levels of carbon leakage exposure, the current binary approach will be continued. Sectors are considered to either be fully exposed or fully unexposed to carbon leakage risk. In principle, sectors considered to be at risk of carbon leakage are entitled to receive 100% of their benchmarked application unless a uniform CSCF needs to be applied across all sectors to keep the total amount of free allocations under the maximum number of allowances available.

In a first effort to avoid the application of a CSCF, policy makers have decided to feed the NER for Phase 4 with allowances diverted from the MSR and unallocated allowances left over from the free allocation share[58] instead of using allowances from the Phase 4 cap. In practice, this, combined with 25 million allowances diverted from the MSR to create a fund for Greece, plus an estimated ~75 million unused Phase 3 Article 10c carried over from Phase 3 auctioning (part of which would have been absorbed by the MSR) for free allocation in Phase 4, all means that the cap for Phase 4 will be artificially increased by at least ~300 million allowances.

To further avoid, or at least delay, the application of a uniform CSCF in Phase 4, the reform allows a larger share of the overall cap to be used for free allocation. The auction share can be reduced by up to three percentage points to free up allowances for free allocation if needed. A 3% reduction in

[57] Same assumptions as Chart X except for emissions projections as described in the text.

[58] Some 145 million allowances from the free allocation share for Phase 3 (leftover as a result of the way the CSCF has been applied) are due to be auctioned in 2020. These will be used for the Phase 4 NER instead.

auction share translates to 465 million less allowances available for auctioning to raise revenues to support climate action at the member states.

Sandbag's modelling shows that avoiding a CSCF could easily be achieved without decreasing the share of the cap available for auctioning, even under a tightened total supply cap, if the percentage of benchmark to be allocated to the different sectors were to more appropriately reflect their different levels of carbon leakage risk[59].

Higher levels of free allocation to some industry sectors

The current benchmarks, determining free allocations to industry sectors, were established based on data collected in 2007 and 2008. In order to reflect technological progress over the last decade, the Commission proposed to reduce the benchmarks by 1% per annum (15x -1% for the first half of Phase 4 and 20x -1% for the second half of Phase 4). In recognition that some sectors currently already have more abatement technologies available than others, it was proposed to apply a maximum benchmark change of -1.5% and a minimum benchmark change of -0.5% depending on information reported under Article 11 of the Directive. However, instead of minimum reductions of 15x and 20x -0.5% (translating to 7.5% benchmark reductions for Ph4 1st half and 10% benchmark reductions for Ph4 2nd half), the minimum reductions are likely to be watered down to 15x and 20x -0.2%. This translates to just 3% benchmark reductions by 2025 and just 4% benchmark reductions by 2030 which means that, in the absence of a CSCF, a current best performer could avoid paying a single penny in compliance costs with just 4% emissions reduction over 20 years. With benchmark reductions like these, these industries can hardly be considered to be on a pathway to deep decarbonisation: not in the short term nor even for the second half of this century. There is still a great deal of uncertainty on exactly what benchmarks will be applied for each sector. A new full data collection exercise will be carried out similar to the first benchmarking exercise in order to decide what percentage reductions to apply within the range of 0.2 to 1.6% but the data for this exercise will not be available before the close of 2017. Data for determining which sectors will be on the carbon leakage list for 100% to benchmark free allocations is also still to be collected.

No diet for the cement sector's ever growing surplus

Emissions in 2016 for installations mapped to NACE code 23.51 (manufacture of cement) are already at the 2020 free allocation level for this sector. The sector is on track to amass a surplus of more than 340 million allowances by 2020 at current emissions levels. That represents approximately two years' worth of emissions. As seen in Section 7.1, aggregate production levels for the cement sector dropped by ~13% from 2010 to 2016 (i.e. by less than the threshold required to reduce the historical activity level used to calculate benchmarked allocation). A small benchmark reduction with no or a delayed CSCF (due to lowered auction share) could mean that the cement sector effectively continues to avoid a significant price signal to abate and the most efficient installations even continue to gain windfall profits in Phase 4.

Eligible member states may opt for higher free allocation to power sector installations but with improved controls

A seen in Section 6.4, a large share of the allocations under Article 10c have been issued to installations burning coal and lignite. A major sticking point during the Trialogue negotiations on the Phase 4 reform was the requirement from the European Parliament to tighten the controls on which

[59] *See 'Last Chance Saloon for the EU ETS: Modelling Phase 4 reform options', Oct 2016, available here.*

projects can receive Article 10c free allocations and to impose strict controls on the use of Modernisation Fund revenues.

These controls mainly related to an emissions performance standard of 450gCO_2e/kWh. Such a criterion would have effectively ruled out Article 10c support for coal projects. It was strongly resisted by many of the member states eligible to use this support mechanism. The compromise reached was that only projects which *"do not contribute to or improve the financial viability of highly emission-intensive electricity generation nor increase dependency on emission-intensive fossil fuels"* may be selected for support. In addition, *"Where an investment leads to additional electricity generation capacity, the operator concerned shall also demonstrate that a corresponding amount of more emission-intensive electricity generation capacity has been decommissioned by it or another associated operator by the start of operation of the additional capacity."*

Eligible member states may also choose to derogate a higher percentage of their Article 10(2)(a) auction share for Article 10c free allocation – provided they have room to do so from their Article 10(2)(b) auction share.

