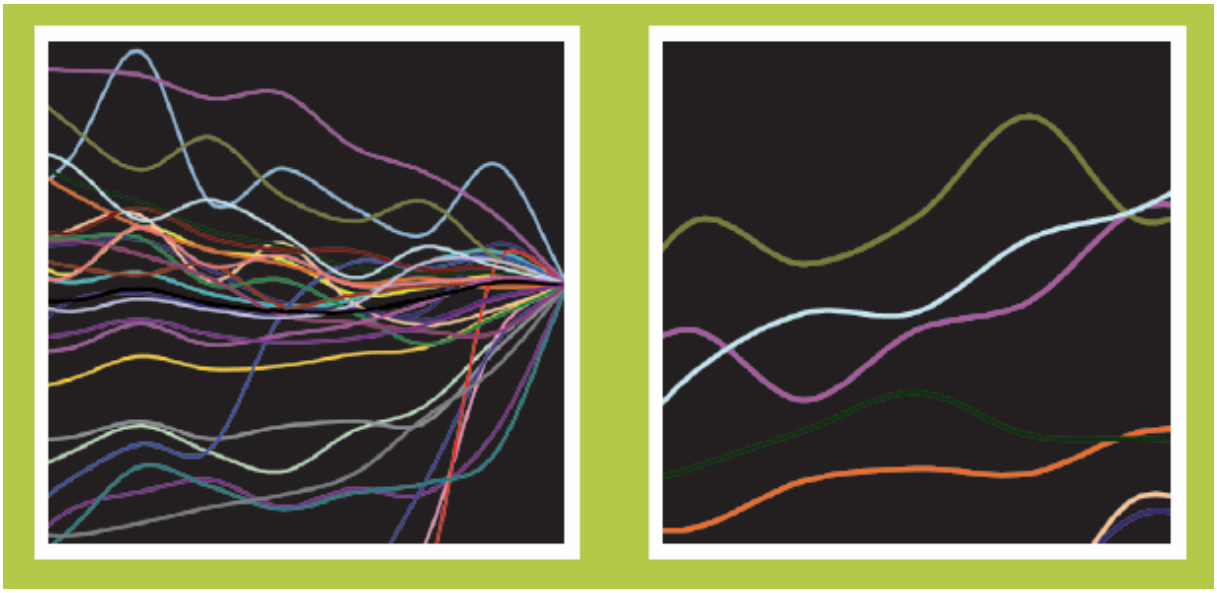
Assessment of the Member States' projections submitted under the EU Monitoring Mechanism in 2011



ETC/ACM Technical Paper 2011/2

February 2012

S. Okamura, J. Watterson, A. Misra, R. Stewart,
A. Griffin, G. Mellios, N. Mandl, E. Rigler

European Topic Centre
on Air Pollution and
Climate Change Mitigation

The European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM)
is a consortium of European institutes under contract of the European Environment Agency
RIVM UBA-V ÖKO AEAT EMISIA CHMI NILU INERIS PBL CSIC

Front page picture:
© EEA from Greenhouse gas emission trends and projections in Europe 2011, Tracking progress towards Kyoto and 2020 targets

Author affiliation:
S. Okamura (AEA), J. Watterson (AEA), A. Misra (AEA), R. Stewart (AEA), A. Griffin (AEA), G. Mellios (Emisia), N. Mandl (UBA-V), E. Rigler (UBA-V)

DISCLAIMER

ETC/ACM Technical Paper 2011/2
European Topic Centre on Air Pollution and Climate Change Mitigation
PO Box 1
3720 BA Bilthoven
The Netherlands
Phone +31 30 2748562
Fax +31 30 2744433
Email etcacm@rivm.nl
Website http://acm.eionet.europa.eu/

Contents

Executive summary

This report presents an overview of the quality of Member States' projections submitted in 2011 under Decision 280/2004/EC (EU Monitoring Mechanism — the MM Decision). The assessment is based on the implementation of the Quality Assurance / Quality Control (QA/QC) procedure for the reporting of projections under Decision 280/2004/EC (the EU Monitoring Mechanism prepared by the European Topic Centre on Air pollution and Climate change Mitigation (ETC-ACM) of the European Environment Agency (EEA).

In 2011 Member States were obliged to report GHG projections, under the biennial requirement set by the MM Decision. In total, 25 of the 27 Member States submitted updated GHG projections (projections submitted in 2009 were resubmitted by Germany and Portugal).Despite the existence of the reporting requirement since 2005, only 11 Member States reported their projections under the MM Decision before the legal deadline of 15th March. All mandatory requirements were met by more than three quarters of Member States. The completeness of the reporting of the sensitivity analysis was the lowest, fulfilled only by 21 of the 27 Member States. Approximately half of the Member States are already projecting emission levels post the Effort Sharing Decision (ESD) target year (2020) and 17 Member States were able to provide their projections split into EU ETS and non ETS sectors. Cyprus and Romania reported the least number of mandatory parameters used in the QA/QC procedure (8 out of 35) and Czech Republic, Denmark, Greece, the Netherlands and Slovenia provided information on all 35 mandatory projections parameters.

The consistency checks on the reported projections showed that there was a high risk that Bulgaria, Portugal and Romania overestimated their GHG projections (c.f Table ES-1). The 2010 projections reported by these three Member States were more than 47% (Romania), 22% (Bulgaria) and 15% (Portugal) higher than the 2010 proxy estimates. Furthermore, Bulgaria and Romania used 2010 GDP assumptions which were 9.6% and 17% higher than the observed GDP in 2010. As a result there was a high risk that the financial crisis has not been accounted for accurately in the projections reported by Bulgaria and Portugal and consequently a high risk that the 2010 projections (and consequently subsequent years) are overestimated. For Romania, the results strongly suggested that the effect of the financial crisis had not been taken into account at all. There were further risks that the GDP and population growth assumptions to 2020 used by these Member States were inaccurate. The risks associated with Bulgaria, Portugal and Romania's projections being inaccurate were too high to use for the purpose of tracking the national and EU-27 against GHG targets in the reports published by the EEA (2011b) and the European Commission (2011). Hence the data was gapfilled using the PRIMES and GAINS trend calibrated against the 2011 inventory. Germany did not submit updated projections, but provided new figures for the 'With Existing Measures' (WEM) scenario in 2010 and for the EU ETS and non ETS split of their

projections for 2015 and 2020. In addition, the checks did not identify any risks of over or underestimation with the German projection.

The 2011 submission showed that further emphasis should be placed to improve the completeness and consistency of the projection parameters, in particular the reporting of parameter units. The QA/QC procedure can be further improved by including a consistency check of the historic projections parameters, which are time series consistent with the projected parameters reported, against surrogate datasets. This identifies any systematic discrepancies in the projections parameters which exist throughout the time series. The 2011 QA/QC procedures assumed a close correlation between the projected emissions and key parameters. In 2013, it is recommended that effort is placed on improving the QA/QC procedure to better use the relationship between the different projections parameters and emissions.

Completeness and timeliness of submissions

In 2011, 25 out of 27 Member States submitted updated GHG projections. The projections submitted by Portugal and Germany were not updated from the previous (2009) submission, although Germany did provide new figures for the 'With Existing Measures' (WEM) scenario in 2010 and for the EU ETS and non ETS split of their projections for 2015 and 2020.

Only 11 Member States reported their projections under the MM Decision before the legal deadline of 15th March. All other Member States submitted their information between 15th March and 26th August.

Most Member States reported all of the mandatory requirements such as reporting of projections split by gas and sector, provision of a 'With Additional Measures' (WAM) scenario (only omitted by Poland and the United Kingdom), description of the methodology and projection parameters used. In particular, the requirement to report projection for the years (2010, 2015 and 2020) was met by all Member States, while reporting the results of the sensitivity analysis remains widely incomplete (reported by only 21 out of 27 Member States). Only seven Member States fulfilled the optional requirement of reporting the 'Without Measures' (WOM) scenario.

The completeness of reporting information on the 35 mandatory projection parameters used in the QA/QC procedure varies across the Member States, with Cyprus and Romania reporting information on only 8 out of 35 parameters to the Czech Republic, Denmark, Greece, the Netherlands and Slovenia, which reported information on all 35 mandatory projections parameters.

Although this was not a legal requirement, Member States were also requested to report projections beyond 2020, a split of total projections between emissions covered by the EU ETS and remaining emissions, and carbon price assumptions. The completeness of this

information was lower than for the mandatory requirements. In particular, only 13 Member States reported 2025 or 2030 projections.

Consistency of projections

The majority of the reported projections were internally consistent, meaning that total emissions (excluding LULUCF), sectoral emission split by IPCC sectors and emission split between ETS and non ETS sectors for the projected years 2010, 2015 and 2020 were consistent with each other. Most internal inconsistencies in the original submissions were corrected during the implementation of the QA/QC procedure. Consistency issues could not be resolved for only three Member States: Bulgaria, France and Slovakia.

For two Member States, a difference of over 3 % was found between emissions reported in the projections data set for a reference (historic) year and emissions for the same year reported in the 2011 national inventory report to the UNFCCC. A difference of 8.9 % was even observed for Bulgaria for emissions in the reference year 2008. Consistency checks of reference year emissions ('reference year check') carried out at sectoral level led to adjustments for 12 out of 27 Member States because differences higher than 3 % was found for at least one of the sectors reported.

Germany, Poland, Portugal, Romania and Sweden used reference years before 2008 to compile their projections. For these Member States and Bulgaria (due to high difference in emissions in the reference year and equivalent emissions in the 2011 inventory) the reported 2010 projections were compared against the EEA 2010 proxy emission estimates. The 2010 projections reported by Romania, Bulgaria and Portugal were 47 %, 22 % and 15 % higher than the EEA 2010 proxy emission estimates, respectively. This shows that there is a high risk that the financial crisis was not properly accounted in their projections and as a result a high risk that the 2010 projections (and consequently the projections for subsequent years) were overestimated. The opposite situation was observed for Sweden, where 2010 projections were 4.9 % lower than the 2010 proxy estimate.

Bulgaria, Germany, Poland, Portugal and Sweden indicated in their submissions that the financial crisis had been taken into account in their projections, which means that Bulgaria and Portugal's projections underestimated the impact of the crisis on emission levels. Romania did not specify whether the financial crisis had been taken into account. However, the large discrepancy between the 2010 projections submitted by Romania and 2010 proxy estimate provides concrete evidence that the impact was not accounted for in the submission.

Consistency and accuracy of key economic parameters

Values of parameters reported by Member States as part of their submissions of projections were compared against corresponding data from a number of reference data sets. This comparison helped assess the consistency and the risk of inaccuracy of the reported projections. The parameter data used are gross domestic product (GDP), population and

corresponding emissions intensities based on GDP and population. The check was split into three components for each parameter. The first check assessed the accuracy of the projected assumption in 2010; secondly the growth rate of the parameter was assessed for the periods 2010-2015 and finally the same assessment was performed for the period 2015-2020. Emission levels for 2010 are not yet available, thus only the latter two checks were performed for emission intensity parameters. Where relevant, from each check a risk level (high, medium or low) was determined for the various parameter regarding potential over (+) or underestimation (-). Where 2010 projections were compared with actual statistics, the assessment clearly showed that the projections were over or underestimated. The risk levels identified from each of these checks are stated in bold in the following texts and summarised for each Member State in Table ES-1.

GDP

2010

2010 GDP data reported by Latvia, Romania and Bulgaria were 20 %, 17 % and 9.6 % higher than the 2010 GDP reported by the statistical office of the European Union (Eurostat). Finland's 2010 GDP assumption was 17 % lower than the data from Eurostat. Further investigation showed that GDP assumptions used by Bulgaria and Romania were higher than the observed GDP in 2010. Finland and Latvia's differences were explained by other reasons not linked to the over or underestimation of GDP assumptions.
Bulgaria: (+) and **Romania:** (+).

2010-2015

Greece and Luxembourg reported pessimistic assumptions about their economic growth between 2010 and 2015 compared to the growth rates reported and used in the 2009 Ageing Report from the European Commission (DG ECFIN, 2009), which presents demographic and economic perspectives at national level within the EU until 2060. Due to the current economic situation and perspectives, the future growth in the European economies (and GDP) might very well be slower than anticipated in the Ageing Report, at least in Greece. Belgium, Bulgaria and Romania expect much higher economic growth than the Ageing Report. Yet, Romania only expects a prolongation of its historic growth. **Greece:** (Low, -), **Luxembourg:** (Medium, -), **Belgium:** (Medium, +), **Bulgaria:** (Medium, +) and **Romania:** (Low, +).

2015-2020

Bulgaria, Poland, Belgium, Romania and Latvia present more optimistic assumptions regarding their economic growth than the Ageing Report. The risk of the economic growth being overestimated is higher for Belgium and Bulgaria: these two countries expect a much higher growth than that observed during the period from 2003 to 2008, while the growths projected by Latvia, Poland and Romania are only as high as those experienced by these

countries during 2003-2008 . **Belgium:** (Medium, +), **Bulgaria:** (Medium, +), **Latvia:** (Low, +), **Poland:** (Low, +) and **Romania:** (Low, +).

Economic emissions intensity

Further decoupling of emissions and economic growth are expected in all Member States during 2010-2020. The rate of decoupling depends largely on the how successful the Member State has been in decoupling their emissions and GDP growth already. Based on the comparison of the projected change in emissions per GDP with the observed change during 2003-2008, there is a low risk that Belgium and Cyprus have underestimated their growth in emissions during 2010-2015 and a low risk that Greece and Portugal has overestimated their growth in emission during the same period.

Between 2015 and 2020, there is a low risk that Belgium, Cyprus and Malta have underestimated and the Netherlands and Romania have overestimated their growth in emission projections. Luxembourg clearly specified that their GDP growth and emission levels are not closely linked. Issues associated with over or underestimation of GDP growth must be resolved to use the indicator emissions per GDP to determine the under or overestimation of emissions with more confidence.

2010-2015 - Belgium: (Low, -), **Cyprus:** (Low, -), **Greece:** (Low, -) and **Portugal:** (Low, -).

2015-2020 – Romania: (Low, +), **Belgium:** (Low, -), **Cyprus:** (Low, -), **Malta:** (Low, -) and **the Netherlands:** (Low, +)

Population

2010

In general, population levels in 2010 assumed by the Member States and the actual figures reported by Eurostat are similar. Discrepancies exist for Bulgaria, France, Luxembourg and Spain. In the case of France, the differences result from different geographical scopes covered by each data set (i.e. whether overseas territories are included or not). The difference between the population data reported by Luxembourg and Spain, and the Eurostat data varies across the time series and the reasons for the discrepancy are not understood. The population assumptions used by Bulgaria for 2010 was higher than the observed population levels in 2010.

Bulgaria: (+), **Spain:** (Medium, +) and **Luxembourg:** (Medium, +)

2010-2015

The population growth projected by Ireland, Portugal and Spain during 2010-2015 is much lower than both the growth reported in the EC Ageing Report, and the observed growth in these countries between 2003 and 2008. There is a medium risk that the population growths expected by these Member States during 2010-2015 have been underestimated.

Ireland: (Medium, -), **Portugal:** (Medium, -) and **Spain:** (Medium, -).

2015-2020

Similar to 2010-2015, during 2015-2020, Ireland and Portugal expect a much lower growth in

population in comparison to the EC Ageing Report and the observed historic trend. **Ireland:** (Medium, -) and **Portugal:** (Medium, -)

Emissions per capita

Unlike the economic emissions intensity, many Member States, in particular in the EU-12, saw their emissions per capita increase during 2003-2008 (Bulgaria, Estonia, Latvia, Lithuania, Poland and Slovenia) and many Member States project their emissions per capita to increase in the future. This is because at least for these countries, emissions per capita are still closely related to the wealth of the country which in turn is linked to the energy consumption. Similar to emissions per GDP, the expected trend is linked to the current emissions per capita levels which are higher in the EU-15 than the EU-12.

The projected change in emissions per capita during 2010-2015 and 2015-2020 are 15 % higher than the observed change during 2003-2008 for Bulgaria, Denmark (2015-2020), Finland (2010-2015), Romania and Lithuania. Both Bulgaria and Romania expect a much quicker increase in total energy consumption relative to their growth in wealth in their projections compared to the observed trend in historic years. The opposite is true for Lithuania and there is a risk that the projected energy consumption reported by Lithuania is too low relative to their growth in wealth. As a result, there is a low risk that Bulgaria and Romania have overestimated and Lithuania has underestimated their emission projections. The difference between the historic change and projected change is higher than 15 % for Denmark and Finland because of the large reduction in emissions per capita observed during 2003-2008 as a result of particularly low rainfall in Norway and Sweden causing insufficient hydropower production in both countries in 2003.
2010-2015 and 2015-2020 - Bulgaria: (Low, +), **Lithuania:** (Low, -) and **Romania:** (Low, +)

The results showed that trends in GHG emissions per capita cannot be directly interpreted and used to determine the risk of over or underestimation of emission projections because they are affected largely by country-specific circumstances.

Accuracy

The risk associated with the reported projections by Member States being over or underestimated have been converted into a quantitative score. This score takes into account each of the risks identified from the range analytical procedures applied to the projections, and associated parameters, described in Chapters 2 to 4. A high score implies a high risk of over or underestimation. Bulgaria, Portugal and Romania score the highest with scores above 7. In total, more than half of the projections from the EU-27 Member States are associated with some risk of over or underestimation. Belgium, Ireland and Spain are also very close to the threshold number of points required for the risk to be considered too high.

Table ES-1 Summary table based on the assessment of GDP and population assumptions and the results from the reference year check of emissions

Member State	Reference year check	GDP – consistency against 2010	GDP Growth 2010-2015	GDP Growth 2015-2020	Growth - GHG Emissions per GDP 2010-2015	Growth - GHG Emissions per GDP 2015-2020	Population consistency against 2010	Population Growth 2010-2015	Population Growth 2015-2020	Growth - GHG Emissions per capita 2010-2015	Growth - GHG Emissions per capita 2015-2020	Total score
Bulgaria	3	3	2	2			3			1	1	15
Romania	3	3	1	1		1				1	1	10
Portugal	3				1			2	2			8
Belgium			2	2	1	1						6
Ireland								2	2			4
Spain							2	2				4
Greece			1		1							2
Finland		2										2
Luxembourg			2				2					2
Lithuania										1	1	2
Cyprus					1	1						2
Malta						1						1
Netherlands						1						1
Poland				1								1
Latvia				1								1
Other MS	0	0	0	0	0	0	0	0	0	0	0	0

Note: (+) indicates overestimate and (-) indicates underestimate

Total points are calculated as follows: Over or underestimate compared against observed GDP or population levels in 2010 or high risk= 3, medium risk= 2 and low risk= 1. The projections from Member States in rows that are shaded grey have been excluded from the EU-27 projections, and their projections have been replaced with gap-filled data.

Romania's projections did not take into account the impact the financial crisis had on emission levels at all. For Bulgaria, the submission indicated that the projections did take into account the impact of the financial crisis. However the results show that the impact of the financial crisis used to calculate the projections did not correctly reflect the observed impact the financial crisis actually had on emission and GDP levels. In addition there was a high risk associated with the projected economic growth during 2010-2020 being very optimistic. In addition, both Bulgaria and Romania expected emission levels in the future to increase much quicker than those observed in historical years despite the historical growth in GDP being similar to the projected growth in GDP.

The risk that Bulgaria, Portugal and Romania's projections are overestimated was too high for the projections submitted by these Member States to be included in the emission projections for the EU-27. Therefore, instead, for the purpose of tracking progress against GHG targets in the reports 'Greenhouse gas emission trends and projections in Europe 2011 - Tracking progress towards Kyoto and 2020 targets' (EEA, 2011b) and 'Progress towards achieving the Kyoto Objectives' (EC, 2011), their projections were replaced with gap filled estimates. The methodology used to gap fill the data is given in Chapter 6.

Gapfilling

GHG projections reported by Member States were replaced with PRIMES and GAINS projections data (adjusted to the 2011 inventory) for Bulgaria, Portugal and Romania due to the high risks associated with their projections being over or underestimated making the projections less accurate.

Additional gap filling was also done in specific situations, where some Member States did not provide all the detailed information required for the detailed assessment of the progress of the EU towards its GHG targets:

- 2011 and 2012 data was reported by only Denmark and Ireland. For all other Member States interpolation between 2010 and 2015 was used;
- Projections reported by Cyprus, Estonia, Finland, Poland and Romania were split using the split reported in PRIMES and GAINS for certain sectors in linked to fuel combustion;
- Bulgaria, Czech Republic, Estonia, Finland, Lithuania, the Netherlands, Poland, Portugal, Romania and Slovakia did not report the projections split between EU ETS and non ETS. This was gapfilled using the PRIMES and GAINS split.
- The WAM scenario was not reported by Poland and the United Kingdom. For these two Member States, WAM = WEM.
- Bulgaria, Cyprus, Estonia, Finland, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Portugal, Romania and Spain did not report either the 2025 nor the

2030 projections. The expected trend reported in PRIMES and GAINS was used to extrapolate the Member States' projections.

1 Introduction

1.1 Reporting requirements for GHG projections

Under Article 3(2)b of Decision 280/2004/EC (the EU Monitoring Mechanism Decision, MM Decision)[1] and Article 10 of its implementing provisions (Decision 2005/166/EC)[2], Member States report to the European Commission (EC) the following information, biennially, as part of their GHG projection submission: 'with measures' (or 'with existing measures', WEM) and 'with additional measures' (WAM) projections scenarios for 2010, 2015 and 2020 by sector and gas, list of policies and measures included in the projections, results of the sensitivity analysis performed for the projections and description of methodologies, models, underlying assumptions and key input and output parameters.

1.2 Objective and scope

A key objective of QA/QC procedure was to improve the quality of projections reported by Member States under the MM Decision, by strengthening the quality assurance process related to projections reporting to ensure that the projections data reported biannually is methodologically and technically credible. The work programme has also compiled the information on projections reported by Member States to be used in the 'Greenhouse gas emission trends and projections in Europe 2011' (EEA, 2011b) and the 'Progress towards achieving the Kyoto objectives' report (EC, 2011).

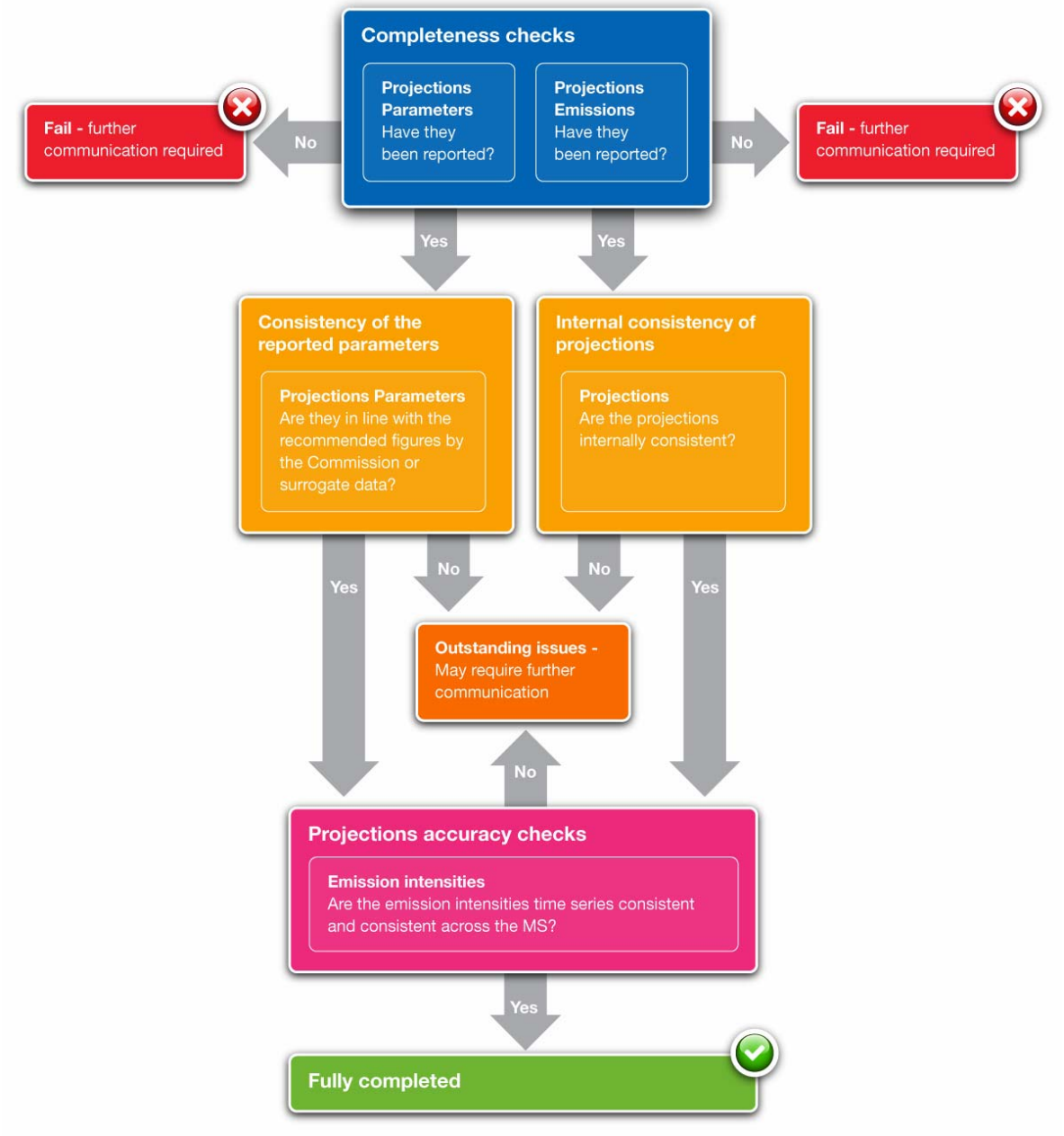
There is currently no formal technical guidance which must be used by Member States to compile projections of greenhouse gases (GHGs), or specific Quality Assurance or Quality Control (QA/QC) procedures that have to be applied during their compilation — apart from the definitions of the different projection scenarios provided in the UNFCCC reporting guidelines for Annex I national communications[3] and the annotated outline which was prepared to facilitate the preparation of the fifth National Communications[4]. This contrasts with the extensive guidance which is available for the compilers of historical GHG emission inventories. To help ensure the quality of the GHG projections from the Member States, a QA/QC procedure has been developed by the European Topic Centre of Air pollution and Climate change Mitigation (ETC-ACM)[5]. This procedure, building on the findings from the 'Assessment and improvement of methodologies used for Greenhouse Gas projections' report (Duerinck, 2008), assesses the Transparency, Consistency, Completeness, Comparability and Accuracy (TCCCA) of the reported projections, as well as their timeliness.

[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:055:0057:0091:EN:PDF
[2] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:055:0057:0091:EN:PDF
[3] http://unfccc.int/resource/docs/cop5/07.pdf
[4] http://unfccc.int/files/national_reports/annex_i_natcom_/application/pdf/nc5outline.pdf
[5] The European topic centre on air pollution and climate change mitigation (ETC/ACM) is a consortium of European institutes assisting the EEA in its support to EU policy in the field of air pollution and climate change

The details of the QA/QC procedures followed can be found in the 'Quality assurance/quality control procedure for the reporting of projections under Decision 280/2004/EC (the EU Monitoring Mechanism Decision)' document (ETC-ACM, 2011). This is referred to in this report as the Quality Assurance plan for simplicity. The elements of TCCCA criteria are assessed. Figure 1-1 shows the overall framework the Quality Assurance plan is built on. This is the first time that the formalised Quality Assurance plan has been applied to the projections submitted under the MM Decisions by Member States.

This report presents the results of the QA/QC performed on the GHG projections (WEM scenario specifically) reported under the MM Decision in 2011. A description of the methodology followed to assess the individual components of the TCCCA criteria is provided at Annex A. Finally, this report covers the geographical area of the EU-27.

Figure 1-1 Steps in the QA/QC procedure and the approval process



Source: ETC ACM, 2011

1.3 Report structure

The checks for completeness and timeliness of the reporting are summarised in Chapter 2. The completeness checks also look at transparency and comparability. Transparency of reporting is based on whether key assumptions used (parameters), methodologies, models, sensitivity analysis and information on which policies and measures are included in the projections have been reported. The assessment of the comparability of the submission relies on the use of the optional reporting template[6] and on the submission of a projections

[6] An optional template for the reporting of projections and policies and measures under the EU MM Decision (hereinafter referred as 'reporting template') was designed by the EEA and its European Topic Centre on Air pollution and Climate change Mitigation (ETC-ACM) in 2006 and made available to Member States. The reporting template improved the comparability and consistency of the reported data significantly.

methodology report. Other aspects covered under the completeness assessment also support the assessment of comparability, such as whether the projections were reported using the high level IPCC sectors.

The completeness check assesses whether the submitted data by the Member State fulfils the reporting requirements set under the MM Decision. The completeness of these parameters is important because they form the core to the assessment of the consistency of the reported parameters which are used to compile the WEM scenario projections. In turn the results of the consistency assessment of the reported parameters in conjunction with the consistency of the reported projections are used to evaluate the accuracy of the reported projections.

The consistency checks are split into checks of the projections (Chapter 3) and the associated parameters (Chapter 4). Assessment of the consistency of the projections is based on:

1. The internal consistency of the reported projections;
2. The consistency between the projections and the 2011 GHG inventory submission; and
3. The consistency of the reported 2010 projections with the early 2010 estimates (EEA 2010 proxy emission estimates (EEA, 2011c)).

The consistency of the projection parameters reported for the WEM scenario is based on comparing:

4. The 2010 assumption used to compile the projections with actual 2010 data (e.g. from Eurostat);
5. The growth assumptions used by Member States for the periods 2010-2015 and 2015-2020 against an alternative projections model and also the actual growth observed in the historic time series (five year period between 2003 and 2008); and
6. The relative change in emission intensity derived using the projected emissions and parameters with the actual change of the equivalent indicator observed between 2003 and 2008.

In the current QA/QC procedure, the analyses set out in points 4 to 6 above are included under the checks for consistency. It may be better to assign these analyses to the group of checks for accuracy since in principle consistency refers to internal consistency of the dataset, not consistency with other data sets. The allocation of the analyses set out in points 4 to 6 above to either the QA/QC test for consistency or accuracy is under review, and may be changed in future.

The results of the consistency check of the parameters can help to identify if there is a risk the key parameters used to compile GHG projections were over or underestimated (accuracy).

Thus the Quality Assurance plan relies on the presence of a close link between the key parameters and emissions data.

Checks 2 to 6 in the list above determined a level of risk (high, medium or low) associated with the projections being overestimated by the Member State. The higher the risk associated with the GHG emission being under or overestimated, the higher the risk that the emission projections are less accurate. To summarise the results to determine the accuracy of the total projected emissions (excluding LULUCF) for each Member State in Chapter 6, a simple point system has been adopted. The points are assigned as follows: high risk = 3; medium risk = 2; and low risk= 1. The weighting is based on the importance of each of the checks. Thus the points are simply summed across all the checks to calculate a total score for each Member State which is proportional to the level of risk associated with the projections being inaccurate. The results are brought together in the form of summary table (Chapter 5). Countries may accumulate high total scores from a few checks which have a high weighting or several checks with lower weighting or a combination of both. It is important to note that the results of this test are indicative only.

The outcome of this assessment, in conjunction with the results of the consistency check of the reported projections, is used by the EEA to support a decision on whether to include or exclude the projections of a Member State in the EU total projections. This decision is based on the checks presented in this report, which presents the results for total emissions (excluding LULUCF) using the key economic parameters, of GDP and population. But the report is complemented by the accuracy of the sectoral parameters for the major GHG inventory sectors presented in Annex I. The sectoral chapters provide further insight into the completeness of the reporting of sector specific parameters and whether there is a risk that these parameters have been over or underestimated.

If projections submitted by Member States were incomplete, or if the assessment concluded that the risk that the submission made by certain Member States being inaccurate was too high, the data has been gapfilled. A list of the data that has been gapfilled and the methodology used to gapfill is summarised in Chapter 6.

2 Completeness and timeliness of submission

In 2011, 25 out of 27 Member States submitted updated GHG projections. The projections submitted by Portugal and Germany were not updated from the previous (2009) submission, although Germany did provide new figures for the With Existing Measures (WEM) scenario in 2010 and the EU ETS and non ETS split of their 2009 submission for 2015 and 2020.

Only nine Member States reported their projections under the MM Decision before the legal deadline of 15th March. All other Member States submitted their information between 15th March and 26th August.

Most Member States reported all of the mandatory requirements such as reporting of projections split by gas and sector, provision of a WAM scenario (only omitted by Poland and the United Kingdom), description of the methodology and projection parameters used. In particular, the requirements to report projection for the years (2010, 2015 and 2020) was met by all Member States, while reporting the results of the sensitivity analysis remains widely incomplete (21 out of 27 Member States). Only seven Member States fulfilled the optional requirement of reporting the WOM scenario.

The completeness of reporting information on the 35 mandatory projection parameters used in the QA/QC procedure varies across the Member States, with Cyprus and Romania reporting information on only 8 out of 35 parameters to the Czech Republic, Denmark, Greece, the Netherlands and Slovenia, which reported information on all 35 mandatory projections parameters.

Although this was not a legal requirement, Member States were also requested to report projections beyond 2020, a split of total projections between emissions covered by the EU ETS and remaining emissions, and carbon price assumptions. The completeness of this information was lower than for the mandatory requirements. In particular, only 13 Member States reported 2025 or 2030 projections.

This Chapter presents the results of the timeliness and completeness checks of the projected emissions and parameters. The completeness of the projections parameters is presented at an aggregated level. Detailed information on the completeness of the individual parameters by Member State can be found in the designated sections of the report where these parameters are analysed in further detail in Chapter 4 for GDP and population and the sector chapters in the Annex for sector specific parameters).

2.1 Timeliness

The timeliness of reporting remains low. Only nine Member States (Austria, Bulgaria, Estonia, Greece, the Netherlands, Slovakia, Spain, Sweden and the United Kingdom)

submitted their projections on or before the deadline (15th March 2011). The remaining Member States submitted between 16th March and 26th August. During this period, some Member States resubmitted updated data. Member States need to increase their efforts to improve the timeliness of their submissions.

Germany and Portugal submitted projections which were not updated from the 2009 submission, although Germany did provide new figures for the With Existing Measures (WEM) scenario in 2010 and the EU ETS and non ETS split of their 2009 submission for 2015 and 2020. Romania reported outdated projections using 2006 as the reference year.

2.2 Completeness

2.2.1 Emissions Projections

Most Member States fulfilled the mandatory reporting requirements:

- 2010, 2015 and 2020 projections were reported by all Member States;
- Bulgaria was the only country to not report their projections disaggregated by gas;
- Emissions were split into high level IPCC sector categories (for sectors used for assessment see Table 6-2) by 21 Member States. Five Member States did not split the energy use sector (IPCC sectors 1A2, 1A4 and 1A5) and one (Cyprus) reported aggregated projections for all fuel combustion sources (IPCC sectors 1A);
- WEM and WAM scenarios were reported by all Member States except Poland and the United Kingdom, which reported only a WEM scenario;
- Information on policies and measures (PAMs) included in the projections was provided by all Member States except Denmark;
- Results of the sensitivity analysis and description of methodologies, models and underlying assumptions were reported by 21 and 23 Member States respectively.

The completeness of the optional requirements was lower:

- The optional Without Measures (WOM) projections were reported by seven Member States (Cyprus, Hungary, Lithuania, Malta, the Netherlands, Slovakia and Spain).
- Emission projections for 2025 and 2030 were reported by 13 Member States, including Hungary who reported only 2025 and Poland who reported only 2030.
- Split of total emissions into ETS and non ETS was provided by 18 Member States but the data reported by only 17 was of sufficient quality for further use and analysis.
- 24 Member States used the optional reporting template, as recommended and only three Member States (Bulgaria, Denmark and Romania) submitted data in a different format.

The summary completeness of the key mandatory and recommended requirements is presented in Table 2-1.

Key for Table 2-1

Key
1- Mandatory reporting requirement fulfilled
1- Recommended reporting requirement fulfilled
0- Recommended reporting requirement not reported
0- Mandatory reporting requirement not reported

Table 2-1 Summary results of the completeness of the even mandatory and two recommended reporting requirements for emissions projections

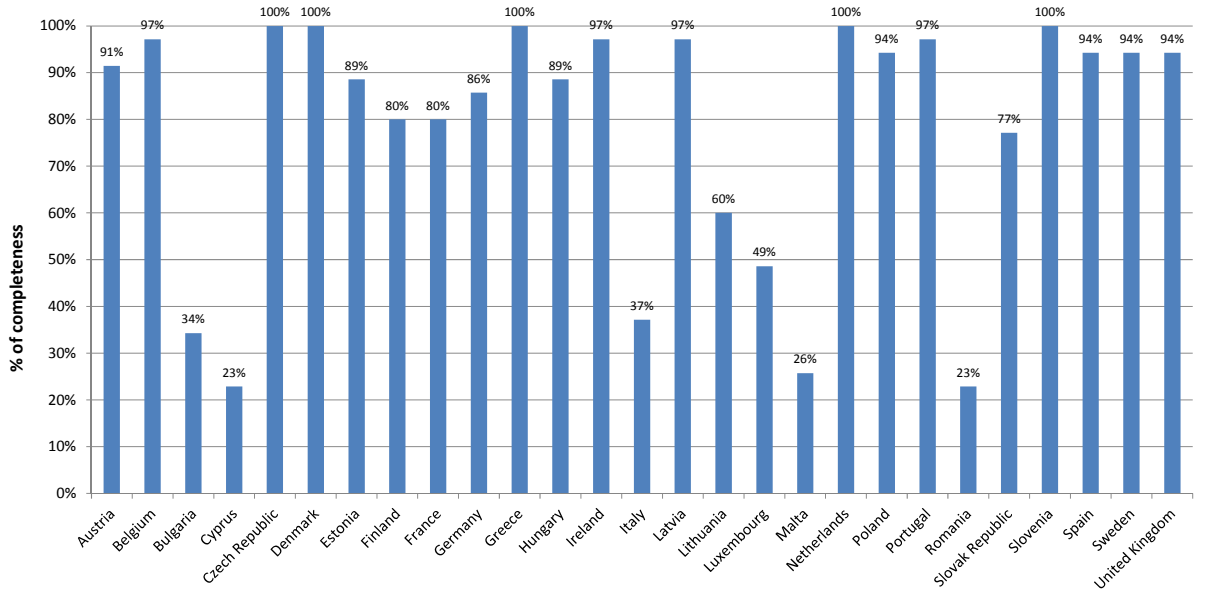
	2010, 2015 and 2020 projections reported	Projections reported disaggregated into the six GHGs	Projections reported at high level IPCC sector categories	Both WEM and WAM scenarios reported	Policies and measures included in the projections scenarios, including EU policies, are clear	Results of sensitivity analysis reported	Description of methodologies, models and underlying assumptions reported	Reported 2025 or 2030 projections?	Reported a valid split between EU ETS and non ETS?	Total (/9)
Austria	1	1	1	1	1	1	1	1	1	9
Belgium	1	1	1	1	1	1	1	1	1	9
Bulgaria	1	0	0	1	1	0	1	0	0	4
Cyprus	1	1	0	1	1	1	1	0	1	7
Czech	1	1	1	1	1	1	1	1	0	8
Denmark	1	1	1	1	0	1	1	1	1	8
Estonia	1	1	0	1	1	0	1	0	0	5
Finland	1	1	0	1	1	0	0	0	0	4
France	1	1	1	1	1	1	1	1	1	9
Germany	1	1	1	1	1	1	1	0	1	8
Greece	1	1	1	1	1	1	1	0	1	8
Hungary	1	1	1	1	1	0	0	1	1	7
Ireland	1	1	1	1	1	1	1	0	1	8
Italy	1	1	1	1	1	0	0	0	1	6
Latvia	1	1	1	1	1	1	1	0	1	8
Lithuania	1	1	1	1	1	1	1	0	0	7
Luxembourg	1	1	1	1	1	0	0	0	1	6
Malta	1	1	1	1	1	1	1	1	1	9
Netherlands	1	1	1	1	1	1	1	1	0	8
Poland	1	1	0	0	1	1	1	1	0	6
Portugal	1	1	1	1	1	1	1	0	0	7
Romania	1	1	0	1	1	1	1	0	0	6
Slovakia	1	1	1	1	1	1	1	1	0	8
Slovenia	1	1	1	1	1	1	1	1	1	9
Spain	1	1	1	1	1	1	1	0	1	8
Sweden	1	1	1	1	1	1	1	1	1	9
United	1	1	1	0	1	1	1	1	1	8
Total	27	26	24	24	26	21	23	13	17	

Source: ETC ACM, 2011

2.2.2 Projection Parameters

The completeness of the mandatory projections parameters required under the MM Decision and used in the Quality Assurance procedure[7] is presented in Figure 2-1. The submitted data were judged complete if the entire time series were reported, with appropriate units required under the MM Decision and used in the Quality Assurance procedure. Five countries (the Czech Republic, Denmark, Greece, the Netherlands and Slovenia) provided all the required information. In general, the completeness of reporting all projection parameters is good, with 20 Member States reporting more than 77 % of the information on parameters required under the MM Decision. Seven Member States (Cyprus, Romania, Malta, Bulgaria, Italy, Luxembourg and Lithuania) will need to improve the completeness of their submissions on this aspect.

Figure 2-1 Percentage completeness for all projections parameters by Member State



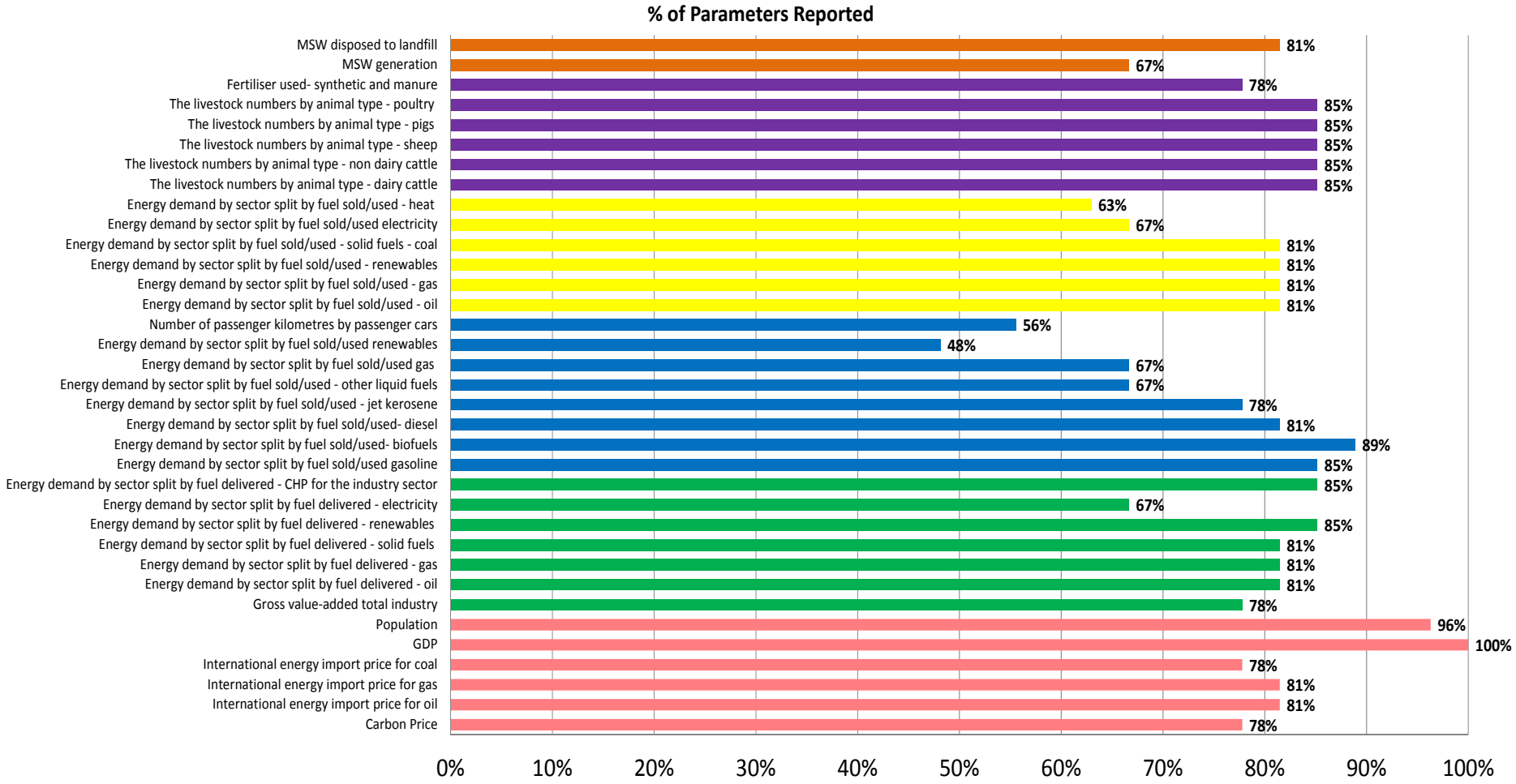
Source: ETC ACM, 2011

Figure 2-2 shows a summary of the completeness of reporting of parameters. The different colours have been used to distinguish the sector the parameter is linked to. The percentage of completeness varies for the different parameters: only 48 % of the data on 'Energy demand by sector split by fuel sold/used renewables' in the transport sector was reported by Member States, while all reported information on GDP assumptions. Most Member States reported projected population figures and the completeness for these two general economic parameters is the highest. For the parameters that reflect energy demand split by fuel type, the completeness is generally high for the dominant fuel types in each sector whereas the completeness tends to be lower derived fuels such as electricity and heat from CHPs. Thus,

[7] 35 mandatory parameters required under the MM Decision and also required to perform the Quality Assurance procedure are listed in the 'Quality assurance/quality control procedure for the reporting of projections under Decision 280/2004/EC (the EU Monitoring Mechanism Decision)' document (ETC-ACM, 2011).

important parameters which will reflect emission levels in the inventory for that sector are reported. Reporting of 'Energy demand by sector split by fuel sold/used renewables' in the transport sector is low because Member States are likely to have included their renewable energy consumed in the transport sector into 'Energy demand by sector split by fuel sold/used- biofuels'. Other parameters, where the completeness is low, are those parameters not commonly used in the projections compilation (for example, 'MSW generation').

