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# Adjusted historic emission data, projections, and optimized emission reduction targets for 2030 – A comparison with COM data 2013

## Part A: Results for EU-28

TSAP Report #16A

Version 1.1

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## Disclaimer

# Executive Summary

With the new information that has been provided by Member States in the course of the bilateral consultations, an updated emission control scenario has been developed that results in the same relative reduction in premature mortality as the original Commission proposal (52% by 2030 compared to 2005) with the same gap closure of 67%. Hence the overall reduction of PM precursor emissions (primary PM2.5, $NO_X$, $SO_2$, VOC and $NH_3$) converted into 'PM equivalent emission quantities' remains the same compared to the earlier proposal. However, the improved information on the structure of PM2.5 emission sources in 2005 and their likely future development suggests a larger decline of PM2.5 emissions in the baseline case, which thus requires less additional measures to achieve the targeted reduction in premature mortality. This also softens the emission reduction requirements for the other pollutants, and reduces costs for the additional measures by one third compared to the original proposal.

From the updated data, it could be derived that about half of the PM equivalent emission reductions that emerge as cost-effective in 2030 have already been achieved in 2012, and about 60% should be attained by the time 2020 (Gothenburg Protocol) targets are met. Compliance prospects for the latter are rather favourable. Moreover, current emission control legislation and projected activity changes resulting from the revised baseline should achieve almost 90% of the required $SO_2$ reductions by 2030, and more than 95% of the $NO_x$ reductions. Implementation of new EU-wide legislation (i.e., new BAT conclusions, MCP and NRMM directives) would result in additional reductions that would largely fill the remaining gap towards the required reductions for $SO_2$ and $NO_x$. For PM2.5, current legislation is expected to achieve 60% of the required emission reduction, and the IED, MCP, NRMM and Ecodesign directives would further deliver a large part of the additional reduction required. With respect to $NH_3$ and VOC, current emission control legislation and projected activity changes would deliver about 30% of the reduction for $NH_3$ and 85% for VOC.

Where the national scenarios provided by MSs showed features that could not be matched with coherent EU-wide scenarios, a sensitivity analysis was carried out. This demonstrates the attainability of re-optimized emission ceilings with available technical emission control measures for the 19 Member States that provided such national projections. A notable exception emerges for Hungary, where the 71 % higher livestock number projected in the national scenario would not allow achieving the $NH_3$ reduction requirement.

National scenarios are also less optimistic about the effects of climate policies and imply for 2030 higher $CO_2$ emissions compared to the baseline scenario that has been used by the Commission for the original proposal in 2013 (and not reflecting the outcome of the Climate and Energy Policy Package that has been agreed upon in 2014). The Climate and Energy Policy Package envisages substantially lower $CO_2$ emissions in the future, and would result as a co-benefit in lower $SO_2$, $NO_x$ and $PM_{2.5}$ emissions compared to what has been assumed for the Clean Air Policy Package. Thus, the recent agreement on climate and energy policy offers an additional margin for the attainability of the emission reduction requirements.

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## More information on the Internet

All details data of the updated GAINS emission inventory and projections for 2030 can be retrieved from the GAINS-online model (http://gains.iiasa.ac.at/gains/EUN/index.login?logout=1).

Under the Scenario group 'TSAP Report #16', the following scenarios can be examined in an interactive mode:

- WPE2014-CLE: The updated 'current legislation' projection for 2030 of the PRIMES 2013 REFERENCE activity projection
- WPE2014-MTFR: The updated 'maximum technically feasible emission reduction' projection for 2030 of the PRIMES 2013 REFERENCE activity projection
- WPE2014-OPT: The re-optimized 67% gap closure scenario of the PRIMES 2013 REFERENCE activity projection for 2030
- NAT2014-CLE: The updated 'current legislation' scenario for 2030 for the national activity projections
- NAT2014-MTFR: The updated 'maximum technically feasible emission reduction' scenario for 2030 for the national activity projections

