Impact of CCUS Scenarios on the EU ETS

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This document requires the following approvals:

AUTHORISATION	Name	Signature	Date
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Project Coordinator	Fernanda de Mesquita Lobo Veloso		20/07/22

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1 Executive summary

Strategic plans for the development of CCUS in 8 regions in Southern and Eastern Europe are being developed by 2050 as part of the STRATEGY CCUS project. The deployment of CCUS may have an impact on the European Union Emissions Trading System (EU ETS), as no European Union Allowances (EUAs) is required for any CO_2 captured and not emitted to the atmosphere.

This deliverable aims at assessing CCUS impact on the EU ETS by evaluating the quantity of allowances not required with CCUS scenarios developed under the project on the regional and European scales. The analysis is performed by evaluating the quantities of CO_2 avoided through CCUS implementation throughout the scenarios with quantities of EU ETS allowances theoretically issued. The projected quantities of allowances are determined by applying linear reduction factors of 2.2 % and 4.2 % to those allocated in 2021.

The STRATEGY CCUS scenarios allow industrials in the 7 regions studied to avoid purchasing a significant volume of allowances equal to 10% in 2040 (and 1.7% in 2030) of the total EU stationary installations allowances using a linear factor of 4.2% of CO_2 reduction per year. At national scale, CCUS may have a stronger impact on the EUAs national demand since it allows reducing sometimes significantly industrial CO_2 emissions.

In terms of CO_2 price, the impact of CCUS on the EU ETS is a reduction of the EUAs demand so mechanically a reduction of the CO_2 price. All else being equal, a 10 % reduction in EUAs demand will be very sensitive to a reduction CO_2 price as the EU-ETS is a very responsive market. That means for the long term if CCUS projects will be largely deployed the Market Stability Reserve (MSR) need to be very efficient and react quickly to the excess of EUAs in the EU ETS.

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Content

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2 Introduction

The objective of this deliverable D5.7 is to assess the impact on the European Union Emission Trading System (EU ETS) of the CCUS deployment scenarios developed in eight Southern European regions as part of the STRATEGY CCUS project. The scenarios from which this assessment is performed, are detailed in the "Deliverable D5.2: Report of regional business cases" (Coussy et al., 2021) [1] & in the "Deliverable D5.3: Economic Evaluation of CCUS Scenarios in Eight Southern European Regions" (Coussy et al., 2022) [2]. These scenarios are listed in

Table 2-1.

Table 2-1: Scenarios considered to assess CCUS impact on the EU ETS

Country	Region	Selected scenario	
		Base	Alternative
Spain	Ebro Basin	×	
France	Paris Basin	×	
	Rhône Valley		×
Greece	West Macedonia	×	
Croatia	Northern Croatia	×	

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Country	Region	Selected scenario	
		Base	Alternative
Poland	Upper Silesia		× (scenario 03)
Portugal	Lusitanian Basin	×	
Romania	Galati	×	

The impact assessment is based on the amount of European Union Allowances (EUAs) that are no longer needed on the EU ETS due to the deployment of CCUS.

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3 Foreword on the EU Emissions Trading System

3.1 Main objective of the EU Emissions Trading System

The European Union Emissions Trading System (EU ETS) is the world's first international emissions trading system. It is a cornerstone of the EU's policy to combat climate change and one of its key instruments to meet greenhouse gas (GHG) emissions reduction targets since its 2005-2007 first phase and into the future.

Currently, the EU ETS limits GHG emissions from more than 11 000 installations in the power sector and manufacturing industry – so called "stationary installations" - in all EU countries[1], as well as airlines operating between these countries. It covers today around 50% of the EU's GHG[2].

The EU ETS is a GHG emissions "cap and trade" system that allows trading of emission allowances - or EUAs / quotas - so that the total emissions of industrial sectors and aircraft operators subject to this system stay within the cap. It was first introduced in 2005 and has undergone several changes since then. The implementation of the system has been divided up into distinct trading periods over time, known as phases. The current phase 4 began in 2021 and will last until 2030, as illustrated in Figure 3-1.

