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Abstract
This report describes the possible future position of a power plant with CCS in the European Emissions Trade Scheme with respect to the allocation of allowances (EUAs). The allocation policies have shown not to be developed with respect to CCS yet. Comparisons of the allocation to conventional plants are made revealing great variations across EU Member States. Conclusions on the need for a further policy development are made.

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1 INTRODUCTION: THE EMISSIONS TRADE SCHEME

The establishment of the European Emissions Trade Scheme (Directive 2003/87/EC) subjects large installations using fossil fuels for power generation - amongst other industrial installations - to a regime where the emissions of CO_2 are regulated and limited. With this regulation of CO_2 emissions and the associated penalties, "CO_2" has acquired a value and becomes part of the economics of the investment into plants and their operation. Ideally, this value of emitting CO_2 will rise to cover the costs of emissions abatement measures such as CO_2 capture and storage.

From an investor's perspective, the Emissions Trade Scheme, however, has the disadvantage that the underlying Directive 2003/87/EC only defines two trading periods. The first one (Phase I) lasts from 2005 to 2007, the following one (Phase II) from 2008 to 2012, having the same duration as the first commitment period of the Kyoto Protocol. The Directive makes some references to subsequent trading periods but fails to give any certainty that a more long lasting regulation of the CO_2 emissions will actually be put in place. Besides the short duration of the fully implemented policy, the absence of binding emissions reductions targets for beyond the year 2012 imposes a high level of uncertainty for investors in low emissions technologies. Although the Emissions Trade Directive itself does not contain emissions reduction targets, the framework of the Kyoto Protocol at least gives some indications by setting targets for the European Union and its Member States out to 2012.

A closer look at the Emissions Trade Scheme regulations reveals that the market mechanisms create a slightly more complex situation than simply a price increase of electricity in the wholesale markets. The ETS is a "cap and trade" system where the overall amount of emissions of all installations being part of the scheme is limited. Each operator of an installation has to submit allowances (European Emissions Allowances EUAs) to the control authority for the amount corresponding to the actual emissions that have occurred from the installation during the preceding year. As the ETS is a cap and trade system, operators can trade allowances amongst each other or to third parties that want to be active in the market for allowances. Hence an operator who is not in possession of a sufficient amount of allowances to match the emissions of his installation can buy those on the market. Offers on the market could come, for example, from operators who have successfully executed emissions reduction measures, thus lowering their actual emissions below their allocated volume of allowances.

With the allowances that have to be "used" for every amount of CO_2 emitted, their value is part of the economic considerations of plant operation. Very simply, an operator will run a plant if the anticipated earnings made during this period are high enough to come up for the entire short term costs including the value of the allowances to be submitted for the associated CO_2 emissions. This in mind, operators will tend to incorporate the costs of emissions into the prices for their goods, namely electricity here. In principle the adoption of the emissions trade should lead to an increase of prices for electricity.

A rise in electricity price due to the costs of emissions could lead to a HYPOGEN plant becoming economically feasible. The extent of this rise in electricity prices is however not easily predictable as the entire cost of CO_2 emissions may not be passed through to the customers. In theory, if assuming fully functioning markets, wholesale prices should be set by the marginal plants. A rise in electricity prices in turn should be dictated by the costs of emissions of the marginal plant being in operation in any time segment. If this were a plant with high specific

CO_2 emission such as a lignite plant, the rise in price could be considerable. If however the price making plant were a highly efficient gas fired combined cycle plant, the rise in prices due to CO_2 emissions would be considerably lower.

The overall eligibility of CCS as a means of emissions reduction under the European Emissions Trade Scheme in Phase II and beyond will be analysed in Dynamis report D 6.3.2 (August 2007). This report will also discuss the monitoring and reporting that would be required for CCS activities.

2 ALLOCATION OF ALLOWANCES TO INSTALLATIONS

The Member States have to allocate allowances to the installations in their own country (Articles 9 to 11, 2003/87/EC); these then must be submitted in order to fulfil the requirements of the directive. Article 9 of the directive specifies that the Member States have to establish a National Allocation Plan (NAP) for each trading period where the overall amount of allowances allocated is stated. Article 10 sets out that for the period from 2008 to 2012 at least 90 % of the allowances have to be allocated free of charge.

