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# **Development of GHG projection guidelines**

**Oko-Institut e.V.** Institut för angewandte Ökologie Institute for Applied Kology

## CLIMA.A.3/SER/2010/0004

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## **Final Report (December 2012)**

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#### Background and objectives 1

Greenhouse gas (GHG) emission projections are essential in the EU climate change policies. Taking into account current and future EU domestic and international needs, GHG emission projections are necessary for:

- tracking progress towards GHG targets as agreed in the climate and energy package
- meeting obligations and commitments under the UNFCCC and the Kyoto Protocol.

To develop the EU-wide GHG emission projections the EU relies on the projections from Member States. In order to ensure proper quality of the EU-wide projections (compiled on the basis of MS data) Member States' projections must be transparent, comparable, consistent, complete and accurate (TCCCA)<sup>1</sup>. The European Commission (EC) therefore is looking to develop guidance to Member States to ensure that the projection data delivered by MS under the Monitoring Mechanism Decision (280/2004/EC) (MMD) is fit for compilation of the EU-wide projections. The work under this contract aims at developing such guidance.

As regards to current EU domestic reporting obligations, Member States are required to report their greenhouse gas projections biennially under the MMD. Member States use diverse methodologies to develop their national projections, making it challenging to compare the national projections and combine them into EU-wide projections. The EC commissioned study "Assessment and Improvement of methodologies used for greenhouse gas projections" which was performed in 2006-2008 was a first step towards a more uniform projection methodology for Member States and the Commission.

The EU guidelines for the GHG emission projections, to be developed under this project, in the first place need to ensure that the EU domestic obligations are fulfilled and reporting of projections by the Members State as required under the MMD will be improved. The MS reporting on projections is crucial in the process of:

- tracking of progress by MS and EU towards Kyoto targets (annual report by the Commission, biennial projections submissions by MS)
- tracking progress towards headline targets under the Europe 2020 strategy (especially the Effort Sharing Decision (406/2009/EC) targets)

The Effort Sharing Decision (ESD) sets annual emission reduction and limitation targets for the Member States in the Non-ETS sector for the period 2013 – 2020. Its implementation requires an enhanced quality and transparency of Member States' actual emission reports for the compliance assessment at the end of each year. Projections and their quality are important in the compliance action plan to be developed in cases of non-compliance with the targets.

The overall organisation of the GHG reduction commitments in the recent EU legislation requires a split of total GHG emissions between the ETS emissions and non-ETS emissions in terms of projections due to the scope of the decision.

The guidelines have to address the above mentioned EU domestic aspects.

<sup>&</sup>lt;sup>1</sup> The TCCCA criteria (Transparency, Completeness, Consistency, Comparability and Accuracy) are the 5 key indicators to be monitored following good practice standards (IPCC, 2006; IPCC GPG, 2000). Final Report: 20 December 2012

Secondly, the guidelines have to address international needs. The European Union (being a Party to the Convention and the Kyoto Protocol) as well as its Member States have to submit National Communications under the UNFCCC that include GHG emission projections. The EU also has to track progress towards its GHG reduction target under the Kyoto Protocol.

The EU National Communications have to comply with the UNFCCC Guidelines for National Communications<sup>2</sup>. All Member States have to comply with the same UNFCCC Guidelines for their own National Communications. The EU projections guidelines need to ensure that all information is available from all Member States that is needed to produce the projection chapters in the EU National Communications and that this information can be consistently combined into the EU projections.

One of the key issues that will ensure better quality of MS data is an enhanced review and compliance cycle for Member States' reports on GHG emission projections, which would include a more advanced QA/QC system for Member States' projections at EU level, e.g. related to:

- the completeness in terms of gases and sources,
- the comparability in terms of assumptions,
- the consistency related to the impacts of policies and measures,
- the consistency with GHG inventories and verified emissions from EU ETS,
- the accuracy and quality of methodologies, data and assumptions used for the projections and the transparency of data and information on methodologies and assumptions provided to the Commission.

This requires additional methodological and reporting guidance for Member States on their internal QA/QC checks and the preparation of a QA/QC system at EU level. There has been already some QA/QC procedure applied (EEA supports the EC in this area) for checks of projections submitted by MS and they have been recently enhanced. This project will build on the QA/QC procedures which are used by the EEA from 2011 on. The QA/QC procedures developed under this project should ensure good quality data on GHG projections.

The projections guidelines will aim at a maximum of transparency, comparability, consistency, completeness and accuracy taking into account the Member States' capabilities. The draft guidelines do not prescribe a specific projection method to each Member State, but will guide the Member States in a tiered methodological approach to reflect different approaches and data situations at Member States level and to provide all information on their projections' assumptions, parameters, algorithms and results that will allow the Commission to derive EU-wide projections that can be seen as a consolidation of the individual Member States' national projections.

The transparency will help, on the EU level, to make TCCCA projections to be used for:

- ✓ Tracking MS and EU progress in reaching the GHG targets agreed in the climate and energy package
- Tracking progress towards the KP target
- ✓ Reporting under the UNFCCC for example in the EU National Communication

Summarised, the key issues for the project are:

The project builds on the findings of previous projects with special attention given to the Transparency, Comparability, Consistency, Completeness and Accuracy quality criteria of projections (TCCCA criteria as defined in the UNFCCC GHG inventory Guidelines can be used as reference).