Figure 3-1: EU ETS trading phases [3]

[1] Plus Iceland, Liechtenstein, Norway (EEA-EFTA states) & Northern Ireland for electricity generation
[2] The EU ETS extension to maritime, road transport and building sectors is proposed

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3.2 Legal framework of the EU Emissions Trading System

The legislative framework of the EU ETS is spelled out in the Directive 2013/87/EC [4].

The legislative framework of the EU ETS has undergone several revisions to maintain the system's alignment with the overarching EU climate policy objectives. For phase 4, it was revised in 2018 to ensure that emissions reductions are in line with the EU's 2030 target of at least -40 % relative to 1990 level. This revision [5] strengthens the EU ETS by increasing the linear reduction factor that determine the quantities of EUAs available on the market. Indeed, the linear reduction factor set previously at -1.7% is increased to -2.2 % as of 2021.

On 14 July 2021 [6], the European Commission (EC) adopted a series of legislative proposals – The "Fit for 55" legislative package - to achieve climate neutrality in the EU by 2050, including the intermediate target of an at least 55 % net reduction in GHG by 2030. The package proposes the revision of several pieces of EU climate legislation, including the EU ETS Directive [7].

In this context, the EC proposes a set of changes to the existing EU ETS that should lead to an emission reduction in sectors covered by EU ETS [7]. This entails adjusting the total number of allowances, with a proposed linear reduction factor of 4.2 % in the year following entry into force of the amendment.

Figure 3-2: Steps of the ordinary legislative procedure 2021/0211/COD [9]

On 28 June 2022 [10], the Environment Council agreed to retain the overall ambition of emissions reduction proposed by the EC and give its assent to a linear reduction factor of 4.2 %.

Now negotiations with the European Parliament can begin so as to reach an agreement on the final legal texts. The compromise texts will become applicable Community legislation by 2024 [11]. In July 2022 pending a likely agreement the current linear reduction factor for phase 4 is -2.2%.

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4 Methodological approach

The impact of the STRATEGY CCUS scenarios on the EU ETS is assessed by comparing the amount of CO_2 avoided each year with use of CCUS in the eight regions (this amount of avoided CO_2 can be considered as the amount of EUAs not needed by industrial installations) with the number of future allowances of fixed installations. This comparison can be assessed at national and European level.

The yearly tons of CO_2 avoided by the CCUS deployment scenarios are compared to the total allowances of the fixed installations over the same period.

Is the number of unnecessary allowances due to CCUS deployment less than 5% of the total allowances available in the EU ETS or more than 50%?

5 Source data

On one side the quantities of CO_2 avoided year by year come from the scenarios presented in the deliverable D5.3: "Economic Evaluation of CCUS Scenarios in Eight Southern European Regions" (Coussy et al., 2022) [2].

On the other side the yearly quantities of allowances granted to stationary installations are extracted from the EU ETS Database named "ETS_Database_v45" [12] made available by the European Environment Agency.

5.1 Evaluation mode

As explained, quantities of CO_2 avoided through CCUS according to the scenarios developed for each region studied, running from 2025 globally to 2050, are compared to quantities of projected allowances granted to stationary installations at national and European levels.

Future quantities of allowances considered until 2050 are obtained by applying a linear reduction factor to those issued in 2021 as listed in the ETS Database.

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2021, as the first year of EU ETS phase 4, is taken as reference year to perform the analysis. It's the year from which emissions caps decrease annually according to the linear reduction factor of 2.2% in force to date. The exercise is also performed using a linear reduction factor of 4.2% in view of developments in legislation.