In the guidelines for monitoring and reporting under the ETS (Decision C(2004)130), the European Commission (European Commission, 2004) states that it stipulated the research into CO_2 capture and storage and that this research would be important for the development and adoption of guidelines on the monitoring and reporting of CO_2 capture and storage. Member States are invited to submit research findings in order to promote the development of guidelines. Until such guidelines are developed by the EU, Member States may develop their own interim guidelines on monitoring and reporting and submit them to the EU Commission.

Summarising this, it can be concluded that the main EU-documents contain a general obligation for the Member States to allocate allowances to all installations covered by the ETS. CCS itself is only mentioned with respect to monitoring and reporting.

As the responsibility for allocating allowances rests with the Member States, they can – and did– develop their own allocation methodologies. The allocation of course has to be in compliance with the targets and rules of the Emissions Trade directive and with the rules for competition in the EU. But still, there is enough freedom for the Member States in creating their methodologies. This can result in differing competitive environments for operators of power plants across the European Union. As a consequence, an installation could be allocated with different amounts of allowances free of charge depending on the Member State in which it is located. This can be the case both for existing installations and for so-called new entrants, meaning installations that commence operation after the start of a trading period.

For a HYPOGEN demonstration plant, its position in the ETS is of crucial importance because the additional income generated has to outweigh the comparatively higher investment costs and fuel costs. As a consequence, the Member States National Allocation Plans should be analysed with the aim of identifying any allocation procedures that would be particularly favourable for the case of a HYPOGEN plant. It has to be noted, though, that in 2006 the allocation plans have been set up for the trading period from 2008 to 2012 only. There is no legislation available for the time beyond this period. Hence, the allocation plans for the period 2008 to 2012 can be taken as estimation guideline only, based on the assumption that the general allocation policy of the Member States will stay more or less constant.

Grubb and Neuhoff (2006) argue that, from a general perspective, the devolution of allocation responsibilities will cause notable problems. In particular they mention regulations for new-entrants to the market, which would form a subsidy to new investments if the allocation were to be granted free of charge. Such subsidies, granted by governments in order to attract investments, usually are connected to a macroeconomic cost, which, in the case of a high allocation of free allowances, would be the need to cut back emissions elsewhere in the economy more strongly.

From the perspective of an individual project such as the planned HYPOGEN plant, a high allocation free of charge would form an additional support that could improve the economic viability of the project. So, even if from a macroeconomic point of view, high allocations for new entrants are criticised, a rationally acting investor has to take into account the outcome of allocation rules for a plant such as HYPOGEN.

2.1 Allocation to new entrants in Phase II of the European Emissions Trade

The amount of EU Emission Allowances (EUAs) actually allocated to new energy production installations in Phase II varies strongly across European Member States depending on the chosen location and technology. For example, a 400 MW coal fired power plant would be allocated allowances of 2,250,000 t CO_{2eq} per year for the five year period in Germany whereas the same plant would receive 949,000 t CO_{2eq} in Luxembourg and only 430,608 t CO_{2eq} in Belgium, the possible maximum difference amounting to 1,819,392 t CO_{2eq} allocated for one year. In Italy, a 400 MW coal fired power plant will receive 2,210,440 t CO_{2eq} in 2008. This would be 1,308,280 t CO_{2eq} more than the amount allocated to a gas fired power plant with the same capacity in the same year. These distortions within and across Member States are the result of the various allocation methods employed, showing no strong signs of harmonisation for Phase II.

Concerning their allocation method, Member States choose from several options: Firstly, most Member States allocate allowances either based on projected emissions or on benchmarks, the latter being either fuel-specific or fuel-neutral. For the case of fuel-specific benchmarks, the construction of further subgroups within a technology is possible (for example for lignite and hard coal). Secondly, Member States apply different activity rates either based on the projected output of the installation, the installation's capacity, or on standardised load factors (with the possibility to further differentiate between technologies). Lastly, the value of the compliance factor (if used) varies greatly between Member States. Such a compliance factor usually is introduced if the sum of allowances allocated without it would surpass the budget of emissions foreseen for the activity by the Member States' government.