Figure 2-2 Summary of the completeness of reporting of parameters



Source: ETC ACM, 2011

Note: The colours indicate the sectors associated with the parameter. Pink – total emissions (overall economic parameters), green – industry, blue – transport, yellow – residential, purple – agriculture and orange – waste.

3 Consistency of projections

The majority of the reported projections were internally consistent, meaning that total emissions (excluding LULUCF), sectoral emission split by IPCC sectors and emission split between ETS and non ETS sectors for the projected years 2010, 2015 and 2020 were consistent with each other. Most internal inconsistencies in the original submissions were corrected during the implementation of the QA/QC procedure. Consistency issues could not be resolved for only three Member States: Bulgaria, France and Slovakia.

For two Member States, a difference of over 3 % was found between emissions reported in the projections data set for a reference (historic) year and emissions for the same year reported in the 2011 national inventory report to the UNFCCC. A difference of 8.9 % was even observed for Bulgaria for emissions in the reference year 2008. Consistency checks of reference year emissions ('reference year check') carried out at sectoral level led to adjustments for 12 out of 27 Member States because differences higher than 3 % was found for at least one of the sectors reported.

Germany, Poland, Portugal, Romania and Sweden used reference years before 2008 to compile their projections. For these Member States and Bulgaria (due to high difference in emissions in the reference year and equivalent emissions in the 2011 inventory) the reported 2010 projections were compared against the EEA 2010 proxy emission estimates. The 2010 projections reported by Romania, Bulgaria and Portugal were 47 %, 22 % and 15 % higher than the EEA 2010 proxy emission estimates, respectively. This shows that there is a high risk that the financial crisis was not properly accounted in their projections and as a result a high risk that the 2010 projections (and consequently the projections for subsequent years) were overestimated. The opposite situation was observed for Sweden, where 2010 projections were 4.9 % lower than the 2010 proxy estimate.

Bulgaria, Germany, Poland, Portugal and Sweden indicated in their submissions that the financial crisis had been taken into account in their projections, which shows that Bulgaria and Portugal's projections underestimated the impact of the crisis on GHG emission levels. Romania did not specify whether the financial crisis had been taken into account. However, the large discrepancy between the 2010 projections submitted by Romania and 2010 proxy estimate strongly suggests that the impact was not accounted in their submission.

3.1 Consistency of total projections with sectoral projections and ETS / non ETS projections

This section covers the results from the consistency checks. It presents the results of the analysis of the detailed sectoral projections Member States reported compared to their total projected emissions.

In the original Member State' submissions inconsistencies were found between the sum of the sectoral projections, the sum of ETS and non ETS components, and the total GHG projections (excluding LULUCF). Most of these inconsistencies were corrected during the implementation of the QA/QC procedure through communication between the ETC reviewer and the Member State. The main issues identified were the following:

- The sum of the sectoral projections reported by Bulgaria remains inconsistent with the total GHG projections (excluding LULUCF).
- The sum of the ETS and non ETS remains inconsistent with the total projections (excluding LULUCF) for the following Member States; Cyprus, Denmark, Germany, Greece, Latvia and Sweden. However Cyprus' discrepancy of 0.7 % of the projected emissions in a given year was the largest, and thus these differences were considered negligible.
- For Slovakia, only the CO_2 emissions were split into ETS and non ETS components and the inconsistency between the sum of ETS and non-ETS was close to 20 % of total projections in 2010. After further communication with Slovakia, the ETS and non ETS data was gapfilled (c.f Chapter 6).
- France provided two sets of projections corresponding to two different geographical scopes, covering either all French overseas territories (sectoral and total projections) or only those part of the EU (ETS / non ETS split), the latter corresponding to the actual requirement under the MM Decision. In order to ensure that the relevant territorial coverage (i.e. EU territory) was used in further assessment using total projections, this was replaced with the sum of the ETS and non ETS data, however the sectoral data was kept as in the original submission. Thus in the final set of projections, there is an inconsistency of around 1 % (varies across the years) between the sectoral projections just covering the French territory within the EU and total projections covering the French territory plus all overseas territories.

3.2 Consistency of projections with historic inventories

Many Member States were unable to use their 2009 inventory data (reported in their 2011 submissions) as the starting point to generate projections. This was because the submission date for the projections under Article 3.2 of the EU MM (see Table 3-1) was too close to the completion of their 2009 GHG inventories to allow integration of these historical data into their projections

Table 3-1 Reference year used for projections submitted in 2011

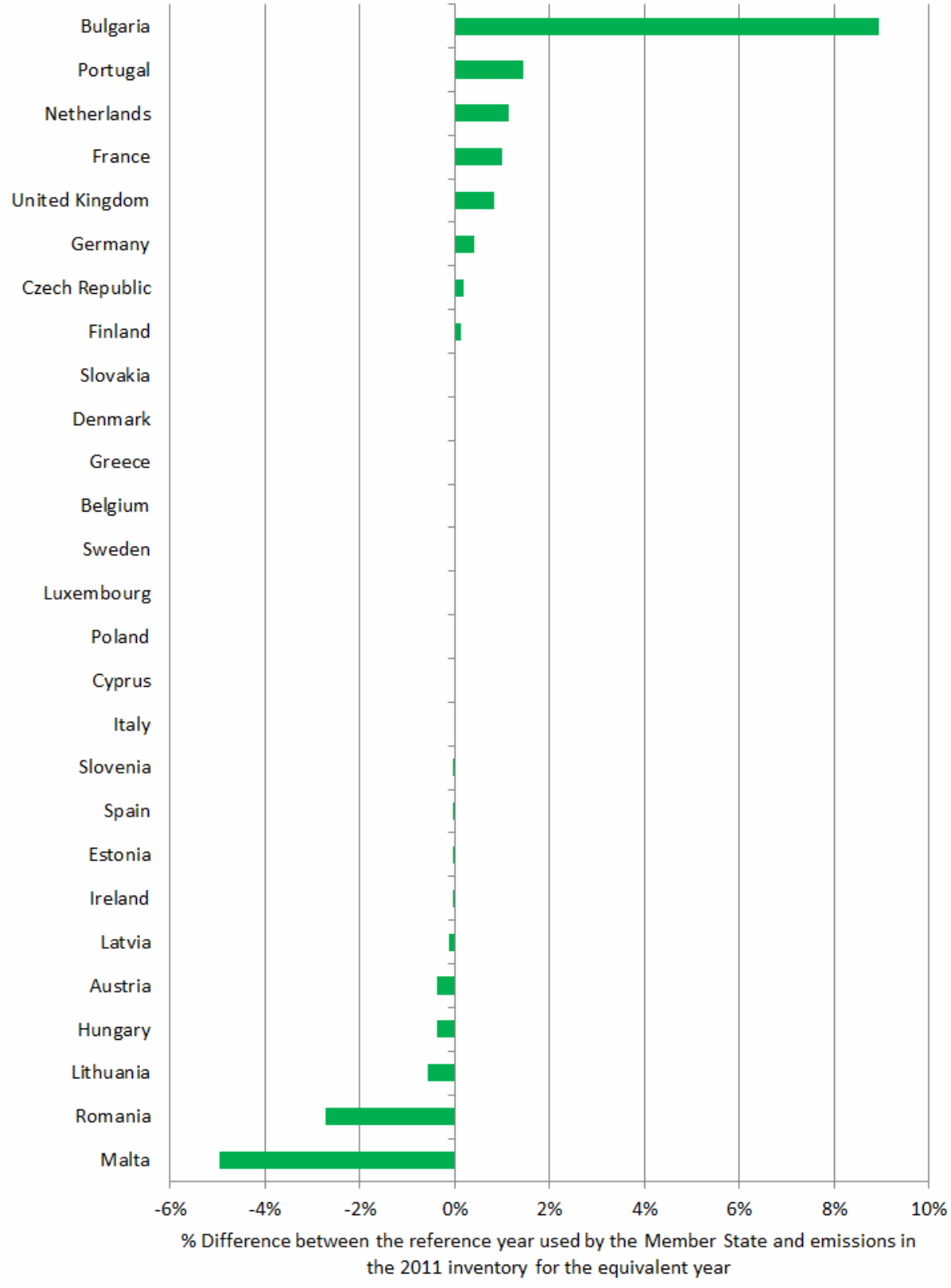
Country	Reference year
Germany (2009 submission), Portugal (2009 submission)	2005
Romania	2006
Poland, Sweden	2007
Austria, Belgium, Bulgaria, Czech Republic, Estonia, Finland, United Kingdom, Greece, Hungary, Latvia, Luxembourg, The Netherlands, Slovenia, Slovakia	2008
Cyprus, Denmark, France, Ireland, Italy, Lithuania, Malta, Spain	2009

Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011)

The comparison of the reference year used by the Member States and emissions from the same year in the 2009 inventory (reported in 2011) checks the time series consistency of the reported projections (c.f Figure 3-1). The largest difference exists for Bulgaria (8.9 %). This assessment was performed on a sectoral basis and if emission levels for the reference year used in the projections and in the 2009 inventory for the same year differed by more than 3 %, then the percentage difference was applied to the projected emissions for the sector for all years. Whereas for total projections the difference was only above 3% for two Member States (c.f Figure 3-1), 12 (Austria, Cyprus, Estonia, Germany, Hungary, Latvia, Lithuania, Malta, the Netherlands, Portugal, Slovakia and the United Kingdom) submissions were found to be time series inconsistent at sector level. The reported projections were adjusted for these Member States. This adjustment brings the reported projections in line with the latest inventory based on the difference in the reference year.

The specific reference year used by Member States for projections also gives an indication of the time when projections were made. For instance, the old reference year used by Romania (2006) suggests that updated emission data was not available at the time these projections were made, which would mean that Romania submitted in 2011 projections that were actually compiled several years before. Consequently, the risk is high for this country that projections did not take into account the latest economic and policy developments at EU and national levels.

Figure 3-1 Difference between the reference year used by Member States and emissions in the 2009 inventory for the same year (total projections excluding LULUCF)



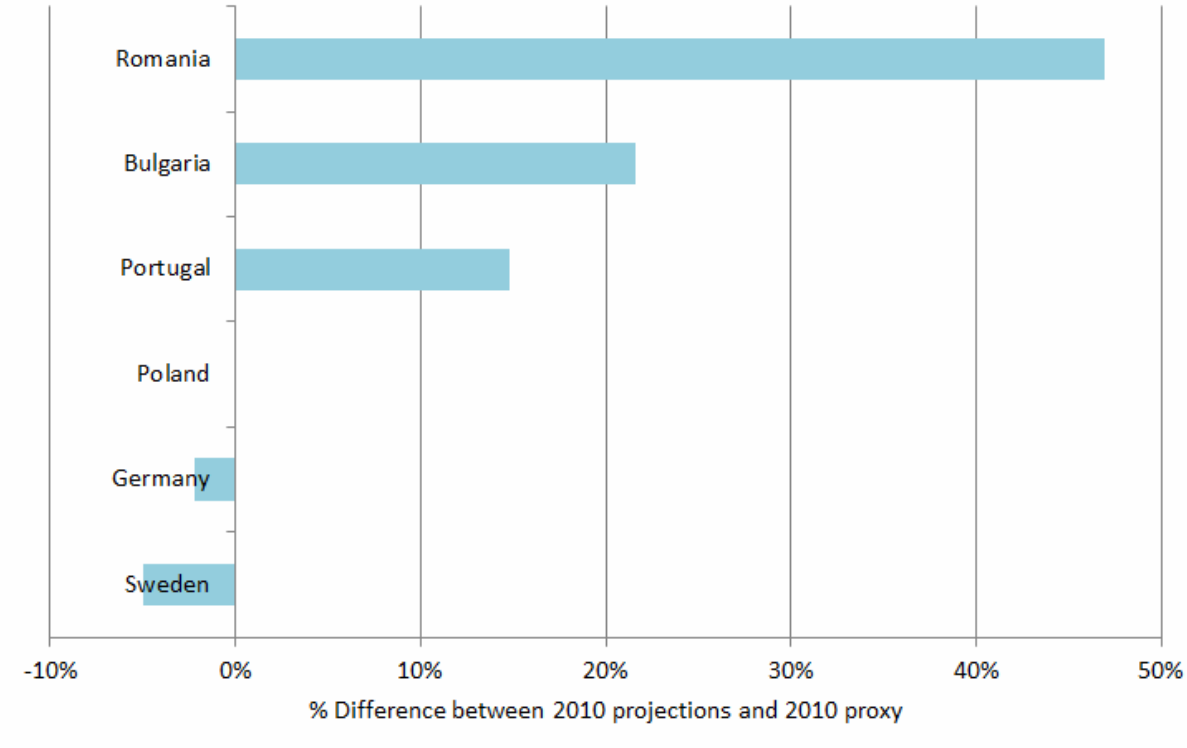
Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), EEA, 2011a

3.3 Consistency against 2010 proxy

If Member States use reference years prior to 2008 as the starting point for their projections, there is a risk that the financial crisis was not taken into account and as a consequence that there is a risk that the accuracy of their projections was reduced. Thus, the 2010 projections in the submissions were compared against the EEA 2010 proxy emission estimates (EEA, 2011c) for those Member States who used reference years prior to 2008 and Bulgaria (due to the large discrepancy observed in the reference year check). It should be noted that such 2010 estimates were not available at the time projections were made, so this check could not have been done by Member States themselves as part of their internal QA procedure before submission under the MM Decision.

Bulgaria, Germany, Poland, Portugal and Sweden indicated in their submissions that the financial crisis had been taken into account in their projections. If projections do not take into account of the financial crisis then the 2010 projections will be much higher than the EEA 2010 proxy emission estimates (EEA, 2011c) which does take into account of the financial crisis. Reported projections will be lower if the recovery from the financial crisis is underestimated.

Figure 3-2 Difference between the 2010 projections reported by Member States and 2010 proxy



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), EEA, 2011c

2010 projections reported by Romania, Bulgaria and Portugal, adjusted to be consistent with the 2011 inventory, is more than 5 % higher (47 %, 22 % and 15 % higher) than the EEA 2010 proxy emission estimates (EEA, 2011c). As a result there is a high risk that the financial crisis has not been accounted accurately in the projections reported by Bulgaria and Portugal and therefore there is a high risk that the 2010 projections (and consequently subsequent years) are overestimated. Romania did not specify whether the impact of the financial crisis had been included in the projections but the old reference year used by Romania suggested that it was highly likely that it had not been taken into account. The large discrepancy between the 2010 projections submitted by Romania and 2010 proxy estimate provides concrete evidence that the impact was not accounted for in the submission. The opposite is true for Sweden and their 2010 projections are 4.9 % lower than the 2010 proxy. There is a risk that Sweden has underestimated their recovery from the financial crisis in 2010, but the difference is just below the threshold for correction of 5 %.

4 Consistency and accuracy of key economic parameters

Values of parameters reported by Member States as part of their submissions of projections were compared against corresponding data from a number of reference data sets. This comparison helped assess the consistency and the risk of inaccuracy of the reported projections. The parameter data used are gross domestic product (GDP), population and corresponding emissions intensities based on GDP and population. The check was split into three components for each parameter. The first check assessed the accuracy of the projected assumption in 2010; secondly the growth rate of the parameter was assessed for the periods 2010-2015 and finally the same assessment was performed for the period 2015-2020. Emission levels for 2010 are not yet available, thus only the latter two checks were performed for emission intensity parameters. Where relevant, from each check a risk level (high, medium or low) was determined for the various parameter regarding potential over (+) or underestimation (-). Where 2010 projections were compared with actual statistics, the assessment clearly showed that the projections were over or underestimated. The risk levels identified from each of these checks are stated in bold in the following texts.

GDP

2010

2010 GDP data reported by Latvia, Romania and Bulgaria were 20 %, 17 % and 9.6 % higher than the 2010 GDP reported by the statistical office of the European Union (Eurostat). Finland's 2010 GDP assumption was 17 % lower than the data from Eurostat. Further investigation showed that GDP assumptions used by Bulgaria and Romania were higher than the observed GDP in 2010. Finland and Latvia's differences were explained by other reasons not linked to the over or underestimation of GDP assumptions.

Bulgaria: (+) and **Romania:** (+).

2010-2015

Greece and Luxembourg reported pessimistic assumptions about their economic growth between 2010 and 2015 compared to the growth rates reported and used in the 2009 Ageing Report from the European Commission (DG ECFIN, 2009), which presents demographic and economic perspectives at national level within the EU until 2060. Due to the current economic situation and perspectives, the future growth in the European economies (and GDP) might very well be slower than anticipated in the Ageing Report, at least in Greece. Belgium, Bulgaria and Romania expect much higher economic growth than the Ageing Report. Yet, Romania only expects a prolongation of its historic growth. **Greece:** (Low, -), **Luxembourg:** (Medium, -), **Belgium:** (Medium, +), **Bulgaria:** (Medium, +) and **Romania:** (Low, +).

2015-2020

Bulgaria, Poland, Belgium, Romania and Latvia present more optimistic assumptions regarding their economic growth than the Ageing Report. The risk of the economic growth being overestimated is higher for Belgium and Bulgaria: these two countries expect a much higher growth than that observed during the period from 2003 to 2008, while the growths projected by Latvia, Poland and Romania are only as high as those experienced by these countries during 2003-2008 . **Belgium:** (Medium, +), **Bulgaria:** (Medium, +), **Latvia:** (Low, +), **Poland:** (Low, +) and **Romania:** (Low, +).

Economic emissions intensity

Further decoupling of emissions and economic growth are expected in all Member States during 2010-2020. The rate of decoupling depends largely on the how successful the Member State has been in decoupling their emissions and GDP growth already. Based on the comparison of the projected change in emissions per GDP with the observed change during 2003-2008, there is a low risk that Belgium and Cyprus have underestimated their growth in emissions during 2010-2015 and a low risk that Greece and Portugal has overestimated their growth in emission during the same period.

Between 2015 and 2020, there is a low risk that Belgium, Cyprus and Malta have underestimated and the Netherlands and Romania have overestimated their growth in emission projections. Luxembourg clearly specified that their GDP growth and emission levels are not closely linked. Issues associated with over or underestimation of GDP growth must be resolved to use the indicator emissions per GDP to determine the under or overestimation of emissions with more confidence.

2010-2015 - Belgium: (Low, -), **Cyprus:** (Low, -), **Greece:** (Low, -) and **Portugal:** (Low, -). **2015-2020 – Romania:** (Low, +), **Belgium:** (Low, -), **Cyprus:** (Low, -), **Malta:** (Low, -) and **the Netherlands:** (Low, +)

Population

2010

In general, population levels in 2010 assumed by the Member States and the actual figures reported by Eurostat are similar. Discrepancies exist for Bulgaria, France, Luxembourg and Spain. In the case of France, the differences result from different geographical scopes covered by each data set (i.e. whether overseas territories are included or not). The difference between the population data reported by Luxembourg and Spain, and the Eurostat data varies across the time series and the reasons for the discrepancy are not understood. The population assumptions used by Bulgaria for 2010 was higher than the observed population levels in 2010.

Bulgaria: (+), **Spain:** (Medium, +) and **Luxembourg:** (Medium, +)

2010-2015

The population growth projected by Ireland, Portugal and Spain during 2010-2015 is much lower than both the growth reported in the EC Ageing Report, and the observed growth in these countries between 2003 and 2008. There is a medium risk that the population growths expected by these Member States during 2010-2015 have been underestimated.

Emissions per capita

Unlike the economic emissions intensity, many Member States, in particular in the EU-12, saw their emissions per capita increase during 2003-2008 (Bulgaria, Estonia, Latvia, Lithuania, Poland and Slovenia) and many Member States project their emissions per capita to increase in the future. This is because at least for these countries, emissions per capita are still closely related to the wealth of the country which in turn is linked to the energy consumption. Similar to emissions per GDP, the expected trend is linked to the current emissions per capita levels which are higher in the EU-15 than the EU-12.

The projected change in emissions per capita during 2010-2015 and 2015-2020 are 15 % higher than the observed change during 2003-2008 for Bulgaria, Denmark (2015-2020), Finland (2010-2015), Romania and Lithuania. Both Bulgaria and Romania expect a much quicker increase in total energy consumption relative to their growth in wealth in their projections compared to the observed trend in historic years. The opposite is true for Lithuania and there is a risk that the projected energy consumption reported by Lithuania is too low relative to their growth in wealth. As a result, there is a low risk that Bulgaria and Romania have overestimated and Lithuania has underestimated their emission projections. The difference between the historic change and projected change is higher than 15 % for Denmark and Finland because of the large reduction in emissions per capita observed during 2003-2008 as a result of particularly low rainfall in Norway and Sweden causing insufficient hydropower production in both countries in 2003.

2010-2015 and 2015-2020 - Bulgaria: (Low, +), **Lithuania:** (Low, -) and **Romania:** (Low, +)

The results showed that trends in GHG emissions per capita cannot be directly interpreted and used to determine the risk of over or underestimation of emission projections because they are affected largely by country-specific circumstances.

The previous chapters have presented an assessment of the completeness and consistency of the emission projections and parameters reported by the Member States. This chapter analyses specifically the parameters GDP and population which are reported as part of these projected emissions. Projection compilers in each Member State may use country specific values for these parameters to create the national projections. This means that problems with the consistency of the parameters could reduce the accuracy of the projections. It is likely that there is a close or in some cases a very close association between these key economic parameters and projections. Some Member States emission levels may be more sensitive to these parameters because economic growth and emission levels are not as decoupled as in other Member States and methodologies used to generate the projections vary. For simplicity, we assume there is a very close association between the parameters and projections. The approach to assessing the quality of the parameters was to first check whether the reporting of the parameters was complete, and to then assess the consistency of the parameters. The results then feed into an assessment of the accuracy of the projections (see Chapter 5).

The reporting of GDP and population was generally complete. All Member States reported a complete time series of GDP and 26 of the 27 Member States reported a complete time series of population data. Population data was not reported by Cyprus because the parameter was not used to compile the projections and as a result the consistency check of the projected population was not possible for Cyprus.

4.1 Consistency

Two checks were applied to the reported time series of GDP and population to help determine the consistency of projections submitted by the Member States:

1. **2010 comparison** – compares the 2010 assumptions of GDP and population used by the Member States with the actual 2010 data reported by Eurostat;

2. **Growth check** – compares the growth assumptions of GDP and population used by Member States for the periods 2010-2015 and 2015-2020 against the projected trend in the EC Ageing Report and the actual growth observed between 2003 and 2008;

Following this, both GDP and population are analysed in the context of their relationship with emissions projections by using the indicators *GHG emissions per GDP* and *GHG emissions per capita*. A final check is then performed using both of these indicators:

1. **Emission intensity trend** – compares the relative change in emission intensity, derived using the projected parameters (GDP and population) and the reported projections, for the periods 2010-2015 and 2015-2020 with the actual change observed between 2003 and 2008.

The results of these checks are then combined to help judge the accuracy of the reported projections (Chapter 5). The same checks are performed for the key IPCC sectors in the Annex using sector specific parameters. The 2010 comparison is not carried out if the actual 2010 statistics are not yet available and the emission intensity trend check has not been carried out for the sectoral parameters.

4.1.1 Gross Domestic Product

4.1.1.1 Consistency against 2010 Eurostat data

The 2010 GDP parameter data reported by the Member States has been compared against 2010 historic data reported by Eurostat. This reveals the consistency between the data used by the Member States and the Eurostat data. This consistency is important as the GDP assumption used by Member States is likely to affect the starting points of their projections, and hence can lead to a systematic over or underestimation of the trajectories of the projected economic growth out to 2020. The most likely reason for the deviation of the 2010 estimates of GDP reported by Member States against the reported Eurostat data is a failure to have fully, or to only have partly, taken the effects of the economic crisis into account.

To reveal whether there is a risk that the 2010 assumptions of GDP used by Member States are over or underestimates, the difference between the Member State's assumption and Eurostat is calculated as a percentage of the Eurostat figure. If this difference is greater than 10 %, further analysis is then performed to identify whether there is in fact a risk, and if so, the qualitative level of the risk (low, medium or high). The 2010 data reported by Eurostat are actual data rather than estimates. Therefore, divergence from these Eurostat data indicates that there is a high risk that the GDP estimates used by Member States are over or underestimates unless defensible reasons for the differences can be found.

Figure 5-2 shows how the projected 2010 GDP estimates from the submission of each Member State compares with the actual 2010 GDP data reported by Eurostat. Where the percentage change is positive in Figure 5-2, the GDP in 2010 assumed by the Member States is higher than the Eurostat data, and where the change is negative, the opposite is true. Where the Member State data is more than 10 % higher than the Eurostat data, the bars are red, and where the Member State data is lower than 10 % of the Eurostat data the bars are green.

Figure 4-1 Difference between the projected 2010 GDP assumption reported by the Member States and the 2010 data in Eurostat as a percentage of the Eurostat value

Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), Eurostat, 2011 – parameter "nama_gdp_k-GDP and main components – volumes"
Note: Red bars indicate Member States whose assumptions are higher than Eurostat by 10 % or more and green bars show those which are lower by 10 % or more

Reported GDP assumptions by Member States vary significantly because the information reported by many Member States have to be converted to harmonised units to enable a comparison with Eurostat which introduces uncertainty. In addition GDP has varied can be volatile as observed during the financial crisis.

A difference of greater than 10 % exists for three Member States (Latvia, Finland and Romania). In addition, the difference for Bulgaria is very close to 10 %.

- Latvia's GDP assumption in 2010 is 20 % lower than the GDP reported in Eurostat in 2010. A closer inspection of the historic GDP figures shows that the historic GDP data reported by Latvia is systematically 20 % lower than the Eurostat data for all years, thus there is no risk of overestimation;

- Romania's 2010 GDP assumption is 17 % higher than the data in Eurostat. Comparison of the GDP figures in 2000 reported by Romania and Eurostat show that there is no systematic discrepancy similar to the one observed for Latvia. Thus, there is a high risk that the GDP assumption for 2010 used by Romania is too high and that the impact of the financial crisis was not accounted for in the projections.;

- Finland's GDP assumption in 2010 is 17 % lower than the Eurostat data. No historic GDP figures have been reported, thus it is not possible to determine whether the deviation in the 2010 data is the result of a systematic difference (as it is for Latvia). There is a risk that the GDP estimate is an underestimate but further investigation on the projections in 2010 is required to see if the GDP has been underestimated. If the GDP is an underestimate then this would reflected on the emission trend.

- Bulgaria's 2010 GDP estimate is 9.6 % higher than the value in Eurostat. The comparison of the reported GDP for 2005 and those in Eurostat show that there is no systematic discrepancy. Thus, there is a high risk that the 2010 GDP assumption used by Bulgaria is an overestimate as a result of not taking into account the impact of the economic downturn. As for Romania, this partly explains the large discrepancy observed between the 2010 projections reported by Bulgaria and 2010 proxy estimated by the EEA (Section 3.3).

4.1.1.2 Growth check during 2010-2015 and 2015-2020

The expected growth in GDP assumed by the Member States has been compared against the forecasted growth over the same period in the EC Ageing Report, published by DG EC FIN (2009). This check identifies Member States who are using optimistic or pessimistic assumptions for their economic growth compared to the projected growth estimated by DG EC FIN. The projected economic growth estimated by DG EC FIN is derived from modelling studies, and the data will be associated with some uncertainty. Hence it is unlikely that there

would be very close agreements between the two data sets. The criteria applied to judge the risk of over or underestimation by Member States have been selected to take this into account.

The difference between the growths rates of the two datasets are calculated by subtracting the growth rate estimated by DG EC FIN from the growth rate reported in the Member State submissions. This method only identifies notable absolute differences which exist for Member States and does not reflect the notable relative differences. This is valid because large differences in relative terms (e.g. 0.5 % is five times higher than 0.1 % but the absolute difference is very small) do not lead to significant differences in the actual parameter. The criteria below have been applied:

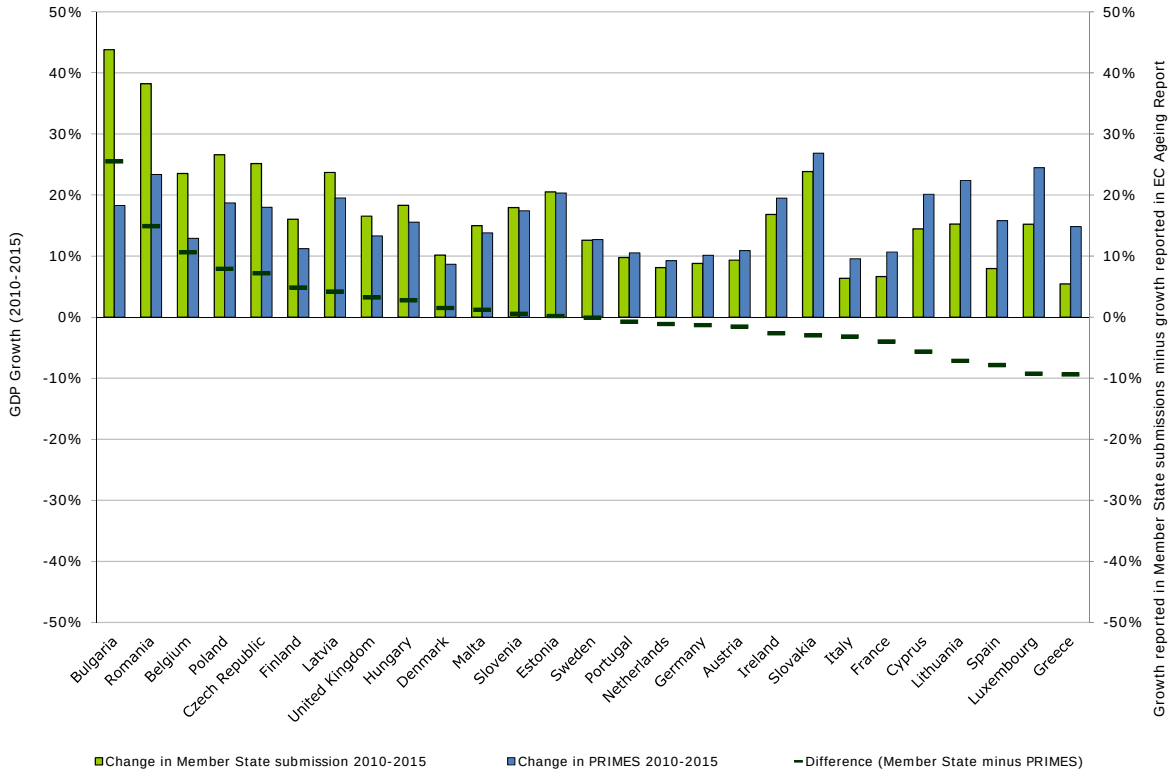
- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated their GDP growth if the difference between the data estimated by Member States and by DG EC FIN is less than or equal to 10 %.
- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated their GDP growth if the difference between the data estimated by Member States and by DG EC FIN is less than or equal to 10 %.

The highest risk assigned to this check is a medium risk (that Member States have over or underestimated their growth rates), because of the inherent uncertainties in the data sets used.

The reports submitted by Member States with their projections under Article 3.2 of MM Decision (hereinafter referred to as Member States' projections reports) were examined for those Member States with percentage differences of +/-10 %, to check for any information to understand the reasons for the differences between the two sets of projections. In addition, the growth rates for the Member State were compared against the actual growth which took place between the five year period 2003 and 2008. The most recent five year period 2004 to 2009 is omitted because the use of 2009 data will distort the trend observed in historic years due to the financial crisis.

If the historic change is more in line with the growth assumptions used by the Member States to compile their projections, any medium risk of over or underestimation is downscaled to a low risk. The risk is also only considered as low if the projections reports contain reasons behind the growth trend projected by the Member State. Figure 5-3 shows the difference between the GDP growth assumptions from 2010 to 2015 reported by Member States and in the EC Ageing Report.

Figure 4-2 Difference between economic growth assumptions 2010-2015, Member State submissions and the EC Ageing Report



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), DG ECFIN, 2009

Where the difference in percentage change is positive in Figure 4-2, the projected growth of GDP assumed by the Member States is higher than the EC Ageing Report and where the change is negative, the opposite is true. Greece and Luxembourg are much more pessimistic about their economic growth during 2010 - 2015 than the EC Ageing Report. Greece and Luxembourg predict GDP to grow by 5 % and 15 % during 2010-2015, whereas the EC Ageing Report predicts a growth of 15 % and 24 % (difference very close to the 10 % threshold).

Greece and Luxembourg expect their economies to grow much more slowly than the historical growth observed during the 5 year period between 2003 and 2008 (see Table 4-1). However, based on the recent events related to the economic collapse, a slower future growth in the economies may better reflect the likely GDP growth, at least in Greece. Thus there is a low risk that Greece's GDP growth assumption between 2010 and 2015 is an underestimate and a medium risk for Luxembourg.

Between 2010 and 2015, Belgium, Bulgaria and Romania predict growth rates of more than 9 % higher than the EC Ageing report. Bulgaria has a more optimistic view of their economic growth in their WEM scenario in comparison to the EC Ageing Report. Bulgaria reported three projection scenarios with varying GDP assumptions of which the WEM scenario assumes the largest growth (44 % growth between 2010 and 2015) (see Figure 4-8). Bulgaria

experienced a significant economic growth (37 %) between 2003 and 2008 but the projected growth expected during 2010-2015 is even higher (by 7.1 %) than the historic five year period. This suggests there is a medium risk that Bulgaria's GDP assumptions between 2010 and 2015 are overestimated. Although the difference between the growth predicted by Belgium and the EC Ageing report is slightly smaller, the conclusion drawn for Belgium is the same.

Table 4-1 Difference between the projected growth rate of GDP during 2010-2015 and 2015-2020, and the actual growth from 2003 to 2008, EC Ageing Report and Member State submissions

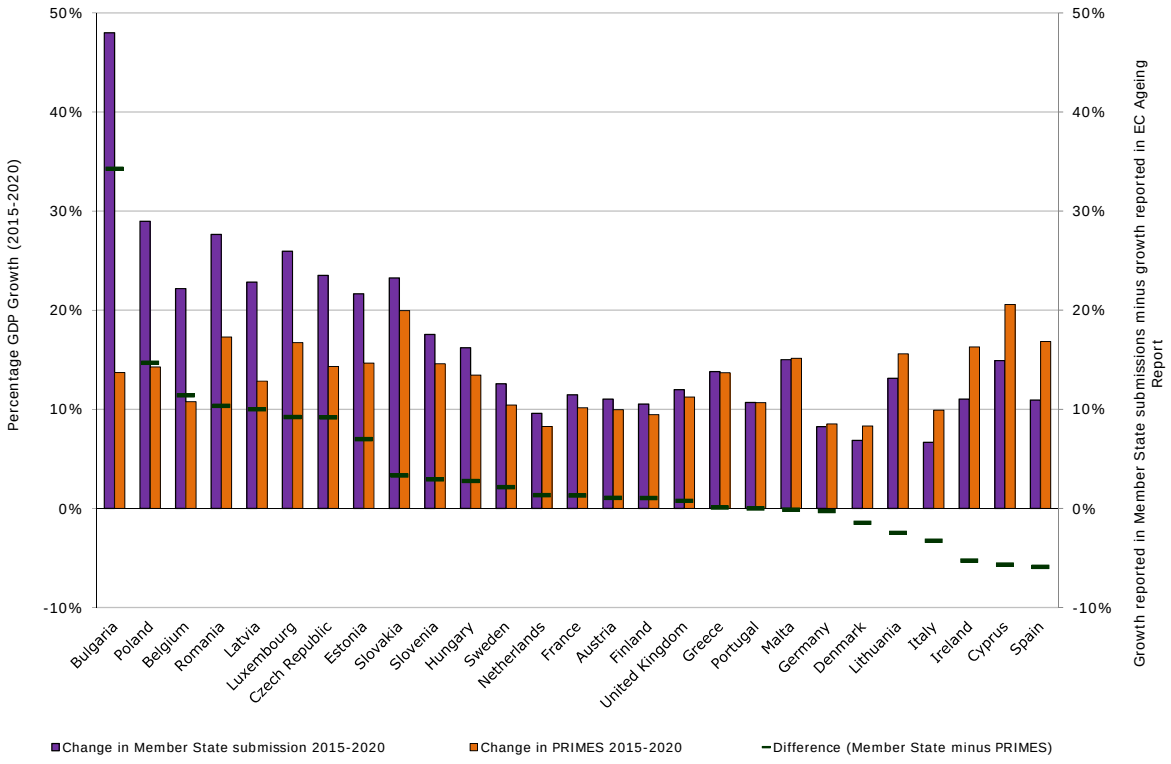
	2010-2015		2015-2020		
	Member State growth assumption	EC Ageing Report growth assumption	Member State growth assumption	EC Ageing Report growth assumption	Member State growth (2003-2008)
Belgium	23.5 %	12.9 %	22.2 %	10.8 %	12.1 %
Bulgaria	43.8 %	18.3 %	48.0 %	13.7 %	36.7 %
Greece	5.4 %	14.8 %	13.8 %	13.7 %	18.3 %
Latvia	23.7 %	19.5 %	22.8 %	12.8 %	42.1 %
Luxembourg	15.2 %	24.5 %	26.0 %	16.7 %	25.0 %
Poland	26.6 %	18.7 %	29.0 %	14.3 %	30.2 %
Romania	38.2 %	23.3 %	27.7 %	17.3 %	39.1 %
Spain	7.9 %	15.8 %	11.0 %	16.8 %	16.3 %

Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), DG ECFIN, 2009, Eurostat, 2011 – parameter "nama_gdp_k-GDP and main components – volumes"

For Romania, again their reported GDP growth estimate is much higher than that anticipated in the EC Ageing report. However, Romania experienced a very high growth of 39 % in GDP between 2003 and 2008 which is comparable to their expected growth of 38 % between 2010 and 2015. Thus, based on the observed economic growth in historic years, Romania's growth estimate can be considered a fair assumption. However because expected growth is much higher than the figure expected in the EC Ageing Report, it is concluded that there is a low risk that the GDP growth during 2010-2015 assumed by Romania is an overestimate.

Figure 4-3 shows the difference between GDP growth assumptions from 2015 to 2020, reported in Member State submissions and in the EC Ageing Report.

Figure 4-3 Difference between GDP growth assumptions 2015-2020, Member State submissions and EC Ageing Report



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), DG ECFIN 2009

Between 2015 and 2020, no Member States projected economic growth of less than 10 % compared to the EC Ageing Report. Bulgaria, Poland, Belgium, Romania and Latvia are more optimistic about their economic growth and expect growth more than 10 % higher. Belgium and Bulgaria's expected GDP growth between 2015 and 2020 are considerably higher in comparison to the historic growth rates observed between 2003 and 2008 supporting the evidence that an optimistic economic growth is expected. Hence there is a medium risk that the GDP growth assumed by Bulgaria and Belgium are overestimated. Poland's expected growth is in line with its historic growth. Latvia and Romania's expected growth is lower than the growth they experienced between 2003 and 2008. This shows that Latvia, Poland and Romania, despite the comparison against the EC Ageing report indicating that their projected GDP growth during 2015-2020 is optimistic; they expect their economies to grow in line with the historic trends. This implies there is a low risk that Poland, Latvia and Romania have overestimated their GDP growth.

4.1.2 GHG emissions per GDP

This GHG emission intensity check tries to identify the risks of the projections reported by Member states being over or underestimated by studying how emissions change with GDP.

The projected change in emissions per GDP (2010-2015 and 2015-2020) is compared against the observed change from the most recent historical data reported by Member States (2003 to

2008), excluding 2009. The comparison provides an indication of whether the Member States are being realistic, optimistic or pessimistic about the decoupling of emissions and economic growth compared to what has taken place in their countries in the past.

The analysis is supported by a commentary on the reasons for why difference exists for those Member States with large differences between the historical and projected GHG emission intensity trends (calculated using total emissions excluding LULUCF). This is based on projection reports submitted under the MM Decision in 2011 and National Inventory Reports (NIR) from previous years. GHG emission intensities are affected by a large number of factors such as the types of fuel used in the Member State, and the general structure and nature of the economy. There is normally a strong correlation between GDP and GHG emissions for Member States, but there are exceptions. For example, in the case of Luxembourg, the link between GDP and emission levels is weak, firstly because emissions from freight transport, which accounts for a significant share of the total emissions, is better correlated to an aggregated GDP from the surrounding Member States rather than the GDP of Luxembourg and secondly, because Luxembourg's economy is primarily made up of service sectors (Luxembourg, 2011).

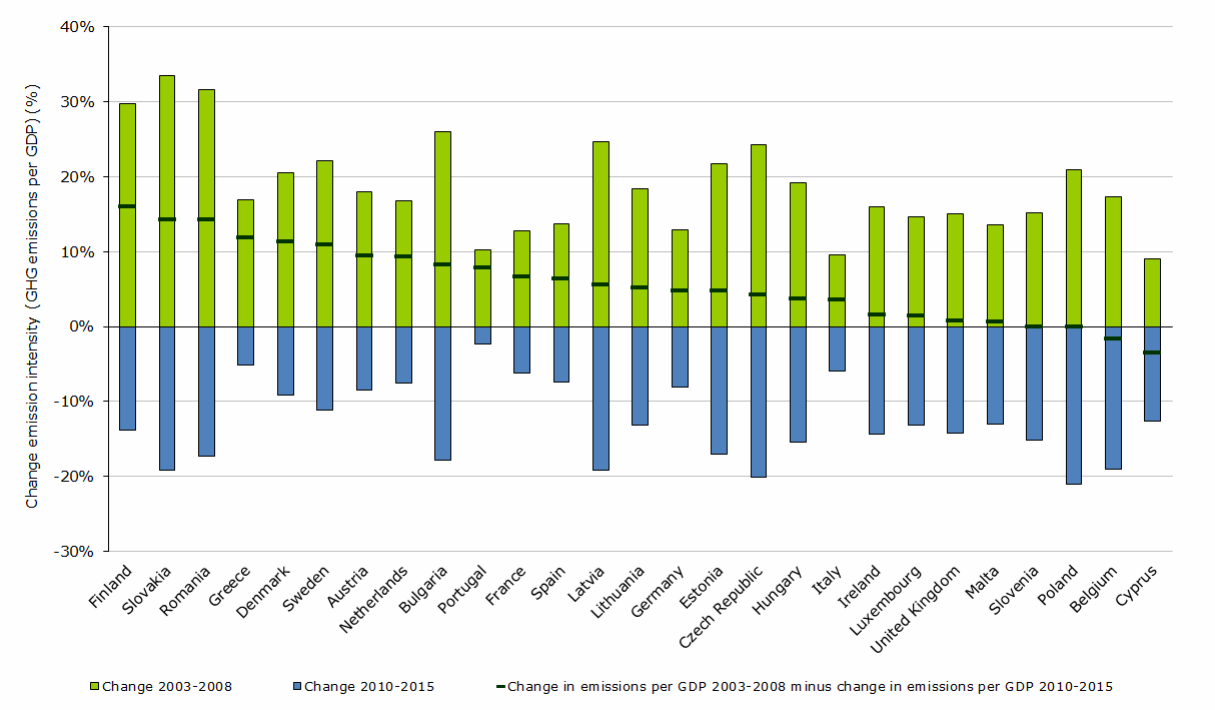
As previously stated, change in emission intensities can be attributed to a number of factors. Hence, it is not expected that the trend observed between 2003 and 2008 will continue at the same rate in projected years but is expect to reduce. If a Member State expects decoupling of emissions and GDP in future years at a significantly different rate to the historic trend, then there is a risk that the projected emissions have been over or underestimated. Information in the projections report and the NIR can provide explanations behind the change in the emissions per GDP trend. For example, if large changes in the economy, energy use or infrastructure are expected. If sufficient explanation is provided by Member States explaining why the historic trend deviates from the projected trend then there is little or no risk associated with over or underestimation of their projections. If no reasons have been provided there is a low risk that the emissions projections are over or underestimated. A much faster decline in emission per GDP thus indicates that there is a risk that the GHG projections have been underestimated and a much slower decline or an increase in emissions per GDP indicates that there is a risk that the GHG projections have been overestimated.