6 Analysis results

6.1 Profile of EU ETS allowances granted to stationary installations in 2021

Total EUAs issued to stationary installation holders in 2021 amount to 1,02 billion tonnes of CO_{2e}[3] in the ETS database. This quantity of allowances represents 65 % of the Union-wide cap for 2021 [13, 14] fixed at 1.57 billion tonnes of $CO2_e$ .The gap is highly due to the reduced demand because of the COVID-19 pandemic which led to a lower level of industrial activities[4] resulting in more allocations than emissions [15].

In 2021, EUAs dedicated to stationary installations operating in the seven countries considered in the STRATEGY CCUS project represent 39 % of 2021 EUAs issued at EU level, as illustrated in Figure 6-1.

[3] Each allowance gives the holder the right to emit one tonne of CO_2 or the equivalent - CO_{2e} - amount of N_2O and PFCs [13]

[4] The number of available allowances surpassed annual emissions for the first time since 2013 [15]

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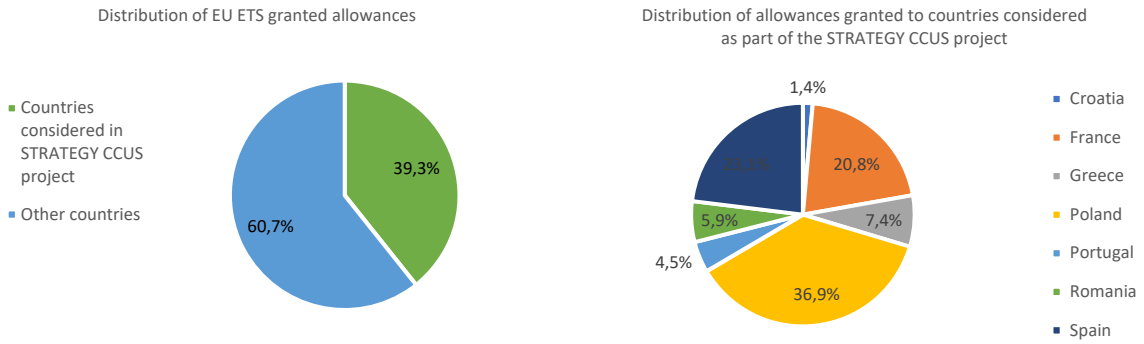
Figure 6-1: Features of EUA granted to stationary installations in 2021



With respect to countries considered within the STRATEGY CCUS project, Poland has the highest number of allowances issued to stationary installations (36.9 %), largely due to its substantial reliance of coal-fired power plants, followed by Spain and France.

6.2 Application of a linear reduction factor of 2.2 %

To determine, until 2050, the quantities of EUAs available to the stationary installations in the EU ETS, projected EUAs are calculated by applying the 2.2 % linear reduction factor to the volume of EUAs allocated in 2021. Total stationary installation allowances cover 1.02 billion tonnes of CO_{2e} overall the EU or 0.4 billion tonnes of CO_{2e} for the 7 countries studied under the STRATEGY CCUS project.

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A linear reduction factor of 2.2 % amounts to a fix 22 488 943 allowances decrease per year from 2021 to 2050 at EU level[5]. Distribution of these allowances' reductions are presented in Table 6-1.

Table 6-1: Yearly EUA reduction (stationary installations) from 2021 to 2050 considering a linear reduction factor of 2.2 %

Geographical perimeter	Yearly allowances reduction, Mt
EU	22.5
7 countries considered in the STRATEGY CCUS project	8.8
Spain	2.0
France	1.8
Greece	0.7
Croatia	0.1
Poland	3.3
Portugal	0.4
Romania	0.5

In view of these reduction levels, EUAs are still to be issued to stationary installations in 2050.

[5] Applying this factor to total allowances theoretically issued pursuant to Commission Decision (EU) 2020/1722 [13] would lead to a smaller share of allowances offset by CCUS. Nevertheless, this would not affect the results in terms of countries' relative positions.