Although in Phase II most Member States allocate to the electricity sector according to benchmarks, the type of benchmark, and therefore its value, differ strongly between Member States. For example, Germany, Italy and Spain employ fuel-specific benchmarks. The benchmark for coal being in all cases higher than the one for gas (0.75 tCO_{2eq}/MWh vs. 0.365 tCO_{2eq}/MWh for the case of Germany), so coal fired plants will receive more allowances than gas fired plants with the same capacity. For the case of Germany, this difference amounts to 1.155.000 t CO_{2eq} for an installation of the foreseen capacity of 400 MW of a HYPOGEN demonstration plant. It can be noted that fuel-specific benchmarks subsidise certain technologies to the detriment of others.

By contrast, Belgium, Luxembourg und the UK employ benchmarks uniform for all technology types. Any installation producing below this benchmark will be able to generate an additional financial benefit by selling the surplus allowances on the carbon market. Therefore, a uniform benchmark results in a strong incentive to invest in more efficient technologies. From the

investment perspective of a HYPOGEN plant, it would therefore be favourable to locate a coal fired variant in a Member State applying fuel specific benchmarks.[1]

Another influencing factor on the amount of allowances allocated is the activity rate, which varies in type and value across Member States. Again, it is possible to either use the same value for all technologies (Germany, Luxembourg and the UK) or to differentiate between technology types (Belgium and Italy). A differentiation between technologies results in the same subsidising effect as in the case for benchmarks. In Belgium for example, the applied benchmarks are identical but the activity rate for gas is higher than for coal, resulting in a higher allocation to gas installations. For the case of an assumed capacity of 400 MW, this difference amounts to 473.668,8 t CO_{2eq} allocated per year. But even if a uniform activity rate is employed, its value differs strongly across Member States, being 5600 h/yr. in the UK, 6500 h/yr. in Luxembourg and even 7500 h/yr in Germany, for example.

Lastly, some Member States employ a compliance factor causing a reduction of the allocated amount of allowances while others don't. Again, the compliance factor can be uniform or technology-specific, resulting in the same effects as for benchmarks and activity rates. While Germany guarantees no compliance factor to new installations for 14 years[2], the UK applies a compliance factor of up to 0.7 for large electricity generators.

To sum up, one can note that there are great differences in the amount of allowances allocated to new installations in the power sector under current methods within Member States (according to technology type) and across Member States (see table for quantitative analysis). They are mostly due to different values of the chosen basis for allocation (benchmark or projected emissions), to varieties of the applied activity rate (projected output, capacity, or standardised load factors), and to the chosen compliance factor (if used). Differences within Member States have subsidising effects for certain technology types, for example for coal in Germany and for gas in Belgium. Differences in the allocated amount across Member States may influence the future site selection of European power generators. Therefore, "… to avoid possible competition distortion across Member States arising from the different rules of allocation to new projects, not only the benchmark levels but also the applied activity rates and the compliance factors would have to be harmonized across Member States." (Betz et al. 2006)

[1] This of course holds only true when assuming that the allocation rules of the Member States will not change in a Phase III of the ETS.
[2] The policy of guaranteeing allocation principles for a period going beyond the five years of Phase II has not been accepted by the European Commission and is subject to debate between the European Commission and the German government.

Table 2-1: Calculated allocations of EUAs to a new entrant 400 MWe power plant[3].

EU Member State	all. EUAs (t CO_{2eq}/a) coal		all. EUAs (t CO_{2eq}/a) gas		difference (t CO_{2eq}/a) (coal – gas)	
Belgium*	430,608		904,277		473,667	
Finland	188,325		140,519		47,806	
Germany**	2,250,000		1,095,000		1,155,000	
Italy	2008 2,210,440	2012 1,768,352	2008 902,160	2012 721,728	2008 1,308,280	2012 1,046,624
Lithuania	1,000,000		1,000,000		0	
Luxembourg	949,000		949,000		0	
Spain***	-		438,000		-	
Sweden****	0		0		0	
United Kingdom	846,229		846,229		0	

*The allocation for gas fired-plants is higher due to the application of a uniform benchmark for all technologies in connection with a higher load factor for gas-fired plants.
**no final decision on benchmarks
***no Benchmark for coal available, compliance factor yet to be set up
****free allocation of EUAs only granted to high-efficiency CHP-installations

[3] Calculations could only be performed where complete data was available in the National Allocation Plans for Phase II