# List of acronyms

| | |
|---|---|
| CAPRI | Agricultural model developed by the University of Bonn |
| $CH_4$ | Methane |
| CLE | Current legislation |
| $CO_2$ | Carbon dioxide |
| COM | European Commission |
| ERC | Emission Reduction Commitments |
| EU | European Union |
| GAINS | Greenhouse gas - Air pollution Interactions and Synergies model |
| GDP | Gross domestic product |
| IED | Industrial Emissions Directive |
| IIASA | International Institute for Applied Systems Analysis |
| kt | kilotons = $10^3$ tons |
| MTFR | Maximum technically feasible emission reductions |
| NEC | National Emission Ceilings |
| $NH_3$ | Ammonia |
| NMVOC | Non-methane volatile organic compounds |
| $NO_x$ | Nitrogen oxides |
| PJ | Petajoule = $10^{15}$ joule |
| PM10 | Fine particles with an aerodynamic diameter of less than 10 µm |
| PM2.5 | Fine particles with an aerodynamic diameter of less than 2.5 µm |
| PRIMES | Energy Systems Model of the National Technical University of Athens |
| $SO_2$ | Sulphur dioxide |
| TSAP | Thematic Strategy on Air Pollution |
| VOC | Volatile organic compounds |
| WPE | Working Party on Environment of the European Council |
| YOLL | Years of life lost |

# 1 Background

Current levels of air pollution in Europe cause substantial health and environmental impacts. For instance, in 2010 more than 400,000 premature mortalities annually are linked to exposure to fine particulate matter (EC 2013a). In 2013, the European Commission has proposed a Clean Air Policy Package with the aim to reduce in 2030 health impacts from air pollution by 52% compared to 2005 (EC 2013b).

It is important to note that fine particles remain in the atmosphere for several days during which they are transported over several hundreds of kilometres. As a consequence, locally occurring PM ambient air quality levels are to a significant extent influenced by emission sources in other countries. The analyses for all Member States that are provided in TSAP Report #12 (Kiesewetter and Amann 2014) remain relevant.

To provide a realistic chance for local and national authorities to take effective measures for achieving compliance with air quality limit values, the Clean Air Policy Package includes a proposal for amending the Directive on National Emission Ceilings. To limit the transboundary exchange of emissions, the proposal contains national emission reduction commitments for the five main precursor emissions of fine particulate matter in ambient air and for methane. In addition, the proposal will have further positive side-effects in relation to ground-level ozone, acidification and eutrophication problems.

The proposal of the European Commission has been informed by quantitative modelling of baseline emissions and associated impacts, the scope for further emission reduction options, and cost-effective emission reduction strategies. These analyses have been carried out by the International Institute for Applied Systems Analysis (IIASA) using the GAINS Integrated Assessment Modelling suite (http://gains.iiasa.ac.at). Final results are presented, inter alia, in the impact assessment accompanying the Commission proposal (EC 2013a) and the TSAP Report #11 (Amann et al. 2014a).

For the analysis for the Clean Air Policy Package, IIASA has compiled information from a variety of different statistical sources, with the aim to reproduce as closely as possible the emission inventories for the year 2005 as they were reported by countries in 2012 while matching international energy, agricultural, transport and industrial statistics. However, after 2012, many Member States have come forward with revised statistical information on emission inventories for the year 2005, with numerous significant changes compared to the 2012 submission.

After the start of the deliberations on the Clean Air Policy Package of the Council Working Party on Environment (WPE), between March and July 2014 IIASA held bilateral meetings with all 28 Member States involving more than 110 experts to review and update input data in view of new statistical information.

Outcomes of these bilateral consultations are summarized in TSAP Report #13 (Amann et al. 2014b). The new information emerging from the consultations has been incorporated into the GAINS databases (TSAP Report #14, Amann et al. 2014c). Due to late information from Member States, some adjustments could not be accounted for in that report. In general, for national totals, the new GAINS estimates for 2005 now match the latest 2014 national submissions quite closely, and differences are now typically within a few percentage points, which is well within the range in which national submissions have changed between 2012 and 2014. Remaining discrepancies between updated GAINS estimates and reported number for 2005 can be explained by objective reasons.

Changes in the 2005 GAINS estimates also affect projections of future emissions and mitigation potentials. As shown in TSAP Report #14, the originally proposed health and environmental targets as well as the resulting emission reduction requirements remain technically achievable also in the updated context (i.e., for the revised emission baseline projections), although not necessarily cost-effective. Since the Commission has proposed cost-effectiveness as an important criterion for setting national emission reduction commitments, this TSAP Report #16 presents an updated set of emission reduction commitments that would meet the health and environmental targets proposed by European Commission in the Clean Air Policy Package in a cost-effective way, based on the revised historic emission estimates and the consequently adapted projections.

This report addresses emissions of air pollutants $SO_2$, $NO_x$, PM2.5, $NH_3$ and VOC. Although the Commission proposal also includes emission reduction commitments for methane (due to its role as an ozone precursor), this report does not deal with $CH_4$ emissions, as they are subject of ongoing deliberations between the Member States and the Commission in the context of the 2014 Climate and Energy Package. To maintain consistency with the Climate and Energy Package, no further changes on $CH_4$ were introduced in GAINS at this time, pending further discussions in Council and Parliament on synergies between the Climate and Energy Package and the Air Quality Package.