<sup>&</sup>lt;sup>2</sup> Guidelines for the Preparation of National Communications by Parties Included in Annex I to the Convention; Part II: UNFCCC Reporting Guidelines on National Communications (document FCCC/CP/1999/7)

http://unfccc.int/national\_reports/annex\_i\_natcom/\_guidelines\_for\_ai\_nat\_comm/items/2707.php Final Report: 20 December 2012

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- ~ The main results of the project are draft guidelines for GHG projections which are to assist the Member States to compile their national GHG projections in an EU-wide harmonised way.
- The project is to be seen in the light of internal EU obligations (MMD, ETS and ESD) as well as the UNFCCC obligations. Its result is to be applicable for both purposes. Therefore the guidelines should specifically address, and give distinctive guidance for the separate projections for the ETS and non-ETS sectors as well as total projections. Practical tools/guidance on the ETS/non-ETS split is one of the important and challenging issues to be addressed in this study. The results of this study are to feed into the process of the MMD and its implementing provisions.
- This year revision of the UNFCCC reporting guidelines for National Communications is  $\checkmark$ to start. As the projections are part of the National Communications (NC) the project should also provide some ideas as regards improvements/changes in the UNFCCC reporting guidelines for NC, which could feed into the negotiations on this revision.
- The EEA, in cooperation with the Commission, has been working over the past years to provide adequate support to Member States in order to improve the quality of their projections. Links should be established between the present project and the work done on this issue for the EEA by its European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM), in order to foster mutual benefits. The 2008 EC study assessed projections methodologies from Member States, their methodologies and sensitivity analyses and compared the results to European top-down models. Furthermore preliminary guidelines for projections were drafted for the most relevant sectors/gasses. This project will build on these results and will draft projection guidelines for all sectors and gases in close consultation with the Commission, Member States and EEA.

#### Project results and Deliverables 2

This chapter describes the progress of the work performed in the different Tasks as described in the Inception Report. This progress reported is kept short as most of the work for the different tasks is already incorporated in the (attached) draft guidelines (part A and B).

#### 2.1 Task 1: QA/QC checks for Member States reporting

This task is completed in close cooperation with the EEA. The work is incorporated in the chapter "A.8 Quality Assurance and Quality Control (QA/QC) for Projections" in part A of the draft guidelines.

#### 2.2 Task 2: Indicators for development of GHG projections

In chapter 3 of part A : General Guidance, the concepts of indicators and parameters as relevant for the GHG projections are elaborated. This project did not identify a need for additional indicators compared to the one proposed in the previous work from Vito et. Al. (Assessment and improvement of methodologies used for Greenhouse Gas projections, 2008).

The proposed indicators and how to report them are reflected in the revised reporting template which is attached as an Excel file to this report.

#### 2.3 Task 3: Harmonised nationally independent methodology for GHG projections

Up to this date the project has developed draft guidelines for GHG projections. They consist of two parts:

- A) General Guidance
- B) Sectoral Guidance

The outlines and principles of the guidelines were presented in the WGII meeting of 15 March 2011 and in a workshop the 13<sup>th</sup> September 2011. The comments made by the Commission and MSs during these sessions and the answers to the questions in the project questionnaire to the MS are processed into the current guidelines. Also the comments from the Commission made during the meeting with the project team on  $10^{\text{th}}$  February 2012 are also included in the draft guidelines.

The General Guidance starts with a chapter on the Harmonised Approach for GHG projections and then describes in detail the general concepts and important issues for GHG projections including QA/QC for MS and the EC. The concluding chapter deals with reporting (including the proposed reporting template) and gives an annotated outline for a National Projection Report.

In the Sectoral Guidance details on how to project GHG emissions from the different IPCC categories are described. The layout of the chapters is as much as possible harmonised regarding aspects as, source description, emission factors and activity data projections, how to deal with policies and measures, ETS/non-ETS (if appropriate) and source specific QA/QC.

#### 2.4 Task 4: Differentiation between EU-level and national policies

As mentioned before in the General and the Sectoral Guidance special attention is given to aspects related to PAMs (CCPMs and as far as possible National PAMs). From the tables in the Sectoral Guidance chapter MSs can determine which PAMs will influence the projection from that (sub)sector including cross cutting issues from relevant PAMs.

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## 2.5 Task 5: Improved 3-tiered methodology

The inception report states "The project team will propose three options for an improved 3-tiered methodology to be potentially applied by Member States for all sectors (energy, industrial processes, transport, waste, agriculture, residential and services, forestry)". The project team found during the compilation of the guidelines that the wording "Tier" could lead to confusion as the tiered approach is very much associated with the "inventory world". Therefore the Guidelines use the word "Grade" instead of "Tier". In the guidelines the different grades are defined for the different source categories including the corresponding models and information sources.

The draft guidelines as attached to this report reflect the completion of tasks (1 to 5).

## 2.6 Task 6: Methodology Test

In order to verify whether or not the proposed draft Guidelines are useable by Member States in preparing their projections, the following MS have tested the proposed methodologies;

- Bulgaria
- Ireland
- Luxemburg
- Malta

The report on the testing is enclosed as appendix to this final report.

### 2.7 Task 7: Crosscheck test results from Member States and Commission models

As the testing only resulted in incomplete projections this task could not be performed as intended. Please see testing report for additional remarks.