The level of decoupling of GHG emissions from the economic growth needs to increase in future years to ensure that economic growth will not lead to increasing GHG emissions. This is an important ambition for Member States, particularly for those with negative targets under the Effort Sharing Decision (ESD). Member States with positive targets under the ESD will also need to further decouple GHG emissions from economic growth and must ensure that increases in economic growth lead to increases in GHG emissions at a slower rate.

Due to the uncertainty of projected emission intensities per GDP in relation to historic years, Member States are not assigned a high or medium risk of over or underestimating their

projections. A risk that the projections have been over or underestimated can only be identified if the change in emissions per GDP is significantly different from the historic change. Figure 4-4 shows the change in greenhouse gas emission intensity (kg CO_2 / Euro GDP at 2000 prices) between projected years (2010 to 2015) and the actual change between 2003 and 2008.

Figure 4-4 Difference in the greenhouse gas emission intensity (kg CO_2 / Euro GDP at 2000 prices) between projected years (2010-2015) and the actual change between 2003-2008



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM 2011), EEA, 2011a, Eurostat, 2011 – parameter "nama_gdp_k-GDP and main components – volumes"
Note: Both the negative and positive y-axis shows a reduction in emission intensity. The black lines show the difference between the historic change and the projected change. The green bars show the percentage reduction of emissions per GDP observed between 2003 and 2008, and the blue bars show the projected reductions between 2010 and 2015. The black horizontal lines indicate the difference between these two intensities which have been calculated by subtracting the magnitude of the blue bar from the green bar for each Member State. The line above the x axis indicates that Member States have reported slower reduction in projected emission intensities compared to the observed reduction in the emission intensity between 2003 and 2008.

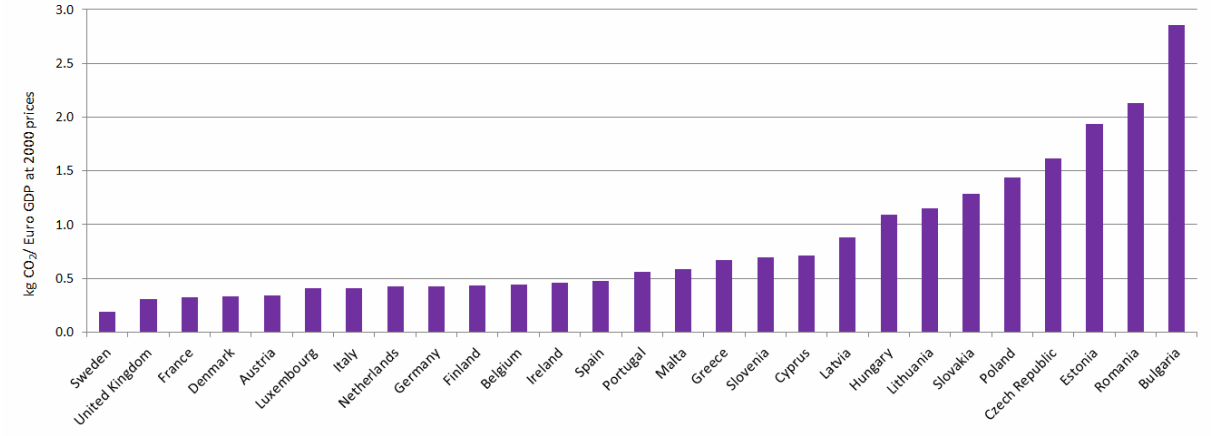
Figure 5-6 indicates that although the decoupling of economic growth and GDP is expected to continue in the future the speed at which the decoupling takes place will slow down compared to the historic trend for most Member States. Countries with negative differences on the right hand side predict a rapid decoupling of their emissions from GDP in future years compared to their historic trends.

All Member States expect to further decouple emission levels and economic growth in projected years. However the rate Member States expect to improve their GHG emission intensity to levels observed in the latest five year, varies significantly. Between 2010 and

2015, only Cyprus and Belgium expect a faster decline in GHG emission intensities than those observed between 2003 and 2008. No specific reasons have been reported by Belgium and Cyprus in their projections reports (Belgium, 2011) (Cyprus, 2011) which explain the greater decoupling of emissions and GDP in future years. A greater decline in emissions per GDP might indicate the risk that projected emissions are underestimated because the Member State is projecting that emissions will decouple much quicker than the decoupling observed in historic years. There is a low risk that Belgium and Cyprus' emission projections are underestimated.

Finland, Greece, Denmark, Sweden, Austria, Netherlands, Portugal and France, towards the left hand side of Figure 4-4, expect a decoupling of emissions and GDP slower than half of the observed rate between 2003 and 2008. All these Member States are all part of the EU-15. If all EU-27 Member States were ranked in ascending order by their 2009 economic emission intensities, six of the Member States mentioned above, excluding Greece and Portugal are ranked in the top 10 (c.f Figure 4-5). Thus, it is likely that many of the key and cost effective steps which drive down the emission intensity of GDP have already been implemented in these Member States.

Figure 4-5 Emission intensity (kg CO_2 / Euro GDP at 2000 prices) of Member States in 2009



Source: EEA, 2011a, Eurostat, 2011 – parameter "nama_gdp_k-GDP and main components – volumes"

GHG emission intensities in the EU-27 have declined in historic years as a result of the transitions from solid fuels to gaseous fuels, and from energy intensive industries to the services sector, and, from reduced economic activity in the chemical industry sector (EEA, 2009). As a result, it will become more difficult for these Member States with relatively low GHG emission intensities to further reduce their emissions per GDP. Therefore any decline in the rate of improvement of future GHG emission intensity does not necessarily imply a risk that the projected emissions are underestimated.

In 2009, Greece had the highest emissions per GDP in the EU-15 (16th in the EU-27) and as a result of the slow reduction between 2010 and 2015, they will become 18th in the ranking in 2015. The report accompanying Greece's projections states that the economic emission

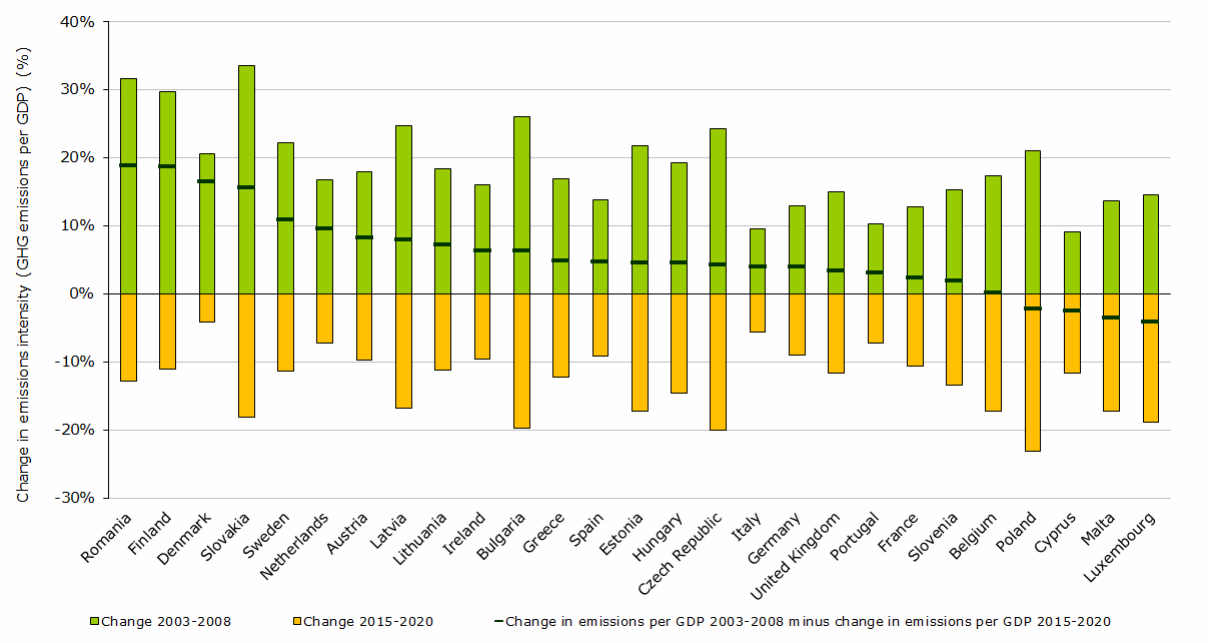
intensity 'shows a significant decrease during the period 2000-2020, as a result of implemented and adopted policies and measures, and particularly because of the penetration of natural gas and various renewable energy sources into the energy system.' The change in the GHG emission intensity figures reported in their report shows that between 2000 and 2010 they expect a reduction of 24 % but between 2010 and 2020 the reduction will falls to 15 % during the ten year period (Greece, 2011). The change in GHG emission intensity reported by Greece for 2010-2015 is thus pessimistic compared to the historic trend. Portugal's pessimistic view of further decoupling emissions and GDP compared to the rate of decoupling observed in historic years also indicate that there is a low risk that Portugal has overestimated their emissions respective to the GDP growth projections.

The fall in emission per GDP observed in Slovakia during 2003-2008 is the highest decline of all EU-27 Member States, as result of a small fall in emissions despite a large increase in GDP. Slovakia project further decoupling of emissions and GDP but at a slower rate than the impressive rate observed during 2003-2008. Based on the trend observed in other Member States, it is fair to assume that Slovakia's emissions per GDP may not continue to fall at the same impressive rate observed in historic years.

There are low risks that Belgium and Cyprus have underestimated their emission projections and a low risk that Greece and Portugal has overestimated their projections based on the GDP growth projected by these Member States. However, Belgium and Greece are associated with risks of overestimated projected GDP growth (Belgium) and underestimated projected GDP growth (Greece). The results from analysing the projected trend of emissions per GDP shows that the emission levels reported by these Member States may in fact better reflect a lower growth in GDP for Belgium (slower decline in emissions per GDP) and higher growth in GDP (quicker decline in emissions per GDP) for Greece which are more in line with the Ageing report and historic growth. This would reduce the risk associated with the projections being over or underestimated. In order to use emissions per GDP to determine the over or underestimated emission projections with more confidence, these issues around over or underestimating GDP growths must be resolved in the first instance.

Figure 4-6 shows the difference in the change in greenhouse gas emission intensity (kg CO_2/ Euro GDP at 2000 prices) between projected years (2015 to 2020) and the actual change between 2003 and 2008. This figure complements Figure 4-4, but provides an analysis of the GHG emission intensity further into the future.

Figure 4-6 Difference in the greenhouse gas emission intensity (kg CO_2 / Euro GDP at 2000 prices) between projected years (2015-2020) and the actual change between 2003-2008



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), EEA, 2011a, Eurostat, 2011 - nama_gdp_k-GDP and main components – volumes
Note: Both the negative and positive y-axis shows a reduction in emission intensity. The black lines show the difference between the historic change and the projected change.

In Figure 4-6, the yellow bars show the projected reductions between 2015 and 2020. For the period 2010 to 2015, Belgium and Cyprus expect their GHG emission intensities to fall more quickly than the observed reduction between 2003 and 2008. For the period 2015-2020, these countries also expect their GHG emission intensities to fall more quickly, and in addition, so do Poland, Malta and Luxembourg.

In previous years, energy efficiency in Poland improved largely due to progress in energy efficiency of products such as new water heating boilers fired by liquid and gaseous fuels and household appliances. This and technological modernisation projects such as commissioning of fluidised-bed boilers, co-incineration with biomass and cogeneration also contributed to reducing energy intensity of GDP. Poland aims to further reduce their energy intensity by:

- improving electricity production efficiency through the construction of high-efficiency generating units;
- increasing electricity production which use high-efficiency cogeneration technology; and
- reducing network loss rate in electricity transmission and distribution.

In addition, the Polish projections assume that the fastest growing economic sector will be services, whereas the share held by industry in the total gross value added for Poland is

expected to fall. Both these factors explain the faster decline in GHG emissions per GDP during 2015-2020 (Poland, 2011).

The magnitude of GDP is not a suitable indicator of GHG emissions in Luxembourg. This is largely because Luxembourg accounts for emissions from road freight transport from traffic in transits between countries which are not solely linked to GDP from Luxembourg but aggregated GDP from various EU Member States surrounding Luxembourg (Luxembourg, 2011). The fall in the economic emissions intensity in Luxembourg during the period 2015-2020 is quicker than the reduction observed between 2003 and 2008. However since the link between GDP and emissions is weak this check does not identify whether there is a risk that Luxembourg's projected emissions are underestimated in relation to the change in GDP. There are no specific reasons provided for the reduction in economic emission intensity for Malta so there is a low risk that the emissions projections are underestimated. But the change is small.

Finland, Denmark, the Netherlands and Romania expect their GHG emission intensity during the period 2015-2020 to fall by less than half of the reduction observed between 2003 and 2008. Finland's GHG emission intensity fell by an impressive 30 % between 2003 and 2008, largely as a result of a decline in emission in the electricity supply sector. Historic emissions peaked in 2003 as a result of increased electricity generated from coal and peat combustion in Finland which was also exported to the Nordic electricity markets (Finland, 2005). Since then, emission levels fell again mainly as a result of electricity import increasing back to levels observed before 2003. As a result the reduction in economic emission intensity observed between 2003 and 2008 was very high. This one off event has introduced a bias, and as a result the change in the projected economic emission intensity is lower than the actual change observed between 2003 and 2008.

In Denmark, the slow future reduction in economic emission intensity is partly due to the fact that Denmark already is one of the least GHG emission intensive economies in the EU-27 (5th). No further explanations are provided in the Danish projections report. The situation is similar for the Netherlands although their current GHG emission intensity is higher than Denmark and other Member States (9th lowest economic emission intensity in 2009) and as a result of this slow decline, they will move to rank 11 in the EU-27 in 2020. Thus there is a low risk that the Netherlands have overestimated their emission projections.

Romania projects emissions per GDP to fall by 13 % during 2015-2020 which is much lower than the rate of change observed during 2003-2008 (32 %). In 2009, Romania had the second highest emissions per capita in the EU-27 and their projections report states that 'a substantive potential still exists to further reduce the carbon intensity of the Romanian economy and to decouple and lower the GHG emissions growth trend from the GDP growth trend'. 'The objective of the Romanian Government is to continue implementing existing and future EU policies and measures in order to reduce the carbon intensity of the Romanian

economy and to stabilize the GHG emissions at current levels considering the potential economic growth' (Romania, 2011). However, their pessimistic view on further decoupling emissions and GDP suggests emissions per GDP in Romania will fall in the future to its potential. There is a low risk that Romania's growth in emissions during 2015-2020 is an overestimate in comparison to the decoupling observed in historic years.

4.1.3 Population

A similar analytical approach to that used for GDP has been applied to projected population assumptions (see Subsection 4.1.1). The single difference in the approach is the criteria used to determine if the assumptions used by the Member States are over or underestimated.

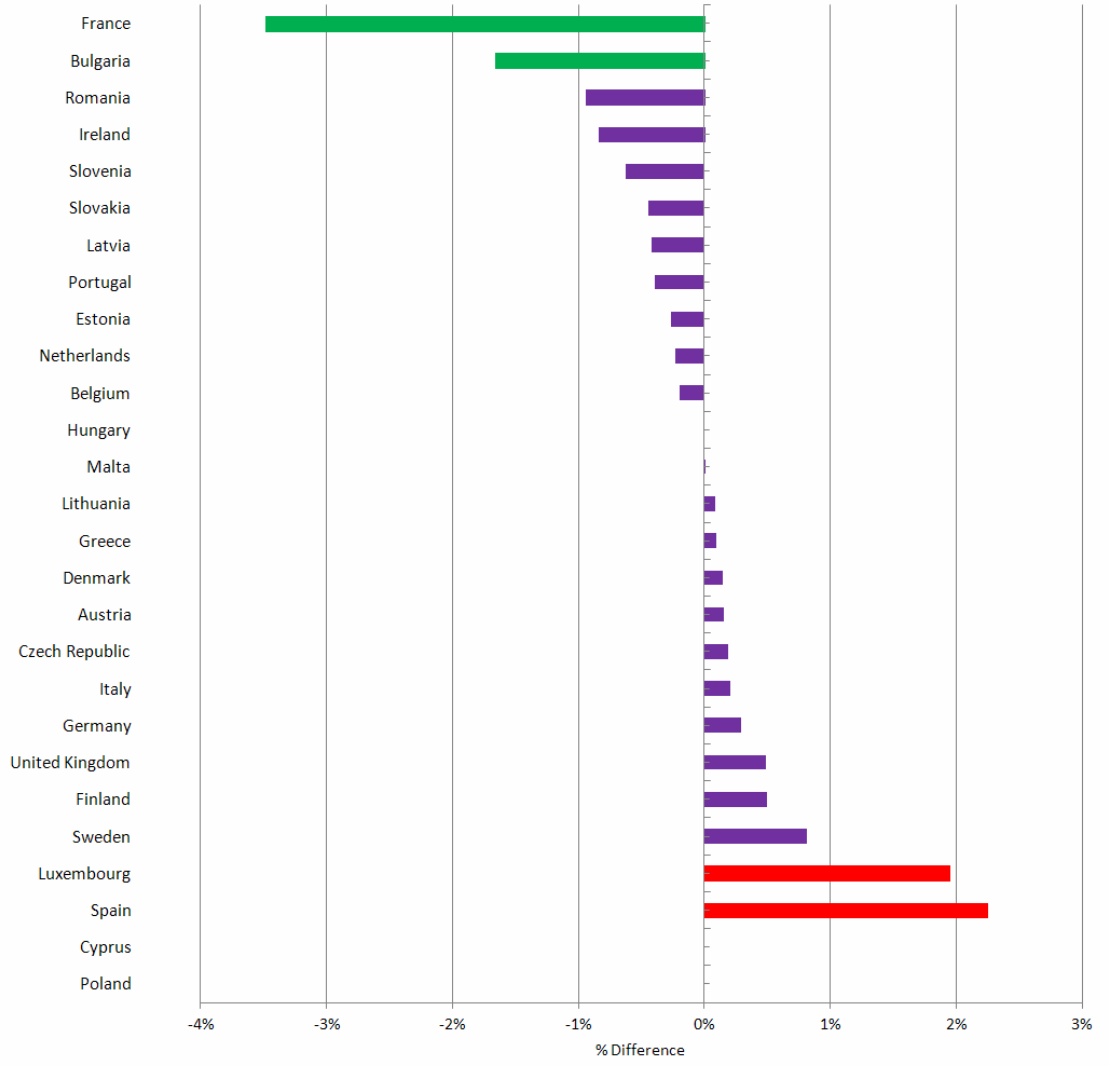
4.1.3.1 Consistency against 2010 Eurostat data

The 2010 population data reported by the Member States under the WEM projection scenario has been compared against data reported by Eurostat, for the same year. This reveals how consistent the WEM parameters Member States have used are when judged against the Eurostat data.

In this assessment, the difference is considered acceptable if the difference between the estimates of the population from Member States compared to those of Eurostat is lower than 1 %. The threshold is much lower than the threshold used in the comparison of GDP because estimates of population should be associated with less uncertainty. In comparison, population statistics are reported using consistent units between the Member States and by Eurostat and has steadily increased since 1990 in the EU-27. There are no clear signs in the trend that the financial crisis has affected population levels in the EU.

Figure 4-7 shows how the projected 2010 population estimates from the submissions of each Member State compare with the actual 2010 population data reported by Eurostat. Where the percentage change is positive in Figure 4-7, the population in 2010 assumed by the Member States is higher than the Eurostat data, and where the change is negative, the opposite is true. Where the Member State data is more than 1 % higher than the Eurostat data, the bars are highlighted in red, and where the Member State data is 1 % lower than the Eurostat data the bars are green. The range of percentage differences is very small and the agreement between Member State estimates and Eurostat data is generally very good; typically within 1 %. Data for Cyprus and Poland are missing because population assumptions were not reported.

Figure 4-7 Projected 2010 population estimates from Member State submissions with the actual 2010 population figures from Eurostat



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), Eurostat, 2011 – parameter "demo_pjan-Population on 1 January by age and sex"
Note: Red bars indicate Member States whose assumptions are more than 1 % higher than Eurostat and green bars show those which are more than 1 % lower than Eurostat

There is a difference of more than 1 % in the population data (either greater or smaller than the Eurostat estimate) for four Member States: Bulgaria, France, Luxembourg and Spain. The reasons for these differences are explored further in the text below.

- France's population assumption for 2010 is 3.5 % below the data reported by Eurostat. A difference of similar magnitude exists when population data reported by France in 1995 and 2000 are compared to those reported in Eurostat.This suggests the population data reported by France is systematically lower than the Eurostat data, and one possible explanation is a difference in the geographical coverage of the two data sets. The population data reported by France exclude its overseas territories. It is likely that the data in Eurostat includes the overseas territories. When the population from the overseas territories are added to the data reported by France the difference

compared to Eurostat data falls below 1 %. The evidence suggests that France has not underestimated its population in 2010.

- Bulgaria's population assumption for 2010 is 1.7 % lower than the data reported by Eurostat. Historic population data reported by Bulgaria for 2000 and 2005 match those reported by Eurostat. Hence, the difference for 2010 is not a systematic difference between the two data sets across the time series. As a result, there is a high risk that Bulgaria has underestimated its population for 2010.

- Spain's population assumption for 2010 is 2.2 % higher than the data reported by Eurostat. Historic population data reported by Spain show that the population data in 2000 and 2005 are also higher than those reported by Eurostat (1.1 % and 2.5 % respectively). This suggests the population data reported by Spain is systematically higher than that reported by Eurostat. The explanation for this systematic difference is not known, and therefore is it not possible to conclude that Spain has overestimated its population for 2010 although it remains a possibility (medium risk).

- Luxembourg's population assumption for 2010 is 1.9 % higher than the data reported by Eurostat. The discrepancy between the reported population estimates for historical years varies: population data reported by Luxembourg for 2000 are higher than those reported by Eurostat (by 1.4 %), and much higher for 2005 (by 7.0 %). The explanation for this variability is not known and therefore is it not possible to conclude that Luxembourg has overestimated its population for 2010, although it remains a possibility (medium)

4.1.3.2 Growth check during 2010-2015 and 2015-2020

The population growth assumption used by Member States has been compared against the projected growth in the EC Ageing Report. The assessment was carried out following the same approach as GDP (see Section 4.1). This check identifies Member States who are using population growth assumptions that are higher or lower compared to the projected growth estimated by DG EC FIN. The criteria below, based on the difference[8] between the Member States' and Eurostat data, have been applied to judge the risk of over or underestimation by Member States

- **Growth between 2010 and 2015.** It is considered that there is no risk that a Member State has over or underestimated population if the difference between the population data estimated by Member States and by DG EC FIN is less than or equal to 2 %.

- **Growth between 2015 and 2020**. It is considered that there is no risk that a Member State has over or underestimated their population if the difference between the

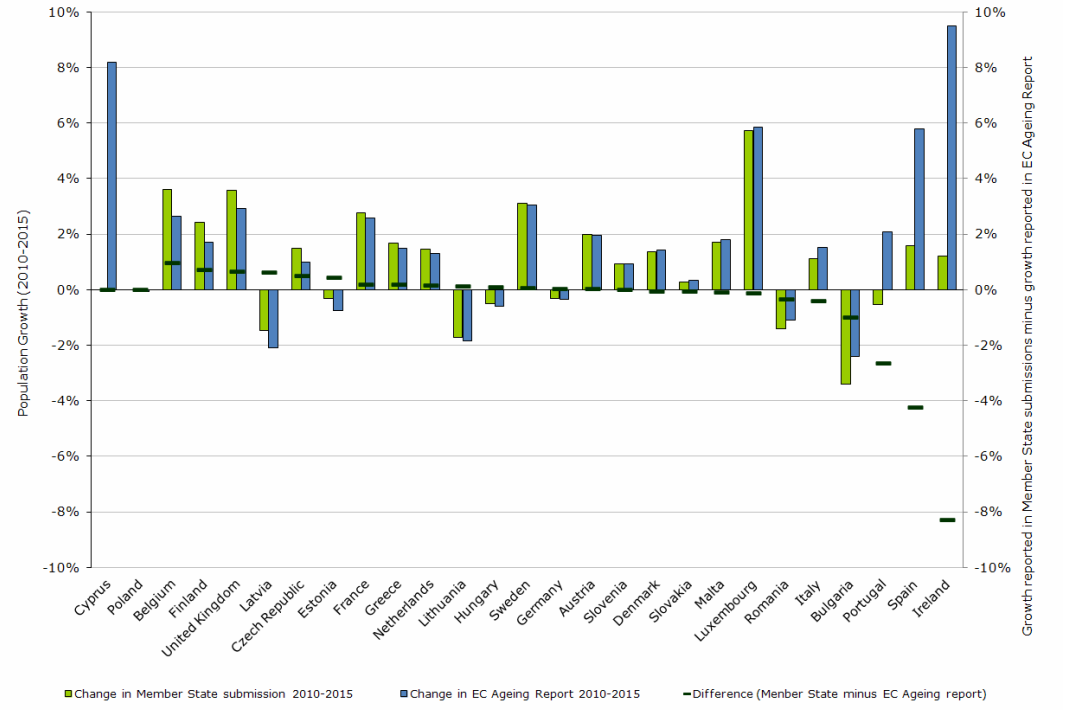
[8] Percentage change reported by the Member State minus the percentage change reported in the EC Ageing Report.

population data estimated by Member States and by DG EC FIN is less than or equal to 3 %.

The magnitude of the selected percentages allow for the fact that both the DG EC FIN and the Member States use different methodologies to predict population growth, and that the growth estimates are associated with some uncertainty. Hence it is unlikely that there will be a very close agreement between the two data sets and therefore the maximum risk which can be assigned as a result of this check is a medium risk (that Member States have over or underestimated their growth rates). If there is a risk that the population growth has been over or underestimated by the Member States, following the same approach as GDP (see Section 4.1), Member States' projections reports were examined to see if the reports contained any information to help understand the reasons for the differences between the two sets of projections. In addition, the growth rates for the Member State were compared against the actual growth which took place between the five year period 2003 and 2008. If explanations were found in the Member States projections report or if the historic change is in line with the growth assumptions used by the Member States in their projections, any medium risk of over or underestimation was downscaled to a low risk.

Figure 4-8 shows the difference between the population growth assumptions from 2010 to 2015 reported in Member State submissions and in the EC Ageing Report.

Figure 4-8 Difference between population growth assumptions 2010-2015, Member State submissions and EC Ageing Report



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), DG ECFIN, 2009
Note: The horizontal lines indicate the difference between the population growth reported by Member States and that in the EC Ageing report. This is calculated by subtracting the growth reported in the EC Ageing report away from the growth reported by Member States during 2010-2015.

The projected change in population levels is greater in the Member State submissions than the EC Ageing Report where the percentage change is positive in Figure 4-8, and where the change is negative the opposite is true. Cyprus and Poland[9] has been excluded from the analysis because their reported data were incomplete. In general, population growth predicted by Member States and the EC Ageing report are similar. The largest differences between the population growth rates expected by Member States and the EC Ageing report are observed for those Member States who are expecting a slower growth in population compared to the EC Ageing report.

The difference between the growth rates reported by Member States and the EC Ageing report during 2010-2015 exceed 2 % for Ireland, Portugal and Spain. The largest difference exists for Ireland. The data in the Ageing Report indicates that population in Ireland will increase by 9.5 % between 2010 and 2015 which is the highest growth in population of all EU-27 Member States. The population growth rate in the EC Ageing report (2009) in Ireland is closely linked to the high fertility rate of Ireland in 2008 (2nd in the EU-27), which is expected to remain high in the future, long life expectancy and high immigration. Ireland expects its population to grow by 1.2 % over the same time period in their projections. Ireland's population grew by 11 % during 2003 and 2008 (see Table 4-2). Therefore, there is a medium risk that Ireland has underestimated its population growth between 2010 and 2015.

Spain's population growth assumption between 2010 and 2015 is 4 % lower than that estimated in the EC Ageing Report. Historical data show Spain's population grew by 8.7 % between 2003 and 2008 (see Table 4-2) whereas Spain uses a growth assumption of 1.1 % between 2010 and 2015 in its projections. Thus, based on the historic trend and the data in the EC Ageing report, there is a medium risk that Spain has underestimated its population growth between 2010 and 2015. Portugal predict that population will decline by 0.5 % between 2010 and 2015. The EC Ageing Report expects a growth in population of 2.1 %. Between 2003 and 2008, population levels in Portugal increased by 2.0 % (see Table 4-2) which is in close agreement with the future growth expected in the EC Ageing Report. Therefore, there is a medium risk that the population growth between 2010 and 2015 in Portugal is underestimated.

[9] Poland reported population assumptions for 2015 and 2020 only

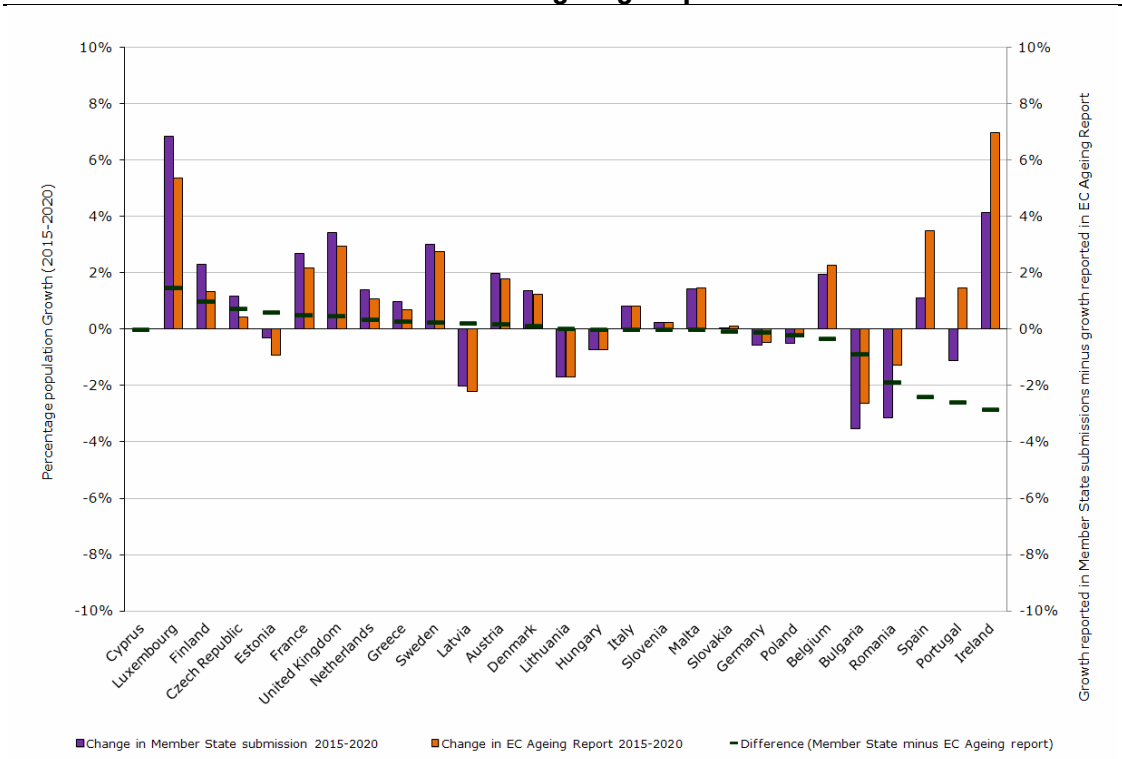
Table 4-2 Difference between the projected growth rate of GDP during 2010-2015 and 2015-2020, and the actual growth from 2003 to 2008, EC Ageing Report and Member State submissions

	2010-2015		2015-2020		
	Member State growth assumption	EC Ageing Report growth assumption	Member State growth assumption	EC Ageing Report growth assumption	Member State growth (2003-2008)
Ireland	1.2 %	9.5 %	4.1 %	7.0 %	11.0 %
Portugal	-0.5 %	2.1 %	-1.1 %	1.5 %	2.0 %
Spain	1.6 %	5.8 %	1.1 %	3.5 %	8.7 %

Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), Eurostat, 2011 - parameter "demo_pjan-Population on 1 January by age and sex", DG ECFIN 2009

Figure 4-9 shows the difference between the population growth assumptions from 2015 to 2020 reported in Member State submissions and in the EC Ageing Report.

Figure 4-9 Difference between population growth assumptions 2015-2020, Member State submissions and EC Ageing Report



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), DG ECFIN, 2009
Note: The horizontal lines indicate the difference between the population growth reported by Member States and that in the EC Ageing report. This is calculated by subtracting the growth reported in the EC Ageing report away from the growth reported by Member States during 2010-2015.

The difference between the projections reported by Member States and the EC Ageing Report does not exceed 3 % for any Member State. Portugal and Ireland show the largest differences of 2.6 % and 2.8 % respectively. Both these Member States predict their population levels to grow much slower than the growth assumptions expected in the EC Ageing report. Portugal expects a decline in its population between 2015 and 2020 (by 1.1 %)

whereas the EC Ageing Report anticipates population will increase in Portugal (by 1.5 %). Between 2003 and 2008 population in Portugal increased by 7.9 % (see Table 4-2). Therefore neither the EC Ageing report nor the historical trend suggests that Portugal's population is likely to decline between 2015 and 2020. Therefore, there is a medium risk that Portugal has underestimated its population growth during 2015-2020. Ireland projects their population to grow by 4.1 % whereas the EC Ageing report anticipates population to grow by 7.0 %. The difference in the growth rates is much smaller than the difference during 2010-2015. But because Ireland's population growth assumption is nearly 3 % lower than the growth assumption in the EC Ageing report and much lower than the observed population growth between 2003 and 2008 (see Table 4-2), there is a medium risk that the population growth projected by Ireland has been underestimated.

4.1.4 Emissions per capita

This subsection presents an analogous check to subsection 4.1.2 but assesses the GHG emissions per capita. The GHG emissions per capita check helps to identify risks of the projections reported by Member states being over or underestimated by studying how the projected emissions levels change in relation to the population growth. The projected change in emissions per capita is compared against the actual observed change from the most recent historical data reported by Member States for a five year period (2003-2008).

All Member States observed a reduction in emissions per GDP during 2003-2008 and projected a fall during 2010-2015. But emissions per capita increased during 2003-2008 in some Member States (Bulgaria, Estonia, Latvia, Lithuania, Poland and Slovenia) (see Figure 4-10). This is because emissions per capita are driven partly by the level of wealth (which tends to increase the overall levels of energy demand). In 2008, emissions per capita in the EU-15 were 23 % higher than the EU-12 (EEA, 2011a and Eurostat, 2011). Reduction in emissions per capita is driven by improvements in energy efficiency and the shift towards low carbon fuels used in electricity generation. Therefore, emissions per capita may continue to increase for Member States whose energy demand is increasing as the country becomes wealthier. However for Member States who have high emissions per capita, GHG emissions and population needs to decouple further in future years. This is an important ambition for Member States to try and achieve to ensure population growth is not a key factor driving up GHG emission levels.

Although the change in emissions per capita during 2003-2008 can be used as a reference to compare with projected change in emissions per capita, it is not expected that the trend observed between 2003 and 2008 will continue at the same rate in projected years. The comparison provides an indication of whether the Member States are being realistic, optimistic or pessimistic about the decoupling of emissions and population growth compared to what has taken place over the historic time series. The criteria below, based on the difference between the projected and historic change in emissions per capita, have been applied to judge the risk of over or underestimation by Member States:

- **Growth between 2010 and 2015.** It is considered that there is no risk that a Member State has over or underestimated their projected emissions in 2015 if the difference between the change in emissions per capita estimated by Member States and the change in emissions per capita during 2003-2008 is more than or equal to 15 %;
- **Growth between 2015 and 2020**. It is considered that there is no risk that a Member State has over or underestimated their projected emissions in 2020 if the difference between the change in emissions per capita estimated by Member States and the change in emissions per capita during 2003-2008 is more than or equal to 15 %.

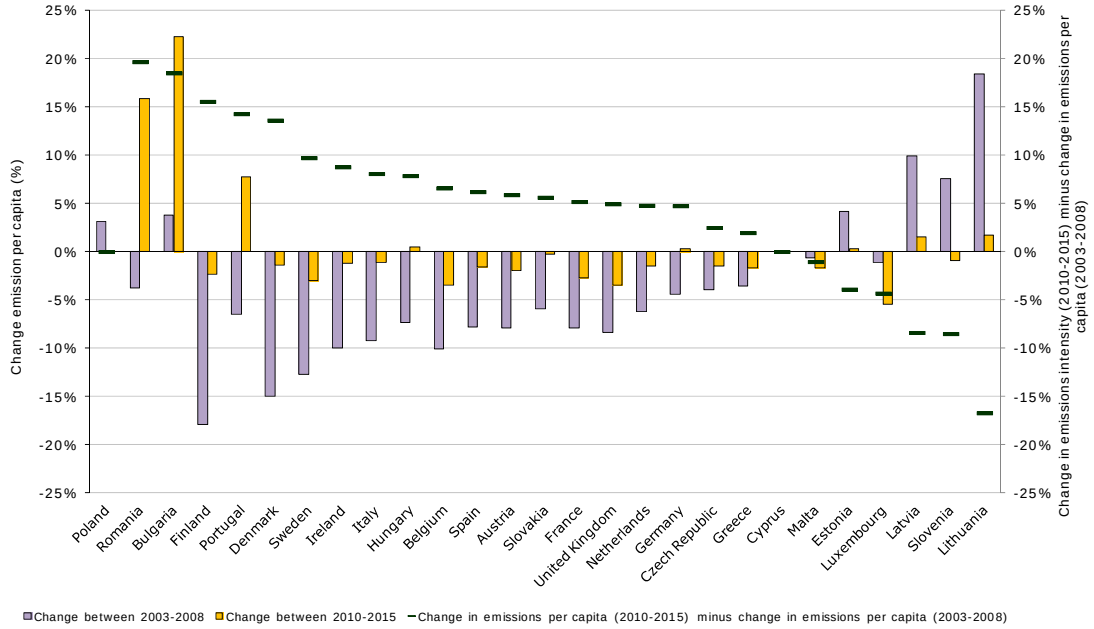
The magnitude of the difference where it is considered that there is no risk that a Member State has over or underestimated their projected emissions is high. This is because of the number of factors that impact emissions per capita and the uncertainties associated with whether the projected change in emissions per capita should follow the observed trend in historic years.

Information in the projections report and the NIR is studied if a risk of over or underestimation is detected to provide explanations behind the change in the emissions per capita trend. Emission per capita is closely related to the change in energy consumption of a Member State which in turn has a strong influence on emission levels, but is less dependent on the change in population which tends to have a steadier trend. Therefore, for those Member States that expect a change in emission per capita 15 % higher or lower than the observed change during 2003-2008, the projected total energy consumption and GDP growth over the two (projected and historic) five year periods are studied. This is based on the assumption that there is a close link between GDP growth and total energy consumption. If Member States expect a higher growth in energy consumption per percentage growth of GDP in the projected five years than the historic years, the Member State is being pessimistic about the decoupling of energy consumption and population growth. If the high increase in energy consumption is being reflected in the change in projected emissions then there is a risk that the projections have been overestimated. The exception to this is if the increase in energy consumption is as a result of renewable energy sources.

If emissions per capita are falling much more quickly than the change observed during 2003-2008 then the opposite is true. Member States may be projecting energy consumption per unit GDP to fall quicker compared to the historic time period. If this is reflected in the projected emissions, the emissions are likely to be underestimated.

If sufficient reasons behind the large difference in the change of emissions per capita are provided by the Member State then we have assumed there is no risk associated with the over or underestimation of their projections but if no reasons have been provided there is a low risk that the emissions projections are over or underestimated. Figure 4-10 shows the change in greenhouse gas emission intensity (tonnes CO_2 / capita) between projected years (2010 to 2015) and the actual change between 2003 and 2008.

Figure 4-10 Difference between the change in emissions per capita between projected years (2010-2015) and the actual change in historical years (2003-2008)



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), EEA, 2011a, Eurostat, 2011 – parameter "demo_pjan-Population on 1 January by age and sex"

The difference between the projected change in emissions per capita during 2010-2015 and the observed change during 2003-2008 is higher than 15 % for Romania, Bulgaria, Finland and Lithuania. Bulgaria and Romania expect their emissions per capita to increase by over 15 % between 2010 and 2015. In 2008, Romania's emissions per capita were the second lowest in the EU-27. During 2003-2008, emissions per capita were stable, only falling by 3.8 % which largely reflects the trend in total energy consumption which was relatively flat during this period. Between 2010 and 2015, a large increase in energy consumption is projected in Romania as a result of high economic growth (Romania, 2011). The economic growth projected by Romania during 2010-2015, is similar to the growth experienced by Romania during 2003-2008 (see Subsection 4.1.1). Despite the Romanian economy growing during 2003-2008, both trends in total energy consumption and the emissions per capita remained stable. Therefore, although the economic growth and increase in wealth projected by Romania consequently leads to an increase in total energy consumption which supports the increase in emissions per capita expected during 2010-2015, the percentage increase is high compared to the trend observed in historic years. As a result, there is a low risk that the emission growth in Romania during 2010-2015 is overestimated.

Bulgaria's emission per capita is projected to increase by 22 % during 2010-2015, which is 19 % higher than the increase observed between 2003 and 2008. Emission per capita is expected to increase during 2010-2015 as a result of an increase in energy consumption despite a fall in population. The increase in total energy consumption is driven by an increase in economic development (GDP) (Bulgaria, 2011). During 2010-2015, final energy

demand is projected to increase by 9 % and GDP by 44 %, and population is projected to continue to fall by 3.4 %. During 2003-2008, total energy consumption in Bulgaria increased by 3.4 % according to Eurostat[10], and during the same period, GDP increased by 37 % despite a fall in population by 2.6 %. These statistics show the large increase in GDP has not resulted in a large increase in energy consumption and that only a relatively small increase in energy use per capita is underpinning this GDP growth in historic years.. The expected increase in total energy consumption/ GDP is much faster during 2010-2015 compared to 2003-2008. This provides a key explanation behind the large increase in emissions per capita during 2010-2015 compared against the increase observed in 2003-2008. Based on this result, there is a low risk that Bulgaria's emission growth (total energy consumption) between 2010 and 2015 has been overestimated.

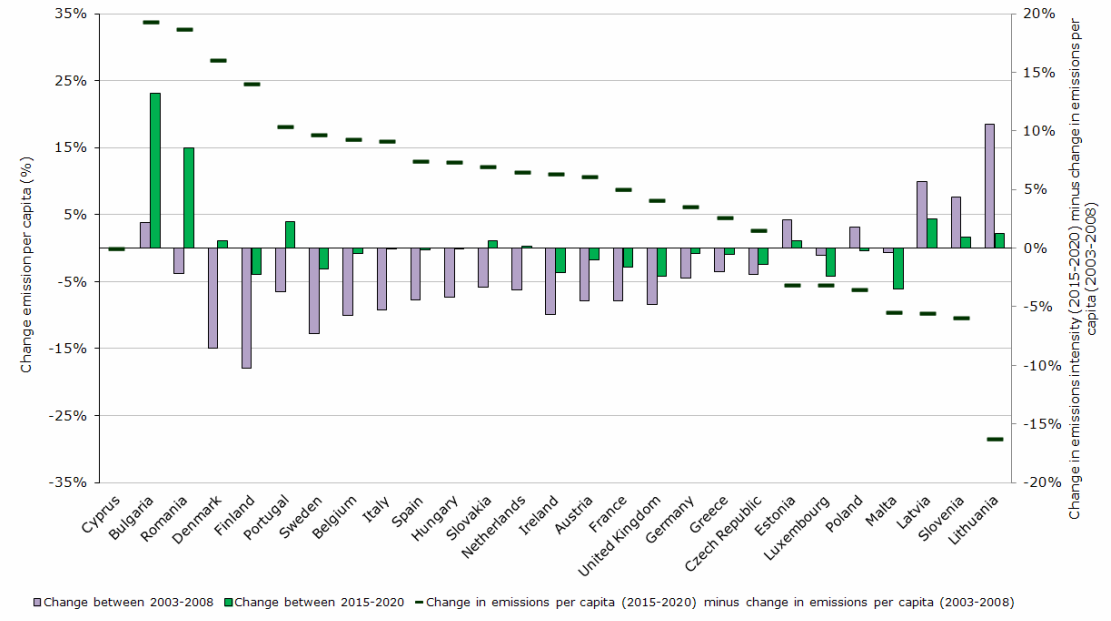
The projected fall in emissions per capita in Finland during 2010-2015 is 16 % lower than the large fall in emissions per capita observed during 2003-2008. Emissions per GDP also fell during 2003-2008 and the reasons behind this can be found in subsection 4.1.2. The same reasons explain the large fall in emissions per capita between 2003 and 2008 (highest percentage reduction in the EU-27). Hence there is no risk that projected emissions in Finland have been over or underestimated based on this assessment.