The remainder of this report is organized as follows: Section 2 summarizes the changes that have been introduced in the GAINS databases based on the bilateral consultations. The consequences on baseline emissions in 2030 and the scope for further emission reductions are discussed in Section 3. Section 4 presents an updated optimized emission control scenario that meets the health targets established in the Clean Air Policy Package, taking into account the new statistical information. The robustness of the resulting emission reduction requirements in view of alternative national projections of future activity levels is discussed in Section 5. Conclusions are drawn in Section 6. Results at the Member States level, including explanations of the differences to the original 2013 Commission Proposal, are provided in Part B of this report.

# 2 Recent changes in the GAINS database

As mentioned above, the bilateral consultations with national experts resulted in a number of updates in the GAINS databases compared to status of the analyses for the Commission proposal of the Clean Air Policy Package (documented in TSAP Report #11). The main updates relate to the representation of the structure of emission sources in 2005, for which new and sometimes more detailed statistical information has emerged after 2012. In many cases, this new information has also impacts on the future the evolution of emissions due to, e.g., different structures of emission sources in the base year and their foreseen evolution until 2030, or modified implementation schedules for current legislation. In addition, national experts provided also alternative projections of energy or agricultural activities, which have now been implemented in the GAINS database as a separate scenario to facilitate sensitivity analyses.

The bilateral discussions revealed that most of the discrepancies between the 2005 GAINS estimates for the Commission proposal and the latest (2014) submissions of national inventories for 2005 are related to four factors:

- changes in national 2005 estimates between the 2012 and 2014 submissions,
- different coverage of sources,
- IIASA's use of a uniform calculation methodology, and
- discrepancies between national and international official statistics.

A considerable number of Member States have revised their emission estimates for the year 2005 in the last two years as compared to the 2012 submission of national inventories against which the GAINS model was calibrated after the last round of bilateral consultations in 2012. These changes were discussed at the bilateral meetings, and updated information was subsequently implemented in the GAINS databases. Sectors that are not reported in national inventories have been identified, and plausible estimates have been developed with national experts for inclusion in the international cost-effectiveness analysis. This was also done for sources for which Member States applied simplified methodologies in the inventories that do not take account of important national circumstances with large impact on mitigation potentials. Finally, Member States provided additional statistical information to improve the accuracy of information derived from international statistics.

All this information has been incorporated into the GAINS databases and is documented in detail in TSAP Report #14 (Amann et al. 2014c). However, some of the information came in too late to be included into the TSAP report #14. Updated emission estimates have been performed, resulting in a largely improved match of GAINS estimates with national inventories while preserving international comparability, as documented in this report. In general, for national totals, the new GAINS estimates for 2005 match the latest reported estimates for 2005 (2014 national submissions) quite closely, and differences are now typically within a few percentage points.

Nevertheless, there remain notable exceptions where differences for national totals are significant. In all cases, there are important and objective reasons that explain these differences, e.g., missing sectors in national inventories, different calculation methodologies, differences in statistical data (e.g., on fleet composition), or forthcoming new submissions that will be close to the updated GAINS estimate. Also, the remaining differences at the sectorial level, often being larger, can be explained by objective reasons. Unresolved differences have been discussed with national experts, quantified and well documented.

Compared to the 2005 GAINS estimates used for the Commission proposal, largest differences occur for $SO_2$, where for the EU-28 the updated GAINS inventory for 2005 is six percent lower than before due to significant downwards revisions of the recent national inventories in a few countries (especially Bulgaria, Germany, Hungary and Portugal). For VOC, EU-28 emissions in 2005 are estimated now four percent lower (mainly due to changes in France, Italy, Romania, Spain, Czech Republic and Finland). Total $NO_x$ declined by two percent (Italy and Spain), PM2.5 by one percent, and the total $NH_3$ estimate for the EU-28 remains constant.

Changes in the 2005 GAINS estimates (e.g., different sector splits, implementation levels of emission control measures, etc.) will also affect projections of future emissions and further mitigation potentials. Member States experts have also provided pieces of new information that affects the likely future evolution of emissions. This includes, e.g., modified implementation schedules of specific emission control measures in a country, or physical circumstances that limit the applicability of emission control measures (e.g., different size distributions of installations, etc.). To the extent that this new information was well documented and coherent with data and assumptions for other Member States, changes have been incorporated into the baseline scenario of the GAINS database. Other proposed modifications (as long as they are internally consistent), together with alternative projections of emission generating activities, have been included into a 'NATIONAL PROJECTIONS' scenario that is used for the sensitivity analysis presented in this report.