### 2.8 Task 8: Recommendations for linking the draft guidelines to the MM and ES Decisions

The draft Guidelines were much appreciated by the Member States and EEA. One point of discussion was always the use of default values for key parameters. Therefore it would be helpful for comparable national projections to send out EC proposals for GDP and ETS carbon prices one year before the projections are due, to assure that MS could make use of these values. In this notice to the Member States also proposed timeframes for cut-off-dates for the inclusion of (new) PaM into WOM, WEM and WAM projections could be added.

## 2.9 Task 9-12: Workshops, training sessions and other meetings

Following the completion of Tasks 1 to 6, a second MS workshop was organised 21th November 2012 in Brussels to present the results of the methodology tests and to ensure that the MS are familiar with the methodologies for estimating GHG projections and being able to apply them in their own projections. This workshop covered:

- presentation of the draft guidelines including the highlights from the different tasks so far
- analysis of the results of the MSs' tests
- implications of these results for the guidelines

The recommendations from the workshop discussions are incorporated in the final version of the draft GHG Projection Guidelines (Part A and B) as attached to this report.

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## 3 Conclusions

The project resulted in draft GHG projection guidelines which the European Commission can use in defining future provisions for the Member States in preparing and reporting on their projected GHG emissions.

From the interaction with the EEA, Member States and the European Commission during the project, it is concluded that these draft guidelines are much appreciated as a useful document.

MS can use the guidelines to improve their projections and their in country QA/QC.

The European Commission can use the Guidelines for their own projection but also for QA/QC of the MS projections.

In this sense the Draft Guidelines will contribute to more transparent, comparable, consistent and complete GHG projections in the European Union.

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## **ANNEXES:**

- 1. GHG projection Guidelines Part A: General Guidance (WORD document and spread sheet Table 2)
- 2. GHG projection Guidelines Part B: Sectoral Guidance (WORD document)
- 3. Proposed Reporting Template (Excel spread sheet)
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## Annex 4 Testing Report and Testing Log

#### 3.1 **Background and objectives**

The project team is developing the EU guidelines for the greenhouse gas (GHG) emission projections in order to further improve transparency, comparability, consistency, completeness and accuracy of Member States' projections. There are two main parts of the GHG projection guidelines: (i) general guidance; and (ii) sector-specific guidance. The general guidance describes the background and objective of GHG projections as well as a number of concepts and issues relevant for all sectors. This includes policies and measures (PAMs), data collection strategies, methodological choices, time series consistency, uncertainties, areas for harmonisation and quality assurance and quality control (QA/QC) for projections. The sectoral guidance describes the grades approach for projecting activity rates and emission factors for each sector, as well as sector-specific PAMs and QA/QC.

As a part of the process in developing the guidelines, the project team tested the draft guidelines with four Member States - Bulgaria, Ireland, Luxembourg and Malta - which had volunteered to participate in the process. The objective of the testing was to verify whether the proposed grades approach for each sector, general guidance and a set of projection indicators and parameters for reporting is practical for MS in preparing their GHG projections and to gather feedback for further improvement of the projection guidelines.

#### 3.2 Testing invitation and instruction

In November 2011, the project team organised a workshop presenting the first draft general and sectoral GHG emission projections guidelines to the Commission and Member States and invited three to five Member States to participate in the testing. Eight Member States volunteered and four Member States - Bulgaria, Ireland, Luxembourg and Malta - were selected to participate in the testing.

In March 2012, the project team sent the selected Member States testing instructions, draft general and sectoral guidance of GHG projection guidelines and a projections reporting template. In the testing instructions, the project team asked the participating Member States to first undertake an initial review of the draft guidelines and proposed reporting format and provide the project team with a list of any issues for clarification and/or any other points for discussion.

The project team also asked the Member States to use the draft guidelines, once all comments/clarifications have been discussed and - where possible - resolved, to develop two sets of GHG emissions projections for 2020 and 2030 for all sectors (with the exception of Ireland, which volunteered to test the guidelines for agriculture and waste sectors only) at the highest grade possible. One set was to be based on current methods used by the Member States whilst the other was to follow the projections method of the highest grade possible, given data availability, as described in the draft guidelines. The draft reporting template was to be used to report these projections. Member States were also asked to provide feedback on their experiences of testing the draft guidelines, in particular if there were any problems with using the guidance (e.g. feasibility) and/or suggestions for improvements.

The project team provided support to the Member States by providing answers to any questions and helping to interpret the guidelines for both general and sector-specific issues via the use of e-mails and telephone conferences. The team also offered an in-country meeting with the Member State to talk through the guidance and any issues identified either at the start of the testing or during the process although none requested this.

In the invitation and instruction for the testing, it was clearly stated that the Member States' testing experience, comparison between the two projection datasets, and views and suggestions on the

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for life guidelines and reporting template would be taken into consideration to further improve the guidelines. It was also noted that the testing was to ensure that the proposed grades approach would work in practice.

#### 3.3 **Testing results**

AMEC, with support from TNO and other project partners, coordinated the testing with the Member States. A testing contact log was created to record all correspondences with Member States, and it was made available to the Commission throughout the testing in order to provide an update on the testing progress. Testing took place primarily between April 2012 and August 2012, although some input was received as late as October 2012. A final contact log will be provided to the Commission along with this report.

