

Working Paper

Implementing New GWP Values in the EU: A Quantitative
Analysis

Oeko-Institut Working Paper 3/2019

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Abstract

At the 2018 climate change conference in Katowice, Poland, Parties decided that new Global Warming Potential (GWP) values from the 5th Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) will be used to report national greenhouse gas (GHG) emissions under the Paris Agreement. At the same time, countries may for their first nationally determined contribution (NDC) continue to use different GWP values to track progress and account for their NDCs. The EU communicated in its first NDC that it will use AR4 values for its first NDC and current EU legislation for reporting of GHG inventories and the EU's Emissions Trading System (ETS) also uses AR4 values. This raises the questions whether the EU should continue to use AR4 values to account for its first NDC or update its NDC to AR5 and which values the EU should use under its domestic legislation and regulations, including the reporting of national GHG inventories under the EU Governance Regulation, the allocation of allowances and the reporting of emissions under its ETS, the allocation of emission budgets to member states under the Effort Sharing Regulation (ESR), and the EU LULUCF Regulation. This working paper aims to inform the ongoing discussions on this matter by quantitatively assessing the impacts of changing GWP values.

The quantitative analysis for the EU-28 and all member states indicates that a change of GWP values from AR4 to AR5 would have very small effects. Based on the emission reductions achieved so far as well as projections by member states for 2030, the EU-28 would have to conduct slightly smaller emission reductions to achieve its NDC (about 0.1 percentage points considering current progress). The same holds true for the achievement of the ESR targets. Even at member state level, the differences in emission reductions with AR4 and AR5 values are small for national totals (between +/-0.5 percentage points) but somewhat larger for the effort sharing sector. This is mainly because the increase in the GWP value of methane partially levels out with the decrease in the GWP value of nitrous oxide. If the EU internally adopted an approach where ESR target levels are determined using AR4 values but emissions are reported using AR5 values, there is a larger, and opposite, effect: in this case, the EU-28 would need to implement more emission reductions to achieve the ESR targets (in aggregate about 1 percentage point). Under this approach the impact on member states also differs more strongly as compared the situation that AR5 values were used for both ESR target levels and reporting of emissions.

A change of the EU's NDC to AR5 would make tracking progress towards its NDC simpler and could considerably facilitate accounting for international carbon market mechanisms under Article 6. In this context, it would be important that all countries that are part of, or link to, the EU ETS would update their NDC to AR5 values. For the reporting of GHG inventories and other GHG data under the Governance Regulation, it is important to avoid double-reporting and the associated additional efforts and sources of error, and to aim at using one single set of GWPs, to the extent possible. Using AR5 values would ensure consistency with GHG inventories reported under the Paris Agreement and avoid such double-reporting. A switch to AR5 would affect member states in different ways with respect to their ESR targets. With regard to the EU ETS, it has to be taken into account that the reporting and the setting of benchmarks are currently based on data expressed in AR4. Approaches are needed which are consistent with current legislation but address the reporting requirements at international level and ensure consistency with the systems of non-EU countries which participate in or are linked to the EU ETS. Lastly, it is important to consider that the systems of the EU ETS, the ESR and the LULUCF regulation are not independent but that transfers may take place between these systems. Comparability would be best ensured if the same GWP values were used consistently, at least for reporting of GHG emissions and removals.

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1. Introduction

At the 2018 climate change conference in Katowice, Poland, Parties adopted a comprehensive rulebook for implementing the Paris Agreement. A central part of this rulebook is the modalities, procedures and guidelines (MPGs) for implementing the enhanced transparency framework established under Article 13 of the Paris Agreement (Annex of decision 18/CMA.1). The framework requires all Parties to prepare biennial transparency reports (BTRs) which includes a national inventory report as well as all information necessary to track the country's progress in implementing and achieving its nationally determined contribution (NDC). The first BTR is to be submitted at the latest by 31 December 2024.

The MPGs include many new reporting requirements. One new element is that all Parties must use the new Global Warming Potential (GWP) values from the 5th Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) to report their national greenhouse gas (GHG) emissions as part of their national inventory reports (Paragraph 37 of the MPGs). The Katowice decisions further specify that countries shall apply these values (or any future update if agreed by the CMA) to account for their **second and subsequent** NDCs, while they **may** elect to apply this accounting approach for their **first** NDC (paragraph 13 and 14 of decision 4/CMA.1, and paragraph 1a of Annex II to decision 4/CMA.1). This means that countries can choose for the first NDC whether they continue to use the values in their current NDC or whether they move to AR5 values. In their first NDCs, most developed countries currently use AR4 values while most developing countries use AR2 values.

The EU communicated in its first NDC that it will use the values from the AR4 to account for its 2030 target. Currently, the EU legislation for reporting of GHG inventories and the Emissions Trading System (ETS) also uses AR4 values.

This raises several questions of how the EU should implement the decisions taken in Katowice:

1. At **international level**, the EU could:

Option 1: Continue to use AR4 values to account for its first NDC, which implies that national inventory reports would have to be prepared in AR5 values whereas information to track progress in implementing and achieving the EU's NDC would be reported in AR4 values; or

Option 2: Update its first NDC and move towards the use of AR5 values to account for its 2030 target.