In Lithuania, emissions per capita increased by 18 % between 2003 and 2008 (the largest increase in the EU-27). Despite this increase, Lithuania had the 4th lowest emissions per capita levels in 2008. According to Eurostat, final energy consumption in Lithuania increased by 18 % between 2003 and 2008 and during 2010-2015 final energy consumption in Lithuania is projected to increase by 9 % (Lithuania, 2011). The GDP growths during the two periods are similar. The Lithuanian projections report states that the National Energy (Energy Independence) Strategy sets the target to achieve annual savings of 1.5 % of the total final energy consumption, in the period through to 2020 and as a result reduce energy consumption/GDP. The strategy partly provides the explanation behind the slow growth in energy consumption in Lithuania during 2010-2015. However, the increase in energy consumption during 2010-2015 compared to 2003-2008 is considered still too low considering GDP is expected to grow at a similar rate during the two periods. There is a low risk that Lithuania's projected growth in emissions has been underestimated.

Figure 4-11 shows the difference between the change in emissions per capita in projected years (2015-2020) and the actual change in historical years (2003-2008).

[10] Final Energy Consumption

Figure 4-11 Difference between the change in emissions per capita between projected years (2015-2020) and the actual change in historical years (2003-2008)



Source: GHG projection submissions under Article 3.2 of the MMD (ETC/ACM, 2011), EEA, 2011a, Eurostat demo_pjan-Population on 1 January by age and sex

The projected change in emissions per capita during 2015-2020 and the observed change during 2003-2008 are higher than 15 % for Bulgaria, Romania, Denmark and Lithuania.

For Bulgaria and Romania, the increase in emissions per capita during 2015-2020 is as a result of a high increase in total energy consumption which in turn arises as a result of the high economic growth (GDP) predicted during the same period. Bulgaria projects final energy consumption to increase by 10 % between 2015 and 2020 (Bulgaria, 2011) largely driven by the 48 % increase in GDP during the same period. During 2003-2008, final energy consumption increased by 3.4 % (Eurostat, 2011) following a growth in GDP of 37 %.

Romania projects primary energy consumption to grow by 6.4 % and GDP to grow by 28 % between 2015 and 2020. During 2003-2008, final energy consumption increased only by 2.8 % despite a much higher growth in GDP (39 %) in Romania. Therefore, both Bulgaria and Romania project final energy consumption to increase much more quickly as a result of GDP growth compared to the increase in energy consumption per growth in GDP in historic years. There is a low risk that the growth of total energy consumption (a proxy to emissions) reported by Bulgaria and Romania during 2015-2020 have been overestimated.

Lithuania predicts an increase in emissions per capita of 2.2 % between 2015 and 2020 whereas the actual increase in emissions per capita during 2003-2008 was 18 %. The comparison of the growth in energy consumption and GDP growth shows the following results. Total energy consumption is projected to increase by 18 % during 2015-2020 and 2003-2008. However the historic and projected GDP growth during the two periods differ

significantly (41 % during 2003-2008 and 13 % during 2015-2020). This shows that energy consumption per GDP growth increase in Lithuania between these five year periods. During 2015-2020, emissions are projected to increase by 9 % whereas the same percentage increase in final energy consumption led to an increase of emissions by 15 % between 2003 and 2008. This may partly be explained by the fact that a high proportion of the increase in energy use is sourced from renewables and hence does not lead to increase in emissions. The information in the projections report is not sufficient to support the very low increase in emissions per capita during 2015-2020 in comparison to the large increase observed between 2003 and 2008. As a result, there is a low risk that emissions growth during 2015-2020 in Lithuania is underestimated.

In Denmark, emission per capita is expected to increase by 1 % between 2015 and 2020 whereas it fell by 15 % during 2003-2008. A closer inspection shows that the fall in emissions per capita observed during 2003-2008 is higher than all other Member States excluding Finland. Similar to Finland, Denmark's emission levels are heavily influenced by electricity import and export. In 2003, electricity export levels were at its highest since 1997 and as a result, emission levels were approximately 7 Mtonnes higher than if there was no electricity exported. In turn, Denmark was a net importer of electricity in 2008. This is the key reason which lies behind the fall in emissions per capita between 2003 and 2008 (leading to lower emission). Similar to Finland, this fluctuation in electricity import and export is a result of low rainfall in Norway and Sweden causing insufficient hydropower production in both countries. Such event cannot be projected accurately into the future and as a result, the fall in emissions per capita is much lower during 2015-2020 in comparison. In addition, consumption of biomass in Denmark increased from only accounting for 9.5 % of the overall fuel consumption in 2003 to 14 % in 2008 which would have contributed to the observed emission reduction during this period. The use of renewables as a proportion of the overall fuel used is projected to increase during 2015-2020 but at a slower rate (Denmark, 2011a and Nielsen et al, 2011). The findings support the reasons behind the difference between the change in emissions per capita during 2003-2008 and 2015-2020.

The results show that trends in GHG emissions per capita are country specific and affected largely by country specific circumstances and is not a simple indicator to determine the over or underestimation of emission projections.

5 Accuracy

The risk associated with the reported projections by Member States being over or underestimated have been converted into a quantitative score. This score takes into account each of the risks identified from the range analytical procedures applied to the projections, and associated parameters, described in Chapters 2 to 4. A high score implies a high risk of over or underestimation. Bulgaria, Portugal and Romania score the highest with scores above 7. In total, more than half of the projections from the EU-27 Member States are associated with some risk of over or underestimation. Belgium, Ireland and Spain are also very close to the threshold number of points required for the risk to be considered too high.

Romania's projections did not take into account the impact the financial crisis had on emission levels at all. For Bulgaria, the submission indicated that the projections did take into account the impact of the financial crisis. However the results show that the impact of the financial crisis assumed to calculate the projections was inconsistent with the observed impact of the financial crisis on emission and GDP levels. In addition there was a high risk associated with the projected economic growth during 2010-2020 being very optimistic. In addition, both Bulgaria and Romania expected emission levels in the future to increase much quicker than those observed in historical years despite the historical growth in GDP being similar to the projected growth in GDP.

The risk that Bulgaria, Portugal and Romania's projections are overestimated was too high for the projections submitted by these Member States to be included in the emission projections for the EU-27. Therefore, instead, for the purpose of tracking progress against GHG targets in the reports 'Greenhouse gas emission trends and projections in Europe 2011 - Tracking progress towards Kyoto and 2020 targets' (EEA, 2011b) and 'Progress towards achieving the Kyoto Objectives' (EC, 2011), their projections were replaced with gap filled estimates. The methodology used to gapfill the data is given in Chapter 6.

5.1 Overview

This section presents the results of the accuracy of the GHG emission projections reported by Member States. The results of the consistency check against the 2010 proxy estimates (see Section 3.3), 2010 comparison check (see Sections 4.1.1.1 and 4.1.3.1), growth check (see Section 4.1.1.2 and 4.1.3.2) and the emission indicator analysis (see Section 4.1.2 and 4.1.4) determined the level of risk (high, medium or low) associated with the projections being overestimated by the Member State. The accuracy of the Member State projections is a synthesis of the results from these checks.

At the time this report was written, the accuracy of the GHG projections was strongly affected by the degree to which the financial crisis of 2008 to 2011 was included in the projections of Member States. The crisis was (and remains) severe, and has significantly

slowed down economic activity across Europe. There has been some recovery but this has been variable, and the levels of future growth are uncertain. In turn GHG emissions have been reduced (as observed in the 2011 emissions inventory) although the extent and longevity of the reductions, and the sectors where the greatest reductions have occurred, vary according to Member State and are dependent on country specific circumstances. If Member States have not taken the effects of the financial crisis into account, their GHG projections are very likely to be overestimated, and in some Member States there is a high risk this has happened. In other instances, the impact of the financial crisis may have been taken into account but the actual decline in activity data which affects emission and the magnitude of the recovery in 2010 has not reflected reality. Any discrepancies in emissions in the starting year of the projections (2010) will also have an impact on whether the 2015 and 2020 projections are over or underestimated.

The outcome of the accuracy assessment is used by the EEA to support a decision on whether to include or exclude the projections of a Member State in the total projections for the European Union. A similar check for the sectoral parameters complements this assessment and provides insight into which sectors are contributing to the inaccuracy of the Member State projections (see Annex).

The accuracy of the Member State projections has been determined by the summary of the risks assigned as a result of the checks described in Chapters 3 and 4. A point system matrix for the risk levels where High = 3, Medium = 2 and Low = 1 has been used to summarise the level of risk associated with the over or underestimate of the projections. If the score for a Member State is higher than five the risk that the projections have been over or underestimated is too great to allow the projections to be included in the EU-27 projections and to be used to judge whether the Member State will meet their target. The same matrix has been used to determine the accuracy of the sectoral projections in the Annex. However, the results in the Annex are not used to determine whether the projections should be used to calculate the EU-27 projections. Table 5-1 shows the results of this analysis.

Table 5-1 Summary table based on the assessment of GDP and population assumptions and the results from the reference year check of emissions

Member State	Reference year check	GDP – consistency against 2010	GDP Growth 2010-2015	GDP Growth 2015-2020	Growth - GHG Emissions per GDP 2010-2015	Growth - GHG Emissions per GDP 2015-2020	Population consistency against 2010	Population Growth 2010-2015	Population Growth 2015-2020	Growth - GHG Emissions per capita 2010-2015	Growth - GHG Emissions per capita 2015-2020	Total score
Bulgaria	3	3	2	2			3			1	1	15
Romania	3	3	1	1		1				1	1	10
Portugal	3				1			2	2			8
Belgium			2	2	1	1						6
Ireland								2	2			4
Spain							2	2				4
Greece			1		1							2
Finland		2										2
Luxembourg			2				2					2
Lithuania										1	1	2
Cyprus					1	1						2
Malta						1						1
Netherlands						1						1
Poland				1								1
Latvia				1								1
Other MS	0	0	0	0	0	0	0	0	0	0	0	0

Note: (+) indicates overestimate and (-) indicates underestimate

Total points are calculated as follows: high risk= 3, medium risk= 2 and low risk= 1. The projections from Member States in rows that are shaded grey have been excluded from the EU-27 projections, and their projections have been replaced with gap-filled data.

Bulgaria, Portugal and Romania have the highest score of greater than 7 showing that the projections submitted by these Member States have a high risk of being inaccurate. In total, the projections of more than half the Member States have a risk of being over or underestimated. Belgium, Ireland and Spain are also very close exceeding five, the threshold number of points required for the risk to be considered too high.

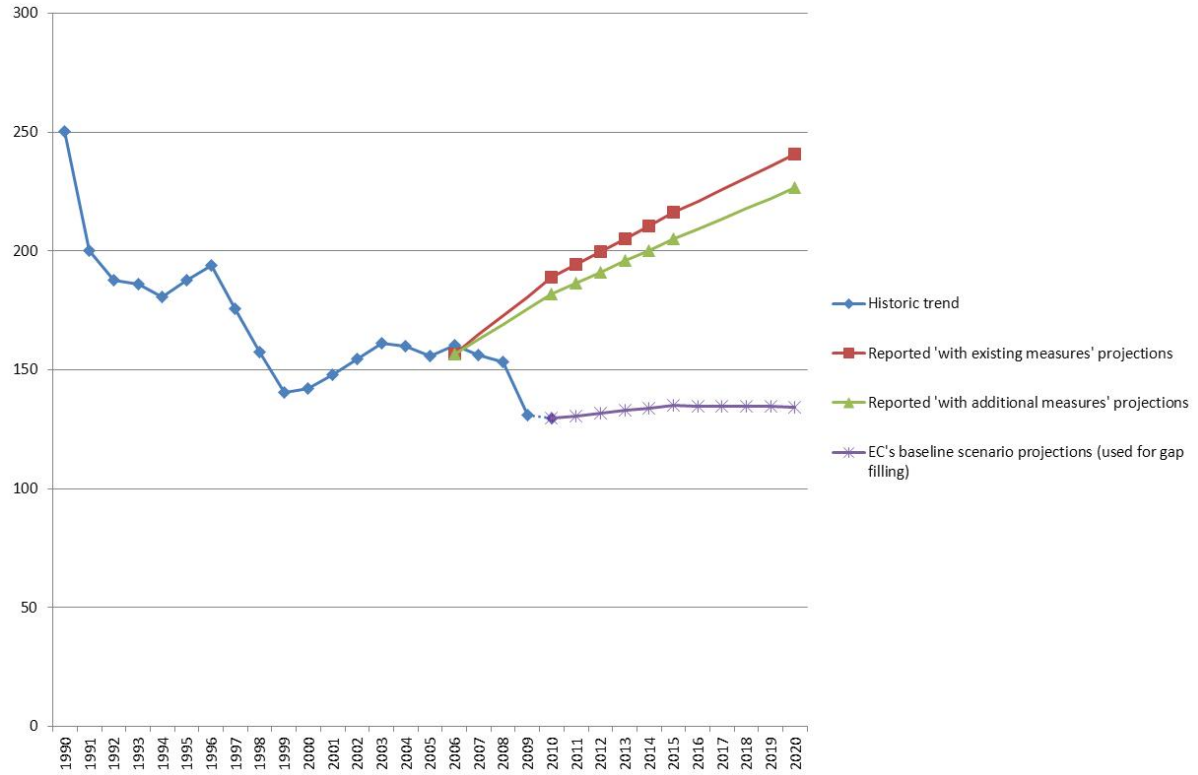
The projections submitted by Bulgaria, Portugal and Romania were deemed too inaccurate to be included in the emission projections for the EU-27. Therefore for the purpose of tracking progress against GHG targets, in the reports 'Greenhouse gas emission trends and projections in Europe 2011 - Tracking progress towards Kyoto and 2020 targets' (EEA, 2011b) and 'Progress towards achieving the Kyoto Objectives' (EC, 2011), their projections were replaced with gap filled estimates. The methodology used to gapfill the data can be found in Chapter 6.

The results from the table, in particular for Bulgaria, Portugal and Romania, are discussed in further detail below. In addition, the projected emission trend for Finland is studied because a risk was identified for the one of the two most important checks (GDP – consistency against 2010), which was to a degree inconclusive because of the incompleteness of the historic GDP trend.

5.2 Romania

The results of the reference year check and the consistency of the GDP assumptions against the actual 2010 GDP figure are the two checks that can help determine if Member States have partly or fully taken into account the financial crisis in their projections. The reference year check (see Section 3.2) showed that Romania used an old reference year (2006). The 2010 projections reported by Romania were 45 % higher than the EEA 2010 proxy emission estimates (see Section 3.3) which showed that the actual emission levels in 2007, 2008 and 2009 (and consequently the effect of the financial crisis) were not considered when projecting emissions to 2020. This was confirmed by the results of the 2010 GDP consistency check, which showed that Romania used GDP assumptions for 2010 17 % higher than the actual 2010 GDP statistics reported in Eurostat (see Section 4.1.1.1). This difference in 2010 is a crucial factor in determining if the projections are inaccurate because the effect of this discrepancy will be carried forward into the 2015 and 2020 projections. Projected emissions in Romania support the reported trend of the parameters. Emission levels in 2009 were 156 Mt CO_2-equivalent in the 2011 inventory and Romania projected that their emission levels would be 191 Mt CO_2-equivalent in 2010 (increase of 22 %, which is very high) (see Figure 5-1). The steep increase in emissions from 2009 to 2010 does not exist in the data used for gapfilling.

Figure 5-1 GHG Emission trend in Romania, 1990-2020



Source: EEA, 2011a, EEA, 2011c, European Commission, 2010, Romanian National Report under Article 3(2) of Decision 280/2004/EC, 2011
Note: European Commission projections adjusted to EEA's 2010 proxy inventory value

The projected growth of GDP by Romania during 2010-2020 was high compared to the EC Ageing Report but the growth was no greater than the economic growth Romania experienced between 2003 and 2008, thus the risk that Romania's future economic growth is overestimated is low. Despite future economic growth in Romania increasing at a similar rate to the historic economic growth (2003-2008), emissions are expected to increase much quicker between 2010 and 2015 than between 2003 and 2008. The check comparing the projected change in emissions per population expected against the trend observed in historic years showed that energy consumption per GDP growth in Romania was predicted to increase much quicker in the future than in historic years (2003-2008). This observation implied that the projected emission growth during 2010-2020 (strongly linked to energy consumption) in Romania is also overestimated.

5.3 Bulgaria

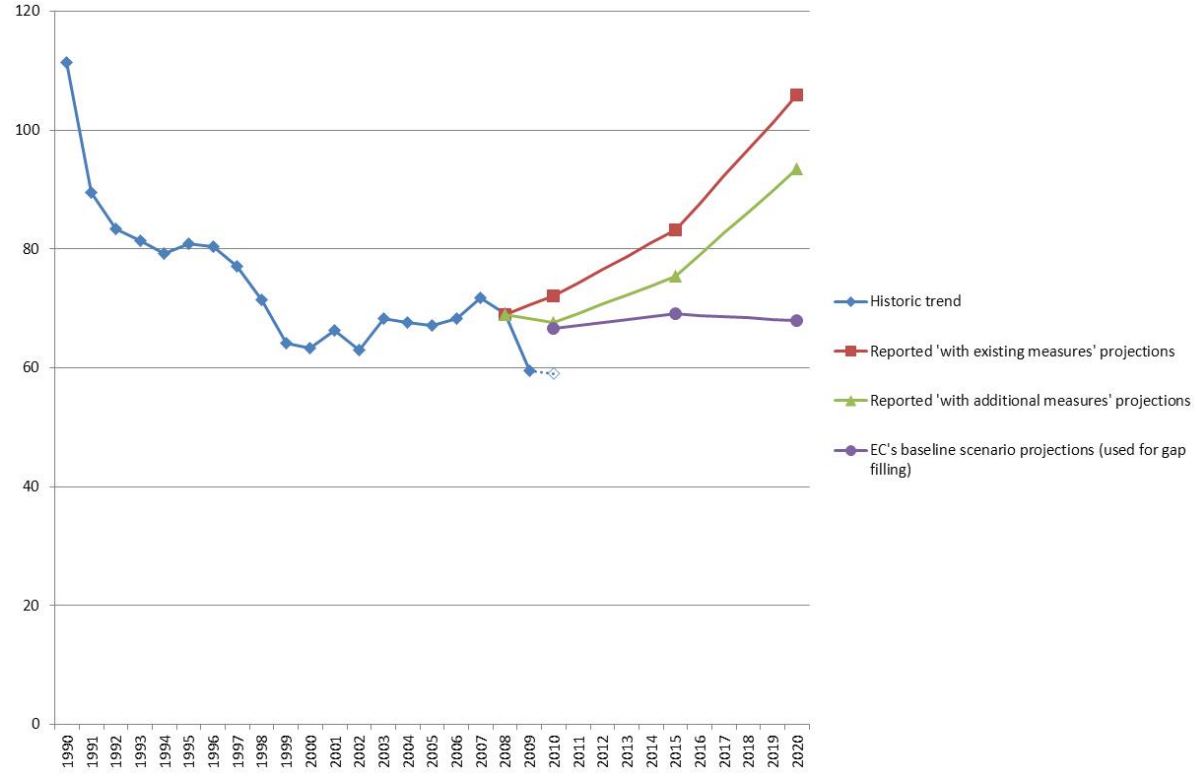
Bulgaria scores the highest number of points in Table 5-1. The check against the EEA 2010 proxy emission estimates showed that there was a medium risk that Bulgaria had not taken into account the full impact of the financial crisis. This was confirmed by the high GDP assumption Bulgaria used for their 2010 projections in comparison to the actual 2010 GDP data from Eurostat. Whereas Romania's projected GDP growth was high compared to the EC Ageing report but similar in magnitude to the historic trend (2003-2008), Bulgaria projected a

much higher economic growth compared to both the EC Ageing report and the historic trend. As a result, there is a medium risk that the projected growth of GDP reported by Bulgaria is overestimated for both periods 2010 to 2015 and 2015 to 2020.

The internal consistency check (see Section 0**Error! Reference source not found.**) showed Bulgaria's sum of sectoral emissions was not consistent with the national total reported (excluding LULUCF) contributes to the inaccuracy of the reported data. In addition, the check which assessed the consistency of the change in emissions per population against this historic trend showed that there was a risk that Bulgaria's projections were overestimated for the same reasons as Romania (projected increase in total energy consumption high with respect to the growth in GDP, compared to the trend observed in the period 2003-2008).

The results are clearly presented in Figure 5-2. There is quite a sharp increase in emissions between 2009 and 2010 but this is not the main concern with the time series. The main concern is the very optimistic view of their economic growth during 2010-2020 in contrast to the Ageing report and the steep increase in emissions as a result of the slow decoupling between emissions and GDP.

Figure 5-2 GHG Emission trend in Bulgaria, 1990-2020



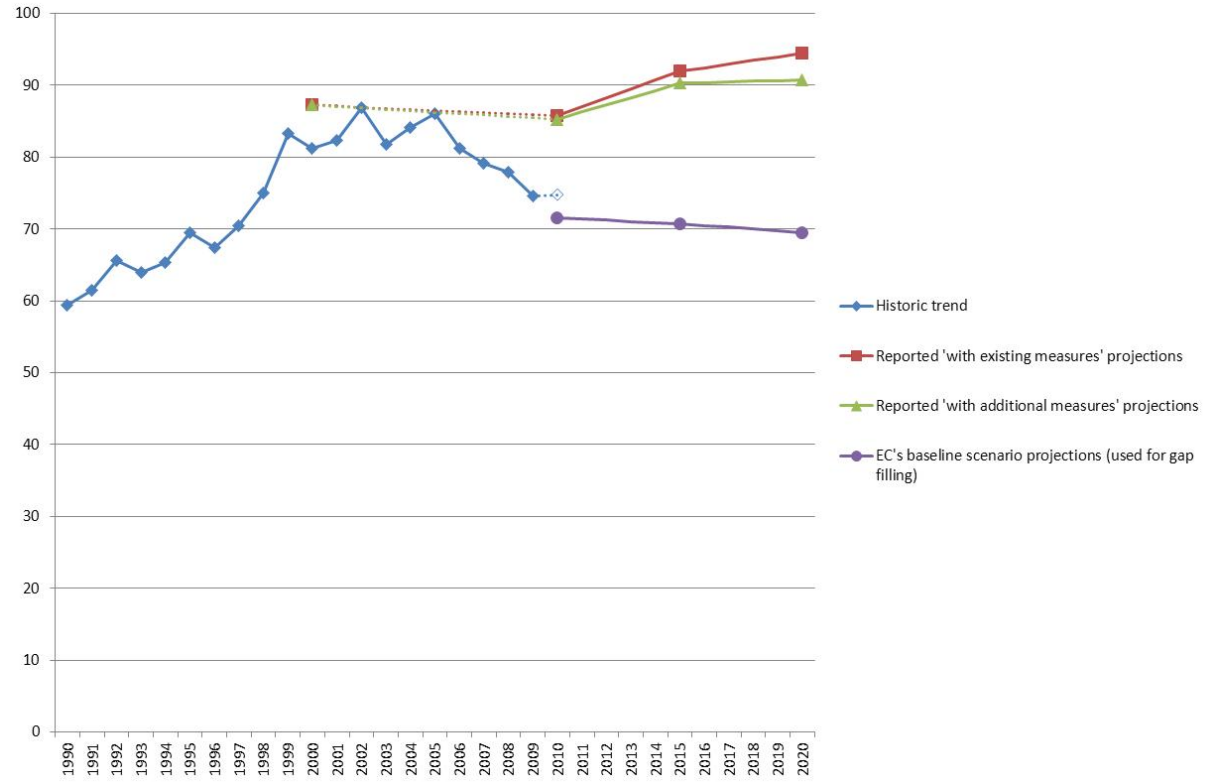
Source: EEA, 2011a, EEA, 2011c, European Commission, 2010, Bulgarian National Report under Article 3(2) of Decision 280/2004/EC, 2011

Portugal

The reference year check showed that there is a high risk that Portugal's projections were an overestimate due to an old reference year being used to compile the projections. The jump in

emissions between 2009 and 2010 (see Figure 5-3) shows that the impact of the financial crisis has not been taken into account in the projections accurately. The subsequent checks showed that there is a medium risk that the population growth assumptions used for the projections are an underestimate.

Figure 5-3 GHG Emission trend in Portugal, 1990-2020



Source: EEA, 2011a, EEA, 2011c, European Commission, 2010, Portuguese National Report under Article 3(2) of Decision 280/2004/EC, 2009

Other Member States

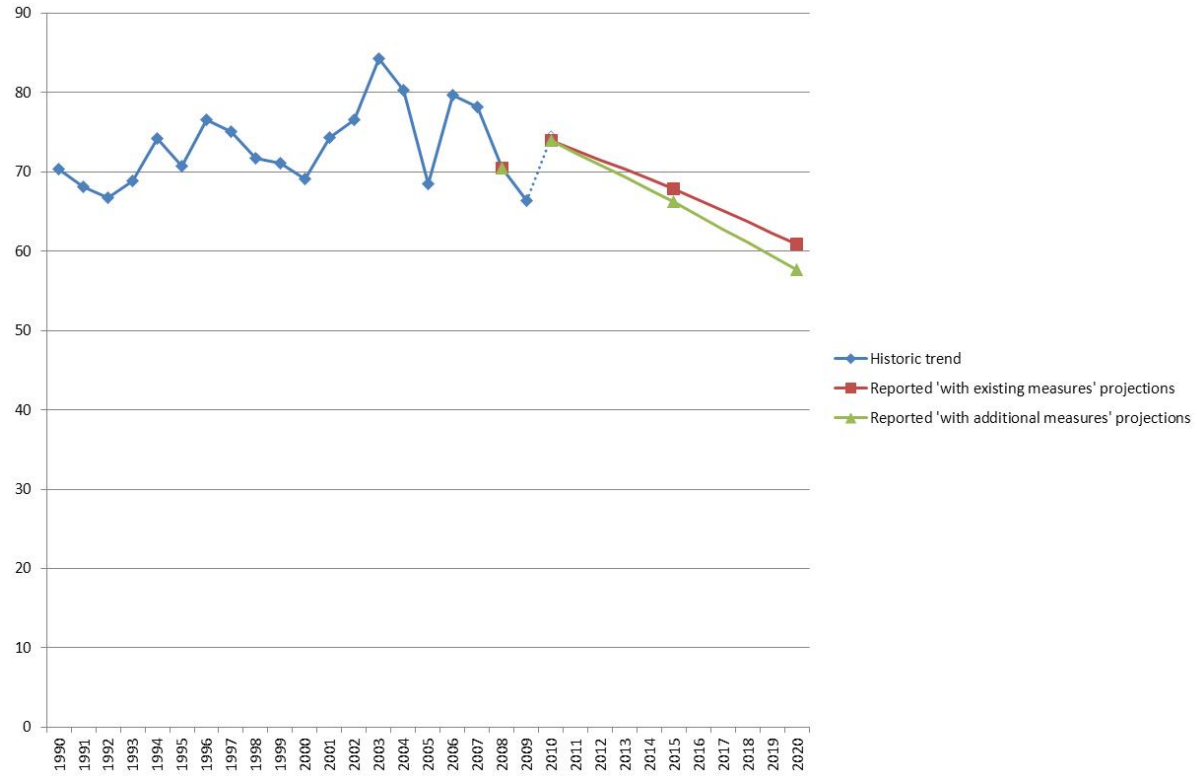
Other Member States have risks associated with the assumptions used for the growth of GDP and population being an under or overestimate. Risks have been identified because the Member States are being optimistic or pessimistic about their economic and population growth compared to the EC Ageing report. But for these Member States, the total points in Table 5-1 which reflect the overall risk that the key parameters have been over or underestimated was not high enough (the evidence of over or underestimation not strong enough) to reject their projections in the EEA (2011) and EC (2011) reports.

Germany did not report an updated set of projections in 2011 but provided a split of the EU ETS and non ETS emissions for their 2009 submission. The checks did not find any risks associated with the German projections being over or underestimated. This reflects the fact that both the recession and the climate and energy package were taken into account in the projections submitted in 2009. Furthermore, the projections are consistent with the latest

political development regarding the phase out of nuclear power. For these reasons, the 2009 projections were used in the EEA (2011) and EC (2011) reports.

The 2010 consistency check for GDP identified that the 2010 GDP assumption reported by Finland was 17 % lower than the reported GDP for 2010 in Eurostat. Thus, there is a risk that the 2010 GDP assumption was underestimated, possibly as a result of pessimistic forecast of the economic recovery. Finland did not report any historic GDP figures, thus it was not possible to determine whether this was a result of a systematic discrepancy between Eurostat and the submission. According to Eurostat[11], Finland's GDP grew by 3.1 % between 2009 and 2010. Figure 5-14 shows the historical trend for GHG emissions from Finland, the WEM and WAM projections shows an increase in projected emissions from 2009 to 2010, which would not be expected if Finland underestimated their GDP in 2010 by 17 %. Finland's 2010 projections do not reflect an underestimated GDP in 2010. Further communication with Finland concluded that the difference was because GDP figures reported by Finland are expressed in value added at basic prices whereas the Eurostat figure is expressed at market prices. Hence the difference arises as a result of indirect taxes and subsidies.

Figure 5-4 GHG Emission trend in Finland, 1990-2020



Source: EEA, 2011a, Finnish National Report under Article 3(2) of Decision 280/2004/EC, 2009

[11] Eurostat - nama_gdp_k-GDP and main components – volumes

6 Gapfilling

GHG projections reported by Member States were replaced with PRIMES and GAINS projections data (adjusted to the 2011 inventory) for Bulgaria, Portugal and Romania due to the high risks associated with their projections being over or underestimated making the projections less accurate.

Additional gap filling was also done in specific situations, where some Member States did not provide all the detailed information required for the detailed assessment of the progress of the EU towards its GHG targets:

- 2011 and 2012 data was reported by only Denmark and Ireland. For all other Member States interpolation between 2010 and 2015 was used;
- Projections reported by Cyprus, Estonia, Finland, Poland and Romania were split using the split reported in PRIMES and GAINS for certain sectors in linked to fuel combustion;
- Bulgaria, Czech Republic, Estonia, Finland, Lithuania, the Netherlands, Poland, Portugal, Romania and Slovakia did not report the projections split between EU ETS and non ETS. This was gapfilled using the PRIMES and GAINS split.
- The WAM scenario was not reported by Poland and the United Kingdom. For these two Member States, WAM = WEM.
- Bulgaria, Cyprus, Estonia, Finland, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Portugal, Romania and Spain did not report either the 2025 nor the 2030 projections. The expected trend reported in PRIMES and GAINS was used to extrapolate the Member States' projections.

To assess the projected progress of the EU as a whole towards its GHG targets, the projections of those Member States where the results of the QA/QC procedure concluded that there was a high risk that the projections submitted were over or underestimated, were gapfilled. Also, where Member States did not submit projections data used in the 'Greenhouse gas emission trends and projections in Europe 2011report' (EEA, 2011) or the 'Progress towards achieving the Kyoto objectives' report (EC, 2011) the data was gapfilled by the ETC/ACM. The method used to gapfill the different data and for which Member States the gapfiling methodology was applied is summarised below. Information on which Member States' data was gapfilled is summarised in **Error! Reference source not found.**.

Table 6-1 Member States with gapfilled data

Member State	Total Projections	Annual projections (2011 and 2012)	Sectoral split	EU ETS and non ETS	WAM	2025 and 2030 projections
Austria		x				
Belgium		x				
Bulgaria	x	x		x		x
Cyprus		x	x			x
Czech Republic		x		x		
Denmark						
Estonia		x	x	x		x
Finland		x	x	x		x
France		x				
Germany		x				x
Greece		x				x
Hungary		x				
Ireland						x
Italy		x				x
Latvia		x				x
Lithuania		x		x		x
Luxembourg		x				x
Malta		x				
Netherlands		x		x		
Poland		x	x	x	x	
Portugal	x	x		x		x
Romania	x	x	x	x		x
Slovakia		x		x		
Slovenia		x				
Spain		x				x
Sweden		x				
United Kingdom		x			x	
Total number of Member States with gapfilling	3	25	5	10	2	14

Source: ETC/ACM, 2011

Note: Pink shaded cells indicate where the data has been gapfilled.

6.1 Total projections (2010, 2015 and 2020)

For Bulgaria, Portugal and Romania, whose reported projections were associated with high risks of over or underestimation, the data was gapfilled by applying the trend reported in PRIMES and GAINS between 2005 and 2030 on the 2005 emissions in the 2011 inventory.

In the 2013 submission, the historic emission levels for 2010 will be available inventory submissions. The gapfilling methodology can be improved to include calibration with 2010 emissions, increasing the accuracy of the projections.

6.2 Annual projections for 2011 and 2012

Only Ireland and Denmark[12] reported 2011 and 2012 projections. For all other Member States, 2011 and 2012 projections were derived by interpolating the 2010 and 2015 emission figures.

6.3 Sectoral split

Table 6-2 below presents the list of sectors that were not reported by Member States and thus gapfilled.

Table 6-2 Summary of the gapfilled sectors

Sector	IPCC Category	Member States that did not report the split
Energy supply	1A1a	Cyprus
Energy – industry, construction	1A2	Cyprus
Energy – households	1A4bi	Cyprus, Estonia, Finland, Poland, Romania
Energy (Services and other)	1A4a + 1A4c + 1A5	Cyprus, Estonia, Finland, Poland, Romania
Transport (energy)	1A3	Cyprus
Industrial processes	2	
Waste	6	
Agriculture	4	
Other	3 + 7	

For these Member States, the projected emissions were split according to the sectoral split in PRIMES and GAINS for each projected year. Estonia and Malta reported no emissions for the 'other' sector, despite emissions existing for the sector in the historical inventory. These possible omissions were not gapfilled.

6.4 Split between EU ETS and non ETS

17 Member States reported their projections split into the EU ETS and non ETS components[13]. During the Quality Assurance plan, a check was carried out to ensure that the

[12] Denmark only reported 2011 and 2012 data for WEM scenario. The 2011 and 2012 WAM scenario emissions were derived based on the assumption that the AM savings increase linearly from 2010 to 2015.

sum of the ETS and non ETS emissions matched the total GHG projections excluding LULUCF. A small discrepancy (less than 1 %) was found for seven Member States (Cyprus, Denmark, Germany, Greece, Italy, Latvia and Sweden) but due to the magnitude of the difference the data was considered acceptable. For those that did not report the split (Bulgaria, Czech Republic, Estonia, Finland, Lithuania, the Netherlands, Poland, Portugal, Romania and Slovakia) the percentage contribution of the ETS and non-ETS sectors available in PRIMES and GAINS (excluding aviation) was used to split the total GHG projections. If the split was only reported for the WEM scenario and not the WAM scenario, the same percentage split in the WEM scenario was applied to the WAM scenario.

6.5 With Additional Measures

Poland and the United Kingdom did not report a WAM projections scenario. For these two Member States, the WAM scenario is considered to be equal to the WEM scenario.

6.6 2025 and 2030 projections

13 Member States reported 2025 and 2030 projections (Hungary and the United Kingdom reported only 2025 and Poland only reported 2030). For the other 14 Member States that did not report 2025 or 2030 projections (Bulgaria, Cyprus, Estonia, Finland, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Portugal, Romania and Spain), the percentage-change from 2020 to 2025 or 2030 in the PRIMES and GAINS model was applied to extrapolate the projections into the future.

[13] This includes Germany who did not report new data in 2011 but provided the split of ETS and non ETS to apply to their projections submitted in 2009.

References

Belgium, 2011, *Report by Belgium for the assessment of projected progress.*

Bulgaria, 2011, *BULGARIAN NATIONAL REPORT UNDER ARTICLE 3(2) OF DECISION 280/2004/EC.*

Cyprus, 2011, *National Projections of Greenhouse Gases Emissions Policies and Measures for the Reduction of Greenhouse Gases Emissions 2011 submission.*

DG ECFIN, 2009, *2009 Ageing Report, Economic and budgetary projections for the EU-27 Member States (2008-2060).* (http://ec.europa.eu/economy_finance/publications/publication14992_en.pdf)

Nielsen et al, 2011, *Nielsen, O-K.; Winther, M.; Nielsen, M.; Mikkelsen, M-H.; Albrektsen, R.; Gyldenkærne, S.; Plejdrup, M.; Hoffmann, L.; Thomsen, M.; Hjelgaard, K.; & Fauser, P. Projection of Greenhouse Gas Emissions 2010 to 2030.*

Duerinck J et al, 2008, *Assessment and improvement of methodologies used for Greenhouse Gas projections, VITO.* (http://ec.europa.eu/clima/policies/g-gas/docs/ghg_projections_en.pdf)

EC, 2011, *PROGRESS TOWARDS ACHIEVING THE KYOTO OBJECTIVES, COM(2011) 624 final.* (http://ec.europa.eu/clima/policies/g-gas/docs/com_2011_624_en.pdf)

EEA, 2009, *Greenhouse gas emission trends and projections in Europe 2009, Tracking progress towards Kyoto targets. EEA Report No9/2009, European Environment Agency.* (http://www.eea.europa.eu/publications/eea_report_2009_9)

EEA, 2011a, *Annual European Community greenhouse gas inventory 1990–2009 and inventory report 2011, EEA Technical report No 2/2011, European Environment Agency, submission to the UNFCCC Secretariat.* (http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2011)

EEA, 2011b, *Greenhouse gas emission trends and projections in Europe 2011, Tracking progress towards Kyoto and 2020 targets. EEA Technical report No xx1/2011.* (http://www.eea.europa.eu/publications/eea_report_2009_9/ghg-trends-and-projections-2009-summary.pdf)

EEA, 2011c, *Approximated EU GHG inventory: early estimates for 2010*, EEA Technical report No 11/2011, European Environment Agency. (www.eea.europa.eu/publications/approximated-eu-ghg-inventory-2010).

ETC/ACM, 2011, *Quality assurance/quality control procedure for the reporting of projections under Decision 280/2004/EC (the EU Monitoring Mechanism Decision)', EEA.*

European Commission, 2010, *EU energy trends to 2030 — Update 2009, European Commission Directorate-General for Energy in collaboration with Climate Action DG and Mobility and Transport DG.* (http://ec.europa.eu/energy/observatory/trends_2030/index_en.htm)

European Commission, 2009b, *European Commission (2009) Fifth National Communication from the European Community under the UN Framework Convention on Climate Change (UNFCCC)*

European Commission, 2011, *Report from the Commission to the European Parliament and the Council. Progress towards achieving the Kyoto objective. COM(2011) 624 final.* (http://ec.europa.eu/clima/policies/g-gas/docs/com_2011_624_en.pdf)

Eurostat, 2011, http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/

Finland, 2005, *Greenhouse gas emissions in Finland 1990-2003, National Inventory Report to the UNFCCC.* (http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/2761.php)

Greece, 2011, *SUBMISSION OF INFORMATION UNDER ARTICLE 3(2) OF THE DECISION 280/2004/EC RELATED TO, "NATIONAL POLICIES AND MEASURES AND GHG EMISSIONS PROJECTIONS"*

IEA (2011b), *international historic fuel prices.* (http://www.iea.org/stats/index.asp)

Lithuania, 2011, *Policies & Measures and Projections of Greenhouse Gas Emissions in Lithuania* (http://www.am.lt/VI/files/0.035296001301042234.pdf)

Luxembourg, 2011, *Projected Greenhouse Gas Emissions in Luxembourg and Assessment of Policies and Measures.*

Point Carbon (2011), (http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.1496966)

Poland, 2011, *A Report for the European Commission under Article 3 (2) of Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.*

Romania, 2011, *Romania's 2011 report for the assessment of projected progress under Decision no 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.*

Annex

A. Methodology

The QA/QC methodology applied to the projections is based around the guiding principles which underpin the estimation, compilation and reporting of all emission inventories (IPCC, 2006). The five reporting principles are Transparency, Completeness, Consistency, Comparability and Accuracy (TCCCA). In addition to TCCCA, the MM Decision also requires 'Timeliness'. Table A-1 shows how the general QA/QC methodology applied ensures these criteria are met.

These six principles are then considered again in the QA/QC checks applied on a sectoral basis. The overall check on total emissions (excluding LULUCF) is covered in Chapters 3 and further checks on six sectors, which complements this Chapter, is included in the Annex B. This chapter only contains the methodology used in the Quality Assurance plan. Further information on the methodology of the QA/QC performed for this report can be found in the Quality Assurance plan (ETC-ACM, 2011).

Table A-1 The six principles of QA/QC, transparency, completeness, accuracy, consistency, comparability and timeliness in the context GHG projections

QA/QC principle	Definition in the inventory context and how the objectives are assessed in this report	Name of check to assess the principle and the section the methodology and results of the check are presented
Timeliness	*'All data and information are delivered on time.'* The timeliness of the projections is based on the date the data was uploaded on EIONET. Under the MM Decision, Member States were required to submit their projections data and information on policies and measures by 15th March 2011.	Timeliness: • Section 2.1
Transparency	*'The methods used to estimate the historical emissions and projections are clearly documented. The sources of all data used, including any parameters reported, are clear.'* The transparency check covers the reporting of the following elements: methodology used; sensitivity analysis; policies and measures included in the projections and the underlying assumptions used.	Transparency elements under completeness check - Section 2.2

QA / QC principle	Definition in the inventory context and how the objectives are assessed in this report	Name of check to assess the principle and the section the methodology and results of the check are presented
Completeness	*'Confirm that estimates are reported for all categories and for all appropriate years. For subcategories, confirm that the entire category is being covered.'* The completeness of the reported projections is assessed in line with the requirements set by the MM Decision and additional data requested by the European Commission in 2011. The completeness of the parameters is assessed for those parameters in Annex IV of the MM Decision which are used in the Quality Assurance procedure.	Completeness check - Section 2.2 Completeness of sector specific parameters by Member State can be found in the Annex B.

QA/QC principle	Definition in the inventory context and how the objectives are assessed in this report	Name of check to assess the principle and the section the methodology and results of the check are presented
Time series consistency	*'All emissions estimates in a time series should be estimated consistently, which means that as far as possible, the time series should be calculated using the same method and data sources in all years.'* Time series consistency with the 2009 inventory is assessed by comparing the reference year reported by Member States and emissions from the same year in the 2009 inventory for each high level IPCC sector. If emission levels for the reference year used in the projections and in the 2009 inventory for the same year differed by more than 3% (on a sectoral basis), then the percentage difference was applied to the projected emissions for all years. This adjustment brings the reported projections in line with the latest inventory In addition, the 2010 projections in the submissions were compared against the EEA 2010 proxy emission estimates (EEA, 2011c) for those Member States who used reference years before 2008 and Bulgaria (due to the large discrepancy observed in the reference year check). These two checks give an indication of whether the impact of the financial crisis has been taken into account.	Reference year check– Section 3.2 Comparison against the EEA 2010 proxy emission estimates – Section 3.3
Comparability	*'Comparability means that estimates of emissions and removals reported by Member States in their inventories and projections should be comparable among MS. For this purpose, Member State should use clearly documented and methodological sound approaches (accepting these will differ between MS as currently there is no commonly agreed projection methodology) and report in formats agreed under the MM Decision reporting inventories and projections.'* The comparability of the submission is based on if the optional reporting template[1] was used and if a projections methodology report was submitted. Other aspects covered under completeness supports the assessment of comparability, such as whether the projections were reported using the high level IPCC sectors.	Comparability elements under the completeness check – Section 2.2

[1] In an effort to improve the comparability and consistency of the reported data, an optional template for the reporting of projections and policies and measures under the MM Decision (hereinafter referred as 'reporting template') was designed by the EEA and its European Topic Centre on Air pollution and Climate change Mitigation (ETC-ACM) in 2006 and made available to Member States. The reporting template is updated each reporting year.