# 3 Revised baseline emissions and the scope for further reductions in 2030

Suggested changes to the historic emission estimates and projections that have been incorporated in the GAINS database have resulted in a revised baseline and MTFR. These were used as the basis for the re-optimization (Table 4.1).

The largest changes emerge for PM2.5, where the new reduction in baseline emissions for the EU-28 in 2030 is five percentage points greater than before. A large part of this relates to the revised 2005 inventory reported for France for its industrial non-combustion process emissions. The remaining part of the difference largely relates to updated data on emissions of agricultural waste burning and more detailed structural information on small combustion sources.

The reduction in baseline emissions of VOC in 2030 would be one percentage point less than before, resulting from the new inventory information. For $NO_x$, again, the reduction in baseline emissions in 2030 is two percentage points less than before (due especially to lower emissions in the industrial sectors, inter alia, of Germany and Spain). Finally, changes in the baseline emissions for $SO_2$ and $NH_3$ are very limited (less than one percentage point difference at the EU-28 level).

In summary, and in relation to the respective 2005 levels, the decline in the EU-28 baseline emissions for 2030 is now 74% instead of 73% for $SO_2$, 63% instead of 65% for $NO_x$, 8% instead of 7% for $NH_3$ and 40% instead of 41% for VOC. The largest difference occurs for PM2.5, where the revised baseline leads to a 32% reduction in 2030 compared to 2005 instead of the 27% decline that was estimated before.

The differences between the revised and former estimates of the Maximum Technically Feasible Reductions (relative to 2005) are less than two percentage points for all pollutants. There is an exception for VOC, where updated information on the applicability of low solvents paints, coating and inks provided by some countries and extrapolated to all Member States reduces the emission reduction potential by five percentage points.

In 2030, the larger baseline decline in PM2.5 emissions lead to slightly higher overall emission reductions in terms of PMeq (-50% instead of -49%). At the same time, estimated costs for implementation of current legislation are slightly lower (€89.6bn/yr instead of €90.2bn/yr), mainly as a consequence of the more detailed information on the structure of non-road mobile machinery.

# 4 Re-optimized emission reduction targets

## 4.1 Re-optimizing whilst keeping the health target of the initial Clean Air Policy Package

In its 2013 Clean Air Policy Package, the Commission proposed for 2030 a 67% gap closure in terms of PM health impacts, corresponding to reduction of air pollution related mortality of 52% between 2005 and 2030. The proposal defines the 'gap closure' as the additional percentage improvement of premature mortality between what will be achieved with current legislation and what can be achieved with implementation of all available technical measures

The updated statistical information that has emerged from the consultations with Member States has implications for a cost-effective achievement of this target. First, the boundaries of the 'gap closure', i.e., the current legislation (CLE) starting point as well as the scope for further measures (MTFR) in 2030, are different from what has been assumed for the original Commission proposal in absolute terms (Figure 4.1, left panel).