2. At **domestic level**, the EU has to decide which GWP values to use under its domestic legislation and regulations. This includes several aspects, including the reporting of national GHG inventories under the EU Governance Regulation (EU Regulation 2018/1999), the allocation of allowances and the reporting of emissions under its ETS, the allocation of emission budgets to member states under the ESR (EU Regulation 2018/842) for emissions not covered by the ETS, and the EU LULUCF Regulation (EU Regulation 2018/841).

The use of GWPs is currently being discussed, for example, between the European Commission and the member states, as the Commission plans to adopt GWP values under the Governance Regulation, as mandated by Article 26(6) of that Regulation. This working paper aims to inform these ongoing discussions by quantitatively assessing the impacts of changing GWP values.

2. Quantitative implications of switching to AR5

This section analyses the quantitative implications of changing GWP values from AR4 to AR5 for the EU-28 and all member states. A change from AR4 to AR5 would imply that the GWP of methane (CH₄) increases from 25 to 28¹ while the GWP for nitrous oxide (N₂O) decreases from 298 to 265. The GWP of SF₆ increases from 22 800 to 23 500, for NF₃ it decreases from 17 200 to 16 200. For HFCs and PFCs the changes are diverse.² In our analysis, the changes of the GWP values for HFCs and PFCs have not been taken into account, as these constitute only a minor share in total emissions and include a large group of gases with specific GWPs that change in different directions.³

To understand the implications of a change in GWP values, this paper conducts a number of quantitative analyses. We first analyse the impact on the calculated emission reductions that countries have achieved so far. This includes a comparison of current emissions with 1990 levels (section 2.1) and a comparison of current emissions covered by the Effort Sharing Directive (ESD) sector in relation to the base year 2005 (section 2.2). These comparisons allow understanding how the reporting of progress achieved so far is affected by a change in GWP values. This is followed by an assessment of the implications on the effort sharing targets for 2030 (section 2.3) and on the projected emission reductions in 2030 (section 2.4). Lastly, section 3 provides brief conclusions from this quantitative analysis.

2.1. Impact on reported reductions since 1990

Table 2-1 illustrates the impact of GWP values for the progress by countries in reducing emissions since 1990. The results under “Difference of change” show that the impact of a change from AR4 to AR5 is small with up to ± 0.5 percentage points for the EU and all member states individually. This is because in most countries the increase in the GWP value for CH₄ partially levels out with the decrease in the GWP value for N₂O.

On EU level the calculated reduction achieved between 1990 and 2017 using GWP from AR5 is higher by 0.1 percentage point. With this, the difference to the NDC reduction target of -40 %, if calculated with GWP from AR5, is slightly smaller than with GWP from AR4.

¹ The Fifth Assessment Report of the IPCC provides, in chapter 8, two GWPs for some gases (with and without carbon feedback). It is expected that in the inventory reporting tables to be adopted by the CMA in 2020, the GWPs will be listed explicitly. We assume for this paper that the value of 28 will be used for Methane.

² https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf

³ To give an estimation of the size of this omission, the right column of Table 2-1 shows the percentage of these gases on total GHG in all countries. In most countries the share of these “unconverted” gases is not higher than 3 %. For Malta this share is considerably higher at 14 %, especially due to its HFC emissions.

Table 2-1: Total GHG emission reduction for 1990 to 2005, 2016 and 2017 in AR4 and AR5 (without LULUCF and without indirect CO₂)