Overall, the project team received very positive feedback from the Member States that participated in the testing. It was noted that the language, terminologies and explanations used in the general and sectoral guidelines were clear to readers. The grade system was also well received and there were no substantial changes in the methodology suggested by the Member States.

While the draft general and sectoral guidelines were well received, the selected Member States provided very limited input in terms of actual GHG emissions projections, policies and measures (PAMs) reflected in the projections and projection indicators and parameters despite multiple requests from the project team. Where the two sets of GHG emissions projections were provided, there was not enough information to determine what assumptions or methodological approaches contributed to the differences in the projections. The project team requested explanation behind the differences, but Member States did not provide much information in response.

As the testing only resulted in incomplete projections it was not possible to cross-check the emissions projections from the testing to the emissions projections from Member States and Commission models.

In terms of projection indicators and parameters, the project team created a new sheet "ProjectionParameters 0" in the reporting template where MS could indicate whether these parameters described in general guidelines section 0.4 were used to estimate GHG emissions. The project team also modified two other sheets "ProjectionParmeters" and "ProjectionIndicators". Member States were asked to provide information in these sheets, but little information was provided on the indicators or parameters.

Ireland and Malta, nevertheless, used the reporting template to provide emission projections. It was noted by the Member States that the consistency check sheet in the reporting template did not work properly). The project team suggests that the Commission looks into the reporting template in detail to assess how they could be amended to remove the erroneous calculations built into the template.

A summary of the inputs provided by the selected Member States and responses by the project team is provided in Table A4.1.



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## Table A4.1 Summary of testing input received from Member States

Member	Testing Input							
States	Review of draft guidelines	GHG emissions projections						
Bulgaria	Bulgaria asked a few questions on the draft guidelines and clarification was provided via a conference call and email. Overall, the feedback on both general and sectoral guidelines was very positive: Bulgaria indicated that explanation of the grade approach was easy to understand and follow, detailed and user-friendly. It was also noted that the terminology was useful. Bulgaria queried which economic/energy sector model should be used in projecting GHG emissions, and the project team responded that it is not up to the team to give any advice or preference on the models. However, it was noted that the draft general guidelines have a section providing information on different types of models available.	Only one set of GHG emissions, which were prepared by following the draft guidelines, was provided using the template provided for the testing. As a result, it was not possible to compare the emissions projections and see what changes were made from applying the draft guidelines. The project team asked Bulgaria's views on how the new projections might be different to previously prepared projections. Bulgaria responded that it was not possible to compare because the previous version was completed by a contractor, whereas the emissions projections prepared using the guidelines were prepared internally. While emissions projections were provided, there was little information provided on how different policies and measures (PAMs) were taken into account in projecting emissions.						
Ireland	Ireland reviewed both general and sectoral guidelines and provided very useful comments to both guidelines. Most comments and suggested amendments were editorial and did not require significant methodological changes in the draft guidelines. Questions and comments received from Ireland were taken into account in revising the draft guidelines. Revised guidelines for agriculture and waste sectors were sent to Ireland, who were satisfied with the revisions.	Ireland sent one set of projections covering all sectors. For the agriculture and waste sectors, Ireland sent an additional set of projections. The emissions projections using the draft guidelines largely matched the projections previously developed, except for a very small change in CH <sub>4</sub> and N <sub>2</sub> O emissions from waste water handling and a small change in N <sub>2</sub> O emissions from direct and indirect emissions from agricultural soils. A short summary of the grades and emissions projections methodology was provided alongside for each sector (see Appendix A for detail). The agriculture and waste sector leads in the project team reviewed the summaries and concluded that the grades applied were reasonable and the explanations provided were sufficiently detailed.						
Luxembourg	Luxembourg suggested clearer definitions on some of the terms used in the general guidelines. It was also recommended that the structure of the document is revised to minimise redundant explanations. Luxembourg provided a few comments on the agricultural sector in regard to the use of livestock numbers and crop areas / yield statistics and the types of information that could be used to estimate emissions.	No emissions projections were submitted from Luxembourg due to time and resource constraints.						

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Member	Testin	g Input
States	Review of draft guidelines	GHG emissions projections
Malta	Malta asked a few questions on the draft guidelines and clarification was provided via conference calls and email. Malta commented that the language, terminology and explanations used in the general and sectoral guidelines were clear enough to understand and explanations of the grade system were sufficiently detailed. For the energy sector, the draft guideline suggests not to use Grade 1 but to use 2 or above. For Malta, information availability and modelling capability issues make it difficult to use Grade 2. Malta queried which economic/energy sector model should be used in projecting GHG emissions, and the project team responded that it is not up to the team to give any advice or preference on the models. However, it was noted that the draft general guidelines have a section providing information on different types of models available.	Malta submitted two sets of projections using the template provided for the testing (see Appendix B). Emissions from the energy sector were different: overall, the projections using the guidelines showed greater level of emissions (3% in 2015 and 14% in 2030). Malta explained that the differences in emissions were due to different macroeconomic assumptions. Whilst the project team requested more information on what these assumptions are and what sources of information were used, little information was provided in response. No information was provided on projection parameters and indicators or which PAMs were included. Malta did not provide any information on any problems and/or challenges in providing this data.