11. Key findings & conclusions

What has this extensive trawl through the numbers told us?

We set out to ask questions of the numbers and to identify leaders and laggards. We have seen that the most highly emitting member states, Germany and Poland, have been lagging behind the overall EU28 emissions reduction rate and we have seen that many countries have significantly grown GDP whilst at the same time achieving significant reductions in emissions which indicates some degree of decoupling. Industry emissions reductions overall seem to have stalled, but power emissions reductions continue. The only member state with increasing power emissions, the Netherlands, has committed to close all its coal generation plants – even very new ones.

We have seen how fuel mix is a strong determinant of power sector emissions and that there is much potential for further abatement - particular for Germany and Poland where coal and lignite generation dominates. Without further national measures, Germany will continue to be the 'carbon haven' of Europe, despite its rapid deployment of renewables. Poland has a huge challenge to decarbonise its power sector but has been making at least some progress in reducing generation from coal. Civil society stakeholders must keep up pressure on these member states together with other high coal burners such as the Czech Republic and Spain, to join the leaders Austria, Belgium, Finland, France, Italy, Luxembourg, Portugal and the UK who have all already pledged to phase out coal.

Industry sectors such as chemicals and paper have led the way on industrial emissions cuts but the three highest emitting sectors, iron and steel, cement and lime, and mineral oil, are lagging behind. Trends in approximated emissions intensities indicate that much more needs to be done in all industrial sectors to accelerate widespread industrial decarbonisation.

The cement sector retains its position as most overallocated sector in 2016, amassing a surplus of more than two years' worth of emissions at current levels. Mineral oil is the most tightly squeezed sector and, after accounting for allowance transfers, iron and steel is now eating through the surplus it accumulated during Phase 2. Italy has seen its free allocations across the whole phase adjusted downwards by a huge 24% of the current industry allocations for the whole phase – far above the 6% reduction for the EU28 overall.

A quick look at aviation emissions under the ETS has revealed that just six parent companies account for more than half of the emissions. Indeed, one operator, Ryanair, even makes it into the top 20 emitting installations overall for the ETS.

Last but not least, we have seen that the Phase 4 reforms to temporarily double the MSR withdrawal rates and to introduce an automatic mechanism to cancel allowances from in the reserve will not be enough to keep pace with projected emissions reductions by achieved via other overlapping EU level and national level policies. With national measures to drive out high carbon generation (despite relatively low EU ETS prices) and with EU level policies to increase share of renewables generation and to keep stimulating demand reduction via energy efficiency, we look likely to finish the phase with a similar level of overall surplus as we have at the end of 2016. Admittedly, as we have seen for Phase 3 so far, the supply tightness will vary from sector to sector but overall the system will continue to be oversupplied – even under more conservative emissions reduction paths.

Unfortunately, the opportunity to introduce alternative approaches to protect industry from carbon leakage risk has not been grasped during the reform for Phase 4. Emissions trading to identify least cost abatement across the whole scope of the ETS will continue to be diluted by levels of free allocation more or less locked-in to current best technology emissions intensities.

We must now keep up pressure for ratcheting down the cap in line with 'Paris Agreement'-style increases in ambition as part of the 2018 Facilitative Dialogue and 2023 Stocktake Reviews, and we must keep up pressure to stimulate process and materials innovation to get industry sectors on a steeper decarbonisation pathway more quickly.