	With AR4			With AR5			Difference of change			Share of non-converted F-Gases 2017
	Reduction of total GHG compared to 1990						Percentage points			
	2005	2016	2017	2005	2016	2017	2005	2016	2017	
EU28 (Convention)	-7,5%	-23,8%	-23,5%	-7,6%	-23,9%	-23,6%	-0,1%	-0,1%	-0,1%	3%
EU (KP)	-7,4%	-23,8%	-23,4%	-7,6%	-23,9%	-23,5%	-0,1%	-0,1%	-0,1%	3%
Austria	17,7%	1,2%	4,6%	17,2%	0,7%	4,1%	-0,5%	-0,5%	-0,5%	2%
Belgium	-0,9%	-21,0%	-21,9%	-1,0%	-21,0%	-21,9%	-0,1%	0,0%	0,0%	3%
Bulgaria	-37,3%	-42,0%	-39,7%	-37,3%	-42,3%	-40,1%	0,0%	-0,3%	-0,3%	3%
Croatia	-5,8%	-23,5%	-21,5%	-5,8%	-22,9%	-21,0%	0,0%	0,5%	0,4%	2%
Cyprus	64,6%	54,2%	57,8%	64,4%	54,2%	57,7%	-0,3%	0,0%	0,0%	3%
Czechia	-25,3%	-34,3%	-34,8%	-25,4%	-34,3%	-34,9%	-0,1%	-0,1%	-0,1%	3%
Denmark	-5,2%	-27,9%	-31,2%	-4,8%	-27,6%	-30,9%	0,4%	0,3%	0,3%	1%
Estonia	-52,5%	-51,4%	-48,4%	-52,4%	-51,4%	-48,4%	0,1%	0,0%	0,0%	1%
Finland	-1,9%	-18,4%	-22,2%	-2,2%	-18,6%	-22,4%	-0,3%	-0,2%	-0,2%	2%
France	1,2%	-16,0%	-15,2%	1,5%	-15,7%	-15,0%	0,2%	0,3%	0,2%	4%
Germany	-20,6%	-27,2%	-27,5%	-20,8%	-27,4%	-27,8%	-0,2%	-0,2%	-0,2%	1%
Greece	32,2%	-11,1%	-7,4%	32,2%	-10,8%	-7,2%	0,0%	0,2%	0,3%	7%
Hungary	-19,5%	-34,7%	-31,9%	-19,6%	-34,6%	-31,8%	0,0%	0,1%	0,1%	3%
Iceland	9,7%	28,9%	32,1%	10,0%	29,0%	32,1%	0,3%	0,1%	0,0%	6%
Ireland	25,4%	10,6%	9,6%	24,9%	10,4%	9,5%	-0,5%	-0,1%	-0,1%	2%
Italy	12,1%	-16,5%	-17,4%	12,0%	-16,4%	-17,2%	-0,1%	0,2%	0,2%	4%
Latvia	-56,6%	-57,1%	-56,9%	-56,7%	-57,2%	-57,1%	0,0%	-0,1%	-0,1%	2%
Liechtenstein	15,7%	-18,0%	-15,4%	15,7%	-17,9%	-15,4%	-0,1%	0,1%	0,1%	6%
Lithuania	-52,6%	-58,1%	-57,7%	-53,0%	-58,2%	-57,7%	-0,4%	-0,1%	-0,1%	3%
Luxembourg	2,1%	-21,2%	-19,8%	2,1%	-21,1%	-19,7%	0,0%	0,1%	0,1%	1%
Malta	38,3%	-9,9%	2,3%	38,8%	-9,3%	2,8%	0,5%	0,5%	0,5%	14%
Netherlands	-2,9%	-11,5%	-12,5%	-3,4%	-11,7%	-12,7%	-0,4%	-0,2%	-0,2%	1%
Norway	8,1%	4,7%	2,9%	7,9%	4,7%	3,0%	-0,2%	0,0%	0,0%	3%
Poland	-15,0%	-15,9%	-12,8%	-15,1%	-16,0%	-13,0%	-0,1%	-0,2%	-0,2%	2%
Portugal	44,9%	11,6%	19,4%	44,7%	11,6%	19,3%	-0,2%	0,0%	-0,1%	5%
Romania	-39,0%	-53,9%	-54,1%	-39,0%	-53,9%	-54,1%	0,0%	0,1%	0,0%	2%
Slovakia	-30,3%	-42,5%	-41,0%	-30,2%	-42,4%	-40,8%	0,1%	0,2%	0,2%	2%
Slovenia	10,1%	-5,1%	-6,4%	9,9%	-5,3%	-6,6%	-0,2%	-0,2%	-0,2%	2%
Spain	52,9%	13,1%	17,9%	52,7%	13,2%	18,0%	-0,2%	0,1%	0,0%	2%
Sweden	-6,6%	-25,8%	-26,1%	-6,7%	-26,0%	-26,4%	-0,1%	-0,2%	-0,3%	2%
United Kingdom (Convention)	-13,0%	-39,2%	-40,8%	-13,2%	-39,5%	-41,1%	-0,2%	-0,3%	-0,3%	3%

Source: (EEA 2019a), own calculation

2.2. Impact on reported ESD reductions since 2005

The effects of changes in the Effort Sharing Decision (ESD) sector are larger than for total national emissions because the share of non-CO₂ gases in the ESD sector is considerably higher than in the EU ETS. Information on the share of non-CO₂ emissions covered under the EU ETS is, however, not publicly available by country. To approximate the impact of a change of GWP values for the ESD sector, we assume here, as a simplification, that all ETS emissions are CO₂ emissions. This simplification does not have a large impact because the share of PFC and N₂O emissions in the EU ETS is relatively small. The ESD emissions are calculated here based on ETS emissions from the EUTL as of 2 May 2019 (EEA 2019b).

Table 2-2: Emission reductions in the ESD sector from 2005 to 2016 and 2017 in AR4 and AR5 (without LULUCF and without indirect CO₂)