QA / QC principle	Definition in the inventory context and how the objectives are assessed in this report	Name of check to assess the principle and the section the methodology and results of the check are presented
Consistency (leading to accuracy assessment)	In addition to the time series consistency, the consistency between the following data has been assessed: • Internal consistency of the projections split by sector, EU ETS and non ETS and the total emissions (excluding LULUCF); • Assumptions (parameters) used to project 2010 emissions and actual 2010 statistics available from other data sources (e.g Eurostat) • Projected trend of parameters and the actual change observed in historic years; • Projected trend of parameters and the forecasted growth over the same period in other projection models (e.g EC Ageing Report). • Projected trend of emission intensity and the actual change observed in historic years	Consistency of ETS / non ETS with sectoral projections and total projections - Section 3.1 2010 comparison – Sections 4.1.1 and 4.1.3 Growth check – Sections 4.1.1 and 4.1.3 Emission intensity check – Sections 4.1.2 and 4.1.4 Consistency of the sector specific parameters can be found in the Annex B.
Accuracy (results of the consistency assessment)	*'Accuracy is a relative measure of the exactness of a GHG emission or removal estimate. Estimates should be accurate in the sense that they are systematically neither over nor under true emissions or removals, as far as can be judged, and that uncertainties are reduced as far as practicable.'* The results of the consistency check results identify the level of risk associated with the key parameters used to compile the projections being over or underestimated (High, Medium and Low). These risk levels resulting from the consistency checks are then summarised for each country to determine the risk that the reported projections have been over or underestimated (accuracy of projections).	Accuracy – Chapter 5 Accuracy of the sector specific projections can be found in the Annex B.

A.1 Timeliness

The timeliness of the reported projections is judged on whether the data was submitted before the deadline of 15th Mach 2011. Member States often resubmit their data up to end of June. The timeliness is assessed based on the timing of the initial submission.

A.2 Completeness

A.2.1 Completeness of projections

The completeness of the projections is assessed based on the mandatory and recommended requirements of the MM Decision, and other additional recommended requested by the European Commission[2] in particular for the 2011 reporting have been met.

Member States must report the following information:

National projections of greenhouse gas emissions by sources and their removal by sinks as a minimum for the years 2005, 2010, 2015 and 2020, organised by gas and by sector, including:

1. *'with measures' (WM) and 'with additional measures' (WAM) projections such as mentioned in the guidelines of the UNFCCC and further specified in the implementing provisions adopted pursuant to paragraph 3 of the Decision;*
2. *clear identification of the policies and measures included in the projections;*
3. *results of sensitivity analysis performed for the projections;*
4. *Descriptions of methodologies, models, underlying assumptions and key input and output parameters.*

The use of a specific template for the reporting of projections and policies and measures was recommended and the following non-mandatory information was also requested:

1. Emissions for 2025 and 2030;
2. Emissions split into EU ETS and non ETS; and
3. Projections for a Without Measures (WOM) scenario

The completeness check covers elements of comparability and transparency. Fulfilling mandatory requirement 1 and using the reporting template increases the comparability of the Member State projections, and mandatory requirements 2, 3 and 4 enhances the transparency of the reporting. The check highlights those Member States that have not met the requirements under the MM Decision.

A.2.2 Completeness of projections parameters

For parameters, the completeness is only assessed for those 35 mandatory parameters used in the Quality Assurance plan rather than all mandatory parameters listed in Annex IV of the MM Decision. These parameters are main general economic parameters (GDP,

[2] Email communication from the Commission to the Climate Change Committee Working Group II "Implementation of the Effort Sharing Decision, Policies and Measures and Projections' on 16th November 2011

population, international import price of fuel and carbon price) and those that reflect the status of the largest emission sources in each of the non-ETS sector. The list of parameters used in the Quality Assurance plan is listed in Figure 2.2 of the main report. The completeness of the projections parameter is based solely on whether they have been reported. There are three scenarios where the parameters are considered incomplete:

1. Non-reporting by Member States;

2. Member States indicating that the parameter were not used to estimate their projections; and

3. Member States reporting a figure for the parameter but without any indication of the units used.

A.3 Consistency to evaluate accuracy

There are a number of consistency checks performed for both the projected emissions and parameters. The first check (see A.3.1) ensures that the submission is internally consistent (Consistency of ETS / non ETS with sectoral projections and total projections). The second check (see A.3.2 and A.3.3) determines the consistency of the reported projections against the 2009 inventory and the EEA 2010 proxy emission estimates. Finally, the most important consistency check (see A.3.4 to A.3.5), which leads to the determination of the accuracy of the reported projections, compares the key parameters used to compile the projections against actual 2010 statistics, assumptions used in other projections models and the historic trend observed for the parameter. The consistency between the submission and surrogate data helps determine the risk that the reported projections are over or underestimated (accuracy).

If a risk of over or underestimation is identified, the projections report of the Member States is consulted to see if further information are available. Depending on the results from the checks and the type of check one of three different risk levels can be assigned (High, Medium or Low risk the projections are over or underestimated). The risk level assigned to the consistency (and accuracy) of the parameters varies in accordance with the uncertainty associated with each check. The risk levels which can be assigned from the individual checks can be found in the text in the grey box for each check (Section A.3.1 To A.3.6).

The sum check and the reference year check (see Chapter 3) are performed for total emissions (excluding LULUCF). The consistency checks using the parameters (see Chapter 4) are carried out for a number of parameters for each sector. The comparison of the projected trend of the emission intensity against the historic trend is performed only for the parameters population and GDP.

A.3.1 Consistency – sum check

The sum check is an internal consistency check to ensure that the sum of the disaggregated projections by sector and split into ETS and non ETS are consistent with the total projections (excluding LULUCF). If inconsistencies were found in the sum check, further communications between the ETC-ACM and the Member States were held. This resolved most of the inconsistencies found.

A.3.2 Time series consistency – reference year check

The time series consistency check of projections assesses whether the reference year of the reported projections are consistent with the 2011 GHG inventory submission.

The UNFCCC guidelines for National Communications (1999) indicate that the starting point for the 'WEM' and 'WAM' projections should be the latest year of the most up to date GHG inventory (i.e. 2009 for the projections submitted in March 2011). The starting point for EU projections is variable due to the aggregation of Member State projections. Member States present projections relative to historic data; it may be assumed that the most recent year of historic emissions presented is the starting point for the projections. This so-called 'reference year' for projections presented by each Member State is detailed in Section 3.2.

To bring the Member States' projections for the 'WEM' and 'WAM' scenarios in line with the most up to date historic inventory data, the difference between the emissions reported by the Member State for the reference year and the equivalent year in the latest inventory was calculated for each key IPCC sectors. If the difference between these two common years was found to be greater than 3 %, this percentage difference was applied to the projections for all years to bring the projections in line with the most recent, inventory, i.e 2011 submissions.

The reference year check is particular important due to the recent financial crisis. If Member States use reference years prior to 2008, there is a risk that projections did not take into account the effects of the financial crisis. Inventory submissions made in 2011 show the impact of the financial crisis characterised by the strong decline in emissions observed between 2008 and 2009. This fall in emission levels will affect 2010 and future emission levels. To determine if Member States included the impact of the financial crisis in their projections, 2010 projections in the submissions were compared against the EEA 2010 proxy emission estimates (EEA, 2011c) for those Member States who used reference years prior to 2008 and Bulgaria (due to the large discrepancy observed in the reference year check).

If the 2010 projections are more than 5% higher than the proxy estimates, it is likely that the impact of the financial crisis has not been taken into account fully in the projections and as a result overestimated.

A large percentage difference between firstly, the reference year used in the submission and the 2011 inventory submission, and secondly the 2010 projections and EEA 2010 proxy emission estimates results in a 'high' level risk being assigned to the Member States' projections indicating the projections are very likely to be over or underestimated. This is because the 2011 inventory and the EEA 2010 proxy emission estimates show the most accurate historic emission estimates available. So any divergence is very likely to indicate an over or underestimate of the projections.

A.3.3 Consistency of the 2010 assumption against the 2010 actual statistics

The assumptions used by Member States (parameters listed in Chapter 2) were compared against actual 2010 statistics available from Eurostat where the statistics were already available. This allows a check the consistency of the starting point used for the projection parameters. Since the reference point of the assumption is compared against is an actual figure, a clear evaluation of whether the accuracy of the 2010 assumption can be made. This check is crucial because any difference identified may also affect the accuracy of projected parameters in 2015 and 2020. The projected parameters are considered consistent with the actual 2010 data if the magnitude of the difference between the two is higher than the set threshold. For each parameter, a different threshold is used to reflect the nature of the parameter. For example, GDP is a much more complicated parameter than population for two main reasons and hence a greater divergence between the 2010 assumption used by the Member State is considered acceptable. These reasons are:

- The trend is more volatile and less linear;
- GDP is reported by the Member States in various units (currency and price year) and to perform the comparison the currency and the price year of the Member States' assumptions need to be harmonised. Member States are likely to have used different exchange and inflation rates and in some cases the wrong units may be reported. In addition, GDP may be reported in value added at basic prices whereas the Eurostat figure is expressed at market prices.

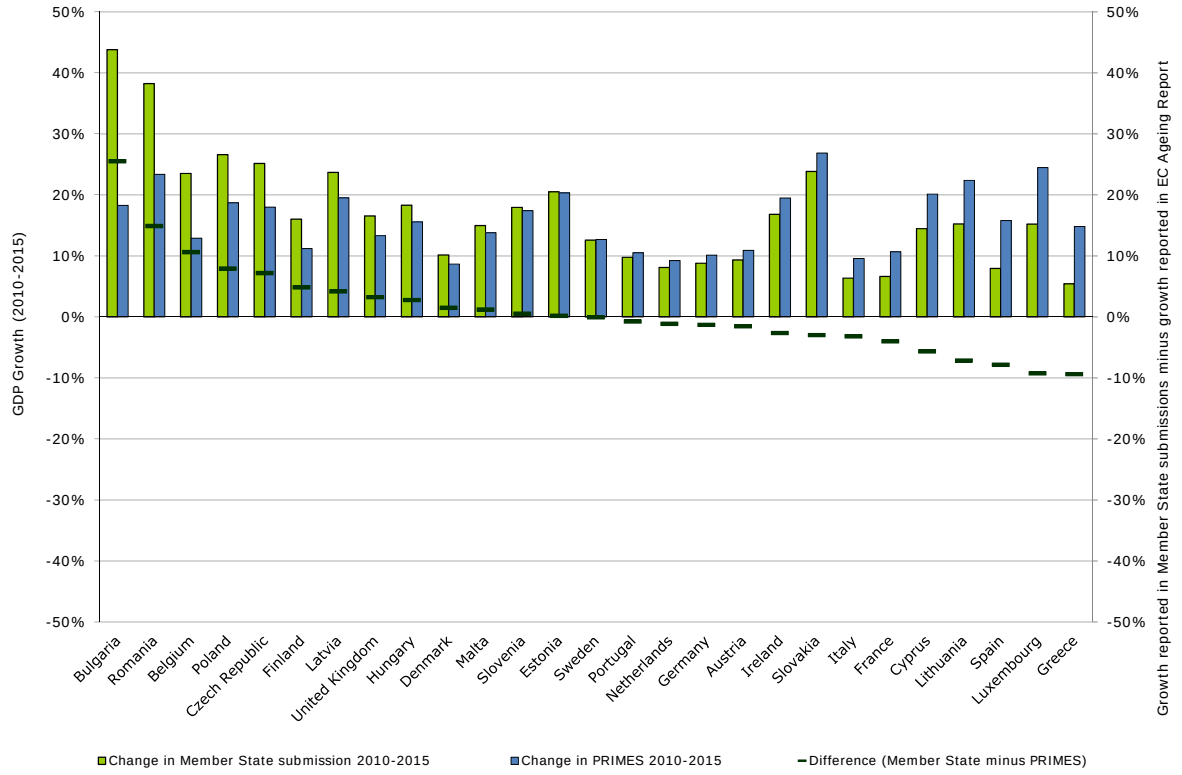
In general, a 'high' risk factor is assigned to the Member States' projections, if the results from this check show that there is a risk that the projections are over or underestimated. This is because the comparison is made against actual 2010 Eurostat statistics. So any significant divergence almost indicates an over or underestimate of the parameter. In some cases, the divergence between the data is explained by other reasons (e.g consistent discrepancy throughout the entire time series), in this case no risk of over or underestimation is assigned to the projections.

For some of the sector specific parameters (namely the carbon price and international oil price) the highest risk resulting from this check is 'medium'. This is because there is some uncertainty in the data reported by the Member States. The results showed high discrepancies between the Member States and the reference data. The uncertainty is expected to be as a result of errors in the units used to report the parameter and the inconsistent conversion rates used by the Member States for energy, price year and currency.

A.3.4 Consistency of the growth assumptions of parameters

The check detailed in Sections A.3.2 and A.3.3 identifies the differences which exist due to different reference years or starting point of the projections. In the next step, the projected growth of these assumptions is compared against another (surrogate) model which also projects the growth of the same parameter. Only the growth rate between the projected years is compared to analyse the consistency between the Member States' assumptions. By comparing the relative change of the parameters between the consecutive years for which projections are reported, it does not take into account the difference in the starting year (2010). The check shows whether Member States are being optimistic or pessimistic about the change in key parameters which have a large impact on GHG emission levels compared to other projection models. It does not assume that the surrogate model provides a more accurate reflection of the expected growth for these parameters. It provides another insight into the expected change of these parameters. This is reflected in the risk level which can be assigned as a result of this check and the criteria which the difference between the models is assessed against. The source of the surrogate model Member States' reported assumptions are compared against are noted in Section A4.

Figure A-1 Difference between economic growth assumptions 2010-2015, Member State submissions and the EC Ageing Report



Source: ETC/ACM 2011, DG ECFIN 2009

Figure A-1 shows an illustrative presentation of the difference between the growths rates of the two models. The difference is calculated by subtracting the growth rate estimated by the surrogate model away from the growth rate reported in the Member State submissions (shown by the black horizontal bars). This method only identifies notable absolute differences which exist for Member States and not the notable relative differences. This is valid in this analysis because large differences in relative terms (e.g 0.1% and 0.5%) do not lead to significant differences in the actual figure used for the parameter. If the difference between the growth rates expected by Member States is higher than the criteria set for each parameter there is a risk that the change in the parameter is over or underestimated. The detail of the criteria used is specified in section 4.1.1 for GDP and section 4.1.3 for population.

If the projected growth of the parameter is found to be inconsistent with the surrogate model, the projected growth rate and the actual growth between the five year period 2003 and 2008 (excluding 2009 because of the financial crisis) are compared. This check shows if the projected growth is consistent with the change observed in historic years for the specific Member State. For some sectoral parameters, where the peaks and troughs in the historic trend show the volatility of the parameter, the comparison against the historic trend is not performed.

For those Member States where the discrepancy is higher than the set threshold, the reasons behind the difference is sought after in the reports submitted with their projections under Article 3.2 of the MM Decision.

Whereas in the previous checks the comparison was made against actual figures, this check is a comparison against another projections model which is also associated with a degree of uncertainty. Thus, only a 'medium' risk of over or underestimation can be assigned to the assumptions used to calculate the projections. If the historic change between 2003 and 2008 is similar in magnitude to the expected growth rate used by the Member State, the medium risk is downscaled to a low risk. This also applies if the projection reports submitted by Member States provide reasons behind the projected growth of the parameter. If the reports contain no information and the change between 2003 and 2008 is in line with the growth rate expected from the surrogate model then the risk level remains at 'medium'.

A.3.5 Consistency of the change in emission intensity with historic trend

In the final assessment, for the total emissions chapter, the projections and parameters were combined to create emission intensity indicators (similar to implied emission factors in the historic inventory). If Member States use 2010 GDP assumptions consistent with the Eurostat data and a GDP growth which is similar to those assumed in the EC Ageing Report, it can be considered that the risk of reporting under or overestimated projections by the Member State is reduced. But, this does not identify whether the actual projected emissions are over or underestimated, because it purely shows that the parameter used to compile the projections is consistent with the surrogate data set and the parameter reported by the other Member States. By studying how emissions change with the parameter the emission intensity check identifies the risks associated with the reported projections being over or underestimated. The projected change of the emissions intensity is compared against the actual trend observed between 2003 and 2008. This shows whether the Member States are being optimistic or pessimistic about the decoupling of emissions and economic (or population) growth compared to what has taken place before. Emission intensities are affected by a large number of factors, e.g. fuel switching, imports and exports of electricity and structure of the economy. This check can identify possible risks in over or underestimated projections from optimistic or pessimistic decoupling of economic growth (or population) and GHG emissions. Emission intensities are country specific and affected largely by country specific circumstances and is not a simple indicator to determine the over or underestimation of emission projections unless the results show significant diversion from the historic trend.

Due to the high levels of uncertainty, only a 'low' risk of over or underestimation can be assigned to the reported projections from this check. If the projection reports or the historic trend of emission intensities provide reasons behind the pessimistic or optimistic decoupling between emissions and economic/ population growth, the risk considered negligible.

A.4 Accuracy

The accuracy of the Member State projections is determined by the summary of the risks assigned as a result of the checks described above. A point system matrix for the risk levels where High = 3, Medium = 2 and Low = 1 is used to summarise the level of risk associated with the over or underestimation of the projections (accuracy of the projections). If the score for a Member State is higher than seven the risk that the projections have been over or underestimated is too great to accept the projections to be included in the overall EU-27 projections. The same matrix is used to determine the accuracy of the sectoral projections in Annex B. However, the results in Annex B are not used to determine whether the projections should be used to calculate the EU-27 projections.

These risk levels are then used to determine whether the Member States' projections should be used to calculate the overall EU-27 projections. If the risk that the projections are over or underestimated is greater than seven then they are gapfilled with PRIMES/GAINS data to ensure that the EU-27 projections used to track progress against emission targets portray a realistic picture based on data which can be considered most accurate (without the use of projections which have a high risk of inaccuracy).

A.5 Data sources

Different data sources were used to perform the consistency check for each parameter. For each of the parameters, the data source used for the projected and historic data is listed below. For GAINS and PRIMES data, the baseline scenario is used.

Table A-2 Data sources used in the consistency checks

Parameter	Historic data source	Projected data source
GDP	Eurostat - GDP and main components – volumes [nama_gdp_k-]	EC Ageing Report (DG ECFIN, 2009)
Population	Eurostat -Population on 1 January by age and sex [demo_pjan]	EC Ageing Report (DG ECFIN, 2009)
Diesel fuel demand	Eurostat – Final energy consumption – Transport diesel – (annual data) [nrg_102a]	PRIMES - Total transport (excluding bunkers) - final energy demand – liquid fuels – diesel oil
Passenger-	Eurostat – Road transport measurement -	PRIMES - Passengers transports - Private Cars

Parameter	Historic data source	Projected data source
kilometres	passengers [road_pa]	– activity (Gpkm)
Numbers of cattle	Eurostat - Cattle population (annual data) [apro_mt_lscatl]	GAINS model - scenario: PRIMES_BL2009_14jan10 activity: dairy cows and non-dairy cattle
Fertiliser use (synthetic and manure)	2011 National GHG inventory submissions CRF - Animal Manure Applied to Soils and Synthetic Fertilizers	GAINS model - scenario: PRIMES_BL2009_14jan10 activity: Mineral fertilizer urea and Mineral fertilizer other
Carbon Price	Point Carbon (2011) [3]	PRIMES baseline scenario (2009) projected carbon price in
International oil price	IEA (2011)	PRIMES baseline scenario (2009) projected international oil price in PRIMES Baseline model
GVA of industry	Eurostat – Gross value added total industry (excluding construction), chain-linked volumes, million Euros, reference year 2000 (at 2000 exchange rates) [(ebt_inpp_mdm and ebt_inpr_mtr]	PRIMES Sectoral value added (in 000 MEURO ´05)
Gas consumption by industry	2011 National GHG inventory submissions CRF – Fuel combustion, manufacturing industries and construction, gaseous fuels	PRIMES – final energy demand industry, gas
Gas consumption by residential sector	2011 National GHG inventory submissions CRF – Fuel combustion, residential, gaseous fuels	PRIMES - final energy demand domestic, gas

[3] http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.1496966

B. Sector specific analysis

Quality Assurance on a sector specific basis has been carried out using the same methodology as for the total emissions (excluding LULUCF) – c.f Chapter 2. For each sector projection parameters which best reflect the largest emission sources from the sector are analysed in a similar way to GDP and population. Further detail on the methodology followed can be found in the methodology section in Annex A and the total emissions chapter (c.f Chapter 2). The results are presented by sector in the Annex because they were not used to determine whether the Member States' projections would be included or excluded in EU total projections. The sectoral chapter provide further insight into the completeness of the reporting of sector specific parameters and whether there is a risk that these parameters have been over or underestimated to support the results of the total emissions chapter.

For some parameters, the consistency against the actual 2010 statistics was not done because the data was not yet available at the time the analysis was performed. The consistency of the change in emission intensity with the historic trend has not been performed. This is primarily because projections are often not reported using the most disaggregated IPCC sectors used in the historic inventory which are required to create meaningful emission intensity indicators using these source specific parameters. In addition, the analysis found that often the definitions used for the sector specific parameters were not consistent between Member States or with historic data sources. In the total emissions chapter, the check using the emission intensities only determined whether there was a low risk that the projections have been overestimated if there was a big difference with the historic change. With these data issues in mind, the sector specific emission intensities were considered unlikely to provide strong arguments as to if there was a risk the projections were over or underestimated. At the end of each Annex B chapter, an analysis of the accuracy of the sectoral parameter has been presented.

B.1 Energy supply

Carbon price and international import price of oil are the key parameters assessed for the energy supply sector. In the 2009 inventory, IPCC sector 1A1 accounted for the highest energy consumption relative to other sectors on the same IPCC sector level (1A2, 1A3, 1A4 and 1A5) in the EU-15 (EEA, 2011a). Carbon price and international oil price were reported by 20 Member States. Italy, Lithuania, Luxembourg, Malta, Portugal, Romania and Slovakia did not report information on carbon price. International oil price assumptions were omitted by Bulgaria, Lithuania, Luxembourg, Romania and Slovakia, plus France and Poland did not report the 2010 data.

Carbon price

- There is a medium risk that five Member States have overestimated their 2010 carbon price assumptions (Bulgaria, Greece, Poland, Slovenia and Sweden).
- 13 Member States are associated with over or underestimating the projected trend of carbon price during 2010-2020. In general, Member States are pessimistic about the increase in Carbon price in the future in comparison to PRIMES probably as a result of the Carbon price trend in historic years.

International oil price

- There is a medium risk that eight Member States (Austria, Greece, Ireland, Italy, Latvia, Malta, Sweden and the United Kingdom) have over or underestimated their 2010 international oil price assumptions. Sweden is the only Member State with a risk of underestimation.
- 13 Member States are associated with over or underestimating the projected trend of international oil price during 2010-2020. During 2010-2015, Member States tend to project a higher increase because PRIMES projects prices will stagnate. During 2015-2020, PRIMES expects international oil price to rise quicker (22%) and Member States tend to project a lower rise in prices.

Of the EU-27 Member States, Sweden and the United Kingdom's energy supply projections have the highest risk of being based on key parameters with inaccurate values and trends. Carbon price and international oil prices are very uncertain parameters in comparison to GDP and population. This is because they are more prone to peaks and troughs and are unlikely to follow a linear trend. In addition Comparing Member States Carbon price and international oil price assumptions with surrogate data is not straightforward because the assumptions are reported in inconsistent units which may already have been converted using inconsistent conversion factors.

The key assumptions studied for the energy supply sector are carbon price and the international energy import price for oil. GHG emissions across all sectors, in particular emissions from the energy supply sector, are strongly influenced by the carbon price and the international fuel prices. In 2009, IPCC sector 1A1 consumed the most fuel relative to other sectors on the same IPCC sector level, 1A2, 1A3, 1A4 and 1A5 in the EU-15 (EEA, 2011a).

Carbon price and international fuel prices are also affected by weather conditions, such as cold winters and hot summers which affect the demand for fuels and in turn affect the economic feasibility of using renewable fuels[4].

B.1.1 Completeness

Carbon price was not reported by 20 Member States and omitted by seven Member States; Italy, Lithuania, Malta, Luxembourg, Portugal, Romania and Slovakia. International oil price were reported by 20 Member States also. Romania, Lithuania, Slovakia, Bulgaria and Luxembourg reported no estimates for all projected years. France and Poland did not report the international oil price assumption for 2010. The completeness of carbon price is high despite the reporting being non-mandatory. Throughout Annex B, assessment using the sector specific parameter could not be carried out for those Member States where the data was incomplete.

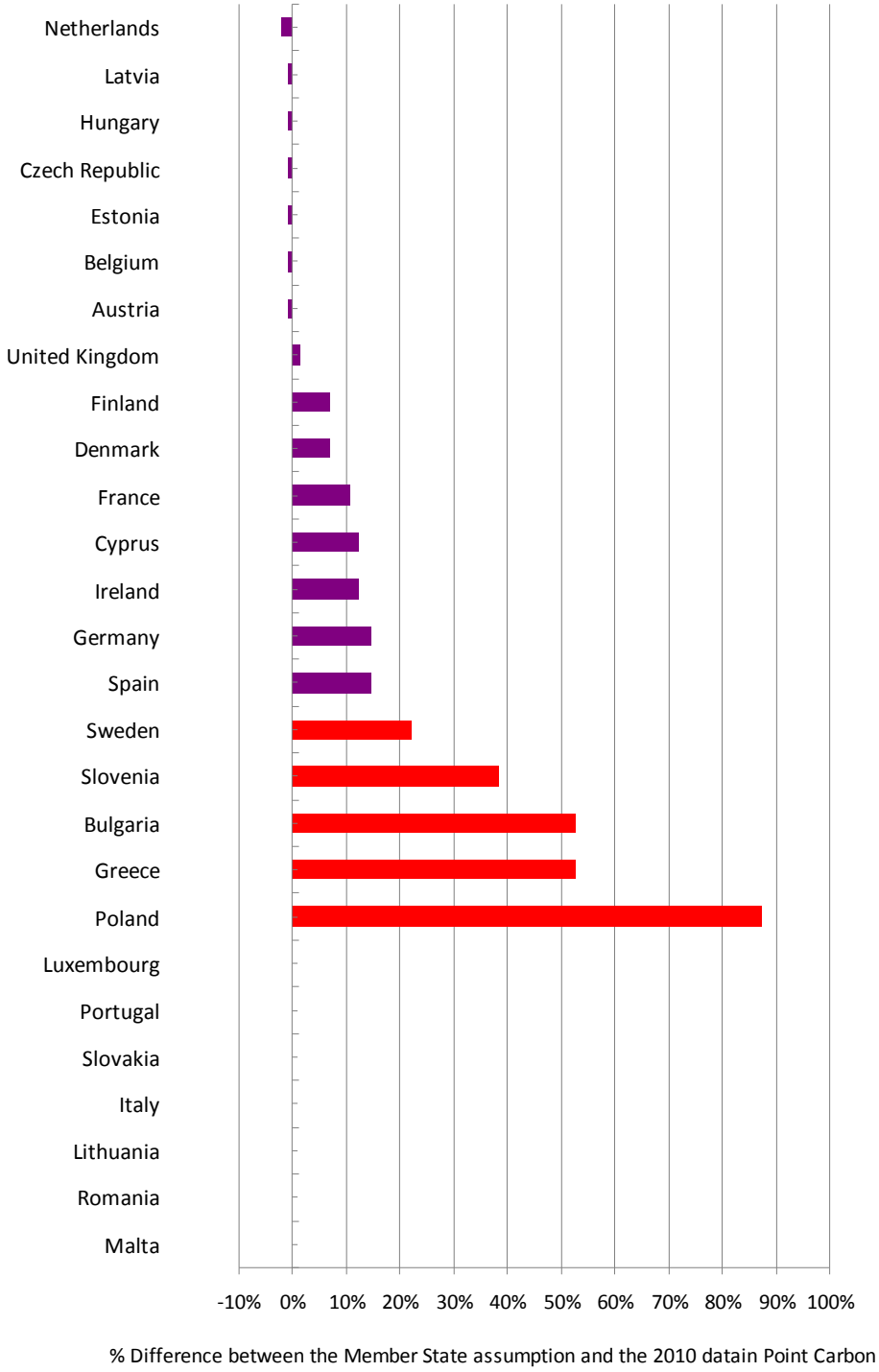
B.1.2 Carbon price

Consistency against 2010 Point Carbon data

Consistency between the 2010 carbon price assumption reported by Member States and the observed 2010 carbon price (Point Carbon, 2011) is assessed using the same methodology as GDP and population (Section 4.1.1 and Section 4.1.3). Figure B-1 shows the difference between the carbon price reported by the Member States and the carbon price in 2010 reported by Point Carbon expressed as a percentage of the Point Carbon value. Where the percentage difference change is greater than +15% the bars are red and where the percentage change is lower than -15% the bars are green.

[4] International fuel prices affect carbon price

Figure B-1 Difference between the projected 2010 carbon price assumptions reported in Member State submissions and the actual 2010 carbon price data from Point Carbon



Source: ETC/ACM 2011, Carbon Point - Weighted-average price per tonne in 2010: http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.1496966

Note: Red bars indicate Member States whose assumptions are more than 15% higher than the 2010 carbon price reported by Point Carbon. Data for Malta, Romania, Lithuania, Italy, Slovakia, Portugal and Luxembourg not available

In general, Member States use carbon price assumptions higher than the figure reported by Carbon Point. The percentage difference is higher than 15% for Poland, Greece, Bulgaria, Slovenia and Sweden (the difference for the first three are over 50%). None of the above Member States reported historic carbon price time series consistent with the projected carbon prices in their submission. As a result, it is not possible to identify if the difference is explained by a systematic discrepancy which exists through the entire time series or because the assumption has been overestimated. The difference is very high for these Member States, which indicates that difference cannot solely be explained by over or underestimation by the Member States. There is a medium risk that Poland, Greece, Bulgaria, Slovenia and Sweden have overestimated their 2010 carbon price assumptions. A higher risk cannot be assigned in the absence of further information.

Time series consistency of the growth expected between 2010-2015 and 2015-2020

In order to identify the risk the development of carbon price in future years has been over or underestimated by the Member States, the projected future carbon price assumed by the Member States has been compared against the forecasted growth in the PRIMES model ($$references). The difference (inconsistency) between the growth rates of the two models are calculated using a similar methodology as GDP and population (Section 4.1.1 and Section 4.1.3). The following criteria have been applied:

- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated their carbon price if the difference between the carbon price data estimated by Member States and by the use of the PRIMES model is less than or equal to 15%;

- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated their carbon price if the difference between the carbon price data estimated by Member States and by the use of the PRIMES model is less than or equal to 15%;

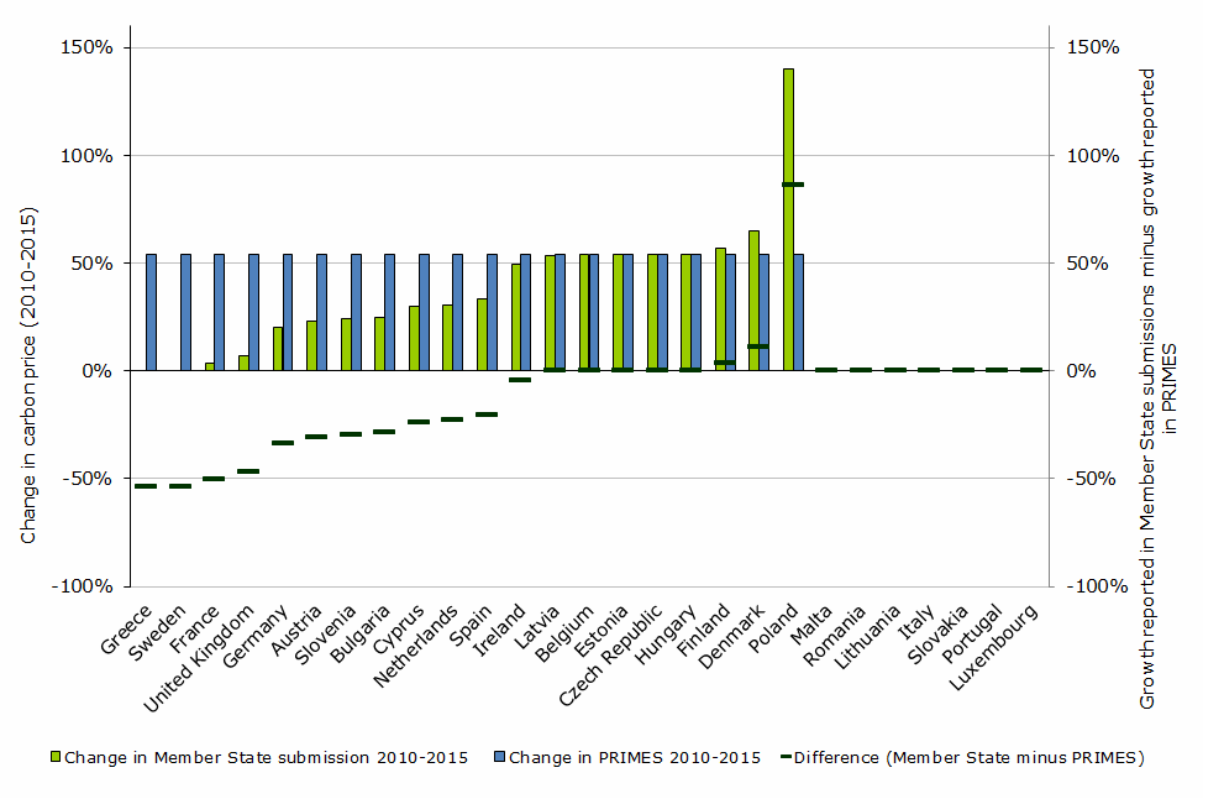
For GDP and population, if the difference exceeded the above criteria, the expected growth was compared with the actual change observed between 2003 and 2008 because these parameters tend to follow a more linear trend. However carbon price is more volatile with peaks and troughs. Hence such comparison has not been carried out against the historic trend. Carbon price is volatile and is affected by a large number of factors (for example, increase in international gas price will shift electricity generation to coal leading to high carbon prices and dry winters would result in less electricity generated from hydro hence high carbon price). This is evident in the historic trend of carbon price (c.f Figure B-2) and as a result projecting the growth of the carbon price is complex. In PRIMES, the ETS carbon price is based on modelling that match cumulative emissions over the period 2008-2030 with cumulative allowances assuming the maximum permissible use of CDM (1600 Mt) (European Commission, 2009a). Due to the high uncertainty of carbon price, although the

equivalent checks for GDP and population resulted in medium risks being assigned to the projected growth of the parameter, even if the difference between the changes in carbon price assumed by the Member State and reported in PRIMES exceed the criteria, the highest risk which can be assigned to the over or underestimation of the growth in carbon price is low.

Figure B-2 Historic EUA trading price (Apr 05-Mar 09)

Source: European Commission (2009b)

Figure B-3 Difference between the assumptions of the change in carbon price during 2010-2015, Member State submissions and PRIMES



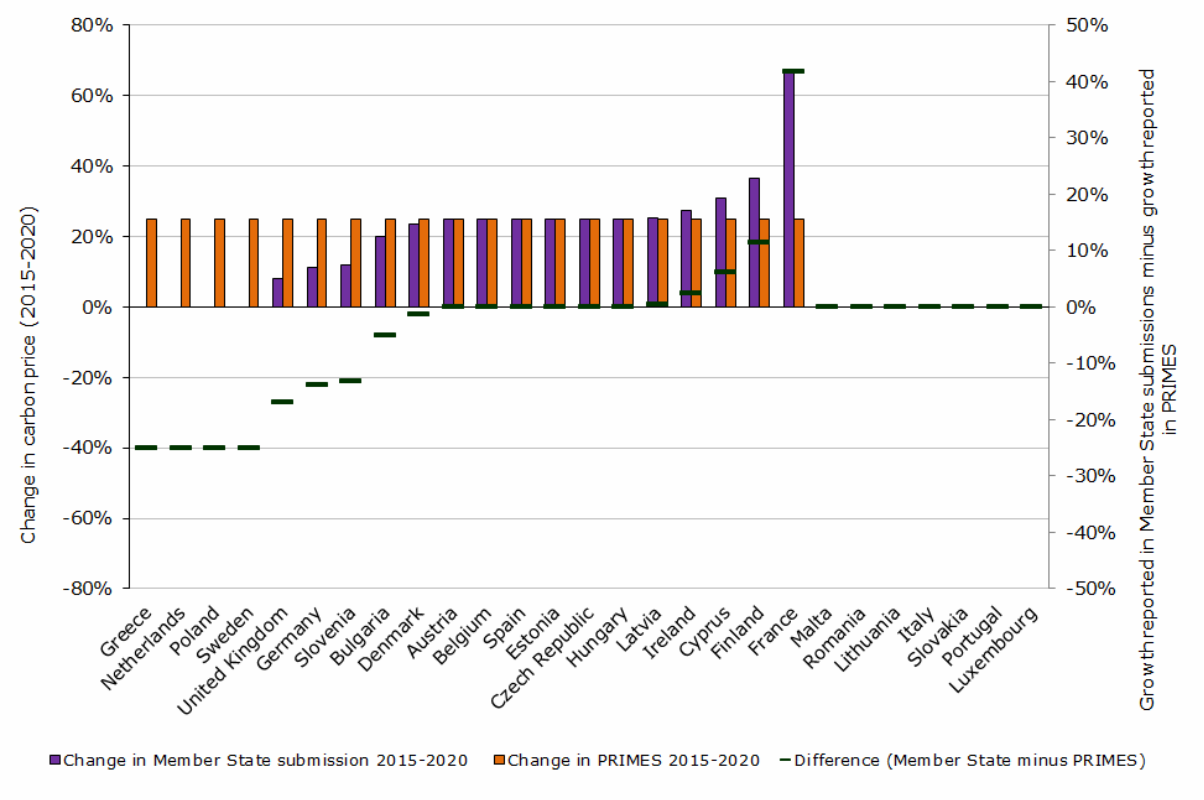
Source: ETC/ACM 2011, PRIMES 2009

Figure B-3 shows the difference between the growth assumptions for carbon price during 2010-2015 reported by the Member State and in PRIMES. Poland and Denmark expect an increase of carbon price 10% higher than the assumptions used in PRIMES. 11 Member States (Greece, Sweden, France, the United Kingdom, Germany, Austria, Slovenia, Bulgaria, Cyprus, the Netherlands and Spain) project an increase in carbon price 15% slower than the growth projected in the PRIMES model between 2010 and 2015. Greece and Sweden use a constant carbon price in 2010 and 2015 and no Member States project a fall in carbon price in the future compared to 2010. There is a low risk that Denmark and Poland are overestimating the growth in carbon price assumptions but for the latter group of 11 Member States, there is a low risk that the carbon price growth assumptions used are an underestimate.

Between 2015 and 2020, PRIMES model a slower increase of carbon price in comparison to the expected increase during 2010-2015 (25%). Four Member States (France, Finland, Cyprus and Ireland) project a higher increase in carbon price. As well as Greece and Sweden who use a constant carbon price between 2010 and 2015, the Netherlands and Poland assume that carbon price will remain constant between 2015 and 2020. France is the only country, who assumes an increase in carbon price 15% higher than the growth assumptions used in PRIMES. Greece, the Netherlands, Poland, Sweden and the UK assume that the change in

carbon price during 2015-2020 will be 15% lower than the change modelled in PRIMES. There is a low risk that these Member States have underestimated the change in carbon price between 2015 and 2020.

Figure B-4 Difference between the assumptions of the change in carbon price during 2015-2020, Member State submissions and PRIMES



Source: ETC/ACM 2011, PRIMES 2009

B.1.3 International energy import price for oil

Consistency against 2010 IEA data

Consistency between the 2010 international import price for oil assumptions reported by Member States and the observed 2010 oil price is assessed using the same methodology as GDP and population (Section 4.1.1 and Section 4.1.3). Figure B-5 shows the difference between the international import price of oil reported by the Member States and the observed international import price of oil reported by IEA (2011) expressed as a percentage of the IEA (2011) value. Where the percentage difference change is greater than +10% the bars are red and where the percentage change is lower than -10% the bars are green.

Figure B-5 Difference between the projected 2010 international oil price assumptions reported in Member State submissions and the actual 2010 data from IEA

Source: ETC/ACM 2011, IEA 2011 average crude oil price during 2010 in 2008 prices
Note: Red bars indicate Member States whose assumptions are more than 15% higher than the data reported by the IEA. Green bars indicate Member States whose assumptions are more than 15% lower than the data reported by the IEA.

Member States tend to use 2010 international oil price assumptions higher than the actual international oil price reported for 2010 by IEA (2011). The percentage difference is higher than 15% for Italy, Malta, Latvia, Ireland, the United Kingdom, Austria and Greece. Differences for the first three are particularly high (exceeds 30%).

Italy, Latvia and the UK reported historic international oil prices time series consistent the projected assumptions. Comparing the historic figures with the IEA (2011) data can show whether the differences are systematic discrepancies which exist for the entire time series:

- Latvia reported that international oil price was 20 Euros per barrel (2000 prices) in 2000 which is lower than the international oil price according to the IEA (2011) calculated based on the average for France, Germany, Italy, Spain and the UK (25.8 Euros per barrel (2000 price year)). The international oil price in 2005 reported by Latvia (45.6 Euros per barrel (2005 price year)) is also much lower than the prices reported by the IEA (2011) (64.9 Euros per barrel).

- Italy reported international oil price of 48.3 Euros per barrel (2005 prices) for the year 2005 which is much less than the figure reported by the IEA (2011b) for oil price in Europe in 2005[5] (64.9 Euros per barrel (2005 prices)).

- The UK reported international oil price was 22.6 Euros per barrel (2000 prices) in 2000, which is 12% lower than the figure reported by the IEA (2011) for oil price in Europe in 2000[5] (25.8 Euros per barrel (2000 prices)).

The historic international oil prices reported by these Member States are lower than the figures reported by the IEA (2011) contradicting the difference observed for 2010 (Member State assumption is higher than IEA figures for 2010). Thus the difference cannot be as a result of a systematic discrepancy. Due to the uncertainty of the data, there is only a medium risk that the 2010 international oil price has been over or underestimated by these Member States where the difference between the two datasets exceeds 15%.

International oil price has been reported using a wide range of units (price year, energy units and currency). Thus, the discrepancy may be explained by the methodology and the values used by Member States to convert units, currencies or the account for inflation. In order to carry out a meaningful consistency check of the assumption used by Member States for international oil price, it is recommended that:

- The units for reporting are harmonised;

- All Member States use the same dataset to convert price years, currencies and energy units;

- The same methodology is used to convert the units; and

[5] calculated based on the average for France, Germany, Italy, Spain and the UK

- The historic dataset which the projected assumptions should be consistent with is specified.