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Table 6-2: Quantity of EUA issued to stationary installations offset by CCUS considering a linear reduction factor of 2.2 %

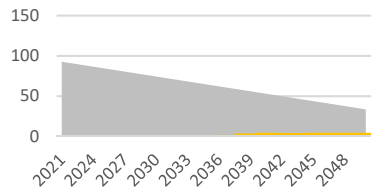
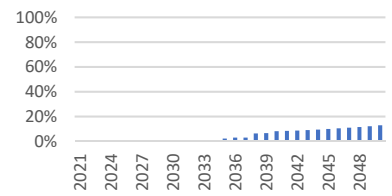
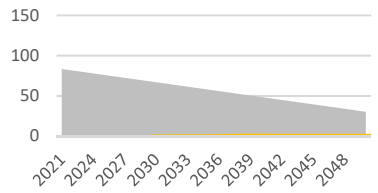
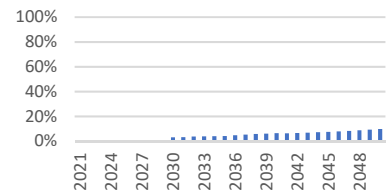
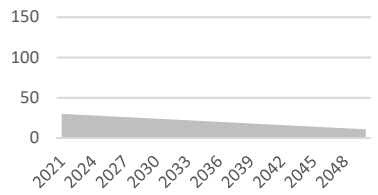
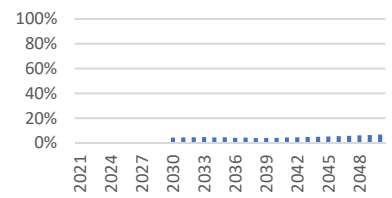
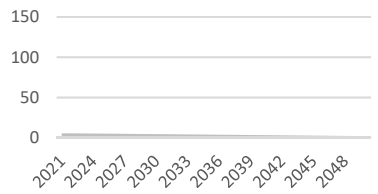
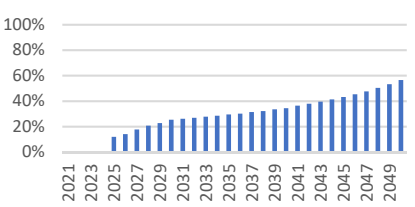
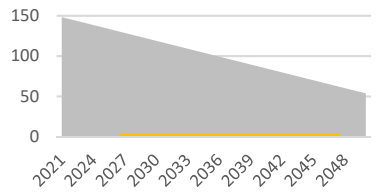
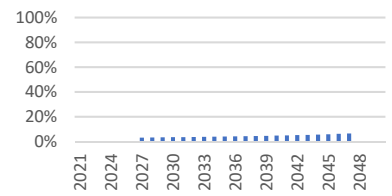
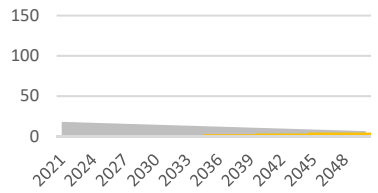
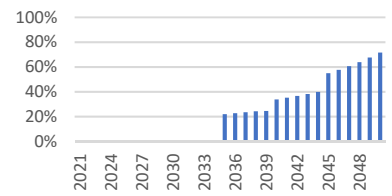
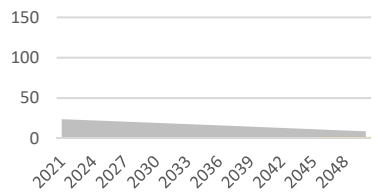
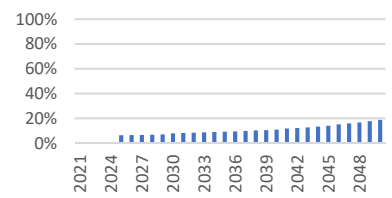
Country	CCUS implemen-tation date	CO_2 avoided through CCUS for the duration of the scenario, Mt	Projected EUA issued over the 2021-2050 period, Mt	CO_2 avoided vs projected EUA for the duration of the scenario, wt %	Yearly projected total EU-ETS allowances vs avoided CO_2, Mt Total allowances Avoided CO_2	Yearly avoided CO_2 vs total EUA, wt %
Spain	2027	66.3	1 892.3	4.9		
France	2027	59.0	1 705.9	4.8		
Greece	2030	17.2	610.1	4.7		
Croatia	2025	28.5	115.9	30.3		
Poland	2025	86.75	3 028.4	3.5		
Portugal	2028	60.2	370.5	23.9		
Romania	2025	39.2	483.6	10.0		