	Reduction of ESD emissions compared to 2005					
	With AR4		With AR5		Difference of change	
	2016	2017	2016	2017	2016	2017
EU-28	-10,6%	-10,1%	-10,7%	-10,2%	-0,1%	-0,1%
Austria	-10,4%	-8,5%	-10,6%	-8,6%	-0,1%	-0,1%
Belgium	-8,3%	-10,1%	-8,1%	-9,9%	0,2%	0,2%
Bulgaria	-1,4%	1,6%	-2,5%	0,4%	-1,1%	-1,3%
Croatia	-8,3%	-5,3%	-7,5%	-4,6%	0,9%	0,7%
Cyprus	-3,5%	0,7%	-3,3%	0,9%	0,2%	0,2%
Czechia	1,4%	0,54%	1,2%	0,3%	-0,2%	-0,2%
Denmark	-16,5%	-16,8%	-16,6%	-16,9%	-0,1%	-0,1%
Estonia	-1,8%	-2,0%	-2,3%	-2,5%	-0,5%	-0,6%
Finland	-9,6%	-11,4%	-9,5%	-11,3%	0,2%	0,1%
France	-10,5%	-10,9%	-10,5%	-10,9%	0,0%	0,0%
Germany	-4,2%	-1,9%	-4,4%	-2,2%	-0,2%	-0,2%
Greece	-27,5%	-26,8%	-27,2%	-26,5%	0,3%	0,3%
Hungary	-8,9%	-5,8%	-8,8%	-5,7%	0,1%	0,1%
Ireland	-6,6%	-6,0%	-6,4%	-5,7%	0,2%	0,2%
Italy	-16,7%	-18,2%	-16,4%	-17,9%	0,3%	0,3%
Latvia	6,6%	8,7%	6,2%	8,4%	-0,4%	-0,4%
Lithuania	23,9%	24,9%	25,1%	26,0%	1,2%	1,1%
Luxembourg	-15,4%	-13,5%	-15,4%	-13,4%	0,0%	0,1%
Malta	40,2%	52,1%	39,1%	50,8%	-1,0%	-1,3%
Netherlands	-17,3%	-17,0%	-16,8%	-16,6%	0,5%	0,5%
Poland	10,4%	16,2%	10,1%	15,7%	-0,3%	-0,5%
Portugal	-15,2%	-14,7%	-15,2%	-14,7%	0,0%	0,0%
Romania	-6,2%	-8,0%	-6,8%	-8,6%	-0,6%	-0,6%
Slovakia	-5,4%	-3,8%	-5,2%	-3,5%	0,2%	0,3%
Slovenia	-4,8%	-7,5%	-5,1%	-7,7%	-0,3%	-0,2%
Spain	-15,5%	-15,1%	-15,4%	-15,0%	0,1%	0,1%
Sweden	-23,1%	-23,6%	-23,4%	-23,9%	-0,3%	-0,3%
United Kingdom	-19,1%	-19,7%	-19,7%	-20,3%	-0,6%	-0,5%

Note: Red coloured changes mark countries with emissions increases between 2005 and 2016 or 2017. Violet marked changes show positive differences between the AR5 and AR4 results, i.e. lower reductions or higher increases if GWPs from AR5 are used instead of AR4.

Source:(EEA 2019a, 2019b); own calculation

Table 2-2 shows the impact of a change from AR4 to AR5 for the ESD sector. The results show that the impact would be small at EU level: the reduction in ESD emissions at EU level is 10.1 % between 2005 and 2017 with AR4 and 10.2 % with AR5. At national level, the differences between AR4 and AR5 vary more strongly than for total national emissions, between 1.1 (Lithuania) and

-1.3 percentage points (Bulgaria and Malta). These three countries are among the Member States experiencing ESD emission increases in this timeframe (highlighted in red in Table 2-2). For Lithuania this increase would be higher with GWP values from AR5, while for Bulgaria and Malta the increase would be lower. Apart from these countries, the changes are between -0.6 (Estonia, Romania) and +0.7 percentage points (Croatia). This means that with AR5 GWP values, under the assumptions made, Croatia would, for example, have a slightly lower historical emission reduction between 2005 and 2017 than with AR4 GWP values (-4.6 % instead of -5.3 %).

Theoretically, it is also perceivable that the future ESR emissions are reported with AR5 GWP values but that the emission reduction is compared with historic 2005 emissions determined with AR4 GWP values. For illustrative purposes, Table 2-3 shows the results for this approach. Overall, the EU would report with this approach a lower emission reduction (only a 9.1% reduction in 2017 compared to 2005 levels, rather than a 10.1% or 10.2% reduction with consistent use of either AR4 or AR5 values respectively). At member state level, the differences are also larger, ranging from -0.1 (Latvia) to 3.3 percentage points (Romania). For Latvia the increase of emissions would be slightly lower, while for all other countries the reductions would be lower or the increases would be higher. This means that under this approach more mitigation would need to be implemented to achieve the same targets.

Table 2-3: Emission reductions in the ESD sector from 2005 to 2016 and 2017 with a mixed AR4 and AR5 approach (without LULUCF and without indirect CO₂)

	Reduction of ESD emissions compared to 2005			
	With 2005 in AR4, 2016 and 2017 in AR5		Difference of change	
	2016	2017	2016	2017
EU-28	-9,6%	-9,1%	1,0%	1,0%
Austria	-9,7%	-7,7%	0,7%	0,7%
Belgium	-7,9%	-9,7%	0,4%	0,4%
Bulgaria	-0,4%	2,5%	1,0%	0,9%
Croatia	-6,4%	-3,6%	1,9%	1,7%
Cyprus	-1,9%	2,4%	1,6%	1,7%
Czechia	3,0%	2,1%	1,6%	1,6%
Denmark	-15,9%	-16,2%	0,6%	0,6%
Estonia	-1,4%	-1,5%	0,5%	0,4%
Finland	-9,5%	-11,3%	0,2%	0,1%
France	-9,9%	-10,3%	0,6%	0,5%
Germany	-3,7%	-1,4%	0,6%	0,5%
Greece	-26,4%	-25,6%	1,1%	1,1%
Hungary	-8,1%	-5,0%	0,8%	0,8%
Iceland	33,5%	36,3%	1,9%	1,8%
Ireland	-4,6%	-3,9%	2,0%	2,0%
Italy	-15,8%	-17,2%	1,0%	1,0%
Latvia	6,5%	8,7%	-0,1%	-0,1%
Liechtenstein	-23,6%	-21,3%	0,5%	0,4%
Lithuania	24,5%	25,4%	0,5%	0,5%
Luxembourg	-15,1%	-13,1%	0,4%	0,4%
Malta	42,0%	54,0%	1,9%	1,9%
Netherlands	-16,3%	-16,1%	1,0%	1,0%
Norway	4,5%	0,4%	1,3%	1,3%
Poland	12,5%	18,2%	2,1%	2,0%
Portugal	-13,5%	-13,0%	1,7%	1,7%
Romania	-2,9%	-4,7%	3,3%	3,3%
Slovakia	-4,0%	-2,2%	1,5%	1,5%
Slovenia	-3,3%	-6,0%	1,5%	1,5%
Spain	-14,3%	-13,9%	1,2%	1,2%
Sweden	-23,0%	-23,5%	0,1%	0,0%
United Kingdom	-18,1%	-18,8%	1,0%	1,0%