3 OUTLOOK ON FUTURE PERSPECTIVES AND CONCLUSIONS

The analysis of the actual state of the National Allocation Plans for Phase II of the European Emissions Trade Scheme has shown that there are substantial differences amongst Member States' allocation of EUAs. In view of the actually very low prices for EUAs these differences might seem less important. It has to be noted though, that the price signal observable now at the end of Phase I of the ETS is most probably not valid for Phase II. This is a consequence of the fact that EUAs from Phase I may not be transferred into Phase II ("banking" is not allowed). With a high overall allocation in Phase I of the ETS and the devaluation of all EUAs of this Phase at the end of 2007, a reduction of prices close to zero has to be expected. With the start of Phase II, where the overall allocated volume probably will be comparatively lower in view of the expected demand, with a high probability, prices will reach a higher level again. As banking into subsequent trading periods after Phase II will be allowed, a more constant evolution of prices could be expected. This of course holds true only if a continuation of the ETS under the same principles will be implemented in time.

Assuming similar allocation rules for subsequent trading periods after Phase II it can be concluded that the differences in allocation will lead to significantly varying investment environments. Based on an estimated EUA price of 10 Euros/t of CO_{2eq} only, the differences in allocation would make up a difference in value of 18 million Euros per year when comparing new coal plants in Germany and Belgium. Extrapolated on a five years period this difference in value of EUAs would make up 90 million Euros, which is a significant amount in view of the overall investment volume of a HYPOGEN demonstration plant.

There is of course no guarantee that the allocation principles from Phase II will be taken over into subsequent trading periods. On the contrary, there are discussions on a possible shift of the allocation method to a full auctioning of EUAs for all installations – both incumbents and new entrants. If this were performed based on a harmonised approach over the entire European market, the emissions trade market would not create any differentiation of location-dependent investment conditions across Europe. It could possibly create higher chances that the traded value of CO_2 would be fully transferred into electricity prices. Then, the value of CO_2 could at least match the cost of its capture in an efficient process and hence a HYPOGEN plant could compete on an economically level playing field with other generation plant. If such a move were also accompanied by the announcement of the stability of the regulatory regime and the ETS framework for a period of, say, 15 years, then financing of a HYPOGEN plant could become a realistic prospect.[4]

Under such conditions a HYPOGEN plant would not generate any income from the sale of unused EUAs that had been allocated for free. Instead the entire income would be generated from the sales of electricity and hydrogen. Within such a mechanism, there remains the option to provide an interim assistance to demonstration plant such as HYPOGEN by retaining the possibility of some free allocation of EUAs[5].

[4] The influence of a stable regulatory regime over a longer period than the actual five years trading period on the investment perspectives is discussed in the DYNAMIS report D6.2.1 "Identification of base conditions for debt finance".

[5] It should be noted that such a procedure would simply be a variant of a subsidy. Allocating allowances however could possibly be more easy from a perspective of politics than directly granting monetary funds.

3.1 Conclusions

Several main conclusions can be drawn based on the discussion above:

1. The Emissions Trading market is not yet prepared for allocating allowances to installations using CCS-technologies. An investor of a hypothetical plant with CCS going operational before the end of 2012 would not know the amount of EUAs that would be allocated to the plant.
2. The actually developed National Allocation Plans create substantial differences in investment conditions across the European Union. If the underlying principles were applied beyond Phase II of the ETS and also to CCS-technologies, the influence of value generation from allowances should be taken into account when locating a HYPOGEN demonstration plant.
3. The influence of the Emissions Trading arrangements on the overall financial viability of a HYPOGEN demonstration plant can not be analysed when only looking at the ETS but has to be assessed in connection with the electricity markets (and hydrogen markets)
4. The unclear outlook on the continuation of the Emissions Trade Scheme beyond its Phase II and on the stringency of the required emissions reduction imposes one of the most significant barriers to the introduction of CCS technologies induced by market mechanisms. A move to a harmonised auctioning of EUAs across all the Member States in the EU ETS for Phase III coupled with a 15-year stability of the accompanying regulatory framework would produce the kind of environment in which private financing of a HYPOGEN plant could become a realistic prospect.

In view of the fact that the National Allocation Plans do not give any indication on the treatment of CCS so far, it is seen as advisable to revise this report at a later stage of the project duration in order to include policy developments possible taking place still during the course of the DYNAMIS project.

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