Time series consistency of the growth expected between 2010-2015 and 2015-2020

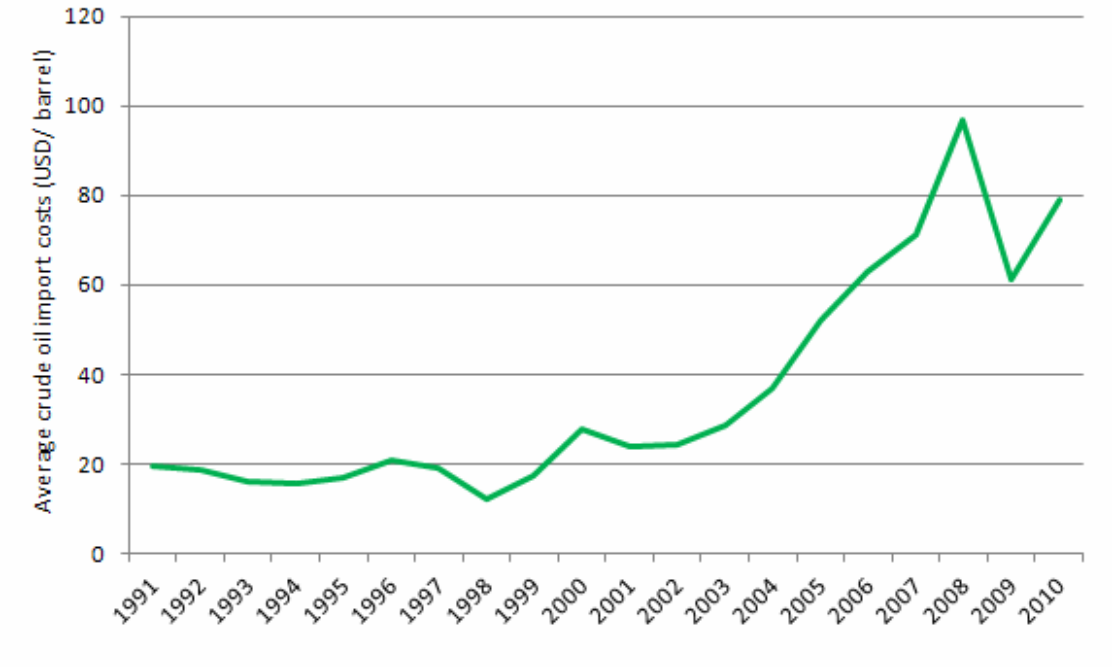
The projected growth of the international oil price reported by the Member States has been compared against the forecasted growth in the PRIMES model ($$reference) in order to identify the risk for over or underestimation of growth rates by Member States. The difference (consistency) between the growth rates of the two models are calculated using a similar methodology as GDP and population (Section 4.1.1 and Section 4.1.3). The following criteria have been applied:

- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated their international oil price if the difference between the international oil price data estimated by Member States and used in the PRIMES model is less than or equal to 10%;

- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated their international oil price if the difference between the international oil price data estimated by Member States and used in the PRIMES model is less than or equal to 15%;

A greater margin of tolerance between the two estimates of data is allowed for predictions made further into the future. International oil price is volatile with peaks and troughs like carbon price. Prior to the turn of the century, prices were relatively stable (c.f Figure B-6) but since then international oil price has been increasing rapidly. For GDP and population, if the growth rate reported by the Member State and the surrogate model exceeded the set threshold, the consistency against the growth rate observed in historic years (2003-2008) was analysed to determine the risk that the projected growth of the parameter was over or underestimated. The trend for international oil price observed between 2003 and 2008 was the highest growth observed since 1990 (239%). Therefore, consistency against the historic trend is assessed using the change observed in the most recent five year period instead (2005-2010), which is still a very steep increase (52%). Thus, if Member States project a higher increase than 52% during a five year period in the future there is a high risk that the growth in international oil price is overestimated. If the difference is higher than the set criteria and lower than the change observed between 2005 and 2010, there is a medium risk that the growth has been overestimated. The PRIMES model projects a very slow increase in international import price of oil only increasing by 1% between 2010 and 2015.

Figure B-6 Average crude oil import cost in Europe (USD / barrel)

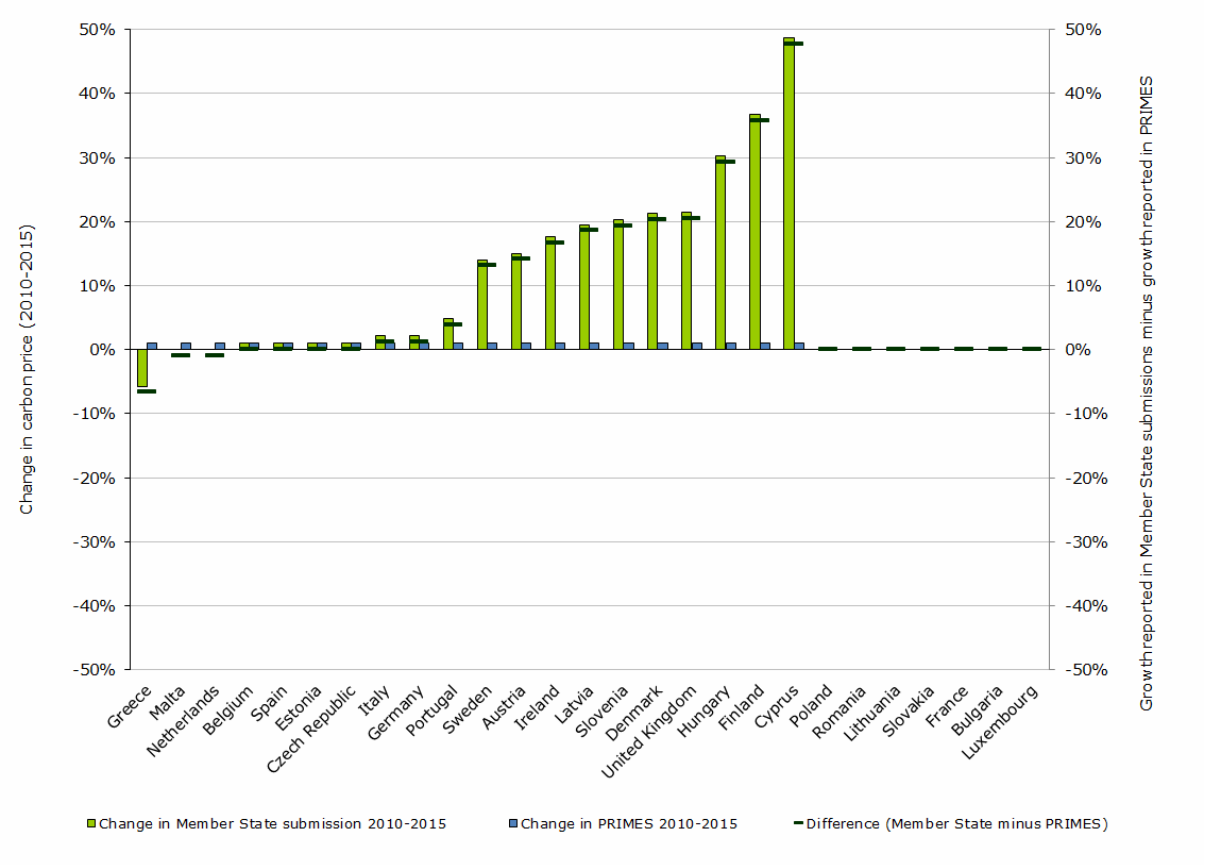


Source: IEA, 2011
Note: Average based on the import cost in France, Germany, Italy, Spain and the UK

Figure B-7 shows the difference between the growth assumptions for international oil price during 2010-2015 reported by the Member State and in PRIMES. Sweden, Austria, Ireland, Latvia, Slovenia, Denmark, the United Kingdom, Hungary and Finland[6] assume an increase in international oil price 10% higher than the assumption used in PRIMES. No Member States project an increase bigger than the increase observed between 2005 and 2010. As a result, there is a medium risk that the increase in international oil price has been overestimated for these Member States. Greece is the only country using an assumption that international oil price will fall between 2010 and 2015 (by 5.7%). Since 1995, oil price has only fallen twice during a five year period (IEA, 2011). Thus, there is a low risk that the growth rate of international oil price during 2010-2015 used by Greece is an underestimate.

[6] Cyprus has not been included in the assessment because they report the price of heavy fuel oil rather than crude oil. The price of heavy fuel oil is linked to the price of crude oil but there are other important factors such as demand for the particular oil which impact price levels.

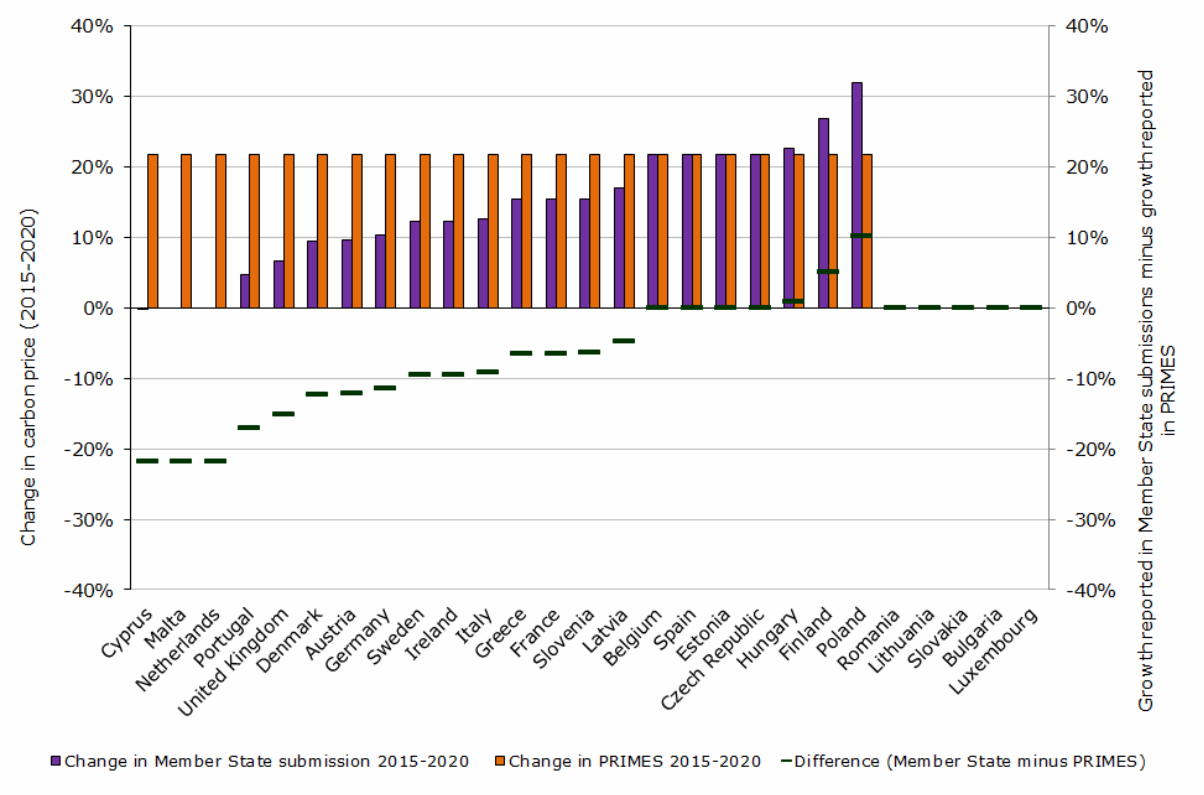
Figure B-7 Difference between the assumptions of the change in international oil price during 2010-2015, Member State submissions and PRIMES



Source: ETC/ACM 2011, projected international oil price in PRIMES Baseline model
Note: Data for Cyprus shows the trend reported for heavy fuel oil.

During 2010-2015, PRIMES reported a slow increase of international oil price. As a result most Member States projected growth assumptions which were higher. During 2015-2020, PRIMES model a much higher increase of international oil price (22%) and consequently the majority of the Member States use a slower growth assumption in comparison. The UK, Portugal, Malta and the Netherlands have assumed increase in international oil price more than 15% lower than the assumption used in PRIMES (Figure B-8). The increase in international oil price assumed by these Member States varies between 0% and 6.7% during the five year period. No Member States project an increase in international oil price 15% higher than the assumption used in PRIMES. There is a medium risk that the UK, Portugal, Malta and the Netherlands have underestimated growth in international oil price during 2015-2020.

Figure B-8 Difference between the assumptions of the change in international oil price during 2015-2020, Member State submissions and PRIMES



Source: ETC/ACM 2011, projected international oil price in PRIMES Baseline model

B.1.4 Accuracy

The checks performed in the previous sections (Sections B.1.2 to B.1.3) identifies if there is a risk that the key parameters used in compiling the GHG projections from the energy supply sector (the parameters identified here also affect other sectors) are under or overestimated. The findings from the different checks have been summarised below, following the method used in Chapter 6 of the main report. Total points reflect the levels of risk associated with the key assumptions being over or underestimated. Member States with the highest points correlate to those Member States whose assumptions used to calculate the projections have the highest risk of inaccuracy.

Table B-1 Summary table based on the assessment of carbon price and international oil price assumptions

Member State	Carbon price – consistency against 2010	Carbon price growth 2010-2015	Carbon price growth 2015-2020	International oil price – consistency against 2010	International oil price – growth 2010-2015	International oil price – growth 2015-2020	Total Points
Sweden	Medium (+)	Low (-)	Low (-)	Medium (-)	Medium (+)		8
United Kingdom		Low (-)	Low (-)	Medium (+)	Medium (+)	Medium (-)	8
Greece	Medium (+)	Low (-)	Low (-)	Medium (+)	Low (-)		7
Austria		Low (-)		Medium (+)	Medium (+)		5
Slovenia	Medium (+)	Low (-)			Medium (+)		5
Ireland				Medium (+)	Medium (+)		4
Latvia				Medium (+)	Medium (+)		4
Malta				Medium (+)		Medium (-)	4
Netherlands		Low (-)	Low (-)			Medium (-)	4
Poland	Medium (+)	Low (+)	Low (-)				4
Bulgaria	Medium (+)	Low (-)					3
Denmark		Low (+)			Medium (+)		3
Finland					Medium (+)		2
France		Low (-)	Low (+)				2
Hungary					Medium (+)		2
Italy				Medium (+)			2
Portugal						Medium (-)	2
Cyprus		Low (-)					1
Germany		Low (-)					1
Spain		Low (-)					1

Note: (+) indicates overestimate and (-) indicates underestimate. Yellow cells indicate parameters where there is a risk of underestimation. Pink cells indicate parameters where there is a risk of overestimation.

The results show that 20 of the 27 Member States are associated with a risk of under or overestimating the carbon and international fuel price assumptions used to calculate GHG projections to a certain degree. Overall, Member States are using higher carbon price assumptions in 2010 but for future growth Member States are more pessimistic about the value of carbon getting stronger in future years in comparison to PRIMES. This may reflect the fluctuation in carbon price observed in recent years without a consistent upward trend. For international oil price, Member States are using a higher assumption in 2010 than the actual figure reported in the IEA (2011). This trend continues and the growth of international oil price during 2010-2015 assumed by Member States is higher than those reported in PRIMES. Similar to carbon price, this may be because Member States expect the trend observed in recent years to continue (high increase). Between 2015 and 2020, PRIMES predicts a higher increase in international oil price (22%) and as a result, the assumptions used by Member States tend to be lower. Overall the total risk associated with the key parameters linked to the energy supply sector being over or underestimated varies significantly across the Member States. Sweden and the United Kingdom scored the highest points. The risk that Bulgaria, Portugal and Romania's parameters have been over or underestimated is low. For Bulgaria and Romania, this is largely because of incomplete reporting of the parameters.

B.2 Energy use (excluding transport)

CO_2 emissions from energy use mainly derive from manufacturing industries (43%) and households (36%). In both sectors, gas is the predominant fuel used. Therefore, for the energy use sector the assumptions for gross value added of total industry and final energy demand for gaseous fuels are considered. In 2009, CO_2 emissions from manufacturing industries and construction contributed with 14% to total CO_2 emissions in the EU-27 of which 43% was a result of the combustion of gaseous fuels. The contribution of households to total CO_2 emissions was 11% with a share of gaseous fuel use of 60%.

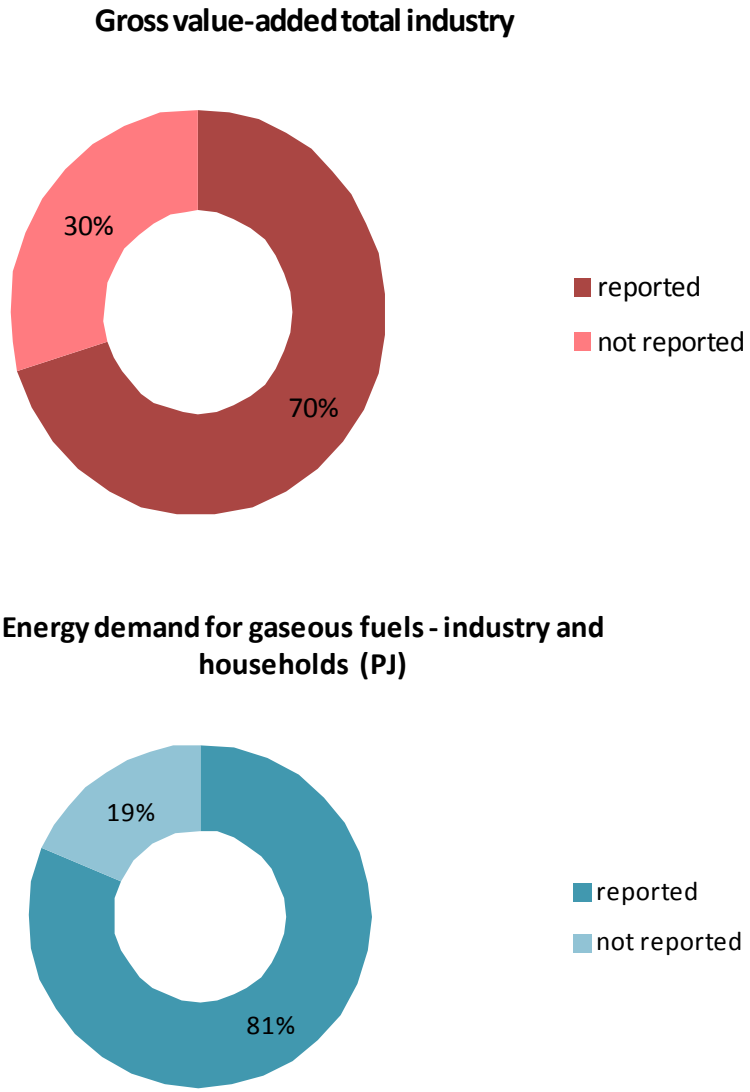
Summary

- Gross value added and final energy demand for gaseous fuels in industry and households have been identified to be the main drivers for GHG emissions from energy use.
- Nineteen Member States (70 %) reported gross value added from industry for the year 2010, final energy demand has been reported by 80 %.
- Five Member States reported gross value added from industry for the year 2010 that differed by more than 30 % from Eurostat data. Different use of reference years and consequently systematic discrepancies throughout the entire time series seems to be the main reason, rather than over or underestimates.
- Member States tend to overestimate parameters used for the projection of GHG emissions from industry, whereas emissions from the household sector tend to be underestimated.
- The Netherlands and Latvia have the highest risk that their energy-related projections from industry have been overestimated; whereas Latvia has the highest risk that its projections from households have been underestimated.

B.2.1 Completeness

Belgium, Germany, Hungary, Luxemburg, Malta, Poland, Portugal and Spain did not report gross-value-added total industry for the year 2010. The energy demand by sector energy use was not reported by five Member States (Bulgaria, Cyprus, Italy, Malta and Romania).

Figure B-9 Percentage completeness of the reporting of GVA total industry (2010) and energy demand in the energy use sector for gaseous fuels by Member States



Source: ETC/ACM 2011

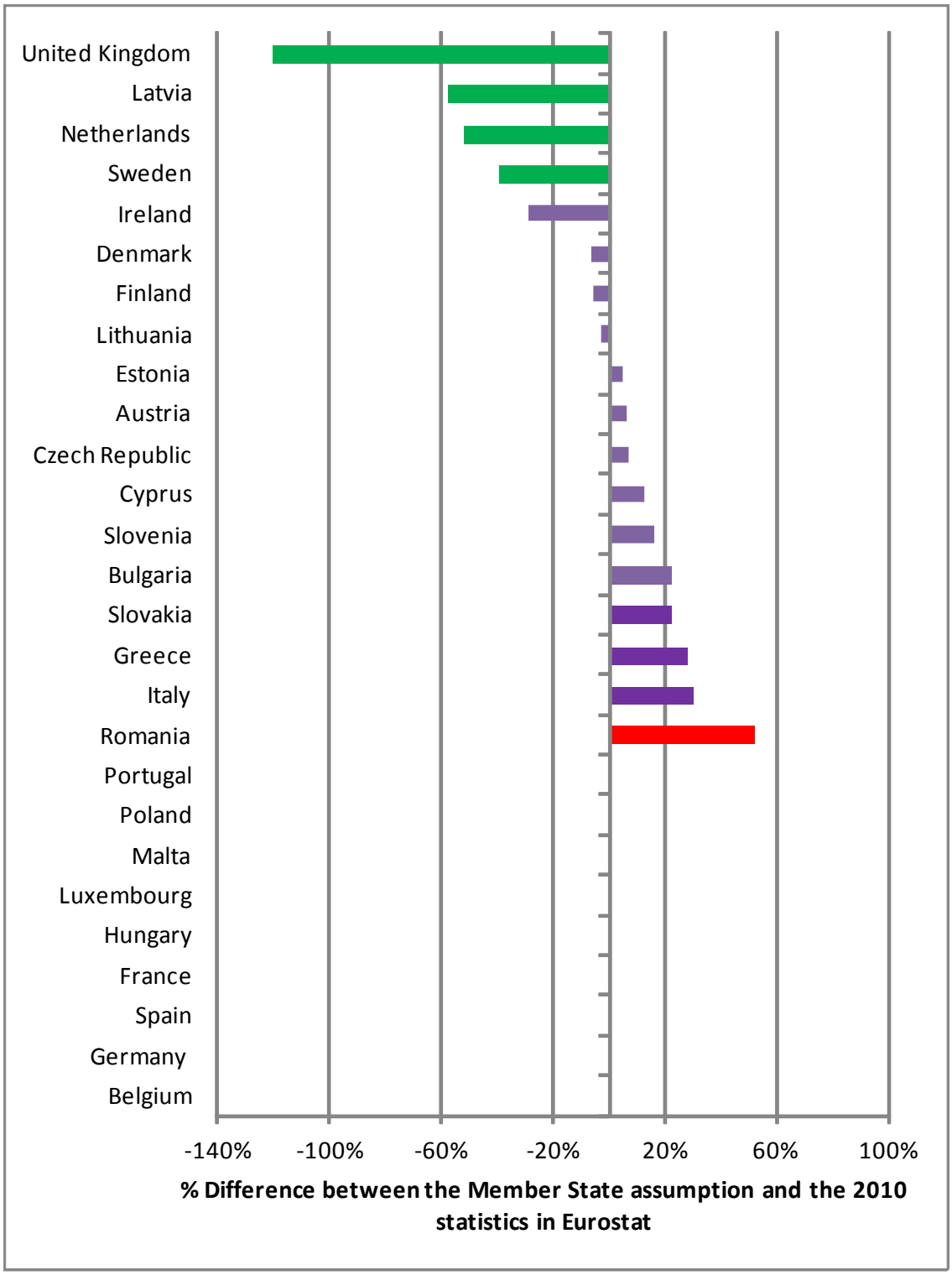
B.2.2 Gross value-added total industry

Consistency against 2010 Eurostat data

Consistency between the 2010 assumptions used by the Member State and the 2010 data reported in Eurostat is assessed using the same methodology as GDP and population (Section 4.1.1 and Section 4.1.3).

Figure B-10 shows how the projected gross value added (GVA) of total industry in 2010 from the Member State submissions compare with the actual number of GVA data reported by Eurostat for 2010.

Figure B-10 Difference between the projected 2010 GVA total industry assumptions reported in Member State submissions and the actual 2010 GVA figures from Eurostat



Source: ETC/ACM 2011, Eurostat – Gross value added total industry (excluding construction), chain-linked volumes, million Euros, reference year 2000 (at 2000 exchange rates)

Note: Red bars indicate Member States whose assumptions exceed Eurostat data by more than 30%; green bars indicate Member States whose assumptions are more than 30% lower than Eurostat data. For France there was no Eurostat data for 2010 available.

The difference between the GVA of total industry reported by the Member States and the Eurostat values expressed as a percentage of the Eurostat values in 2010 is below 30% for all Member States apart from Romania, Sweden, the Netherlands, Latvia and the United Kingdom. Only ten of 20 Member States reporting GVA (GVA) total industry indicated that they report in Billion Euros and only seven Member States are also specific about the price year. Due to this incomplete reporting of units and reference years a comparison of projected data for GVA total industry from Member States with Eurostat data is difficult.

- For Romania, GVA projected for 2010 and Eurostat data for 2010 differs by 51%. Historic Eurostat data does not match historic data reported by Romania in its projections report, possibly due to a different reference year used by Romania (2005 vs. 2000). Therefore, the discrepancy seems to be due to inconsistency which exists throughout the entire time series and is not a result of an overestimation.

- Sweden and Latvia did not report the reference year used for GVA. For both Member States, a comparison of their submitted data for 2010 with the Eurostat GVA for total industry at current prices (instead of 2000) reduces the difference between projected and Eurostat data for the year 2010. Therefore, the discrepancy seems to be due to inconsistency which exists throughout the entire time series because of the difference in price year between the two datasets and is not a result of an underestimation.

- The Netherlands indicate in their projections reporting template that they reported GVA with the year 2000 as reference year. Historic figures were not reported by the Netherlands so it is not possible to assess whether there is a systematic discrepancy throughout the time series or an overestimation of projected values. As a result, there is a medium risk that the assumption used for GVA total industry by the Netherlands in 2010 is an underestimate.

- The United Kingdom indicates in their projections reporting template that GVA at 1995 constant rate excluding mining and quarrying has been reported. It is not clear whether construction is included in the GVA values or not. However, the discrepancy seems to be due to inconsistency which exists throughout the entire time series and is not a result of an underestimation.

Time series consistency of the growth expected between 2010-2015 and 2015-2020

The expected growth in GVA assumed by the Member States has been compared against the forecasted growth in the PRIMES model ($$ reference) in order to identify the risk for over- or underestimation of growth rates by Member States. The difference between the growth rates of the two models are calculated using the same methodology as GDP and population (Section 4.1.1 and Section 4.1.3). However, the reference year for GVA reported by Member States is supposed to be 2000, whereas in the PRIMES model, sectoral GVA figures are based on the year 2005. The following criteria have been applied:

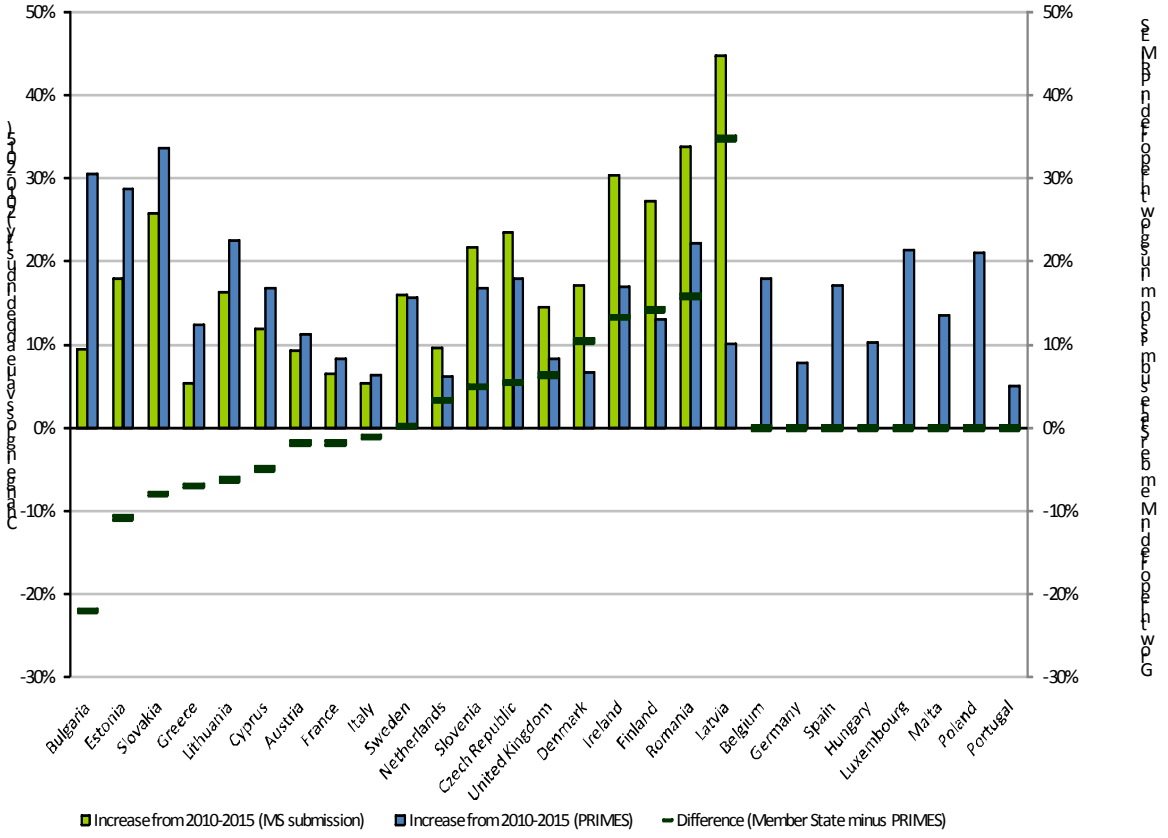
- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated their GVA of the industry sector if the difference between the GVA data estimated by Member States and by the use of the PRIMES model is less than or equal to 10%

- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated their GVA of the industry sector if the difference between the GVA data estimated by Member States and by the use of the PRIMES model is less than or equal to 10%

A greater margin of tolerance between the two estimates of data is allowed for predictions made further into the future. If the difference exceeds the above criteria, the expected growth is compared with the actual change observed between 2003 and 2008 (c.f Table B-2). From this check a risk level is assigned to growth assumption of GVA of industry used by the Member States to calculate their projections. The risk level gages the level of risk associated with the GVA of industry being over or underestimated.

Figure B-11 shows the difference between the growth assumptions for GVA from industry from 2010 to 2015 reported by the Member State and in PRIMES. A difference greater than 10% exists for Bulgaria, Estonia, Ireland, Finland, Romania and Latvia. All, except Bulgaria and Estonia, expect a higher growth of GVA from industry. This suggests that there is a risk that the development of GVA from industry has been overestimated. For Bulgaria and Estonia, on the other hand, GVA from industry might have been underestimated. The growth predicted by Finland is closer to the observed growth between 2003 and 2008 than PRIMES is to the growth between 2003 and 2008 (c.f Table B-2). Hence there is a low risk that the growth assumptions for GVA from industry used by Finland have been overestimated.

Figure B-11 Difference between the growth assumptions for GVA (industry) during 2010-2015, Member State submissions and PRIMES model



Source: ETC/ACM 2011, PRIMES Sectoral value added (in 000 MEURO ´05)

Table B-2 Difference between the projected growth rate of GVA (industry) during 2010-2015 and 2015-2020, and actual growth from 2003 to 2008, PRIMES and Member State submissions

	2010-2015		2015-2020		
	Member State growth assumption	PRIMES growth assumption	Member State growth assumption	PRIMES growth assumption	Member State growth assumption (2003-2008)
Bulgaria	9%	31%	30%	23%	33%
Estonia	18%	29%	16%	15%	31%
Finland	27%	13%	11%	9%	32%
Ireland	30%	17%	12%	15%	21%
Latvia	45%	10%	27%	5%	14%
Romania	34%	22%	24%	20%	27%
Poland	n.a.	21%	35%	12%	48%

Source: ETC/ACM 2011, PRIMES - Sectoral value added (in 000 MEURO ´05), Eurostat – GVA total industry (excluding construction), chain-linked volumes, million Euros, reference year 2000 (at 2000 exchange rates) [nama_nace06_k]

For the remaining four Member States, namely Bulgaria, Estonia, Ireland, Latvia and Romania, there is a medium risk that the assumed growth of GVA of total industry during 2010-2015 is an under or overestimate. Latvia's projections report submitted under the MM Decision provide insight into the reasons behind the differences:

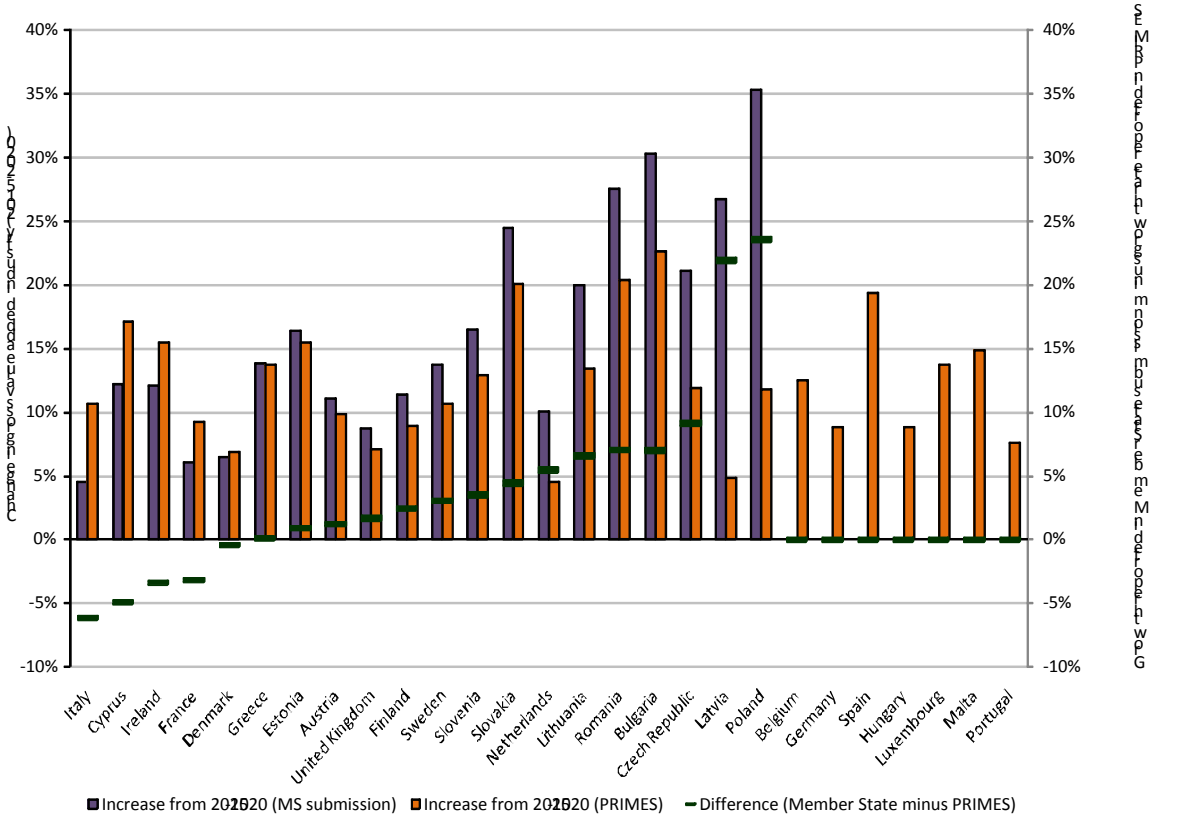
Only Latvia gave some information on the expected development in the industry sector:

- According to Bulgaria´s projections report, Bulgaria seems to expect GVA from industry to need a few years to recover from the economic crisis and to increase significantly only after 2015. However, there is a medium risk that Bulgaria´s growth rate has been underestimated.

- Latvia expects an increase of GVA from industry of 45 % between 2010 and 2015, which is 3 times the increase observed during 2003-2008. PRIMES predict a slightly reduced increase between 2010 and 2015 compared to 2003 and 2008. In its projections report submitted under the MM decision, Latvia states that it intends to encourage the development and export capacity of various industry branches. However, taken a growth rate of 14 % between 2003 and 2008 and a decline between 2006 and 2010, there is a medium risk that Latvia´s estimate of 45 % growth rate during 2010 and 2015 is an overestimate.

No further information on GVA (industry) was provided by the other Member States.

Figure B-12 Difference between the growth assumptions for GVA (industry) during 2015-2020, Member State submissions and PRIMES model



Source: ETC/ACM 2011, PRIMES - Sectoral value added (in 000 MEURO ´05)

The projected growth rates of two models between 2015 and 2020 differ by more than 20% for Latvia and Poland (c.f Figure B-12). Both Member States expect a quicker increase in GVA from industry than PRIMES does. The growth predicted by Poland is closer to the observed growth between 2003 and 2008 than PRIMES is to the growth between 2003 and 2008. Hence there is a low risk that the growth assumption of GVA from industry has been overestimated.

Between 2003 and 2008, Latvia´s GVA from industry increased by 14%. Latvia expects a further increase of GVA from industry by 27% during 2015 and 2020, whereas PRIMES predicts a reduced increase of only 5%. Consequently, there is a medium risk that Latvia has overestimated its growth rate for the period 2015-2020.

B.2.3 Energy demand for gaseous fuels in the industry sector

Consistency against 2010 Eurostat data

Due to the lack of energy consumption data by fuel in the EUROSTAT database for 2010, the consistency check between projected data reported for 2010 and EUROSTAT cannot be performed.

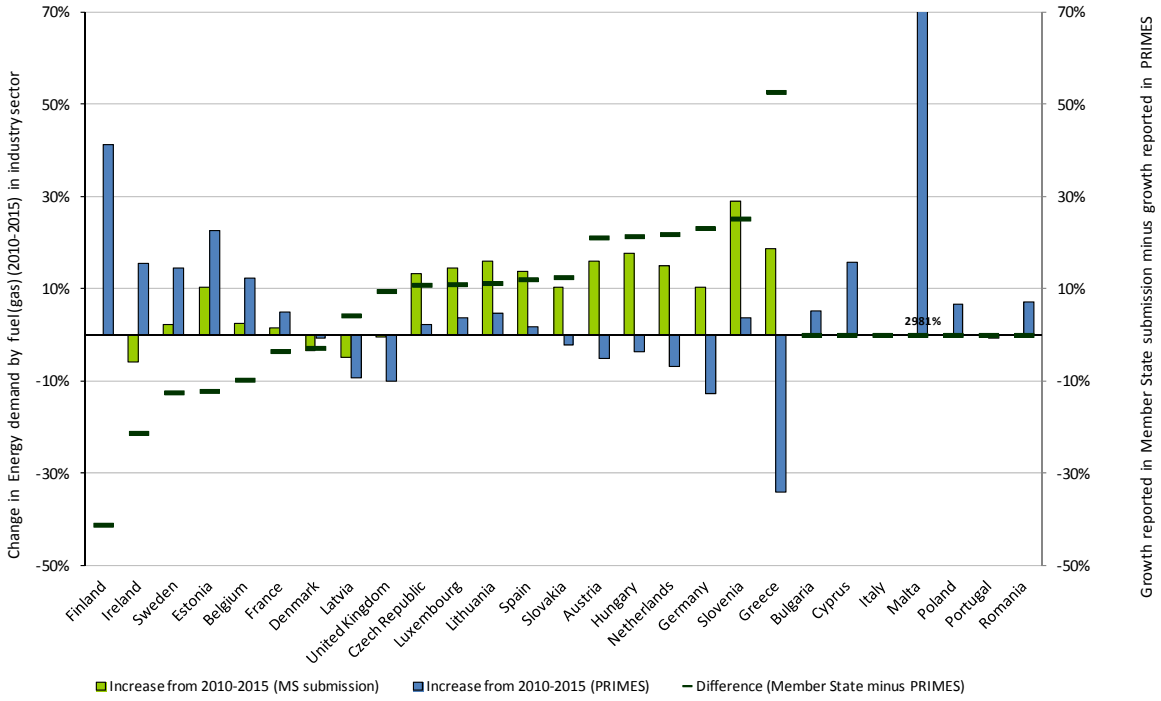
Time series consistency of the growth of energy demand for gaseous fuels expected between 2010-2015 and 2015-2020

The consistency of the growth in energy demand for gaseous fuels in the industry sector with another projections model and with the historic time series is assessed following the same methodology as for GVA (c.f Section B.2.2). The PRIMES model published by the NTUA is used as the surrogate model for comparison purposes. The following criteria have been applied for energy demand by fuel split:

- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated their final energy demand of gaseous fuels the industry sector if the difference between the final energy demand data estimated by Member States and by the use of the PRIMES model is less than or equal to 20%;
- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated their final energy demand of the industry sector if the difference between the final energy demand data estimated by Member States and by the use of the PRIMES model is less than or equal to 20%

In Figure B-13 the difference between the growth assumptions for final energy demand of gaseous fuels in the industry sector from 2010 to 2015 reported in the Member State submissions and in PRIMES is shown. The difference is greater than 20% in eight Member States; in Finland, Ireland, Austria, Hungary, Netherlands, Germany, Slovenia and Greece. Finland and Ireland predict a slower growth compared to PRIMES. All other Member States listed above project their final energy demand to increase (faster) compared to PRIMES. The growth predicted by Finland and Greece are closer to the observed growth between 2003 and 2008 than PRIMES is to the growth between 2003 and 2008. Based on this observation, there is a low risk that Finland and Greece's assumption for the growth in final energy demand of liquid fuels in the industry sector has been over or underestimated.

Figure B-13 Difference between the growth assumptions for the final energy demand of gaseous fuels in the industry sector (during 2010-2015, Member State submissions and PRIMES model)



Source: ETC/ACM 2011, PRIMES – final energy demand industry, gas

- Austria states in its projections report submitted under the MM Decision that its final energy demand for gaseous fuels in the industry sector is projected to increase continuously in line with the sectoral GDP. Growth projections for GVA match well between Austria´s submission and PRIMES. For final energy demand for gaseous fuels, however, Austria projects an increase between 2010 and 20015, whereas PRIMES predicts a slight decrease. Based on this, there is a medium risk that Austria´s growth is overestimated (Table B-3).

- Germany predicts increased growth of final energy demand in industry due to increased fossil fuel consumption by auto-producers. PRIMES, on the other hand, project a decreased use of gaseous fuels in industry. Based on this, there is a medium risk that Germany´s growth is overestimated (Table B-3).

- Hungary´s final energy demand for gaseous fuels decreased by 35 % between 2003 and 2008. PRIMES project a reduction of 4 % for the period 2010-2015, whereas Hungary predicts a growth of 18 % for the same period. Based on this, there is a medium risk that Hungary´s growth is overestimated (Table B-3).

- In contrast to the final energy demand for liquid fuels, the Irish growth projections for gaseous fuels are higher in the PRIMES model than in the Member State´s

submission. Therefore, there is a medium risk, that Ireland´s growth of the final energy demand for gaseous fuels in the industry has been underestimated (Table B-3).

- The Netherlands´ gaseous fuel demand decreased between 2003 and 2008 and is projected by PRIMES to decrease further. The Netherlands, on the other hand, project their gaseous fuel consumption to increase between 2010 and 2015. Consequently, the Netherlands might have overestimated their final energy demand for gaseous fuels (Table B-3).

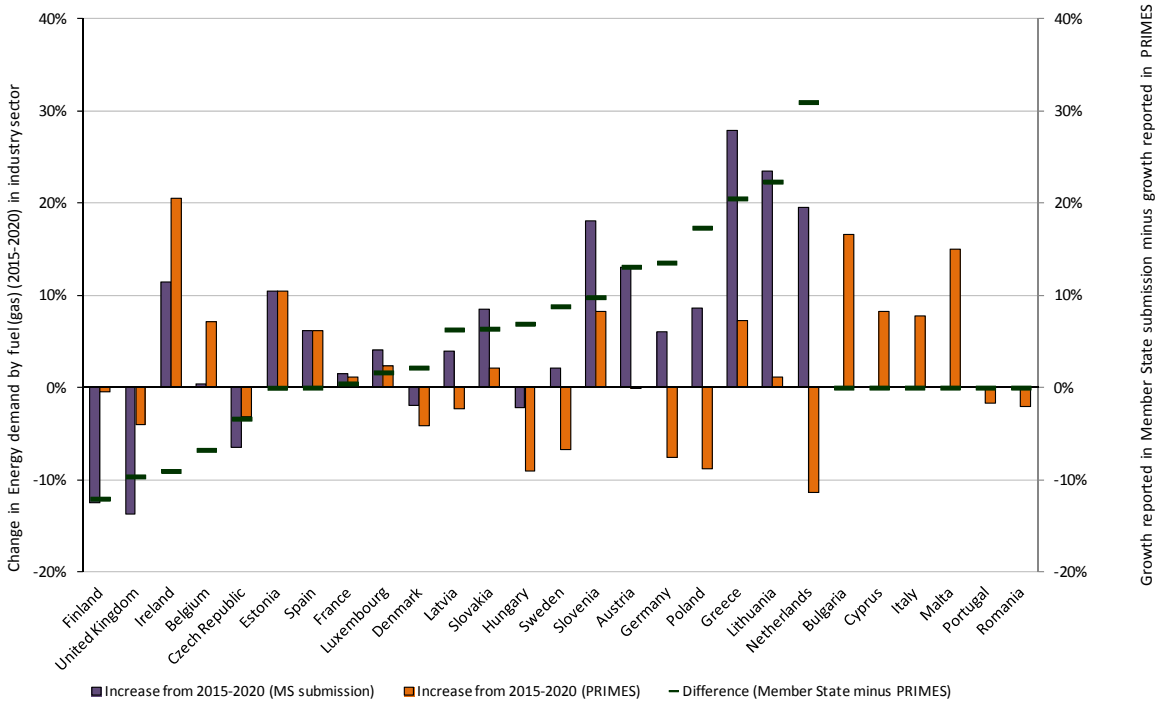
- PRIMES projects Slovenia´s final energy demand for gaseous fuels to increase at a similar rate as rate which has been observed for the period 2003-2008. Slovenia, on the other hand, projects a four-fold growth for the same period. Based on this, there is a medium risk that Slovenia´s growth of the final energy demand for gaseous fuels in the industry has been overestimated (Table B-3).