Note: Red coloured changes mark countries with emissions increases between 2005 and 2016 or 2017. Violet marked changes show positive differences between the AR5 and AR4 results, i.e. lower reductions or higher increases if GWPs from AR5 are used in 2016 and 2017 instead of AR4.

Source: (EEA 2019a, 2019b); own calculation

2.3. Impact on 2030 effort sharing targets

For the period 2021 to 2030, the ESR establishes an emission reduction target for each member state in relation to 2005 emissions. A budget of Annual Emission Allocations (AEAs) is calculated based on a trajectory from 2016-2018 levels to 2030 levels. We estimate the impact of a switch from AR4 to AR5 using the following assumptions:

- For estimating the absolute 2030 targets, 2005 ESD emissions are converted to AR5 using the latest GHG inventory and making the same assumptions on ETS emissions, HFCs and PFs as described above. Emissions reductions pursuant to ESR Annex I have been applied to these 2005 levels.
- To calculate the AEAs for the period 2021 to 2029 average 2016-2018 ESD emissions have to be quantified. For this, emissions for the years 2016 and 2017, as calculated with above assumptions, are used. To allow for the comparison of GWP from AR4 and 5, in the following calculation ESD emissions 2018 are assumed to be equal to 2017 ESD emissions.

With these assumptions absolute ESR target emission levels can be calculated until 2030. Table 2-4 illustrates the impacts of a switch from AR4 to AR5 for absolute 2030 effort sharing targets as well as for the number of AEAs allocated in the period 2021 to 2030.

At EU level, a switch from AR4 to AR5 would lead to higher ESD emissions in 2005. This results in slightly higher absolute target levels in 2030 (2 032 instead of 2 008 Mt CO₂eq). This is an increase of 1.2% related to emissions in AR4. At member state level, differences range from -1% (Lithuania) to +4% (Romania). The total number of estimated AEAs 2021-2030 differs in similar ranges.

Table 2-4: Estimated AEA for the period 2021 to 2030 with GWP values of AR4 and AR5 (without LULUCF and without indirect CO₂)

	Baseyear emissions for AEA calculation								2030 targets				AEA 2021-2030		
	With AR4				With AR5				ESR target	AR4	AR5	Difference compared to AR4	AR4	AR5	Difference compared to AR4
	2005	2016	2017	average 2016-2018 with 2018=2017	2005	2016	2017	average 2016-2018 with 2018=2017							
	Mt CO ₂ eq								% of 2005	Mt CO ₂ eq		%	Mio. AEA		%
EU-28	2.869	2.564	2.580	2.575	2.903	2.593	2.608	2.603	-30%	2.008	2.032	1,2%	22.493	22.761	1,2%
Austria	56	51	52	51	57	51	52	52	-36%	36	36	1%	426	429	1%
Belgium	79	72	71	71	79	72	71	72	-35%	51	51	0%	597	599	0%
Bulgaria	26	26	26	26	27	26	27	26	0%	26	27	2%	260	264	2%
Croatia	18	16	17	16	18	16	17	17	-7%	16	17	1%	164	166	1%
Cyprus	4	4	4	4	4	4	4	4	-24%	3	3	1%	36	37	2%
Czechia	61	62	62	62	62	63	63	63	-14%	53	54	2%	566	576	2%
Denmark	39	33	32	32	39	33	33	33	-39%	24	24	1%	275	277	1%
Estonia	6	6	6	6	6	6	6	6	-13%	6	6	1%	58	58	1%
Finland	34	31	30	30	34	31	30	30	-39%	21	21	0%	247	247	0%
France	396	354	353	353	398	356	355	355	-37%	249	251	1%	2.935	2.953	1%
Germany	476	456	467	463	480	459	469	466	-38%	295	297	1%	3.666	3.691	1%
Greece	62	45	45	45	63	46	46	46	-16%	52	53	1%	491	497	1%
Hungary	46	42	43	43	46	42	44	43	-7%	43	43	1%	426	430	1%
Ireland	47	44	44	44	47	44	45	45	-30%	33	33	2%	373	381	2%
Italy	330	275	270	272	333	278	273	275	-33%	221	223	1%	2.427	2.452	1%
Latvia	9	9	9	9	9	9	9	9	-6%	8	8	0%	85	85	0%
Lithuania	11,32	14	14	14	11,26	14	14	14	-9%	10,3	10,2	-1%	119	119	0%
Luxembourg	10	9	9	9	10	9	9	9	-40%	6	6	0%	72	72	0%
Malta	1	1	1	1	1	1	1	1	-19%	1	1	2%	10	10	2%
Netherlands	123	101	102	102	124	103	103	103	-36%	79	79	1%	884	892	1%
Poland	182	201	211	208	186	205	215	212	-7%	169	173	2%	1.857	1.894	2%
Portugal	47	40	40	40	48	41	41	41	-17%	39	40	2%	393	401	2%
Romania	79	74	73	73	83	77	76	76	-2%	78	81	4%	758	788	4%
Slovakia	22	21	21	21	22	21	22	21	-12%	19	20	1%	202	204	1%
Slovenia	12	11	11	11	12	11	11	11	-15%	10	10	2%	104	106	2%
Spain	237	200	201	201	240	203	204	204	-26%	175	177	1%	1.861	1.886	1%
Sweden	42	33	32	33	43	33	32	33	-40%	25	26	0%	285	286	0%
United Kingdom	414	335	332	333	422	339	336	337	-37%	261	266	2%	2.913	2.959	2%