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# Appendix A

GHG emissions projections and summary of the grade approach used by Ireland



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1 2 3	Em	issions projections															
4 5		The sectors are those specified in table 10 of the CRF: Member State	s are requeste	ed to compl	ete the mai	n sectors (1	I-7) and en	couraged t	o provide fu	irther detail	if available	(LULUCF,	bunkers).	-			
6 7 L	.evel	With existing measures (required)	2010	2010	2015	2020	2025	2030	2010	2010	2015	2020	2025	2030	2010	2010	
8		Total excluding LULUCF	41,268.0	41,268.0	40,397.7	40,790.8	40,364.5	42,350.6	552.6	552.6	545.4	581.1	31.4	31.3	25.2	25.2	1
9		Total including LULUCF	38,257.8	38,257.8	36,690.8	36,152.1	35,126.5	37,053.7	552.6	552.6	545.4	581.1	31.4	31.3	25.2	25.2	
10 1		1. Energy	39,897.3	39,897.3	38,654.3	38,776.3	38,249.6	40,030.7	11.0	11.0	8.4	6.8	6.4	6.1	1.2	1.2	4
45 1		2. Industrial Processes	1,299.0	1,299.0	1,364.9	1,634.1	1,732.7	1,900.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
86 1		3. Solvent and Other Product Use	/1.6	/1.6	12.2	/4.1	/5.9	113.0	506.2	506.2	505.8	549.5	0.0	0.0	23.5	23.6	+
90	2	A Enteric Fermentation	0.0	0.0	0.0	0.0	0.0	0.0	404.6	404.6	404.3	437.2	0.0	0.0	23.5	23.5	1
98	3	1. Cattle	0.0	0.0	0.0	0.0	0.0	0.0	374.5	374.5	370.7	403.13	0.0	0.0	0.0	0.0	t
99	3	2. Buffalo														1	T
100	3	3. Sheep							26.5	26.5	29.9	30.07	0.0	0.0			T
101	3	4. Goats	10	1					0.1	0.1	0.1	0.05	0.0	0.0			
102	3	5. Camels and Llamas										_					+
103	3	6. Horses		_					1.8	1.8	1.8	1.77	0.0	0.0			+
104	3	7. Mules and Asses	-		-				0.1	0.1	0.1	0.09	0.0	0.0		_	⊢
105	2	0. Swite	-	-					0.0	0.0	1.0	2.11	0.0	0.0			+
107	3	10 Other	-	-					0.0	0.0	0.0	0.0	0.0	0.0			t
108	2	B. Manure Management	0.0	0.0	0.0	0.0	0.0	0.0	101.6	101.6	101.5	112.3	0.0	0.0	1.4	1.4	t
109	3	1, Cattle							75.8	75.8	74.0	79.44	0.0	0.0		-	T
110	3	2. Buffalo	100			1	2	1							1 1		Г
111	3	3. Sheep						- 8	0.7	0.7	0.8	0.77	0.0	0.0			I
112	3	4. Goats							0.0	0.0	0.0	0.00	0.0	0.0			+
113	3	5. Camels and Llamas		-	-								-				∔
114	3	6. Horses	-		-	-			0.1	0.1	0.1	0.14	0.0	0.0	<u> </u>		╀
115	2	7. Mules and Asses	-		-	-			10.0	10.4	21.2	26.02	0.0	0.0			+
117	2	9 Doutou	-	-	-				57	5.7	53	5.98	0.0	0.0			+
118	3	10 Other livestock	-								0.0	0.00	0.0	0.0		-	t
119	3	11. Anaerobic Lagoons															t
120	3	12. Liquid Systems		1											0.2	0.2	Ľ
121	3	13. Solid Storage and Dry Lot													1.2	1.2	1
122	3	14. Other AWMS		-													1
123	2	C. Rice Cultivation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
124	3	1. Irrigated	-					_									╀
123	2	2. Rained 3. Deep Water	-	-					-								+
127	3	4 Other	1		1			-									t
128	2	D. Agricultural Soils	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.1	22.1	t
129	3	1. Direct Soil Emissions													9.3	9.3	T
130	3	2. Pasture, Range and Paddock Manure (3)	1			1									8.5	8.5	T
131	3	3. Indirect Emissions													4.3	4.3	r
132	3	4. Other															
133	2	E. Prescribed Burning of Savannas	-														+
134	2	F. Field Burning of Agricultural Residues	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.0.0	0.0	0.0	0.0	0.0	4
140	2	G. Other			200.0	200.0	200.0	200.0	25.4	25.4	24.0	24.0	25.0	05.4	0.5		÷
142	2	A Solid Waste Disposal on Land	0.0	0.0	306.3	306.3	306.3	306.3	34.6	35.4	29.0	29.0	25.0	25.1	0.5	0.5	1
146	2	B Waste Water Handling	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.8	0.9	1.0	1.0	0.5	0.5	t
147	3	1. Industrial Wastewater		0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.4		0.0	t
148	3	2. Domestic and Commercial Waste Water	0						0.5	0.5	0.5	0.6	0.6	0.7	0.5	0.5	T
149	3	3. Other															T
150	2	C. Waste Incineration	0.0	0.0	306.3	306.3	306.3	306.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	r
151	2	D. Other									1.4	1.5	1.6	1.7			r
152 1		7. Other					1	2		1							L