Table B-3 Difference in final energy demand growth of gaseous fuels in the industry sector during 2010-2015 and 2015-2020 for both PRIMES and Member State submissions compared against actual growth from 2003 to 2008

	2010-2015		2015-2020		
	Member State growth assumption	PRIMES growth assumption	Member State growth assumption	PRIMES growth assumption	Member State growth assumption (2003-2008)
Austria	16%	-5%	13%	0%	5%
Finland	0%	41%	-13%	0%	2%
Germany	10%	-13%	6%	-8%	-4%
Greece	19%	-34%	28%	7%	32%
Hungary	18%	-4%	-2%	-9%	-35%
Ireland	-6%	15%	11%	21%	59%
Lithuania	16%	5%	23%	1%	9%
Netherlands	15%	-7%	20%	-11%	-11%
Slovenia	29%	4%	18%	8%	5%

Source: ETC/ACM 2011, PRIMES – final energy demand industry, gas; 2011 National GHG inventory submissions CRF – Fuel combustion, manufacturing industries and construction, gaseous fuels

Figure B-14 Difference between the growth assumptions for the final energy demand of gaseous fuels in the industry sector during 2015-2020, Member State submissions and PRIMES model



Source: ETC/ACM 2011, PRIMES – final energy demand industry, gas;

The projected growth rates of the two models between 2015 and 2020 differ by more than 20% for Greece, Lithuania and the Netherlands. All these Member States expect a faster increase in energy demand for gaseous fuels compared to the projected growth reported in PRIMES.

The growth predicted by Greece is closer to the observed growth between 2003 and 2008 than PRIMES is to the growth between 2003 and 2008. Based on this observation, there is a low risk that Greece has overestimated its final energy demand for gaseous fuels in the industry sector for the period 2015-2020. For the Netherlands, the risk assessment for the period 2015-2020 is similar to the analysis for 2010-2015. The projected trend during 2010-2015 and 2015-2020 are similar both in PRIMES and in the Member State submission. Compared against PRIMES, there is a medium risk that Lithuania has overestimated the growth of final energy demand for gaseous fuels.

B.2.4 Energy demand for gaseous fuels in the residential sector

Consistency against 2010 Eurostat data

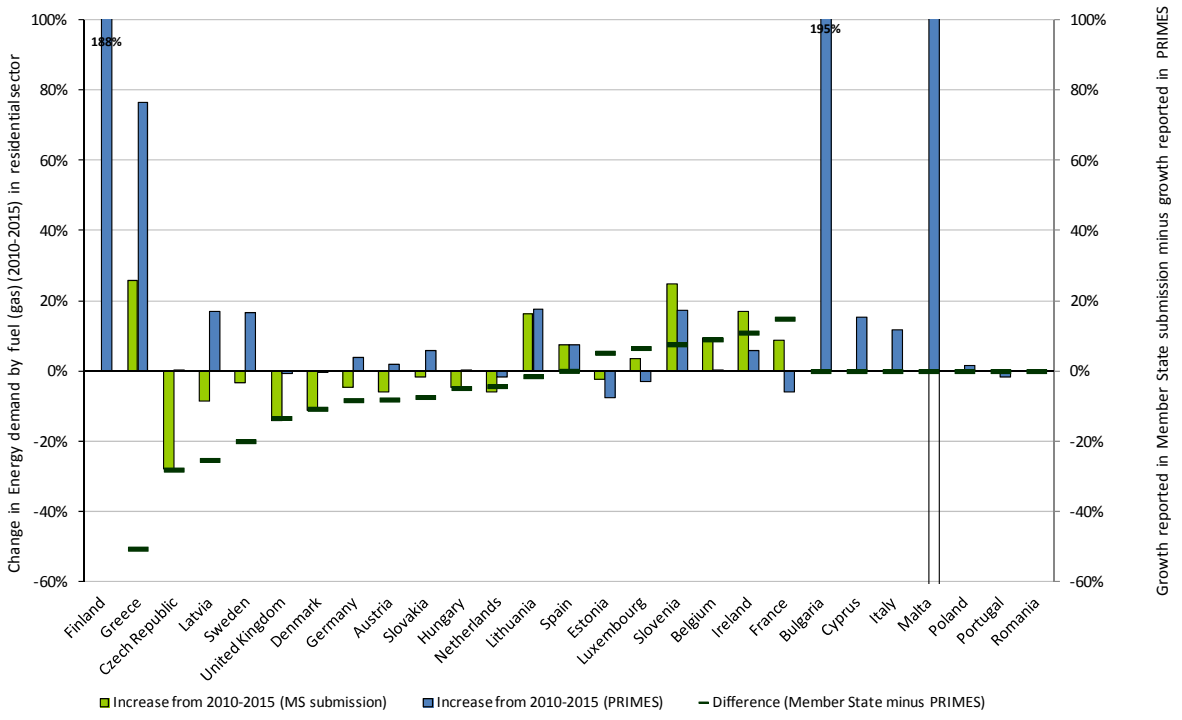
Due to the lack of energy consumption data by fuel in the EUROSTAT database for 2010, the consistency check between projected data reported for 2010 and EUROSTAT cannot be performed.

B.2.5 Time series consistency of the growth of energy demand for gaseous fuels expected between 2010-2015 and 2015-2020

The following criteria have been applied to identify if there is a risk that the parameter has been over or underestimated:

- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated their energy demand for gaseous fuels if the difference between the numbers estimated by Member States and by PRIMES is less than or equal to 20%;
- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated their energy demand for gaseous fuels if the difference between the numbers estimated by Member States and by PRIMES is less than or equal to 15%.

Figure B-15 Difference between the growth assumptions for energy demand for gaseous fuels in the residential sector during 2010-2015, Member State submissions and PRIMES model



Source: ETC/ACM 2011, PRIMES - final energy demand domestic, gas; **Note:** Finland submitted an increase of 0% between 2010 and 2015 compared to the increase of 188% predicted by PRIMES.

Figure B-15 shows the difference between the growth assumptions for energy demand for gaseous fuels from 2010 to 2015 reported in the Member State submissions and in PRIMES. A difference greater than 20% exists for Finland, Greece, Czech Republic, Latvia and Sweden. Finland predicts its final energy demand not to change between 2010 and 2020,

Greece expects a slower increase than PRIMES and all other Member States expect their energy demand for gaseous fuels to decline in contrast to the PRIMES model. The growth predicted by the Finland and Sweden are closer to the observed growth between 2003 and 2008 than PRIMES is to the growth between 2003 and 2008. Based on this observation, there is a low risk that these Member States´ assumptions for the growth in final energy demand for gaseous fuels are underestimated.

Table B-4 Difference in energy demand for gaseous fuels growth during 2010-2015 and 2015-2020 for both PRIMES and Member State submissions compared against actual growth from 2003 to 2008

	2010-2015		2015-2020		
	Member State growth assumption	PRIMES growth assumption	Member State growth assumption	PRIMES growth assumption	Member State growth (2003-2008)
Czech Republic	-28%	0%	-8%	2%	-15%
Estonia	-2%	-8%	0%	20%	37%
Finland	0%	188%	0%	4%	33%
France	9%	-6%	8%	-8%	2%
Greece	26%	76%	40%	38%	1010%
Latvia	-8%	17%	-2%	28%	28%
Lithuania	16%	18%	22%	5%	24%
Slovakia	-2%	6%	-33%	0%	-27%
Sweden	-3%	16%	-4%	14%	-15%

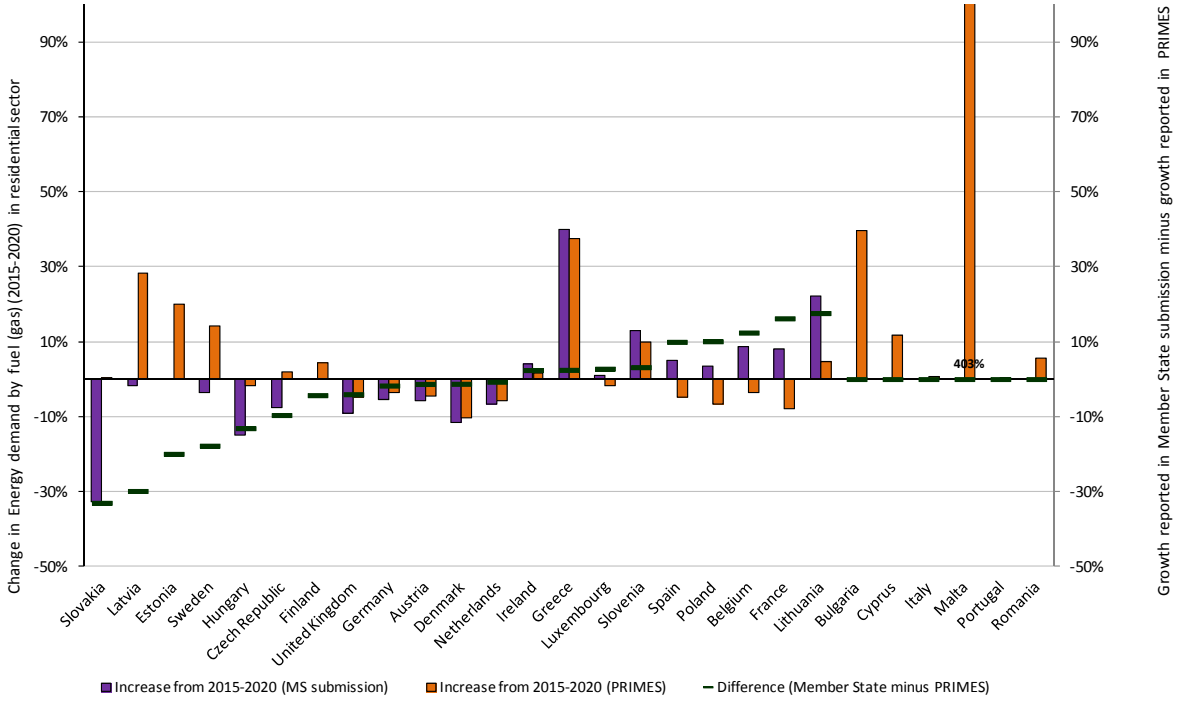
Source: ETC/ACM 2011, PRIMES - final energy demand domestic, gas;

For the remaining three Member States, the Czech Republic, Greece and Latvia, there is a medium risk that the assumed growth or decline of final energy demand during 2010-2015 is an underestimate.

- Greece´s energy consumption of gaseous fuels in households increased sharply in the period 2003-2008 from 0.87 to 8.69 PJ. Greece states in its projections report that it will continue with infrastructure projects for the further penetration of natural gas in the residential/tertiary and industrial sectors and enhance the security of gas supply through the interconnection of the Greek gas network with the networks of neighbouring countries and predicts an increase of 26 % for 2010-2015. PRIMES project a higher increase of 76%. Therefore, there is a medium risk that Greece´s projections of the energy demand for gaseous fuels in the residential sector have been underestimated.
- In the Czech Republic, final energy consumption of gaseous fuels in households decreased by continually between 2003 and 2007 and levelled off thereafter. In their projections report, the Czech Republic states that they will implement the Green Savings Programme in the period 2010-12 aiming at decreasing fossil fuel consumption in households. However, there is a medium risk that final energy demand for gaseous fuels in the residential sector has been underestimated.
- In Latvia, final energy demand for gaseous fuels in households increased continually between 2003 and 2008 by 28 %. PRIMES predicts a decreased increase for the period

2010-2015, whereas Latvia projects a decrease of 8 % due to the implementation of energy efficiency measures in compliance to the national energy efficiency plan. Based in this, there is medium risk that Latvia´s projections of the energy demand for gaseous fuels in the residential sector have been underestimated.

Figure B-16 Difference between the growth assumptions for energy demand for gaseous fuels during 2015-2020, Member State submissions and PRIMES model



Source: ETC/ACM 2011, PRIMES - final energy demand domestic, gas;

During 2015-2020, a difference greater than 15% exits for Slovakia, Latvia, Estonia, Sweden, France and Lithuania (Table B-4). All Member States except France and Lithuania expect their energy demand for gaseous fuels to decrease in contrast to the PRIMES model. France and Lithuania project a faster increase than PRIMES. The growth predicted by Slovakia, Sweden, France and Lithuania are closer to the observed growth between 2003 and 2008 than PRIMES is to the growth between 2003 and 2008. Hence there is a low risk that the growth assumptions for final energy demand for gaseous fuels in the residential sector used by these Member States have been over or underestimated.

For the remaining two Member States, Estonia and Latvia, there is a medium risk that the assumed growth of final energy demand for gaseous fuels in the residential sector during 2010-2015 is an underestimate. Both Member States project that their final energy demand for gaseous fuels will remain constant or decrease slightly during 2015-2020, which differs considerably to the trend observed between 2003 and 2008 and projected by PRIMES.

B.2.6 Accuracy

The checks performed in the previous sections (Section B.2.1 to Section B.2.5) identifies if there is a risk that the key parameters used in compiling the GHG projections from the energy use sector were under or overestimated. The findings from the different checks have been summarised below, following the method used in Chapter 6.

Table B-5 Summary table based on the assessment of GVA total industry and energy demand for gaseous fuels in the industry and residential sector assumptions

Member State	Consistency against 2010	GVA total industry 2010-2015	GVA total industry 2015-2020	Energy demand for gaseous fuels in industry 2010-2015	Energy demand for gaseous fuels in industry 2015-2020	Energy demand for gaseous fuels in house-holds 2010-2015	Energy demand for gaseous fuels in house-holds 2015-2020	Total Points
Latvia	low (-)	medium (-)	medium (-)			medium (-)	medium (-)	9
Netherlands	medium (-)			medium (-)	medium (-)			6
Ireland		medium (-)		medium (-)				4
Estonia		medium (-)					medium (-)	4
Greece				low (+)	low (+)	medium (-)		4
Finland		low (+)		low (-)		low (-)		3
Lithuania					medium (-)		low (+)	3
Romania	low (+)	medium (-)						3
Sweden	low (-)					low (-)	low (-)	3
Bulgaria		medium (-)						2
Czech Republic						medium (-)		2
Slovenia				medium (-)				2
Germany				medium (-)				2
Austria				medium (-)				2
Hungary				medium (-)				2
France							low (+)	1

Poland			low (+)					1
Slovakia							low (-)	1
United Kingdom	low (-)							1

Note: (+) indicates overestimate and (-) indicates underestimate. Yellow cells indicate parameters where there is a risk of underestimation. Pink cells indicate parameters where there is a risk of overestimation.

The results show that there is a risk that 19 of the 27 Member States have under or overestimated the GVA and final energy demand assumptions used to calculate energy-related GHG projections from industry and households. Member States tend to overestimate the key parameters in the industry sector whereas in the residential sector, final energy demand for gaseous fuels tends to be underestimated. The Netherlands and Latvia have the highest risk that their energy- related projections from industry have been overestimated; additionally Latvia has the highest risk that its projections from households have been underestimated.

B.3 Transport

The key assumptions studied for the transport sector are diesel fuel demand and passenger kilometres by passenger cars. The key findings of the analysis conducted for the transport sector are summarised below.

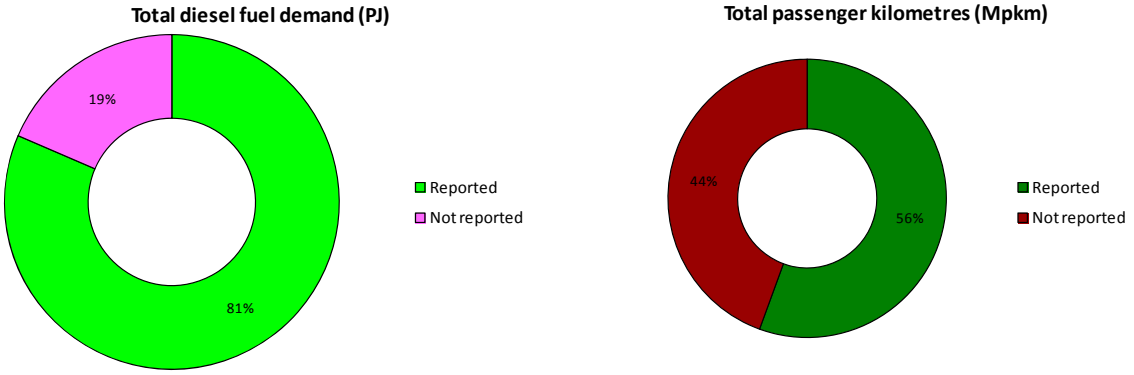
- Diesel fuel demand is an important parameter for monitoring progress towards CO_2 targets (e.g. Regulation EC 443/2009/EC) as dieselisation is expected to play a major role at least in the short to medium term (2010-2020). Total diesel fuel demand has been reported by 22 Member States.
- Passenger kilometres by passenger cars are a useful indication of passenger transport demand. However, in order to have a more complete picture, freight transport demand, expressed in e.g. tonne kilometres, should be also included in the reporting parameters. This is particularly important in view of the objective of decoupling freight transport demand from economic growth. Passenger kilometres by passenger cars have been reported by 15 Member States.
- Comparison with PRIMES estimations indicated large differences in the projected growth of diesel fuel demand for Greece, Portugal, Slovakia and Slovenia. Similarly large differences were observed for the assumed growth in passenger kilometres for Greece, Ireland and Slovenia.
- Passenger transport demand is predicted (by Member States as well as in PRIMES) to grow over the 2010 to 2020 period. However, diesel fuel demand is projected to increase at a slower pace (7% against 17% based on PRIMES estimations), which is an indication of reducing transport CO_2 emissions. Alternative energy sources (e.g. hybrid and electric vehicles) may satisfy the additional demand.
- In principle, fuel demand is linked to "hard" statistical data and hence consistency to estimations from centralised models, e.g. PRIMES, should be expected. On the other hand, transport demand is a much more uncertain parameter.

B.3.1 Completeness

Diesel fuel demand values were not reported by Bulgaria, Cyprus, Italy, Lithuania and Romania. The completeness of passenger kilometres by passenger cars was considerably lower, with only 15 Member States reporting this transport parameter. Passenger kilometres were not reported by Cyprus, Estonia, Finland, France, Hungary, Italy, Lithuania, Luxembourg, Malta, Romania, Slovakia and the United Kingdom. The completeness of the parameters is lower than the completeness levels for GDP and population. The analysis

using diesel fuel demand and passenger kilometres could not be carried out where the data was incomplete.

Figure B-17 Percentage completeness of the reporting of total diesel fuel demand and passenger kilometres (by passenger cars)



Source: ETC/ACM 2011

B.3.2 Diesel fuel demand

Consistency against 2010 Eurostat data

Comparison of the 2010 diesel fuel demand reported by the Member States against actual figures in Eurostat is not possible because historic 2010 values are not yet officially reported by Eurostat.

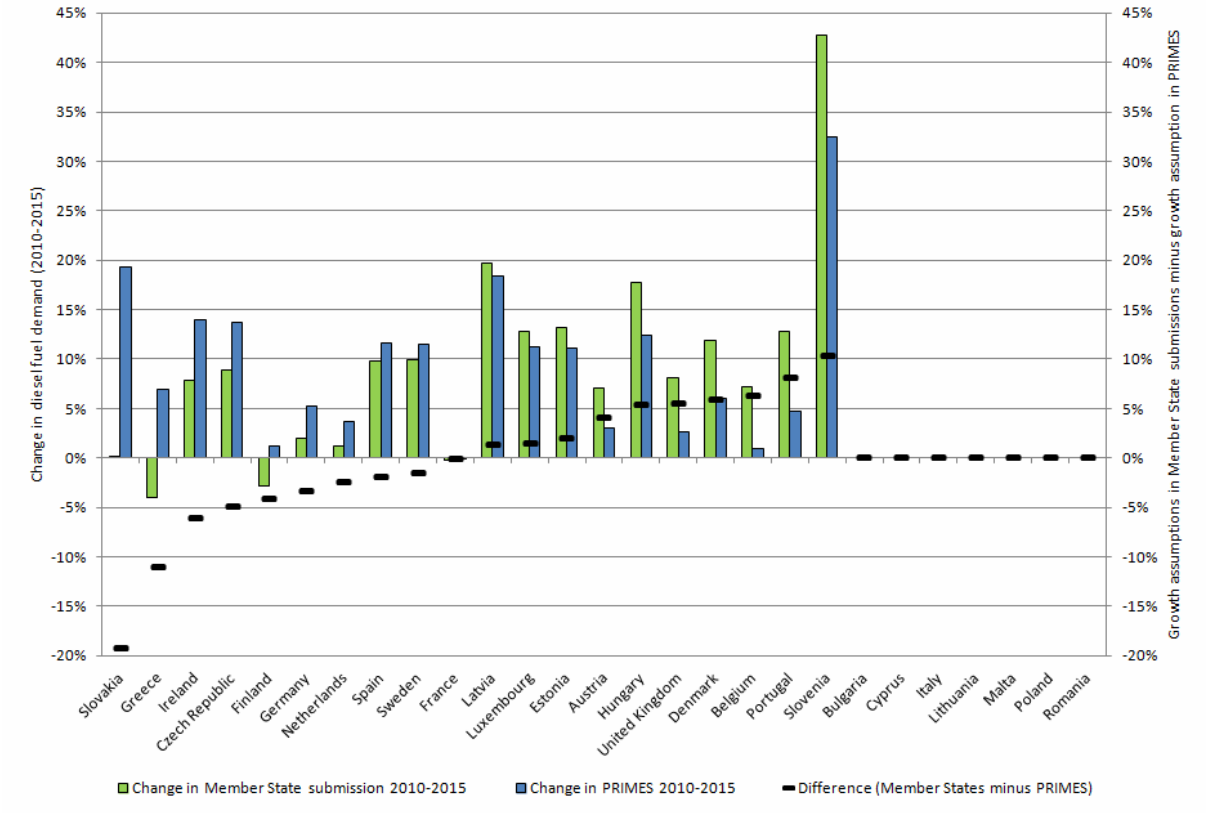
Time series consistency of the growth expected between 2010-2015 and 2015-2020

The expected growth rate of diesel fuel demand assumed by the Member States has been compared against the predicted growth in the PRIMES model, published by NTUA (European Commission, 2010), in order to identify the risk for over or underestimation of growth rates by Member States. The difference (consistency) between the growth rates of fuel demand between the two models are calculated using a similar methodology as GDP and population (Section 4.1.1 and Section 4.1.3). The following criteria have been applied:

- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated its diesel fuel demand if the difference between the demand numbers estimated by Member States and by PRIMES is less than or equal to 10%;
- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated its diesel fuel demand if the difference between the demand numbers estimated by Member States and by PRIMES is less than or equal to 20%.

If the difference exceeds the above criteria, the expected growth is compared with the actual change observed between 2003 and 2008 (c.f. Table B-6). From this check a risk level is assigned to the growth assumption of diesel fuel demand used by the Member States to calculate their projections.

Figure B-18 Difference between the growth assumptions for diesel fuel demand during 2010-2015, Member State submissions and PRIMES model



Source: ETC/ACM 2011, PRIMES model - scenario: PRIMES_BL2009_14jan10 activity: Total transport (excluding bunkers) - final energy demand – liquid fuels – diesel oil

Figure B-18 shows the difference between the growth assumptions for diesel fuel demand from 2010 to 2015 reported by the Member State and in PRIMES. A difference greater than 10% exists for Greece, Slovakia and Slovenia. Slovakia and Slovenia expect a slower and quicker increase respectively, whereas Greece predicts a completely different trend (decrease) in diesel fuel demand. This suggests that there is a risk that the growth of the diesel fuel demand has been underestimated in Slovakia and Greece and overestimated in Slovenia. The growth predicted by Slovenia is closer to the observed growth between 2003 and 2008 than PRIMES is to the growth between 2003 and 2008 (c.f. Table B-6). Hence there is a low risk that the growth assumption for diesel fuel demand used by Slovenia has been overestimated. On the other hand, the growth predicted by PRIMES for Greece and Slovakia is closer to the observed growth between 2003 and 2008 than Member States projections are to the growth between 2003 and 2008 (c.f. Table B-6). Hence there is a medium risk that the

growth assumptions for diesel fuel demand used by these Member States have been overestimated.

Table B-6 Difference between the projected growth rate of diesel fuel demand during 2010-2015 and 2015-2020, and actual growth from 2003 to 2008, PRIMES and Member State submissions

	2010-2015		2015-2020		2003-2008
	Member State growth assumption	PRIMES growth assumption	Member State growth assumption	PRIMES growth assumption	Member State growth assumption
Slovakia	0.1%	19.3%	0.1%	4.9%	57.1%
Greece	-4.1%	7.0%	2.7%	3.4%	3.0%
Slovenia	42.8%	32.5%	17.8%	11.8%	154.8%
Portugal	12.8%	4.7%	23.7%	1.4%	9.8%

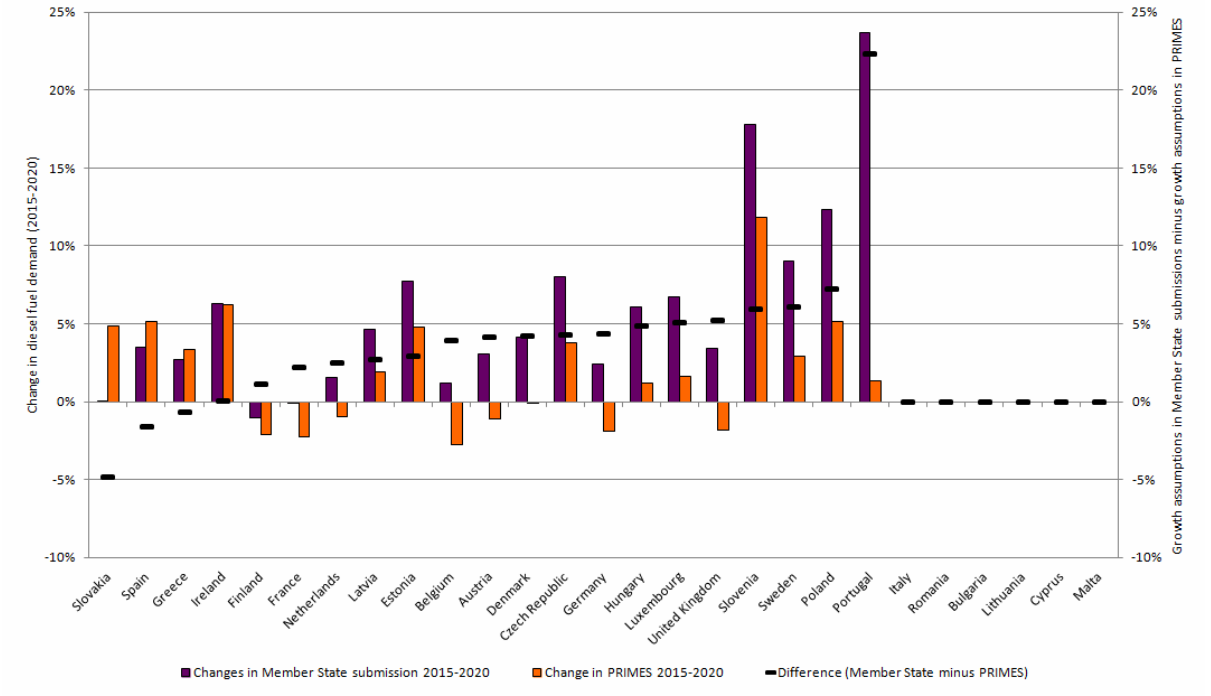
Source: ETC/ACM 2011, PRIMES model - scenario: PRIMES_BL2009_14jan10 activity: Total transport (excluding bunkers) - final energy demand – liquid fuels – diesel oil, Eurostat – Final energy consumption– Transport diesel – (annual data) [nrg_102a]

The Greek and Slovenian projections report submitted under the MM Decision provide insight into the reasons behind the differences:

- Greece expects its diesel fuel demand to decrease by 4% but PRIMES expects it to continue to increase by 7% during 2010-2015. During 2003-2008, Greece's diesel demand numbers increased by 3%. Greece's 2011 projections report submitted under the MM Decision states that excise duty rates for all energy products in Greece were changed three times within 2010 in the framework of the measures taken to tackle the debt crisis. This may not have been taken into account in the projected growth of diesel demand in PRIMES. On the other hand, the ban on diesel passenger cars has been recently lifted, which may result in an increase in the demand for diesel fuel. This may have been taken into account in PRIMES, which then justifies the projected increase of 7%.

- Slovenia's diesel fuel demand increased considerably by 156% during 2003 and 2008. Both Slovenia and PRIMES predict the increasing trend to continue during 2010-2015, at much lower rates though. Slovenia assumes this increase to be on the order of 43%, whereas the PRIMES model predicts a 32.5% increase. Recently (June 2009) Slovenia adopted the draft Act amending the Motor Vehicles Tax Act, which, among other things, introduces progressive tax rates for motor vehicles tied to CO_2 emissions. This may explain the increased demand for automotive diesel, which result in lower CO_2 emissions – and hence also lower tax – due to the higher efficiency of diesel cars compared to petrol ones.

Figure B-19 Difference between the growth assumptions for diesel fuel demand during 2015-2020, Member State submissions and PRIMES model



Source: ETC/ACM 2011, PRIMES model - scenario: PRIMES_BL2009_14jan10 activity: Total transport (excluding bunkers) - final energy demand – liquid fuels – diesel oil, Eurostat, 2011 – Final energy consumption– Transport diesel – (annual data) [nrg_102a]

The projected growth rates of the two models between 2015 and 2020 differ by more than 20% only for Portugal (c.f.Figure B-19). Portugal expects a quicker increase in diesel fuel demand than predicted by PRIMES. The latter is closer to the observed growth between 2003 and 2008 than Portugal's projection is to the growth between 2003 and 2008. Hence there is a high risk that the growth assumption of diesel fuel demand has been overestimated by Portugal. The various policies and measures included in the Portuguese projections report also do not justify such a high expected increase in diesel fuel demand.

B.3.3 Passenger kilometres by passenger cars

Consistency against 2010 Eurostat data

Eurostat includes statistics on passenger kilometres only up to 2009 and hence a comparison against 2010 data is not possible.

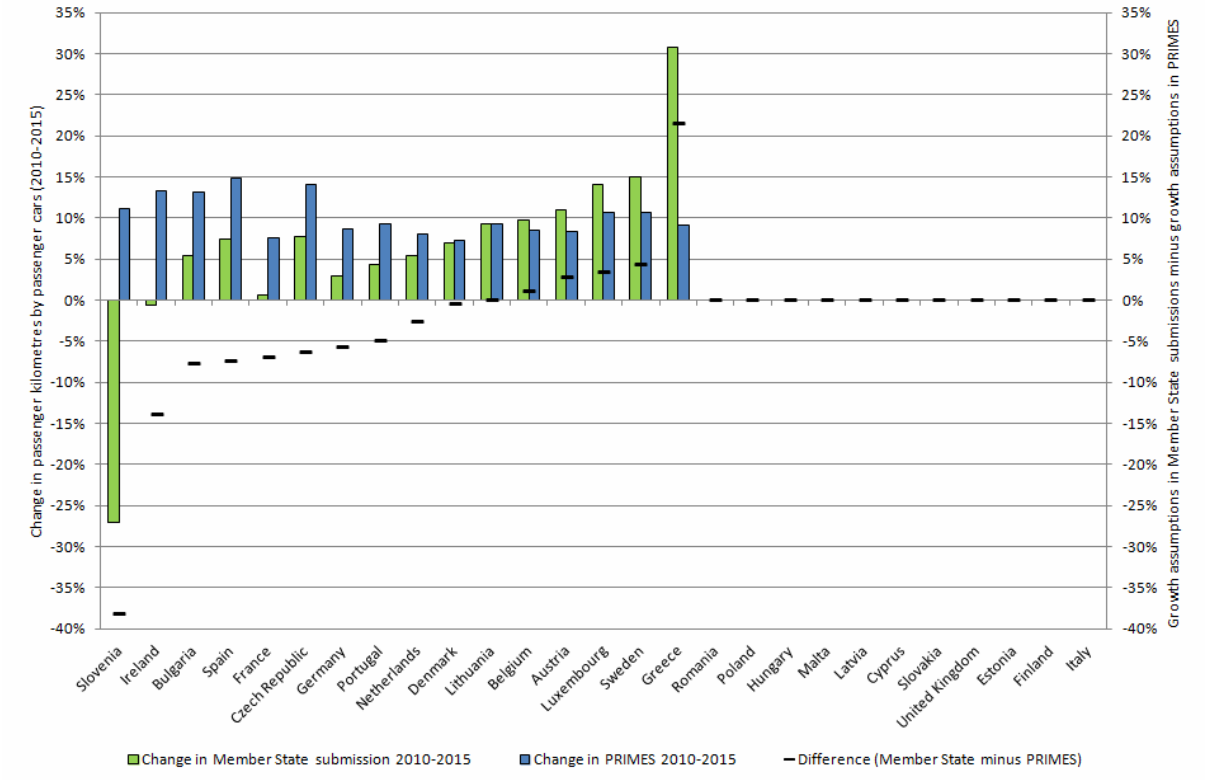
Time series consistency of the growth expected between 2010-2015 and 2015-2020

The expected growth rate of passenger kilometres assumed by the Member States has been compared against the predicted growth in the PRIMES model, published by NTUA (European Commission, 2010). This check tries to identify Member States who are using high or low growth assumptions for the passenger kilometres compared to the projected growth estimated by NTUA. The difference (consistency) between the growth rates of passenger kilometres by passenger cars between the two models are calculated using a

similar methodology as GDP and population (Section 4.1.1 and Section 4.1.3). The following criteria have been applied to identify if there is a risk that the parameter has been over or underestimated:

- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated their passenger kilometres by passenger cars if the difference between the passenger kilometre numbers estimated by Member States and by PRIMES is less than or equal to 10%;
- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated their passenger kilometres by passenger cars if the difference between the passenger kilometre numbers estimated by Member States and by PRIMES is less than or equal to 20%.

Figure B-20 Difference between the growth assumptions for passenger kilometres by passenger cars during 2010-2015, Member State submissions and PRIMES model



Source: ETC/ACM 2011, PRIMES model - scenario: PRIMES_BL2009_14jan10 activity: PASSENGER TRANSPORTS - Private Cars – activity (Gpkm)

Figure B-20 shows the difference between the growth assumptions for passenger kilometres from 2010 to 2015 reported by the Member States and in PRIMES. A difference greater than 10% exists for Greece, Ireland and Slovenia. Slovenia and Ireland expect a decrease in passenger kilometres (significant for Slovenia and only marginal for Ireland), whereas Greece predicts a quicker increase than reported in PRIMES. This suggests that there is a risk that the growth of passenger kilometres has been underestimated in Slovenia and Ireland

and overestimated in Greece. The growth predicted by PRIMES is closer to the observed growth between 2003 and 2008 than Slovenia projections are to the growth between 2003 and 2008 (c.f. Table B-7). Hence there is a high risk that the growth assumptions for passenger kilometres used by Slovenia have been underestimated. For Ireland and Greece there is no Eurostat data on passenger kilometres and hence an assessment of possible underestimations or overestimations on the basis of historic data cannot be made.

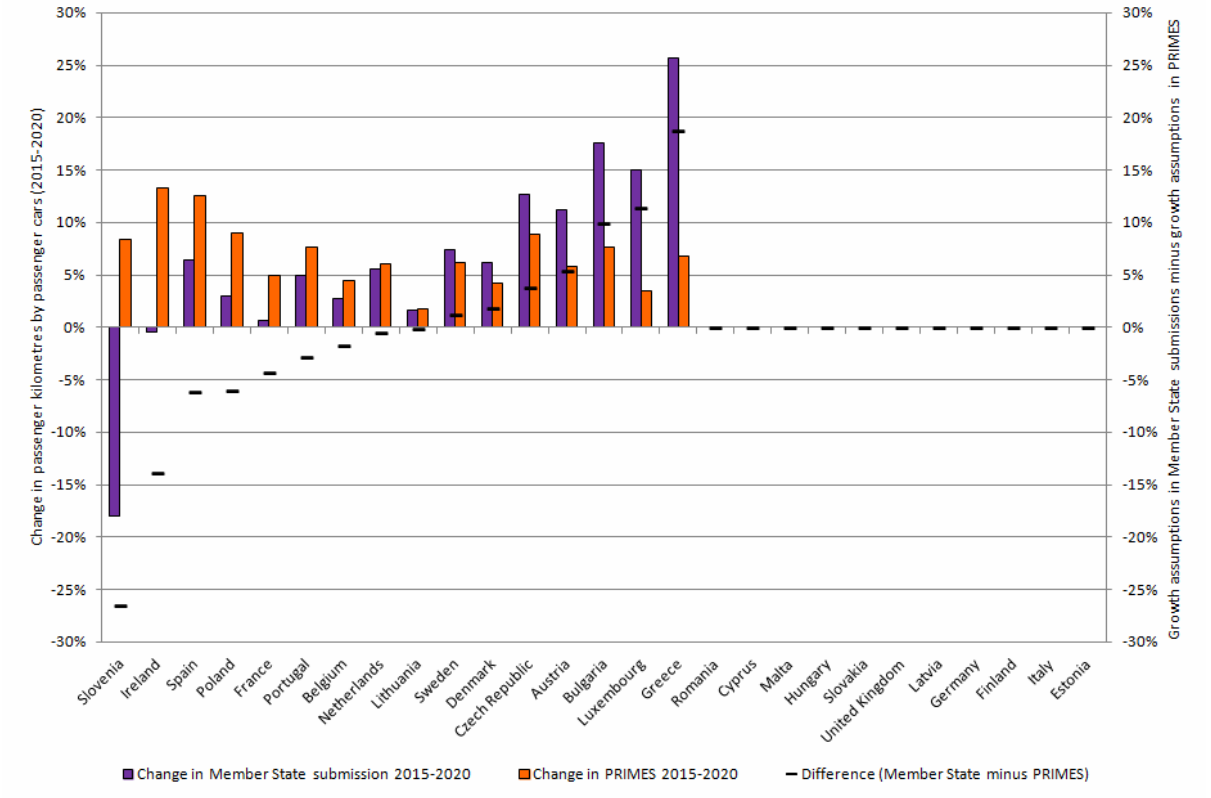
Table B-7 Difference between the projected growth rate of passenger kilometres by passenger cars during 2010-2015 and 2015-2020, and actual growth from 2003 to 2008, PRIMES and Member State submissions

	2010-2015		2015-2020		2003-2008
	Member State growth assumption	PRIMES growth assumption	Member State growth assumption	PRIMES growth assumption	Member State growth assumption
Slovenia	-27.1%	11.1%	-18.0%	8.4%	16.6%
Ireland	-0.5%	13.3%	-0.5%	13.3%	n.a.
Greece	30.7%	9.2%	25.6%	6.8%	n.a.

Source: ETC/ACM 2011, PRIMES model - scenario: PRIMES_BL2009_14jan10 activity: PASSENGER TRANSPORTS - Private Cars – activity (Gpkm), Eurostat – Road transport measurement - passengers [road_pa]

It should be noted that the passenger kilometre numbers reported by Slovenia are considerably lower (by a factor of 30) compared to Eurostat and PRIMES. Therefore, it is highly likely that there is an error in the reporting of this parameter and hence no reason can be provided for the observed differences.

Figure B-21 Difference between the growth assumptions for passenger kilometres by passenger cars during 2015-2020, Member State submissions and PRIMES model



Source: ETC/ACM 2011, PRIMES model - scenario: PRIMES_BL2009_14jan10 activity: PASSENGER TRANSPORTS - Private Cars – activity (Gpkm)

The projected growth rate of two the models between 2015 and 2020 differ by more than 20% only for Slovenia (c.f. Figure B-21). As explained above, this may be due to a possible error in the reporting of this transport parameter.

B.3.4 Accuracy

The checks performed in the previous sections (Section B.3.2 to B.3.3) identify if there is a risk that the key parameters used in compiling the GHG projections from the transport sector were under or overestimated. The findings from the different checks have been summarised below, following the method used in Chapter 6.

Table B-8 Summary table based on the assessment of diesel fuel demand and passenger kilometres by passenger cars assumptions

Member State	Diesel fuel demand growth 2010-2015	Diesel fuel demand growth 2015-2020	Passenger kilometres growth 2010-2015	Passenger kilometres growth 2015-2020	Total Points

Slovenia	Low (+)		High (-)	High (-)	7
Portugal		High (+)			3
Greece	Medium (+)		Low (+)		3
Slovakia	Medium (+)				2
Ireland			Low (-)		1

Note: (+) indicates overestimate and (-) indicates underestimate. Yellow cells indicate parameters where there is a risk of underestimation. Pink cells indicate parameters where there is a risk of overestimation.

The results show that there is a risk that 5 of the 27 Member States have under or overestimated the diesel fuel demand and passenger kilometres by passenger cars assumptions used to calculate GHG projections. There is no clear trend to whether Member States tend to over or underestimate the key parameters in this sector. The main reason for Slovenia having the highest score is the possible error in reporting the total passenger kilometres which are considerably lower (by a factor of 30) compared to PRIMES and to other Member States with similar characteristics of their passenger car fleet (e.g. Latvia and Slovakia).

B.4 Agriculture

Cattle numbers and fertiliser use are the key parameters assessed for the agriculture sector. Cattle numbers were not reported by four Member States; Cyprus, Estonia, Luxembourg (reported 2010) and Malta. Total fertiliser use was not reported by six Member States; Cyprus, Germany, Italy, Luxembourg, Malta and Romania. The completeness of the parameters is lower than the completeness levels for GDP and population.

Number of cattle

- There is a high risk that Romania has overestimated their 2010 cattle numbers, a medium risk that Germany's assumption is an underestimate and a low risk that Lithuania's assumption is an overestimate.
- Seven Member States (Bulgaria, Czech Republic, Hungary, Latvia, Lithuania, Romania and Slovakia) are associated with over or underestimating the change in cattle numbers during 2010-2020. All seven projects a slower decline or quicker increase in cattle numbers compared to the GAINS model. Slovakia is the only exception and there is a low risk that Slovakia has underestimated the increase in cattle numbers during 2015-2020.

Fertiliser use

- Six Member States (Estonia, Greece, Ireland, Latvia, Poland and Slovakia) are associated with over or underestimating the projected trend of in fertiliser use during 2010-2020. Estonia, Greece and Ireland project a much slower growth and Latvia, Poland and Slovakia project a quicker growth of fertiliser use compared to the GAINS model.

Of the EU-27 Member States, Romania and Slovakia's agriculture projections have the highest risk of being based on key parameters with inaccurate values and trends. Bulgaria has the third highest risk. This echoes the findings in the main report. It is likely that the high assumptions used in the agriculture projections partly explains why the total projections reported by Bulgaria and Romania are an overestimate.

The key assumptions studied for agriculture sector are total cattle numbers and synthetic and manure fertiliser use. In 2009, GHG emissions from enteric fermentation and manure management from farm animals accounted for 48% of total emissions in the EU-27 of which 64% was a result of cattle (EEA Dataviewer, 2011). Of the remaining 52% of emissions in the agriculture sector, 51% of the emissions are from agricultural soils which are dominated by the use of fertilisers on land.

B.4.1 Completeness

Cattle numbers were not reported by four Member States; Cyprus, Estonia, Luxembourg (reported 2010) and Malta. Total fertiliser use was not reported by six Member States Cyprus, Germany, Italy, Luxembourg, Malta and Romania. The completeness of the parameters is lower than the completeness levels for GDP and population.

B.4.2 Total cattle numbers

Consistency against 2010 Eurostat data

Consistency between the number of cattle in 2010 reported by Member States and the observed 2010 cattle numbers reported by Eurostat is assessed using the same methodology as GDP and population (Section 4.1.1 and Section 4.1.3). Figure B-1 shows the difference between the number of cattle reported by the Member States and the actual number of cattle in 2010 reported by Eurostat expressed as a percentage of the Eurostat value. Where the percentage difference change is greater than +10% the bars are red and where the percentage change is lower than -10% the bars are green.

Figure B-22 Difference between the projected 2010 total cattle number estimates from Member State submissions and the actual 2010 total cattle numbers from Eurostat

Source: ETC/ACM 2011, Eurostat - Cattle population (annual data) [apro_mt_lscatl]
Note: Red bars indicate Member States whose assumptions are more than 10% higher than Eurostat and green bars show those which are lower by more than -10%

The % difference is under 10% for all Member States apart from Germany, Lithuania and Romania (for the latter two the difference is very high).