Source: : (EEA 2019a, 2019b), own calculation

Lastly, Table 2-5 illustrates the implications of a theoretical scenario where the ESR target levels are determined using AR4 values but the emissions are reported using AR5 values (values are taken from Table 2-4). The table shows that the necessary emission reduction over the period 2017 to 2030 would then be about 1 percentage point higher for the EU-28. At member state level the differences are somewhat larger, varying between -3.3 percentage points for Romania and +0.1 percentage point for Latvia.

Table 2-5: Estimation of the necessary ESR emission reductions over the period 2017 to 2030 using AR4 values for the target value and AR5 values for emissions monitoring (without LULUCF and without indirect CO₂)

	AR4				Partial switch			
	ESD emissions 2005	ESD emissions 2017	ESR emission target 2030	Necessary reduction 2017-2030, related to emissions 2005	ESD emissions 2017	ESR emission target 2030	Necessary reduction 2017-2030, related to emissions 2005 (AR4)	Difference to AR4 only calculation
EU-28	2.869	2.580	2.008	-19,9%	2.608	2.008	-20,9%	-1,0%
Austria	56	52	36	-27,5%	52	36	-28,3%	-0,7%
Belgium	79	71	51	-24,9%	71	51	-25,3%	-0,4%
Bulgaria	26	26	26	-1,6%	27	26	-2,5%	-0,9%
Croatia	18	17	16	-1,7%	17	16	-3,4%	-1,7%
Cyprus	4	4	3	-24,7%	4	3	-26,4%	-1,7%
Czechia	61	62	53	-14,5%	63	53	-16,1%	-1,6%
Denmark	39	32	24	-22,2%	33	24	-22,8%	-0,6%
Estonia	6	6	6	-11,0%	6	6	-11,5%	-0,4%
Finland	34	30	21	-27,6%	30	21	-27,7%	-0,1%
France	396	353	249	-26,1%	355	249	-26,7%	-0,5%
Germany	476	467	295	-36,1%	469	295	-36,6%	-0,5%
Greece	62	45	52	10,8%	46	52	9,6%	-1,1%
Hungary	46	43	43	-1,2%	44	43	-2,0%	-0,8%
Iceland	2	3	2	-34,6%	3	2	-36,3%	-1,8%
Ireland	47	44	33	-24,0%	45	33	-26,1%	-2,0%
Italy	330	270	221	-14,8%	273	221	-15,8%	-1,0%
Latvia	9	9	8	-14,7%	9	8	-14,7%	0,1%
Liechtenstein	0	0	0	21,8%	0	0	21,3%	-0,4%
Lithuania	11	14	10	-33,9%	14	10	-34,4%	-0,5%
Luxembourg	10	9	6	-26,5%	9	6	-26,9%	-0,4%
Malta	1	1	1	-71,1%	1	1	-73,0%	-1,9%
Netherlands	123	102	79	-19,0%	103	79	-19,9%	-1,0%
Norway	26	26	26	0,9%	27	26	-0,4%	-1,3%
Poland	182	211	169	-23,2%	215	169	-25,2%	-2,0%
Portugal	47	40	39	-2,3%	41	39	-4,0%	-1,7%
Romania	79	73	78	6,0%	76	78	2,7%	-3,3%
Slovakia	22	21	19	-8,2%	22	19	-9,8%	-1,5%
Slovenia	12	11	10	-7,5%	11	10	-9,0%	-1,5%
Spain	237	201	175	-10,9%	204	175	-12,1%	-1,2%
Sweden	42	32	25	-16,4%	32	25	-16,5%	0,0%
United Kingdom	414	332	261	-17,3%	336	261	-18,2%	-1,0%

Source: : (EEA 2019a, 2019b), own calculation

2.4. Impact on projected emissions reductions by 2030

In this section, we use emission projections by member states for the year 2030 to illustrate how a switch from AR4 to AR5 is expected to affect the projected emission changes until 2030.