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Table 6-3: Quantities of allowances issued to stationary installations (considering a linear reduction factor of 2.2 %) and quantities of CO_2 avoided by STRATEGY CCUS scenarios

Country		2021	2030	2050
Spain				
	Quantity of allowances, Mt	92,6	74,3	33,5
	Quantity of CO_2 avoided, Mt	-	0,7	4,4
France				
	Quantity of allowances, Mt	83,5	67,0	30,2
	Quantity of CO_2 avoided, Mt	-	2,1	3,0
Greece				
	Quantity of allowances, Mt	29,9	23,9	10,8
	Quantity of CO_2 avoided, Mt	-	1,0	0,7
Croatia				
	Quantity of allowances, Mt	5,7	4,5	2,1
	Quantity of CO_2 avoided, Mt	-	1,2	1,2
Poland				
	Quantity of allowances, Mt	148,2	118,9	53,7
	Quantity of CO_2 avoided, Mt	-	4,1	0,1
Portugal				
	Quantity of allowances, Mt	18,1	14,5	6,6
	Quantity of CO_2 avoided, Mt	-	0,1	4,7
Romania				
	Quantity of allowances, Mt	23,7	19,0	8,6
	Quantity of CO_2 avoided, Mt	-	1,5	1,6
EU				
	Total stationary allowances, Mt	1 022,2	819,8	370,0
	Allowances not required with CCUS, wt %	-	1.3 %	4.0 %

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At EU level and considering a linear reduction factor of 2.2 %, 4.0 % of allowances issued to stationary installations may not be necessary with STRATEGY CCUS scenarios by 2050 (vs 1.3 % by 2030).

6.3 Application of a linear reduction factor of 4.2 %

Calculations are hereinafter performed as in section 6.2, but applying a linear reduction factor of 4.2 % (in discussion in July 2022 at EU level).

The linear reduction factor of 4.2% leads to a fix 42 933 436 allowances decrease per year issued to stationary installations from 2021 at EU level. Distribution of these allowances' reductions are presented in Table 6-4.

Table 6-4: Yearly EUA reduction (stationary installations) considering a linear reduction factor of 4.2 %

Geographical perimeter	Yearly allowances reduction, Mt
EU	42.9
7 countries considered in the STRATEGY CCUS project	16.9
Spain	3.9
France	3.5
Greece	1.3
Croatia	0.2
Poland	6.2
Portugal	0.8
Romania	1.0