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Kicrosoft Exce Reportin D C Emissions projections Guidance The sectors are those specified in table 10 of the CRF: Member States are reors (1-7) and e vide further detail if a ailable (LULUCF, b With existing measures (required) otal excluding LULUCF otal including LULUCF ocesses Other Product Use mentation 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 26.5 26.5 29.9 30.0 0. and Llamas les and Asses 79 ses es and Asses guid Systems old Storage and Dry Lot 122 123 128 129 130 131 132 134 140 141 142 143 144 145 146 147 148 149 asture, Range and Paddock Manure direct Emissions ed Burning of Savannas rning of Agricultural Resid • 0.5 306.3 nsProjections / EU E Emi

Figure A.1 GHG emissions projections prepared using guidelines

## 3.1 A summary of the grades approach used by Ireland

## 3.1.1 Agriculture guidelines calculations

## 3.1.1.1 Methane emissions from enteric fermentation

- Grade 1
  - o Projected livestock population from national sources or extrapolated from historic data
  - Constant emissions factors (from inventory)
- Grade 2
  - More detailed input data is required. In Ireland's case, livestock numbers, including subcategories, are provided by Teagasc, reflecting the Food Harvest 2020 policy (increase in agricultural output)
  - o Emission factors are projected based on the historic trend in emission factors
- Grade 3
  - Requires detailed modelling, taking into account gross energy intake data and methane conversion factors

Ireland uses a Grade 2 approach for cattle, with projected livestock numbers in 11 sub-categories, and emission factors based on inventory emissions factors. Inventory emission factors themselves are based

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on detailed country specific studies, including farm level surveys. For livestock other than cattle, the approach is between Grade 1 and Grade 2.

## 3.1.1.2 Methane emissions from Manure Management

- Grade 1
  - Projected livestock data for sub-classes
  - Constant emission factors (from inventory)
- Grade 2
  - Same basic methodology as Grade 1
  - Requires calculation for projected emission factors. In Ireland, EFs are based on historic values (average over last few years or kept constant)
- Grade 3
  - Requires detailed country specific modelling, taking into account e.g. projected changes in ambient temperature, changes to species distribution
  - Farm-level data for bottom-up approach might be used

The current approach used in Ireland is between Grade 1 and Grade 2, with emission factors based on inventory emission factors. Inventory emission factors themselves are based on detailed country specific studies, including farm level surveys.

## 3.1.1.3 N2O emissions from Manure Management

- Grade 1
  - N excretion is projected
  - Default/historic emission factors are applied
- Grade 2
  - Same basic methodology as Grade 1
  - Requires country specific data and projections for N excretion and manure management systems
- Grade 3
  - o Requires model of N-pathways for the entire process
  - Requires projection of which different manure management systems are expected to be used in the future
  - Might use farm level information for bottom up approach

In Ireland, N excretion rates are projected, building on inventory data. Inventory data are based on detailed country specific studies, including farm level surveys. Emission factors are default values.

## 3.1.1.4 N2O emissions from managed soils

- Grade 1
  - Amount of N input into soil through various pathways
  - Default emission factors
- Grade 2 & 3
  - Significant increase in detail, compared to Grade 1; Grade 3 includes very detailed modelling studies
  - o Grade 2 for direct emissions considers the conditions of application for the N pathways

## 3.1.2 Waste guidelines calculations

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- 3.1.2.1 SWDS
  - Grade 1
    - Activity data is grown in line with projected population growth, starting from last available inventory year (2010)
    - EF (implied EF) is kept constant at 2010 level
    - IEF takes into account a recovery rate (flaring and utilisation) of 71% in 2010
    - The recovery rate will increase to 75% in 2020; this improvement in recovery rate is not included in the Grade 1 projections
  - Grade 2
    - o Grade 2 approach is not currently used in Ireland
  - Grade 3
    - Ireland in submissions under Decision 280/2004 utilises the IPCC GL 2006 FOD model and assigns landfills into groups based on the management structure at the site in terms of size and age. All landfills in Ireland are managed sites.
    - SWD total waste by type of site is estimated. Ireland currently estimates projected emissions from SWDS using projected waste acceptance at each individual SWDS based on the remaining void space and current fill rates in conjunction with the period remaining in each landfills planning permission or licence to operate.
    - Waste composition is assumed to remain the same as the latest inventory year (2010) for all future years. Three bin systems (residual, recyclables and organic) bins are currently in place in Ireland, therefore it is assumed that the composition of waste which will be landfilled will be the same as it is currently. Waste composition for 2010 is country specific, based on waste surveys
    - The recovery of  $CH_4$  in landfill gas on a national basis is assumed to increase from 71% in 2010 to a maximum of 75% in 2020.

Ireland uses a Grade 3 approach for projecting emissions from SWDS.

### 3.1.2.2 Biological treatment of waste

- Grade 1
  - Only composting taken into account.
  - Anaerobic digestion of organic waste assumed to be zero.
  - Grow activity data (tonnes for composting) in line with population growth
  - o CH4/N2O EFs are default values from guidebook and assumed constant
- Grade 2
  - Amount of biologically treated waste is projected by type of treatment (composting and anaerobic digestion, with anaerobic digestion assumed to be zero)
  - Requires country specific EF for CH4/N2O, which are not currently available in Ireland; default values are used
  - There is no anaerobic digestion, and therefore no flaring
- Grade 3
  - Requires site-specific projected activity data, which is not currently available for Ireland
  - Requires site-specific EF, which are not currently available for Ireland

The approach used for biological treatment of waste in Ireland is close to Grade 2, but using default emission factors rather than country specific emission factors.