The analysis is based on emission projections for each greenhouse gas, as reported by member states in 2017 and 2018 under the MMR. As projections by gas are not separately available for ETS and ESR emissions, assumptions have been made to split ETS and ESR emissions by gas and by ESR sector. This is especially relevant for CRF sectors 1 and 2. For CO₂, the split of ETS and ESD emissions on total GHG by sector has been applied. CH₄ emissions only occur in the ESR sector. The same holds for N₂O, except for N₂O emissions in sector 2. There, the overall split of ETS and ESD emissions on total GHG has been applied. F-Gases only occur in sector 2. Percentages of the share of F-gases under the Effort Sharing Legislation are estimated based on an analysis of GHG emissions in source categories by Member States. The sum of gases is not totally equal to total projected ESR emissions in 2030. The sums are on average slightly higher than projected total ESR emissions in 2030; the differences vary between -0.2 to 5.4 %. This method aims to take into account the amounts of non-CO₂ gases covered under the EU ETS, different to the assumption made above in the previous sections. Moreover, different to the calculation in the previous sections, the GWP values for SF₆ emissions have not been converted here.

Table 2-6 shows that projected total EU emissions from 1990 to 2030 would change only by about 0.2 percentage points due to a switch from AR4 to AR5. The EU would report with AR5 values a slightly larger projected emission reduction than it does with AR4 values. With emission reductions calculated with GWP from AR5, the difference to the EU NDC target of -40 % is slightly reduced. At member state level, the differences are somewhat higher, varying by ± 0.5 percentage points. The results are thus similar to the changes in emission reductions over the period 1990 to 2017 (section 2.1).

Table 2-6: Projected national emission reductions from 1990 to 2030 in AR4 and AR5 (without LULUCF and without indirect CO₂)

	AR4 1990 emissions	AR5 1990 emissions	AR4 2030 emissions	AR5 2030 emissions	AR4 Change 2030/1990	AR5 Change 2030/1990	Difference in change between AR5 and AR4
	kt CO ₂ eq				Reduction compared to 1990		Percentage points
EU28	5.646.080	5.690.047	3.824.420	3.844.216	-32,3%	-32,4%	-0,2%
Austria	78.690	79.458	69.767	70.050	-11,3%	-11,8%	-0,5%
Belgium	146.654	146.993	114.134	114.275	-22,2%	-22,3%	-0,1%
Bulgaria	103.989	104.912	55.500	55.865	-46,6%	-46,8%	-0,1%
Croatia	31.894	32.101	24.677	24.975	-22,6%	-22,2%	0,4%
Cyprus	5.591	5.637	9.402	9.474	68,2%	68,1%	-0,1%
Czech Republic	197.476	199.252	108.821	109.510	-44,9%	-45,0%	-0,1%
Denmark	69.245	69.277	50.923	51.076	-26,5%	-26,3%	0,2%
Estonia	40.398	40.470	17.033	14.851	-57,8%	-63,3%	(-5.5%)
Finland	71.143	71.367	48.798	48.731	-31,4%	-31,7%	-0,3%
France	546.369	547.312	396.138	398.277	-27,5%	-27,2%	0,3%
Germany	1.251.635	1.258.861	734.525	736.050	-41,3%	-41,5%	-0,2%
Greece	103.101	103.586	86.036	86.719	-16,6%	-16,3%	0,3%
Hungary	93.797	94.296	58.834	59.178	-37,3%	-37,2%	0,0%
Ireland	55.490	56.421	63.889	64.728	15,1%	14,7%	-0,4%
Italy	518.363	521.226	392.100	394.370	-24,4%	-24,3%	0,0%
Latvia	26.430	26.513	12.195	12.189	-53,9%	-54,0%	-0,2%
Lithuania	48.108	48.365	22.136	22.059	-54,0%	-54,4%	-0,4%
Luxembourg	12.786	12.824	9.504	9.545	-25,7%	-25,6%	0,1%
Malta	2.102	2.109	1.683	1.700	-19,9%	-19,4%	0,5%
Netherlands	220.604	222.476	171.136	172.325	-22,4%	-22,5%	-0,1%
Poland	467.280	471.938	358.849	361.571	-23,2%	-23,4%	-0,2%
Portugal	59.825	60.646	55.847	56.669	-6,6%	-6,6%	0,1%
Romania	246.748	251.901	126.330	128.564	-48,8%	-49,0%	-0,2%
Slovakia	73.980	74.347	40.744	40.999	-44,9%	-44,9%	0,1%
Slovenia	18.627	18.837	16.251	16.386	-12,8%	-13,0%	-0,3%
Spain	287.656	289.808	330.454	332.445	14,9%	14,7%	-0,2%
Sweden	71.515	71.793	45.603	45.585	-36,2%	-36,5%	-0,3%
United Kingdom	796.582	807.322	403.110	406.049	-49,4%	-49,7%	-0,3%

Note: The higher number for Estonia results from a wrong entry in the underlying data by gas.