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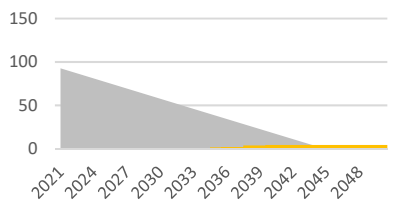
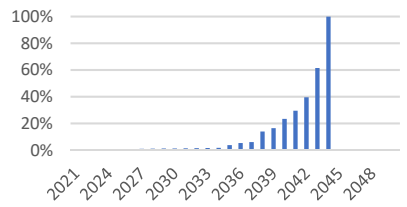
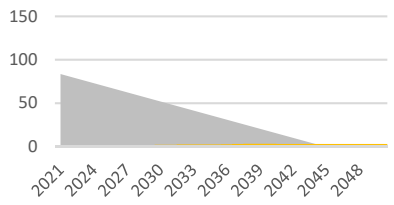
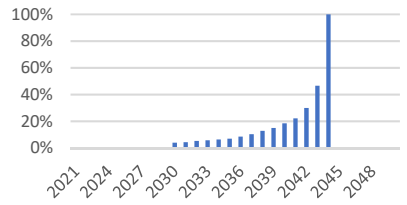
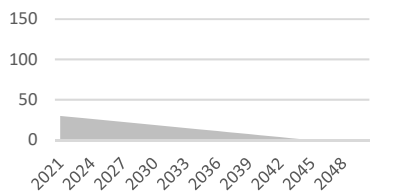
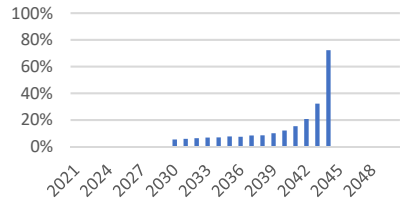
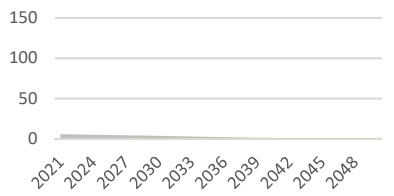
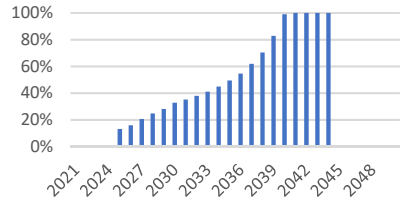
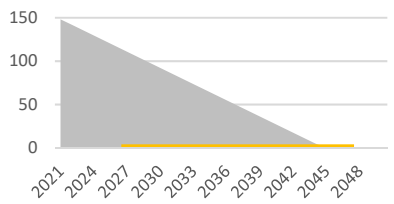
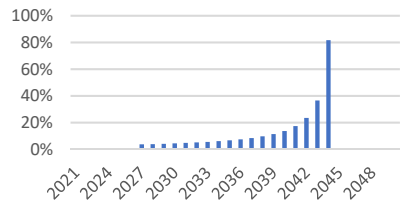
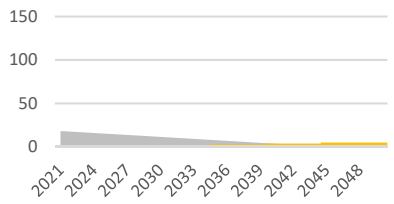
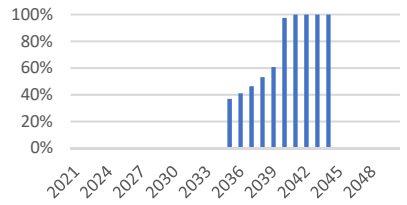
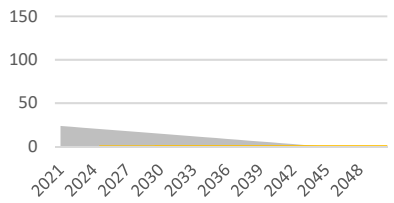
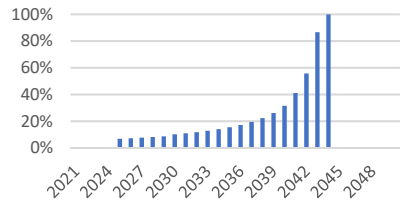
Table 6-5: Quantity of EUA issued to stationary installations offset by CCUS considering a linear reduction factor of 4.2 %