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3.1.2.3 Wastewater handling

## Domestic Methane

- Grade 1
  - Activity data (TOW) is grown in line with population growth
  - The split between centralised aerobic treatment plants and septic tanks is assumed constant (as in last inventory year)
  - All other parameters are assumed constant (as in last inventory year)
- Grade 2
  - Requires projected sludge removal currently there is no estimate available, it is assumed constant
  - Requires the estimation of projected changes in share of different pathways (different MCFs), and changes in maximum CH4 production capacity (Bo) currently, there are no estimates available, and they are assumed constant
- Grade 3
  - Requires, in addition to Grade 2 requirements, country specific and projected changes of biochemical oxygen demand (BOD) – this is not currently available, and assumed constant

The approach used for projecting methane emissions from domestic wastewater/sludge is Grade 1.

## Domestic N2O

- Grade 1
  - Activity data (total N) is grown in line with population growth
  - Parameters (per capita protein consumption, NPR, sludge removal, emission factor etc) are kept constant (as in last inventory year)
- Grade 2
  - Requires projected sludge removal, which is currently not available and assumed constant
- Grade 3
  - Requires (apart from Grade 2 requirements) projected changes in per capita protein consumption; fraction of non-consumed protein and industrial/commercial protein added; these are not currently available and assumed constant

The approach used for projecting N2O emissions from sewage is Grade 1.

## Industrial Sludge

- Grade 1
  - Activity data is grown in line with projected population growth, starting from latest inventory year
  - Activity data used is total amount of industrial sludge (dry solids) based on data provided by the national waste database reports, rather than waste water production and the sludge derived from it
  - Emission factors are assumed constant at last inventory year's levels
- Grade 2
  - Requires total industrial output by type of industry or sector specific economic forecasts, which is not currently available
- Grade 3
  - o Requires total industrial output by type of industry, which is not currently available
  - Requires COD values (kg CH4/kg COD) for each wastewater stream, which is not currently available

The approach used for projecting emissions from industrial sludge is Grade 1.

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### 3.1.2.4 Waste Incineration

- Grade 1
  - No waste incineration in the latest inventory year. Growing from zero in line with population growth yields zero. This does not reflect the known future changes in incineration. Therefore, grade 1 is not suitable for Ireland.
- Grade 1b/Grade 2- (approach used in Ireland)
  - Activity data is projected in line with future incinerator capacity
  - Incineration only for MSW
  - CO2 EF for MSW is country specific (based on waste composition in the last inventory year) and assumed constant into the future
  - CH4/N2O EF are default values from the guidebook
  - o Oxidation factor is assumed as 1
- Grade 2
  - o Requires the use of country specific CH4/N2O EF, not currently available in Ireland
- Grade 3
  - Requires the use of the oxidation factor, not currently available in Ireland
  - Requires the use of country specific CH4/N2O EF, not currently available in Ireland

The approach used for projections of waste incineration in Ireland is between Grade 1 and Grade 2.

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# Appendix B GHG emissions projections submitted by Malta

## Figure B.1 GHG emissions projections previously prepared (i.e. before guidelines)

221		• (* fx															_
	A	В	С	D	E	F	G	H	I	J	K	L	M	N	0	P	
1	En	hissions projections															
2																	
3		Guidance The sectors are those specified in table 10 of the CDE: Hember States	are requeste	d to comole	to the main	eactore /1	7) and an	courseed to	norovide fu	ther detail	if available	A ULUCE	hunkere)				
		The accuration and mose specified in table 10 of the Cru , member States	are requeste	d to compa	see une man	13000013 (1	ier / allo oli	couraged to	provide re	intrier detail	ii avaiau	(LULUCI),	outhers).				
5			-					_									_
6		With existing measures (required)	L.,		CO2	(Gg)					CH4	(Gg)					-
7	Level		2009	2010	2015	2020	2025	2030	2009	2010	2015	2020	2025	2030	2009	2010	
8		Total excluding LULUCF	2,514.0	2,394.0	1,713.3	1,740.9	1,682.8	1,718.4	12.6	12.6	13.8	14.4	14.8	15.1	0.1	0.1	1
10	1	1 Energy	2,453.3	2,332.8	1,650.0	1,6/5.6	1,682.8	1,/18.4	12.6	12.6	13.8	14.4	14.8	15.1	0.1	0.1	1
11	2	A. Fuel Combustion Activities	2,513.6	2,393.5	1,712.8	1,740.5	1,682.3	1,717.9	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0
12	3	1. Energy Industries	1,857.6	1,692.3	961.5	1,004.9	908.1	905.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0
13	4	a. Public Electricity and Heat production	1,857.6	1,692.3	961.5	1,004.9	908.1	905.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	9
15	4	c. Manufacture of Solid Fuels and Other Energy Industries															+
16	3	2. Manufacturing Industries and Construction	66.5	90.3	80.7	71.1	61.5	51.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
17	4	a. Iron and Steel	66.5	90.3	80.7	71.1	61.5	51.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
18	4	b. Non-Ferrous Metals	1											2			1
19	4	c. Chemicals															+
21	4	e. Food Processing, Beverages and Tobacco		8 6		-	-		-	-	-	-					+
22	4	f. Other	Î										1				1
23	3	3. Transport	542.7	561.8	619.0	610.6	655.9	701.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0
24	4	a. Civil Aviation	1.6	1.6	1.6	1.6	1.6	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
25	4	b. Road Transportation	510.1	530.8	581.9	567.3	606.6	645.8	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0
20	4	d Navigation	31.0	29.4	35.5	41.6	47.8	53.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
27	4	e Other Transportation							0.0	0.0							4
29	3	4. Other Sectors	46.7	49.2	51.7	53.9	56.7	59.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
30	4	a. Commercial/institutional															T
31	4	b. Residential	43.8	46.2	48.4	50.4	52.9	55.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
32	3	5 Other	2.9	0.0	0.0	3.6	3.8	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
34	4	a. Stationary							0.0						0.0		1
35	4	b. Mobile															
36	2	B. Fugitive Emissions from Fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
41	3	2. Oil and Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
42	4	a. Oi															T
43	4	b. Natural Gas															+
44	1 4	2. Industrial Processes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
46	2	A. Mineral Products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ō
54	2	B. Chemical Industry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
60	2	C. Metal Production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	위
60	2	E. Production of Halocarbons and SE-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
09	2	E. Consumption of Halocarbone and SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
85	2	G. Other	5.0		5.0			2.0			5.0	5.0	5.0	5.0	5.0		4
86	1	3. Solvent and Other Product Use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
96	1	4. Agriculture				0.0	0.0	0.0	2.8	3.2	3.2	3.3	3.3	3.4	0.1	0.1	1
141	1	0. Waste	0.5	0.5	0.5	0.5	0.5	0.5	9.6	9.2	10.4	11.0	11.4	11.6	0.0	0.0	
153			0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
					00.0	05.0	05.0	05.0	0.0							-	CT.