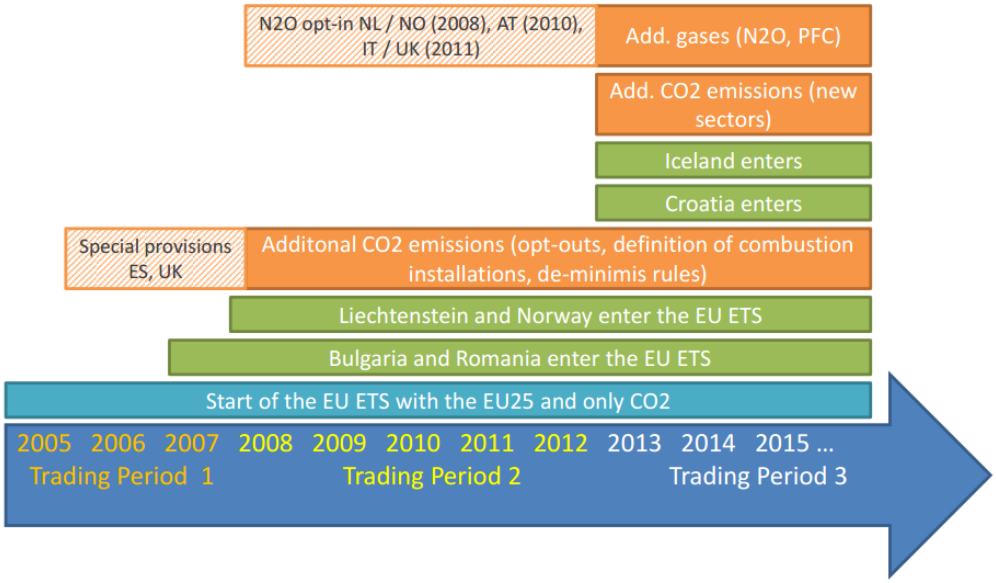
Appendices

A) Scope change

Summary of ETS scope change

Figure 1 on p.23 of the EEA's EU ETS data viewer manual illustrates EU ETS scope change (available at http://www.eea.europa.eu/data-and-maps/data/european-union-emissions-trading-scheme-eu-ets-data-from-citl-6/eu-ets-data-viewer-manual/eu-ets-data-viewer-manual/download)

NB: EU ETS figures in this report cover the EU28 member states only



ETS scope change per member state

Data downloaded from the European Environment Agency.
Dataset last modified Aug 2017, available here.

DataScr	EEA ETS data v27 from v25 zip
Type	emissions
ETS ESD Category	ETS scope correction for stationary installations

Sum of tCO_2e Member State	**Period**				
	2008	**2009**	**2010**	**2011**	**2012**
Austria	2,277,907	2,090,656	1,896,274	1,863,821	1,830,603
Belgium	4,302,321	4,305,076	4,635,458	3,394,002	3,398,351
Bulgaria	1,864,609	1,546,496	1,519,651	1,465,894	1,344,037
Croatia	12,663,003	11,140,548	10,525,509	10,418,645	9,547,631
Cyprus	0	0	0	0	0

Czech Republic	3,255,151	3,060,827	2,888,821	2,887,533	2,851,366
Denmark	0	0	0	0	0
Estonia	0	0	0	0	0
Finland	2,054,583	1,290,360	679,172	639,756	660,906
France	15,245,128	14,258,234	12,335,873	11,535,715	11,101,355
Germany	32,686,800	32,593,358	24,055,741	23,225,962	22,578,820
Greece	2,234,701	2,123,206	2,165,156	2,186,977	2,007,857
Hungary	4,891	14,244	10,236	15,386	21,925
Ireland	365,010	358,872	352,735	346,597	340,460
Italy	8,720,371	8,695,247	8,033,515	7,340,116	7,087,926
Latvia	20,947	20,595	20,243	19,890	19,538
Lithuania	5,220,820	3,017,230	2,900,386	3,154,809	2,836,487
Luxembourg	300,418	295,367	290,315	285,264	280,212
Malta	0	0	0	0	0
Netherlands	1,687,594	1,629,023	1,625,955	1,629,579	1,523,186
Poland	12,220,926	9,122,413	9,024,935	8,781,422	8,748,908
Portugal	1,116,997	886,077	879,533	650,815	637,337
Romania	7,269,056	6,753,193	7,157,185	7,053,939	6,760,687
Slovakia	2,034,207	1,785,941	1,597,314	1,116,147	995,063
Slovenia	-106,682	-133,307	-129,413	-55,577	-31,359
Spain	9,467,984	9,179,843	8,648,592	8,256,743	7,987,319
Sweden	2,082,954	1,796,406	1,923,448	1,666,119	1,530,732
United Kingdom	2,694,793	1,367,075	1,541,502	372,738	153,834
Grand Total	**129,684,489**	**117,196,980**	**104,578,136**	**98,252,292**	**94,213,181**

Estimation of split of ETS scope change by sector

Scope change for Croatia was estimated to be split between industry emissions and power emissions in line with the 2013 split. The remaining scope change was all assumed to be industry.

B) Sandbag categorisation of installations into sectors

SandbagSector	NACE Rev2 codes
Cement and Lime	23.51 23.52
Ceramics	23.20 23.31 23.32 23.40 23.41 23.42 23.43 23.44 23.49
Chemicals	20.11 20.12 20.13 20.14 20.15 20.16 20.17 20.20 20.30 20.41 20.42 20.51 20.52 20.53 20.59 20.60
Coke ovens	19.10
Glass	23.11 23.12 23.13 23.14 23.19
Iron and steel	07.10 24.10 24.20 24.31 24.32 24.34 24.51 24.52
Mineral oil	19.20
Non ferrous metals	07.21 24.42 24.43 24.44 24.45 24.53 24.54
Pulp and paper	17.11 17.12 17.21 17.22 17.23 17.24 17.29
Power and heat	35.00 35.10 35.11 35.13 35.14 35.30 plus additional combustion installations with Ph 3 emissions but no Ph3 free allocation and additional installations flagged as power as a result of desk-based research
Other combustion	rest

Full information on Sandbag and our funding is available on our website sandbag.org.uk.
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Whilst every attempt has been made to be as accurate and precise as we can given the data available to us, the information in this report is based on in-house modelling and as such is, at best, our interpretation of this data.