Country	CCUS implemen-tation date	End date of EUA	CO_2 avoided through CCUS for the duration of the scenario, Mt	Projected EUA issued over the 2021-2050 period, Mt	CO_2 avoided vs projected EUA for the duration of the scenario, wt %	Projected total EU-ETS allowances vs avoided CO_2, Mt Total allowances Avoided $C0_2$	Avoided CO_2 vs total EUA, wt %
Spain	2027	2044	66.3	1 149.3	10.2		
France	2027	2044	59.0	1 036.1	10.0		
Greece	2030	2044	17.2	370.5	11.7		
Croatia	2025	2041	28.5	70.4	58.0		
Poland	2025	2044	86.75	1 839.2	6.8		
Portugal	2028	2041	60.2	225.0	52.8		
Romania	2025	2044	39.2	293.7	19.1		

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In 2050 with a linear reduction factor of 4.2 %, no more EU ETS allowance is issued to stationary installations as illustrated in Table 6-5: such a linear reduction factor applied to actually allocated allowances in 2021 generates the end of these quotas' allocation in 2044 at the latest regarding the 7 countries studied.

Table 6-6 emphasises estimated quantities of EUAs issued to stationary installations and quantities of CO_2 avoided with a linear reduction factor of 4.2 %.

Table 6-6: Quantities of allowances issued to stationary installations (considering a linear reduction factor of 4.2 %) and quantities of CO_2 avoided by STRATEGY CCUS scenarios

Country		2021	2030	2035	2040	2050
Spain	Quantity of allowances, Mt	92,6	57,6	38,2	18,7	-
	Quantity of CO_2 avoided, Mt	-	0,7	1,4	4,4	4,4
France	Quantity of allowances, Mt	83,5	51,9	34,4	16,9	-
	Quantity of CO_2 avoided, Mt	-	2,1	2,4	3,1	3,0
Greece	Quantity of allowances, Mt	29,9	18,6	12,3	6,0	-
	Quantity of CO_2 avoided, Mt	-	1,0	1,0	0,7	0,7
Croatia	Quantity of allowances, Mt	5,7	3,5	2,3	1,1	-
	Quantity of CO_2 avoided, Mt	-	1,2	1,2	1,1	1,2
Poland	Quantity of allowances, Mt	148,2	92,2	61,1	29,9	-
	Quantity of CO_2 avoided, Mt	-	4,1	4,1	4,1	0,1
Portugal	Quantity of allowances, Mt	18,1	11,3	7,5	3,7	-
	Quantity of CO_2 avoided, Mt	-	0,1	2,8	3,6	4,7
Romania	Quantity of allowances, Mt	23,7	14,7	9,8	4,8	-
	Quantity of CO_2 avoided, Mt	-	1,5	1,5	1,5	1,6