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Figure B.2 GHG emissions projections prepared using guidelines

B24	A		с	D	E	F	G	Н	I	J	K	L	М	N	0	P
	E	missions projections														
2																
3		Guidance		d to a small			Trenden		e annulda fu	dia an data il	d augustable		hundren			
-	-	The sectors are those specified in table 10 of the CRP, member St	ates are requeste	d to compa	te the mai	sectors (1	-r) and en	couraged t	o provide tu	rther detail	it available	(LULUUF,	bunkers).			
5			- 10												_	
6					CO2	(Gg)					CH4	(Gg)				
	Lev	with existing measures (required)	2009	2010	2015	2020	2025	2030	2009	2010	2015	2020	2025	2030	2009	2010
7		Total excluding LULUCE	2,514.0	2,395.0	1.666.8	1.855.1	1.897.9	1.993.9	12.6	12.6	13.8	14.4	14.8	15.1	0.1	0.1
9		Total including LULUCF	2,453.3	2,333.8	1,603.5	1,789.8	1,897.9	1,993.9	12.6	12.6	13.8	14.4	14.8	15.1	0.1	0.1
10	0 1	1. Energy	2,513.6	2,394.5	1,666.3	1,854.7	1,897.4	1,993.4	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0
4	2	A. Fuel Compustion Activities	2,513.6	2,394.5	916.1	1,854.7	1,897.4	1,993.4	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0
13	3	4 a. Public Electricity and Heat production	1,857.6	1,693.3	916.1	1,102.6	1,122.5	1,182.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
14	4	4 b. Petroleum Refining									_		_			
1	6 1	C. Manufacture of Solid Fuels and Other Energy Industries A Manufacturing Industries and Construction	66.5	90.3	80.7	71.1	61.5	51.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	7	a. Iron and Steel	66.5	90.3	80.7	71.1	61.5	51.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	8	4 b. Non-Ferrous Metals						-								
19	9	4 c. Chemicals														
20	0	4 d. Pulp, Paper and Print 4 e. Food Processing, Beverages and Tobacco				-										
23	2	4 f. Other														
23	3 3	3 3. Transport	542.7	561.7	617.8	627.1	656.7	699.7	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
24	4	4 a. Civil Aviation	1.6	1.6	1.6	1.6	1.6	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2:	5	4 b. Road Transportation	510.1	530.8	580.7	583.8	607.3	644.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
2	7	d. Navigation	31.0	29.4	35.5	41.6	47.8	53.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	B	4 e. Other Transportation														
29	9 :	3 4. Other Sectors	46.7	49.2	51.7	53.9	56.7	59.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0	4 a. Commercia/Institutional	42.0	46.2	40 4	E0.4	52.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	2	4 c. Agriculture/Forestry/Fisheries	2.9	3.0	3.3	3.6	3.8	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	3 3	3 5. Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	4	4 a. Stationary 4 b. Mobile	-													
30	5 2	B. Fugitive Emissions from Fuels	0.0	0.0	0.0	0,0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	7	3 1. Solid Fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	2	2. Oil and Natural Gas 4 a Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	3	4 b. Natural Gas														
44	4	4 c. Venting and Flaring														
4	6 2	2. Industrial Processes A. Mineral Products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	4 2	B. Chemical Industry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	0 2	C. Metal Production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
00	2 2	D. Other Production E. Production of Halocarboos and SE.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05	2	E. Consumption of Halocarbons and SF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	5 2	G. Other	0.0		5.0			5.6				5.0				
80	5 1	3. Solvent and Other Product Use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	6 1	4. Agriculture		0.5	0.5	0.0	0.0	0.0	2.8	3.2	3.2	3.3	3.3	3.4	0.1	0.1
15	2 1	7. Other	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130	2							1110								