- Total number of cattle in 2010 reported by Lithuania is 45% higher than the cattle numbers reported by Eurostat in 2010. Discrepancy of this magnitude is likely to be as due to inconsistency which exists throughout the entire time series rather than as a result of an overestimation. The historic *dairy* cattle numbers reported by Lithuania with the projections match the total cattle numbers reported in Eurostat. The total cattle number reported in the CRF tables reported by Lithuania (2011b) matches those in Eurostat. The 2009 emissions from enteric fermentation and manure management of cattle from the latest inventory match the 2009 emissions reported for the reference year in the projections. Therefore, the discrepancy is likely to be as a result of an error in the reporting and there is a low risk that Lithuania's cattle numbers in 2010 is overestimated;

- The difference between Romania's submission and the Eurostat data is 52%. Unlike Lithuania, the 2000 and 2005 data for the number of cattle in the two datasets match. Therefore, there is a high risk that Romania's cattle number assumption in 2010 has been overestimated;

- Germany's assumption for number of cattle is 10% lower than those reported in Eurostat. Historic figures were not reported by Germany so it is not possible to assess whether there is a systematic discrepancy throughout the time series. As a result, there is a medium risk that the assumption used for number of cattle by Germany in 2010 is an underestimate.

Time series consistency of the growth expected between 2010-2015 and 2015-2020

In order to identify the risk the development of the number of cattle in future years has been over or underestimated by the Member States, the projected number of cattle assumed by the Member States has been compared against the forecasted growth in the GAINS model, published by IIASA ($$reference). The difference (inconsistency) between the growth rates of the two models are calculated using a similar methodology as GDP and population (Section 4.1.1 and Section 4.1.3). The following criteria have been applied:

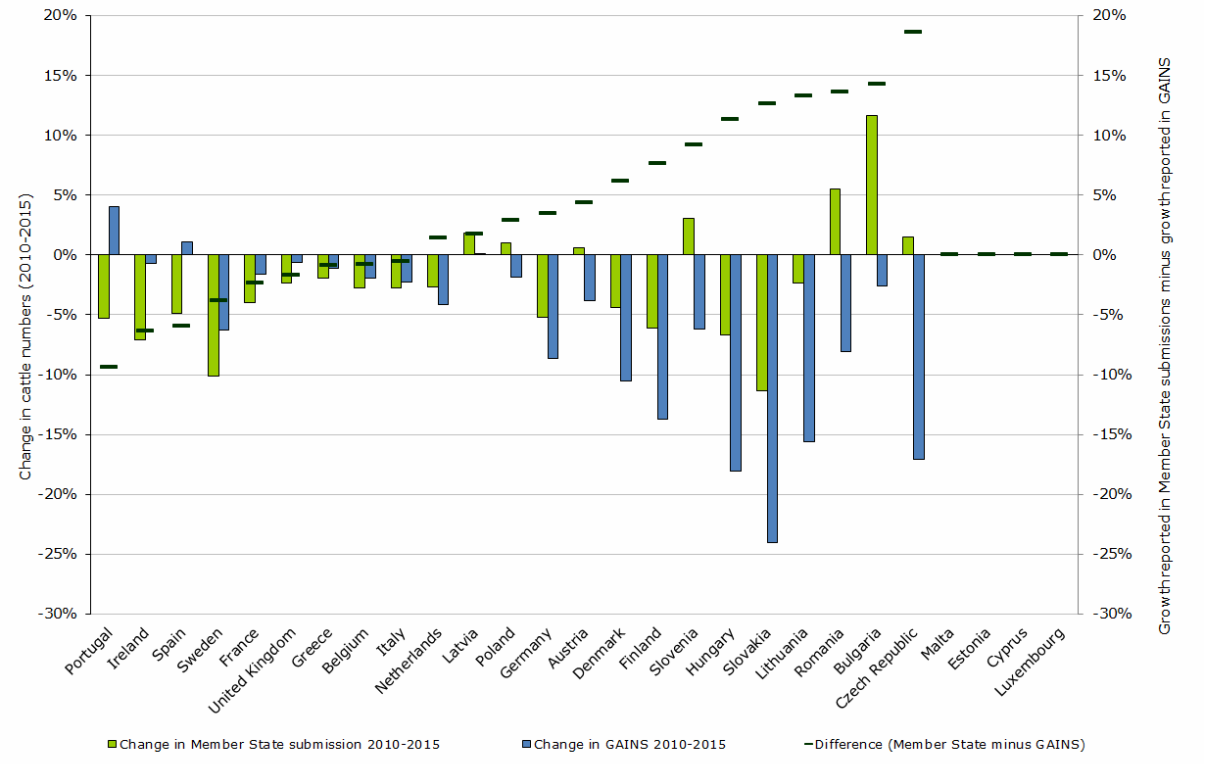
- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated their cattle numbers if the difference between the cattle numbers estimated by Member States and by GAINS is less than or equal to 10%;

- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated their cattle numbers if the difference

between the cattle numbers estimated by Member States and by GAINS is less than or equal to 20%

If the difference exceeds the above criteria, the expected growth is compared with the actual change observed between 2003 and 2008 (c.f Table B-9). From this check a risk level is assigned to the growth assumption of cattle used by the Member States to calculate their projections.

Figure B-23 Difference between the growth assumptions for cattle numbers during 2010-2015, Member State submissions and GAINS model



Source: ETC/ACM 2011, GAINS model - scenario: PRIMES_BL2009_14jan10 activity: dairy cows and Non-dairy cattle

Figure B-23 shows the difference between the growth assumptions for cattle from 2010 to 2015 reported by the Member State and in GAINS. A difference greater than 10% exists for Hungary, Slovakia, Lithuania, Romania, Bulgaria and the Czech Republic. All these Member States expect either a slower decline or a quicker increase in cattle numbers. This suggests that there is a risk that the growth of the number of cattle has been overestimated by these Member States. The growth predicted by Hungary and Lithuania are of similar magnitude to the observed growth between 2003 and 2008. (c.f Table B-6). Hence there is a low risk that the growth assumptions for cattle used by these Member States have been overestimated.

Table B-9 Difference between the projected growth rate of cattle during 2010-2015 and 2015-2020, and actual growth from 2003 to 2008, GAINS and Member State submissions

	2010-2015		2015-2020		
	Member State growth assumption	GAINS growth assumption	Member State growth assumption	GAINS growth assumption	Member State growth assumption (2003-2008)
Hungary	-6.7%	-18.1%	-5.4%	1.2%	-5.1%
Slovakia	-11.4%	-24.0%	-11.1%	14.0%	-17.7%
Lithuania	-2.3%	-15.6%	-0.4%	-0.2%	-5.1%
Romania	5.6%	-8.0%	5.3%	-12.1%	-7.4%
Bulgaria	11.6%	-2.6%	21.0%	-10.3%	-22.0%
Czech Republic	1.5%	-17.1%	5.8%	-18.1%	-4.8%
Latvia	1.8%	0.1%	6.2%	-14.5%	0.4%

Source: ETC/ACM 2011, GAINS model - scenario: PRIMES_BL2009_14jan10 activity: dairy cows and non-dairy cattle, Eurostat - Cattle population (annual data) [apro_mt_lscatl]

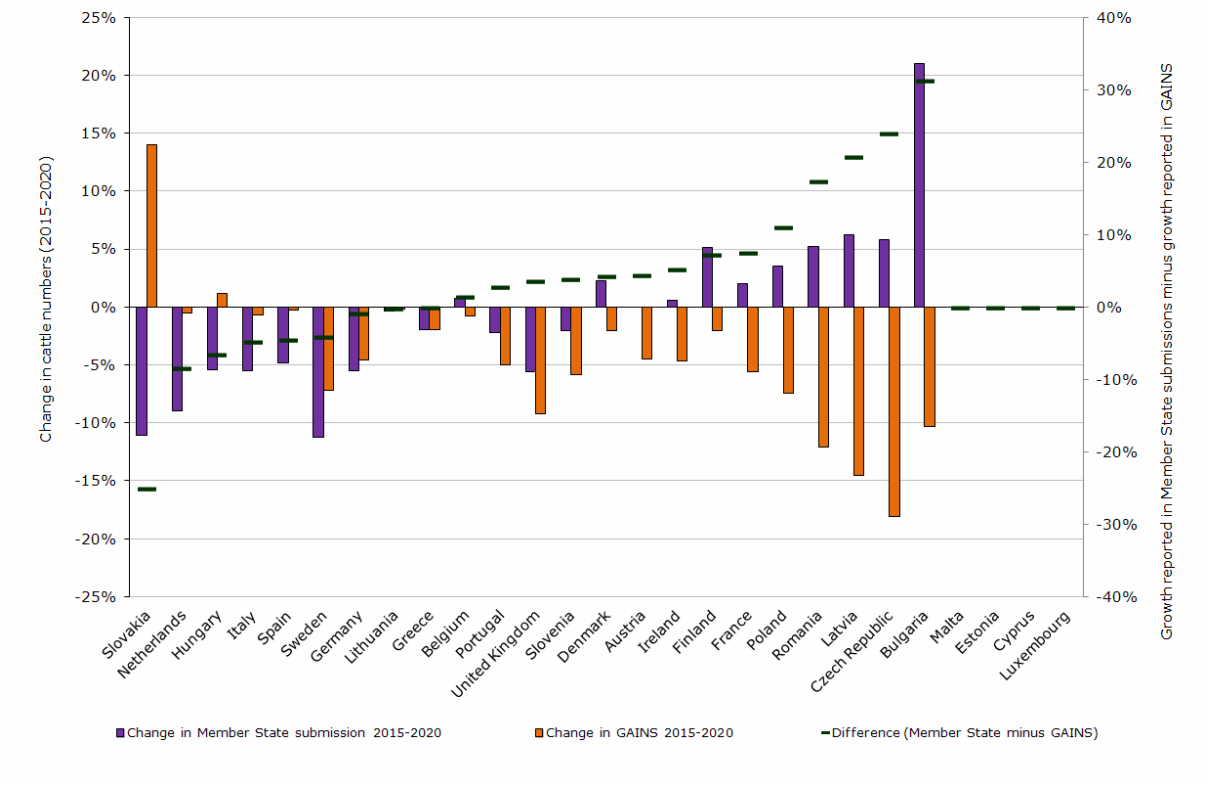
For the remaining four Member States; Bulgaria, the Czech Republic, Romania and Slovakia, there is a medium risk that the assumed growth of cattle numbers during 2010-2015 is an overestimate. The projections reports submitted by these Member States provide further insight into the reasons behind the cattle number assumptions used. These are however not considered as sufficient evidence to lower the risk of overestimation to 'low'.

- Romania expects their cattle numbers to continue to increase by 5.6% but GAINS expect cattle numbers to fall by -8% during 2010-2015. During 2003-2008, Romania's cattle numbers fell by 7.4% and Romania's 2011 GHG inventory submission also shows that cattle numbers have continuously declined since 1990 (Romania, 2011b). Romania's 2011 projections report (2011a) submitted under the MM Decision states that their projections are based on 'livestock and animal production increasing together with the private property consolidation in agriculture' (Romania, 2011b). The report shows that the projected growth of cattle numbers is based on the reference year 2006 and between 2001 and 2006, cattle numbers were increasing. This suggests that the projected growth of cattle used in the Romanian projections did not take into account the decline observed between 2006 and 2009. Based on this, there is a medium risk that Romania's projected growth of cattle during 2010-2015 is an overestimate.

- During 2003-2008 cattle numbers fell in the Czech Republic by 4.8% and during 1990-2008 by more than 60%. The Czech projections report (2011) does not expect such fall to take place again. Numbers of dairy cows are expected to fall (affected by increasing cow efficiency and milk quotation in EU) and increase in the number of sucker cows are expected. GAINS on the other hand expect a rapid fall in cattle numbers during 2010-2015.

- According to Slovakia's projections report, projected cattle numbers in Slovakia's WEM scenario do not take into account the strict implementation of CAP recommendations (Slovakia, 2011). The fall in cattle numbers during 2010-2015 in the WAM scenario is much closer to the GAINS estimate.

Figure B-24 Difference between the growth assumptions for cattle numbers during 2015-2020, Member State submissions and GAINS model



Source: ETC/ACM 2011, GAINS model - scenario: PRIMES_BL2009_14jan10 activity: dairy cows and non-dairy cattle

The projected growth rate of two models between 2015 and 2020 differ by more than 20% for Slovakia, Bulgaria, Czech Republic and Latvia (c.f Figure B-24). All these Member States excluding Slovakia expect either a slower decline or a quicker increase in cattle numbers. The growth predicted by Slovakia is closer to the observed growth between 2003 and 2008 than GAINS is to the growth between 2003 and 2008. Hence there is a low risk that the growth assumption of cattle has been underestimated by the Slovakia. For the Bulgaria and Latvia there is a medium risk that the assumed growth in cattle numbers during 2010-2015 is an overestimate. The projections report submitted under the MM Decision does not provide reasons behind why a high growth in cattle numbers is expected between 2010 and 2020. For the same reasons provided for the growth rate between 2010 and 2015, there is a medium risk that the cattle number growth in Czech Republic is an overestimate.

B.4.3 Fertiliser used- synthetic and manure

Consistency against 2010 Eurostat data

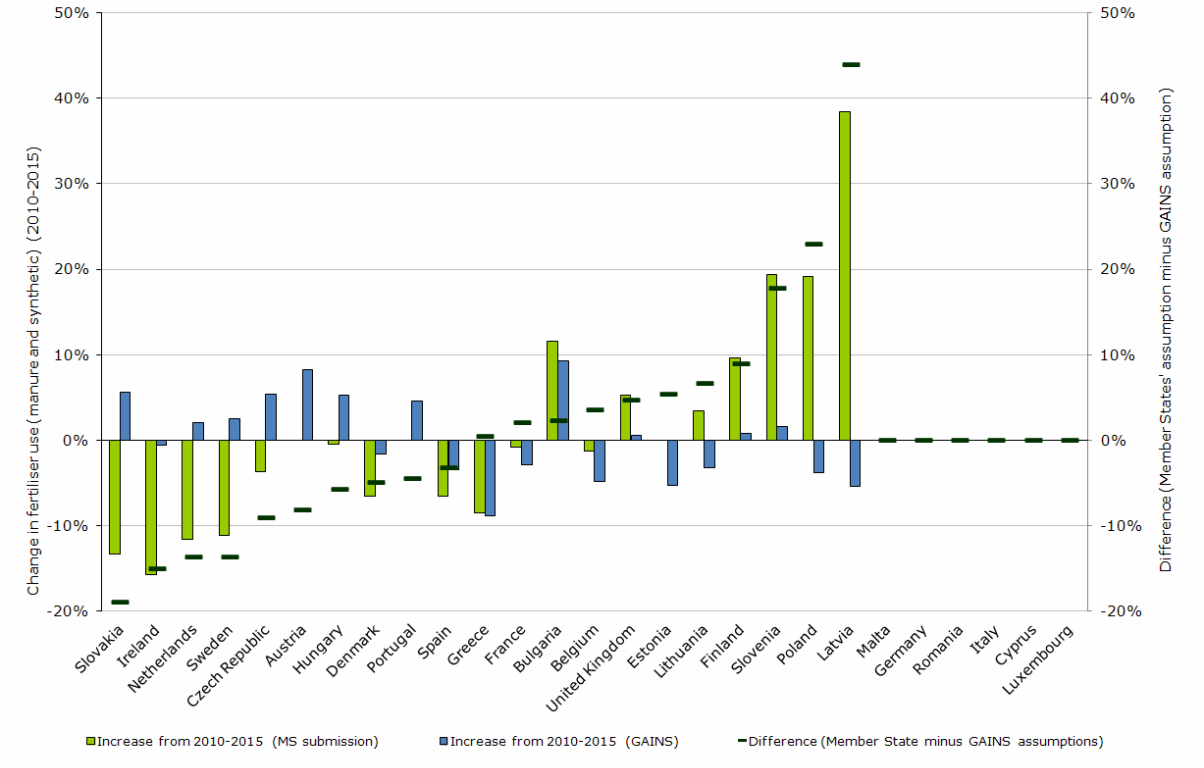
It is not possible to compare synthetic and manure fertiliser use against actual 2010 data because this data is not available in Eurostat at all. The data will be available in the CRF of the 2012 inventory submissions but this will only be available in 2012.

Consistency of the growth expected between 2010-2015 and 2015-2020

The consistency of the growth in fertiliser use (synthetic and manure) with another projections model (GAINS) and with the historic time series is assessed using a similar methodology as GDP and population (Section 4.1.1 and Section 4.1.3). The following criteria have been applied:

- **Growth between 2010 and 2015.** It is considered that there is little or no risk that a Member State has over or underestimated their fertiliser use assumption if the difference between the fertiliser use data estimated by Member States and by GAINS is less than or equal to 15%;
- **Growth between 2015 and 2020**. It is considered that there is little or no risk that a Member State has over or underestimated their fertiliser use assumption if the difference between the fertiliser use data estimated by Member States and by GAINS is less than or equal to 20%.

Figure B-25 Difference between the growth assumptions for fertiliser use during 2010-2015, Member State submissions and GAINS model



Source: ETC/ACM 2011, GAINS model - scenario: PRIMES_BL2009_14jan10 activity: Mineral fertilizer urea and Mineral fertilizer other

Figure B-25 shows the difference between the growth assumptions for fertiliser use from 2010 to 2015 reported in the Member State submissions and in GAINS. A difference greater than 15% exists for Slovakia, Ireland, Slovenia, Poland and Latvia. Ireland and Slovakia expect their fertiliser use to decline much quicker than the GAINS model. Latvia, Poland and Slovenia expect fertiliser use to increase faster than the GAINS mode. The growth predicted by Ireland, Poland and Latvia are in line with the observed growth between 2003 and 2008 than GAINS is to the growth between 2003 and 2008. Based on this observation, there is a low risk that Ireland's assumption for the growth in fertiliser use is underestimated. There is also a low risk that Poland and Latvia's assumption for the growth in fertiliser use between is overestimated.

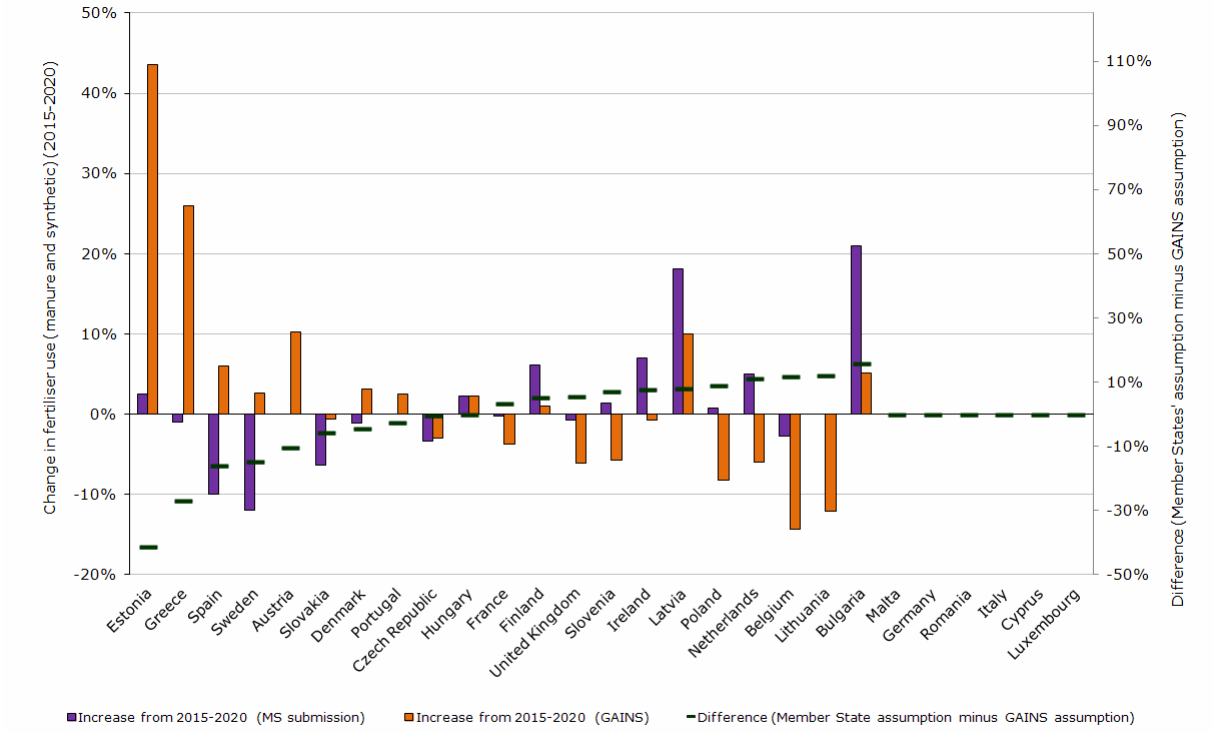
Table B-10 Difference in cattle number growth during 2010-2015 and 2015-2020 for both GAINS and Member State submissions compared against actual growth from 2003 to 2008

	2010-2015		2015-2020		
	Member State growth assumption	GAINS growth assumption	Member State growth assumption	GAINS growth assumption	Member State growth assumption (2003-2008)
Slovakia	-13.3%	5.6%	-6.3%	-0.6%	-4.4%
Ireland	-15.7%	-0.6%	7.0%	-0.8%	-18.3%
Slovenia	19.4%	1.6%	1.3%	-5.8%	-16.2%
Poland	19.1%	-3.8%	0.7%	-8.3%	19.6%
Latvia	38.5%	-5.4%	18.1%	9.9%	18.0%
Estonia	0.0%	-5.4%	2.5%	43.6%	31.7%
Greece	-8.5%	-8.9%	-1.0%	26.0%	-26.5%

Source: ETC/ACM 2011, GAINS model - scenario: PRIMES_BL2009_14jan10 activity: Mineral fertilizer urea and Mineral fertilizer other, 2011 National GHG inventory submissions CRF - Animal Manure Applied to Soils and Synthetic Fertilizers

Slovenia assumes that their fertiliser use will increase 19% during 2010-2015 and GAINS predict a rise in fertiliser use of 1.6%. Between 2003 and 2008, fertiliser use fell by 16%. Slovenia's projections report (Slovenia, 2011) state that measures are being implemented in the context of the Rural Development Programme which directly contributes to reducing the use of mineral fertilisers and that because the use of mineral fertilisers have fallen considerably in previous years as a result of more efficient use, further reduction in fertiliser use will be increasingly slow. The growth assumption during 2010-2015 for fertiliser use reported by Slovenia contradicts these statements and is much higher than the growth observed between 2003 and 2008. As a result, there is a medium risk that the growth in fertiliser use reported by Slovenia is overestimated.

Figure B-26 Difference between the growth assumptions for fertiliser use during 2015-2020, Member State submissions and GAINS model



Source: ETC/ACM 2011, GAINS model - scenario: PRIMES_BL2009_14jan10 activity: Mineral fertilizer urea and Mineral fertilizer other, 2011 National GHG inventory submissions CRF - Animal Manure Applied to Soils and Synthetic Fertilizers

During 2015-2020, a difference greater than 20% exists for Estonia and Greece (Figure B-26). Both Greece and Estonia expect their fertiliser use to increase at a much slower rate than the GAINS model. The growth predicted by Estonia (2%) is significantly lower than the observed growth of fertiliser use between 2003 and 2008 (32%). The projected increase by GAINS is even higher (43%). Estonia plans to promote the reduction of GHG emissions arising from the use of fertilisers through the Estonian Rural Development Plan 2007–2013. This plan will drive the increase in organic farming which will reduce the amount of synthetic fertiliser used in Estonia (Estonia, 2011). Estonia has supported organic farming since 2000, but since then use of fertilisers has increased. Policies may be implemented post 2013 to slow down the increase in the use of fertilisers in Estonia but based on the comparison against the GAINS model and the observed trend during 2003-2008, there is a medium risk that Estonia's assumptions used for the growth in the use of fertilisers is underestimated.

On the other hand, the assumption used by Greece is much closer to the observed trend during 2003-2008 than the GAINS model and the trend between 2003 and 2008. Fertiliser use has been declining since 2000 in Greece and both the Greek and GAINS assumptions expect a further fall during 2010-2015. However, during the period 2015-2020, the GAINS model predict fertiliser use to increase by 26% whereas the assumption used in the Greek projection

is a fall in fertiliser use by 1%. Greece has implemented a policy which has the objective of decreasing the use of synthetic fertiliser expected to save 100 kt CO_2-equivalent in 2010, 2015 and 2020 (Greece, 2011). The evidence available concludes that there is a low risk that Greece's projected growth of fertiliser use between 2015 and 2020 is underestimated.

B.4.4 Accuracy

The checks performed in the previous sections (Section B.4.2 to B.4.3) identify if there is a risk that the key parameters used in compiling the GHG projections from the agriculture sector were under or overestimated. The findings from the different checks have been summarised below, following the method used in Chapter 6.

Table B-11 Summary table based on the assessment of cattle numbers and fertiliser use assumptions

Member State	Cattle – consistency against 2010	Cattle Growth 2010-2015	Cattle Growth 2015-2020	Fertiliser use Growth 2010-2015	Fertiliser use 2015-2020	Total Points
Romania	High (+)	Medium (+)				5
Slovakia		Medium (+)	Low (-)	Medium (+)		5
Bulgaria		Medium (+)	Medium (+)			4
Czech Republic		Medium (+)	Medium (+)			4
Latvia			Medium (+)	Low (+)		3
Estonia					Medium (-)	2
Germany	Medium (-)					2
Lithuania	Low (+)	Low (+)				2
Greece					Low (-)	1
Hungary		Low (+)				1
Ireland				Low (-)		1
Poland				Low (+)		1

Note: (+) indicates overestimate and (-) indicates underestimate. Yellow cells indicate parameters where there is a risk of underestimation. Pink cells indicate parameters where there is a risk of overestimation.

The results show that there is a risk that 12 of the 27 Member States have under or overestimated the cattle numbers and fertiliser use assumptions used to calculate GHG projections. More Member States are overestimating the key parameters in the agriculture sector. The cattle number and fertiliser use assumptions in Bulgaria and Romania are two of the Member States associated with having the highest risk of overestimating their projections. The high risk that the projections from the agriculture sector are overestimated for these Member States echo the findings from Chapter 6 and support the decision taken to exclude their projections in the EU-27 total projections.

B.5 Waste

MSW generation and MSW disposed to landfill are the key parameters assessed for the waste sector. Assumptions used for MSW generation were not reported by nine Member states; Austria, Cyprus, Estonia, Germany, Luxembourg, Malta, Romania, Sweden and the United Kingdom and the assumptions for the amount of MSW projected to be disposed to landfill was not reported by five Member States; Cyprus, Luxembourg, Malta, Romania and Sweden.

MSW generation

- There is a medium risk that Bulgaria has overestimated their increase in MSW generation and the Czech Republic, Portugal and Slovenia have underestimated the growth of MSW generation during 2010-2020.
- Spain projects a much slower growth of MSW generation during 2010-2020 compared to GAINS. The projected growth reported by Spain is however in line with the trend observed during 2003-2008 and Spain reported a policy which is expected to lead to waste reduction in the future. As a result, there is only a low risk that Spain has underestimated the change in MSW generation.

MSW landfilled

Under the MM Decision, Member States report the parameter MSW landfilled whereas GAINS report the amount of MSW landfilled which is biodegradable. The biodegradable component of MSW is largely responsible for the high emissions from landfill in the waste sector. It is recommended that Member States are requested to report the amount of biodegradable waste going into landfill in future submissions in order to increase the transparency and comparability of the submissions.

Of the EU-27 Member States, Slovenia and Bulgaria's waste projections have the highest risk of being based on inaccurate MSW generation rates. Slovenia's emission projections from the waste sector are at risk of being an underestimates whereas Bulgaria's is at risk of being an overestimate.

For the waste sector the assumptions for Municipal Solid Waste (MSW) generation and MSW disposed to landfill are considered. Emissions from the waste sector arise from treating waste thus the emission levels are closely linked waste generation levels and in particular waste going into landfills is the biggest source of emissions (accounts for 76% of the overall emissions from waste in the EU-27 in 2009) (EEA Dataviewer, 2011).

B.5.1 Completeness

Assumptions used for MSW generation were not reported by nine Member states; Austria, Cyprus, Estonia, Germany, Luxembourg, Malta, Romania, Sweden and the United Kingdom and the assumptions for the amount of MSW projected to be disposed to landfill was not reported by five Member States; Cyprus, Luxembourg, Malta, Romania and Sweden.

B.5.2 MSW Generation

Consistency against 2010 Eurostat data

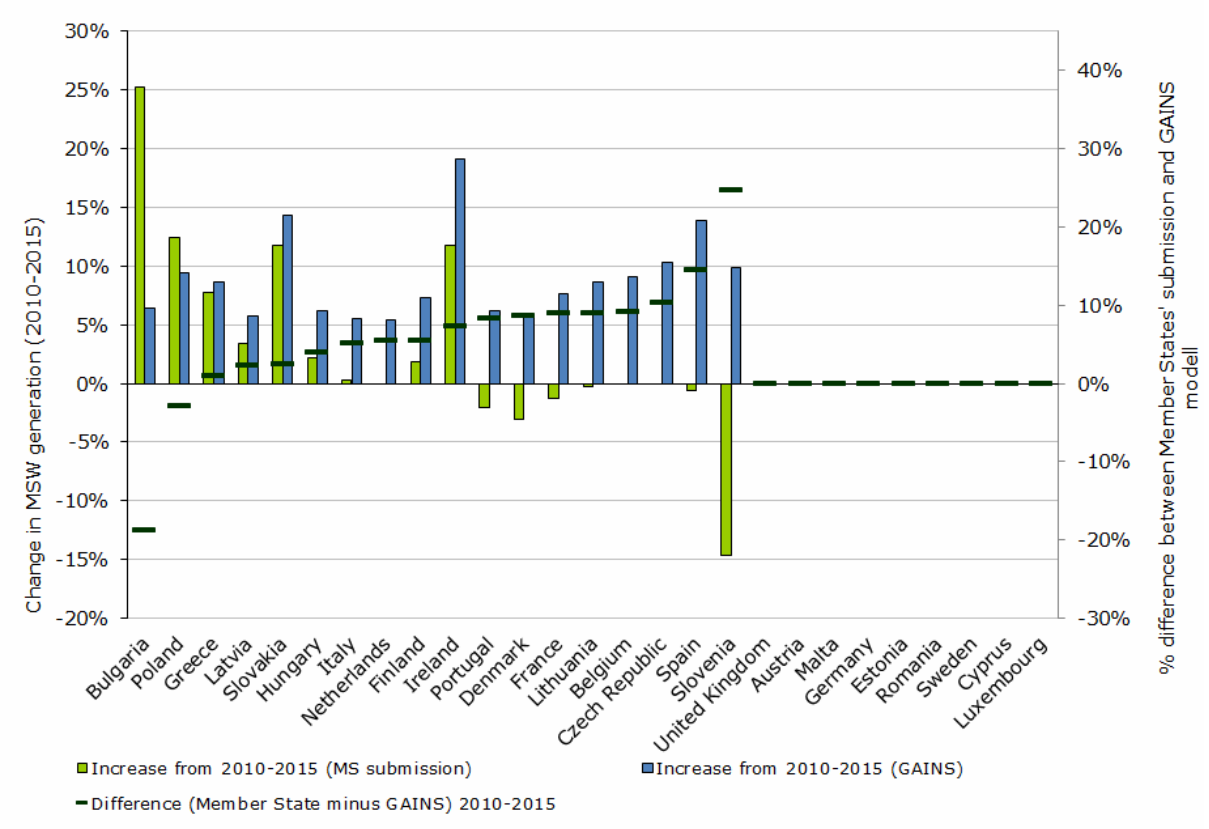
It is not possible to compare the MSW generation rate against actual 2010 data because this data is not yet available in Eurostat. The data will be available in the CRF Tables of the 2012 inventory submissions but this will only be available in 2012.

Consistency of the growth expected between 2010-2015 and 2015-2020

The consistency between the projected change in MSW generation reported by the Member States with another projections model and with the historic time series is assessed following the same methodology as for the GDP and population (c.f Section 4.1.1 and 4.1.3). The GAINS model published by IIASA is used as the surrogate model for comparison purposes. The following criteria have been applied:

- **Growth between 2010 and 2015, and 2015 and 2020.** It is considered that there is little or no risk that a Member State has over or underestimated their MSW generation assumption if the difference between the MSW generation data estimated by Member States and by GAINS is less than or equal to 10%;

Figure B-27 Difference between the assumptions of the change in MSW generation during 2010-2015, Member State submissions and GAINS



Source: ETC/ACM 2011, GAINS model - scenario: PRIMES_BL2009_14jan10 activity: Municipal solid waste - Total generated

Figure B-27 shows the difference between the growth assumptions for MSW generation from 2010 to 2015 reported by the Member State and in GAINS. A difference greater than 10% exists for Slovenia, Spain, Czech Republic and Bulgaria. Of these Member States, only Bulgaria expects a higher increase in MSW generation compared to GAINS.

Table B-12 Difference between the projected growth rate of MSW generation during 2010-2015 and 2015-2020, and the actual growth from 2003 to 2008, GAINS and Member State submissions

	2010-2015		2015-2020		
	Member State growth assumption	GAINS growth assumption	Member State growth assumption	GAINS growth assumption	Member State growth assumption (2003-2008)
Czech Republic	0%	10%	0%	8%	11%
Slovenia	-15%	10%	-17%	8%	11%
Spain	-1%	14%	1%	13%	-7%
Bulgaria	25%	6%	18%	5%	-8%
Portugal	-2%	6%	-7%	6%	17%

Source: ETC/ACM 2011, GAINS model - scenario: PRIMES_BL2009_14jan10 activity: Municipal solid waste - Total generated, Eurostat - env_wasmun-Municipal waste

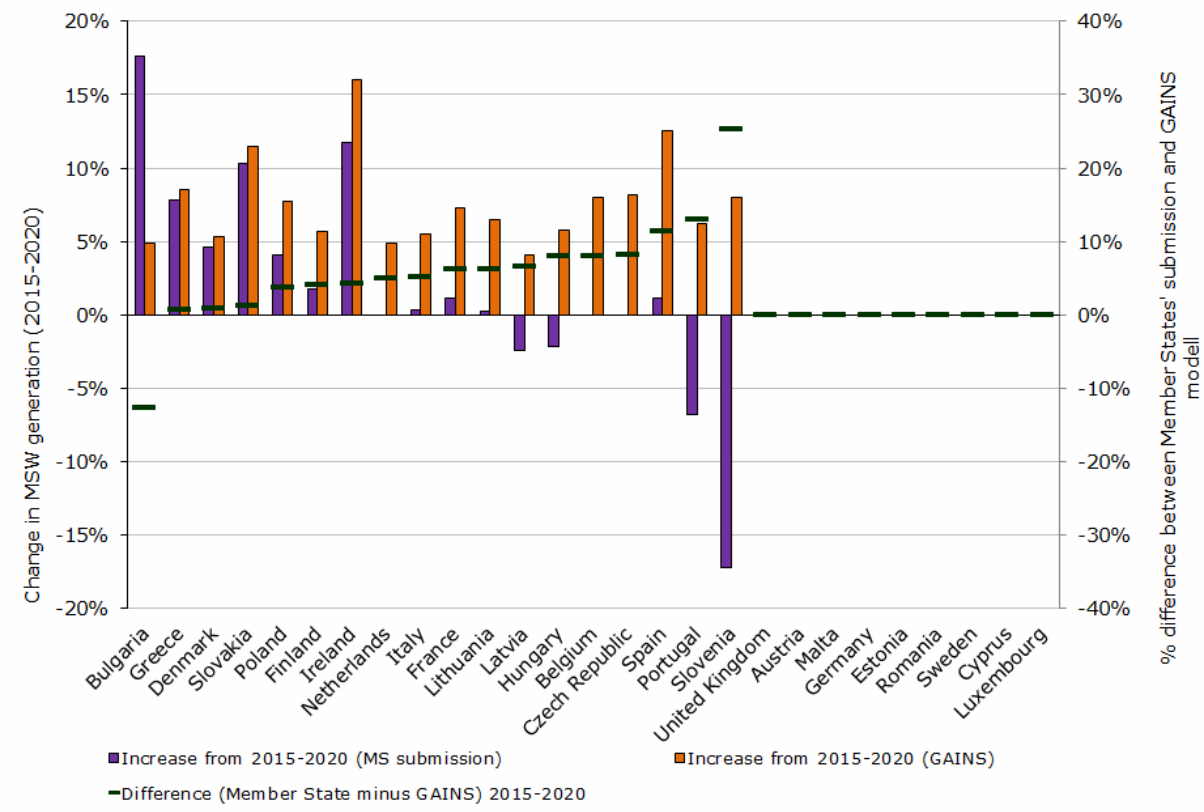
For these Member States, apart from Spain, the projected change in MSW generation contradicts the observed change between 2003 and 2008 (c.f Table B-12). In Spain, MSW generation decreased by 7% during 2003-2008 but GAINS projects an increase during 2010-2015. Spain project a 1% fall in MSW generation, thus project a trend more consistent with the historic trend than GAINS. Spain has in place a 'National Integrated Waste Plan 2008-2015' and one of its main objectives is waste prevention (Spain, 2011). Based on the policy information available and the MSW generation reduction Spain has achieved in recent years, there is a low risk that Spain has underestimated their MSW generation growth between 2010 and 2015.

The Czech Republic and Slovenia both project a much lower increase (decrease in Slovenia's case) in MSW generation compared to GAINS. Neither the Czech nor Slovenian projections report contains any information on policies to reduce MSW generation. Both Member States do have in place policies in the waste sector but focusing on other elements such as reducing the amount of biodegradable waste going into landfills. Bulgaria projects a much higher increase in MSW generation during 2010-2015 than GAINS. Bulgaria state that this takes place due to the economical growth, rise in incomes and household consumption (Bulgaria, 2011). GDP grew 57% during 2000-2008 in Bulgaria (6th highest growth in the EU-27) but during the same period MSW generation has fallen, stagnating in recent years. Bulgaria's MSW generation may increase in the future, however based on the historic trend and due to the inconsistency with the GAINS there is a medium risk that MSW generation assumption used by Bulgaria has been overestimated. Due to the absence of information on how MSW

generation will be reduced in the Slovenia and Czech Republic's projections reports there is a medium risk that the MSW generation assumption used by these two Member States have been overestimated too.

Figure B-28 shows the change in MSW projected by the Member States, GAINS and the difference in the growth rates during 2015-2020. Slovenia, Portugal, Spain and Bulgaria use assumptions where the difference against GAINS is more than 10%. There is a medium risk that the assumption for the change in MSW generation during this period used by Slovenia is underestimated for the same reasons as 2010-2015. In Spain, it may be that a policy will supersede the 'National Integrated Waste Plan 2008-2015' ensuring that MSW generation does not bounce back post 2015. However no information has been reported. Despite this, since the change in MSW generation reported by Spain during 2015-2020 is closer to the reduction observed between 2003 and 2008 than GAINS is to the historic trend, there is only a low risk that Spain has underestimated the change in MSW generation during 2015-2020. For the same reason as 2010-2015, there is a medium risk that the assumption used by Bulgaria has been overestimated. Portugal projects a 7% reduction in MSW generation between 2015 and 2020 whereas GAINS project that MSW generation will increase during 2015-2020 by 6%. Portugal's MSW generation increased by 17% during 2003-2008 and there has been a steady increase since 2000. Since the growth assumption used by GAINS is more in line with the historic trend, there is a medium risk that Portugal's MSW generation growth assumption between 2015 and 2020 is an underestimate.

Figure B-28 Difference between the assumptions of the change in MSW generation during 2010-2015, Member State submissions and GAINS



Source: ETC/ACM 2011, GAINS model - scenario: PRIMES_BL2009_14jan10 activity: Municipal solid waste - Total generated

B.5.3 MSW disposed to landfill

Consistency against 2010 Eurostat data

It is not possible to compare MSW generation and MSW disposed to landfill against actual 2010 data because this data is not yet available in Eurostat. The data will be available in the CRF tables of the 2012 inventory submissions but this will only be available in 2012.

Consistency of the growth expected between 2010-2015 and 2015-2020

The Quality Assurance plan stated that the MSW disposed to landfills reported by Member States will be compared against those in GAINS. GAINS define their parameter as the fraction of biodegradables in MSW landfilled, whereas the MM Decision requires Member States to report total MSW landfilled. Hence the data in GAINS and the Member State submissions are not directly comparable. The biodegradable fraction of waste is responsible for the majority methane emissions from the waste sector. Therefore, the biodegradable fraction of municipal waste landfilled may more accurately reflect GHG emissions from the waste sector than the total municipal waste landfilled.

B.5.4 Accuracy

The checks performed in the previous sections (Section B.5.2) identify if there is a risk that the MSW generation assumption used in compiling the GHG projections from the waste sector were under or overestimated. The findings from the different checks have been summarised below, following the method used in Chapter 6.

Based on Table B-13, the risk that Slovenia's waste projections to 2020 have been underestimated is high. In addition, the results for Bulgaria indicate that there is a high risk that the projections from the waste sector have been overestimated. This echoes the overall results based on the assessment using GDP and population in Chapter 6 where the assessment shows that there is a high risk that the total GHG projections reported by Bulgaria are an overestimate. It is important to bear in mind that the impact of the over or underestimation of the assumption for MSW generation depends on how sensitive GHG projections are to MSW generation. It is recommended that Member States are requested to report the amount of biodegradable waste going into landfill in future submissions to increase the transparency of the submission and increase the comparability of the Member State projections and the GAINS model.

Table B-13 Summary table based on the assessment of MSW generation

Member State	MSW generation Growth 2010-2015	MSW generation 2015-2020	Total Points
Slovenia	Medium (-)	Medium (-)	4
Bulgaria	Medium (+)	Medium (+)	4
Spain	Low (-)	Low (-)	2
Czech Republic	Medium (-)		2
Portugal		Medium (-)	2

Note: (+) indicates overestimate and (-) indicates underestimate. Yellow cells indicate parameters where there is a risk of underestimation. Pink cells indicate parameters where there is a risk of overestimation.

References Annexes

Bulgaria, 2011, BULGARIAN NATIONAL REPORT UNDER ARTICLE 3(2) OF DECISION 280/2004/EC.

Czech Republic (2011), Reporting of Policies and Measures under Article 3(2) of Decision 280/2004.EC concerning projections and assessment of Policies and Measures.

EEA, 2009, Diverting waste from landfill Effectiveness of waste-management policies in the European Union, Available at: http,//www.eea.europa.eu/publications/diverting-waste-from-landfill-effectiveness-of-waste-management-policies-in-the-european-union

EEA, 2011a, Annual European Community greenhouse gas inventory 1990–2009 and inventory report 2011, EEA Technical report No 2/2011, European Environment Agency, submission to the UNFCCC Secretariat. Available at: http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2011

Estonia (2011), Report pursuant to Article 3(2) of Decision 280/2004/EC.

European Commission, 2009a, EU Energy Trends to 2030. Available at: http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2030_update_2009.pdf

European Commission, 2009b, Fifth National Communication from the European Community under the UN Framework Convention on Climate Change (UNFCCC). Available at: http://unfccc.int/resource/docs/natc/ec_nc5.pdf

Greece, 2011, SUBMISSION OF INFORMATION UNDER ARTICLE 3(2) OF THE DECISION 280/2004/EC RELATED TO,
"NATIONAL POLICIES AND MEASURES AND GHG EMISSIONS PROJECTIONS"

IEA (2011), Key World Energy Statistics, Available at: http://www.iea.org/textbase/nppdf/free/2011/key_world_energy_stats.pdf

IPCC, 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 1 General Guidance and Reporting, Chapter 6 Quality Assurance/ Quality Control and Verification. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_6_Ch6_QA_QC.pdf

Lithuania (2011b), CRF Tables submitted alongside the National greenhouse gas emission inventory report 2011 of the Republic of Lithuania. Available at: http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/lie-2011-crf-15apr.zip

Point Carbon (2011), Globally Carbon Markets Gain One Percent in Value from 2009 to 2010. Available from: http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.1496966

Romania, 2011, Romania's 2011 report for the assessment of projected progress under Decision no 280/2004/EC of the European Parliament and of the Council concerning a

mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.

Romania, (2011b), Romania's Greenhouse Gas Inventory 1989-2009. Available at: http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/rou-2011-nir-22sept.zip

Slovakia, (2011), Slovak Republic biennial report part I 2011 pursuant to the Article 3(2) of Decision No 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.

Slovenia, (2011). Report of the Republic of Slovenia to the European Commission in accordance with Article 3.2 of Decision No 280/2004/EC establishing a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.

Spain, 2011. Spanish submission to the European Commission Article 3.2. (a) Decision 280/2004/EC.

UNFCCC, 1999: Guidelines for the preparation of National Communications by Parties included in Annex I to the Convention. FCCC/CP/1999/7. Available at: http://unfccc.int/documentation/documents/advanced_search/items/3594.php?rec=j&priref=600001361#beg