Source: (EEA 2019a, 2019b); Member State reporting of projections under the MMR 2017 and 2018, own calculation

Table 2-7 shows the same analysis but conducted for the ESR emission reductions for the period 2005 to 2030. The analysis shows that – similar to progress until 2017 illustrated in section 2.2 – the changes in emission reductions due to a switch of the GWP values are higher for the ESR sector than for national totals, due to the higher share of non-CO₂ gases in the ESR sector. With AR5 values, the EU-28 would report 0.3 percentage points higher projected emission reductions than with AR4 values. At member state level, the differences are somewhat higher, varying between -2.5 and +0.6 percentage points.

Table 2-7: Projected ESR emission reductions from 2005 to 2030 in AR4 and AR5 (without LULUCF and without indirect CO₂)

	AR4 2005 ESR emissions	AR5 2005 ESR emissions	AR4 2030 ESR emissions	AR5 2030 ESR emissions	AR4 Change 2030/2005	AR5 Change 2030/2005	Difference in change between AR5 and AR4
	kt CO ₂ eq				Reduction compared to 2005	Percentage points	
EU28	2.871.168	2.910.427	2.333.347	2.356.422	-18,7%	-19,0%	-0,3%
Austria	56.421	56.986	44.860	45.207	-20,5%	-20,7%	-0,2%
Belgium	78.676	79.212	69.869	70.105	-11,2%	-11,5%	-0,3%
Bulgaria	25.969	26.613	23.452	23.828	-9,7%	-10,5%	-0,8%
Croatia	17.549	17.790	16.339	16.667	-6,9%	-6,3%	0,6%
Cyprus	4.242	4.300	5.210	5.287	22,8%	22,9%	0,1%
Czech Republic	62.413	63.607	57.253	57.994	-8,3%	-8,8%	-0,6%
Denmark	39.615	39.927	30.805	30.960	-22,2%	-22,5%	-0,2%
Estonia	6.329	6.401	6.393	6.414	1,0%	0,2%	-0,8%
Finland	33.971	34.153	26.799	26.758	-21,1%	-21,7%	-0,5%
France	395.790	398.796	289.711	291.944	-26,8%	-26,8%	0,0%
Germany	476.127	480.420	378.904	380.556	-20,4%	-20,8%	-0,4%
Greece	62.075	62.824	48.730	49.427	-21,5%	-21,3%	0,2%
Hungary	45.810	46.369	39.883	40.238	-12,9%	-13,2%	-0,3%
Ireland	46.604	47.479	47.810	48.654	2,6%	2,5%	-0,1%
Italy	330.203	333.733	253.868	256.219	-23,1%	-23,2%	-0,1%
Latvia	8.529	8.571	9.781	9.775	14,7%	14,0%	-0,6%
Lithuania	11.315	11.518	14.202	14.170	25,5%	23,0%	-2,5%
Luxembourg	10.105	10.144	8.158	8.200	-19,3%	-19,2%	0,1%
Malta	938	958	1.429	1.446	52,3%	50,9%	-1,3%
Netherlands	123.180	124.709	90.013	91.313	-26,9%	-26,8%	0,1%
Poland	182.024	185.944	195.800	198.591	7,6%	6,8%	-0,8%
Portugal	47.050	48.185	37.434	38.262	-20,4%	-20,6%	-0,2%
Romania	79.364	82.878	87.479	89.750	10,2%	8,3%	-1,9%
Slovakia	22.086	22.508	21.140	21.418	-4,3%	-4,8%	-0,6%
Slovenia	11.765	11.974	10.269	10.411	-12,7%	-13,0%	-0,3%
Spain	236.853	239.838	197.646	199.714	-16,6%	-16,7%	-0,2%
Sweden	42.485	42.744	26.421	26.425	-37,8%	-38,2%	-0,4%
United Kingdom	413.678	421.844	293.689	296.691	-29,0%	-29,7%	-0,7%

Note: AR4 2005 ESR emissions are calculated values, not the ESD base year numbers as used to track progress to target in (EEA 2018). ESR emissions 2030 shown in this table are calculated numbers as described above. These are on average higher than projected total ESR emissions in 2030; the differences vary between -0.2 (Spain) to 5.4 % (Bulgaria). Resulting projected emission reductions 2030/2005 can't be directly compared to ESR reduction targets.

Source: (EEA 2019a, 2019b); Member State reporting of projections under the MMR 2017 and 2018, own calculation

3. Conclusions of the quantitative analysis

The analysis indicates that a change of GWP values from AR4 to AR5 would have relatively small effects. Based on the emission reductions achieved so far as well as those projected by member states for 2030, the EU-28 would have to conduct slightly smaller emission reductions to achieve its NDC (about 0.1 percentage points, considering current progress). The same holds true for the progress to ESR targets. Even at member state level, the differences in emission reductions with AR4 and AR5 values are very small for national totals (between +/-0.5 percentage points) but slightly larger for the effort sharing sector. This is mainly because the increase in the GWP value of methane partially levels out with the decrease in the GWP value of nitrous oxide.

If the EU internally adopted an approach where ESR target levels are determined using AR4 values but emissions are reported using AR5 values, there is a larger, and opposite, effect: in this case, the EU-28 would need to implement more emission reductions to achieve the ESR targets (in aggregate about 1 percentage point). Under this approach the impact on member states also differs more strongly as compared to the situation that AR5 values were used for both ESR target levels and reporting of emissions.

4. References

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