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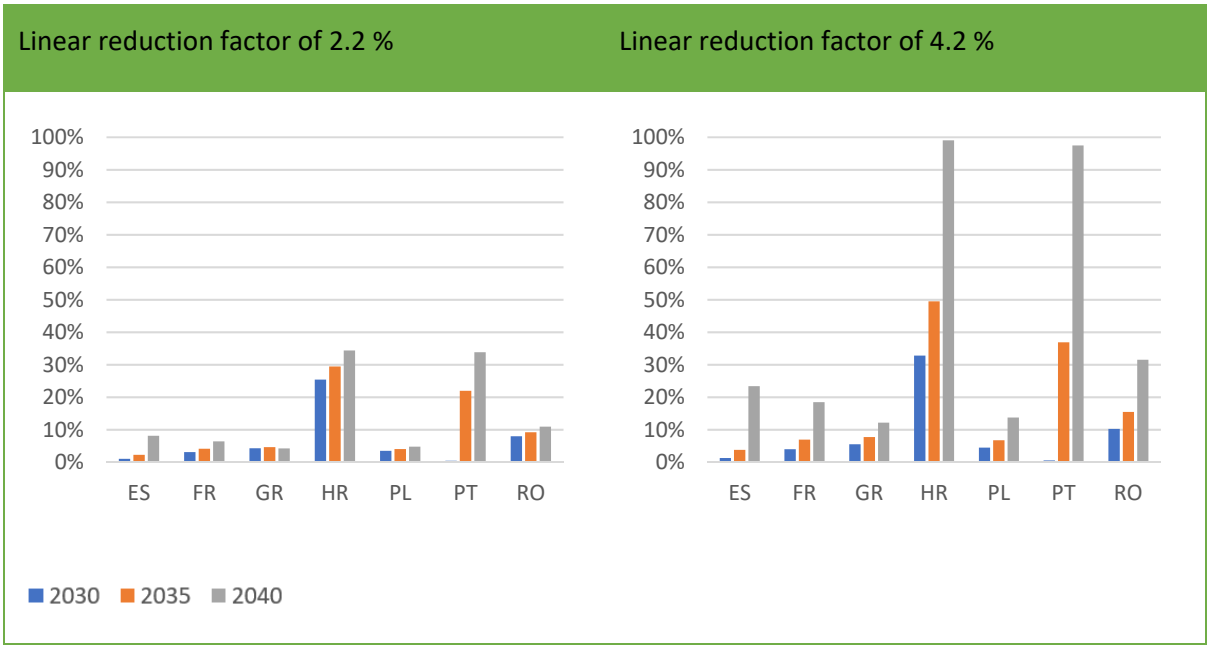
Country		2021	2030	2035	2040	2050
EU	Total stationary allowances, Mt	1 022,2	635,8	421,2	206,5	-
	Allowances not required with CCUS, wt %	-	1.7 %	3.4 %	9.0 %	-

At EU level, the quantity of CO_2 avoided according to the STRATEGY CCUS scenarios represent 1.7 % to 9.0 % of EUA issued to stationary installations over the 2030 - 2040 period considering a linear reduction factor of 4.2 %.

With a linear reduction factor of 4.2%, Croatia and Portugal are the 2 STRATEGY CCUS countries where quantities of CO_2 avoided through CCUS almost equivalent the number of EUA issued to stationary installations (1.1 Mt for Croatia and 3.65 Mt for Portugal) by 2040 as illustrated in **Erreur ! Source du renvoi introuvable.**.

Figure 6-2: Avoided CO_2 vs EUA issued to stationary installations in 2030, 2035 and 2040 at national level (wt %)



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7 Conclusion

The use of Carbon Capture Utilisation and Storage (CCUS) projects will reduce the demand of EU ETS allowances by the equivalent amount of the volumes of CO_2 avoided.

The CO_2 avoided through the STRATEGY CCUS scenarios and the linear reduction factor of 4.2% of the available allowances, allow calculate the share of EU ETS stationary installations allowances not need until 2050. In this way, the STRATEGY CCUS scenarios allow industrials in the 7 regions studied to avoid purchasing a significant volume of allowances equal to 10% in 2040 (and 1.7% in 2030) of the total EU stationary installations allowances. With a linear reduction factor of 2.2% the results are half.

At national scale, CCUS may have a stronger impact on the EUAs national demand since it allows reducing sometimes significantly industrial CO_2 emissions. Indeed, this is the case for Portugal and Croatia, where CO_2 avoided through CCUS scenarios equals to 100% for Croatia and 90 % for Portugal of the total stationary installation's allowances issued in 2040, with a linear factor of 4.2%.

In terms of CO_2 price, the impact of CCUS on the EU ETS is a reduction of the EUAs demand so mechanically a reduction of the CO_2 price. But on the market, all depend on the constraints related to the EU ETS market like the EUAs demand of the other sectors that could increase during the same period and thus increase the demand and the CO_2 price. But all else being equal, a 10 % reduction in EUAs demand (and particularly for the auctioning allowances) will be very sensitive to a reduction CO_2 price as the EU-ETS is a very responsive market. That means for the long term if CCUS projects will be largely deployed the Market Stability Reserve (MSR) need to be very efficient and react quickly to the excess of EUAs in the EU ETS.

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