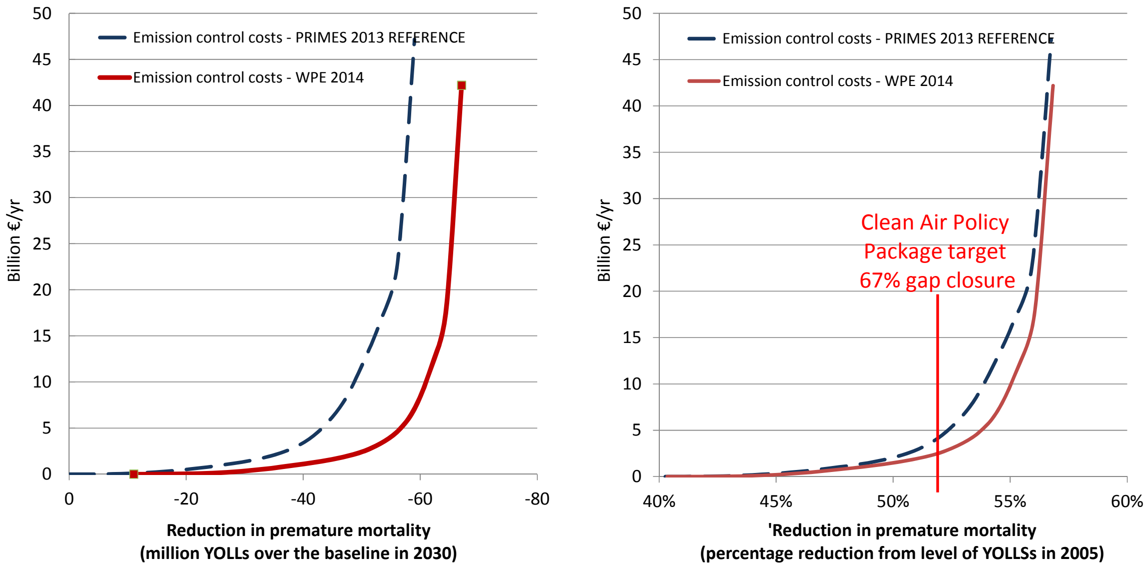


Figure 4.1: Costs for additional improvements of premature mortality beyond the CLE baselines in 2030

However, at the same time the reference point, i.e., the situation in 2005, has been updated too. It turns out that, while for 2030 the absolute values of emissions and resulting health impacts have changed as a consequence of the bilateral consultations, there are only minor differences in the relative change to 2005 if the scope for further emission reductions is compared to the updated 2005 reference level (Figure 4.1, right panel).

On this basis, an updated emission control scenario has been explored that achieves the same gap closure of 67% as in the original Commission proposal. This gap closure results in the same relative reduction in premature mortality compared to 2005 (-52%) as the original Commission proposal.

## 4.2 Main results

### 4.2.1 Emission reductions

To achieve the same 52% reduction in health impacts relative to 2005, the reduction in total emissions - measured in terms of PM-equivalents (see TSAP Report #15) - remains the same in the new optimized scenario (-63% relative to 2005).

However, as a consequence of the updated information on the structure of emission sources in 2030, costs for additional emission reductions beyond the current legislation are now lower than estimated before. While technology costs for emission control measures have not been modified, new information about the current and envisaged structure of emission sources has revealed a larger potential for cheaper reductions beyond the current legislation case.

Especially for PM2.5, there is now a larger potential beyond the baseline for low cost measures to reduce PM2.5 emissions. The new statistics about the structure of solid fuel use in households and more conservative expectations about the turnover of existing stoves in the current legislation case enlarge the scope for implementation of relatively cheap cleaner devices (e.g., improved stoves) to achieve further emission reductions beyond current legislation. Also, the updated information on industrial process emissions in the French emission inventory results in a steeper decline in baseline emissions (−32% instead of −27%). Thus, the need for additional cuts in PM2.5 to achieve the 67% gap closure (and the 52% health improvement) declines from 24 to 22 percentage points. In turn, this results in lower marginal abatement costs in the new scenario, not only for PM2.5 but also for the other pollutants, so that the new scenario does not employ some of the most expensive measures that were contained in the original Commission proposal (Table 4.2).

For these reasons, emission control costs (on top of current legislation) for the 67% gap closure level decline from €3.3bn/yr to €2.2bn/yr (Figure 4.1, right panel). This results also in lower marginal costs of the cost-effective set of measures,

Table 4.1: Summary table for EU-28, emission changes relative to 2005 (2005 and 2012: reported by Parties to CLRTAP in 2014; 2020: Gothenburg protocol commitments; 2030: COM 2013: Commission proposal 2013, WPE 2014: re-optimized ceilings based on the bilateral consultations carried out for the Council Working Party on Environment; figures relative to the GAINS estimates for 2005)

| EU28 | 2005 | 2012 | 2020 | 2030 COM 2013 | | | 2030 WPE 2014 | | | Difference | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [kt][1] | | GP | CLE | 67%GC | MTFR | CLE | 67%GC | MTFR | CLE | 67%GC | MTFR |
| $SO_2$ | 7710 | -48% | -59% | -73% | -81% | -83% | -74% | -81% | -84% | +1% | 0% | +1% |
| NOx | 11531 | -27% | -42% | -65% | -69% | -74% | -63% | -65% | -73% | -2% | -4% | -1% |
| PM2.5 | 1414 | -12% | -22% | -27% | -51% | -63% | -32% | -54% | -62% | +5% | +3% | -1% |
| $NH_3$ | 3878 | -5% | -6% | -7% | -27% | -35% | -8% | -25% | -35% | +1% | -2% | 0% |
| VOC | 8775 | -24% | -28% | -41% | -50% | -66% | -40% | -46% | -61% | -1% | -4% | -5% |
| PMeq | 5315 | -29% | -38% | -49% | -63% | -69% | -50% | -63% | -69% | +1% | 0% | 0% |

[1] Figures reported by Member States, not adjusted for spatial (e.g., Canary Island) and sectoral (e.g., soil $NO_x$) coverage

While at the EU-28 level emission reductions requirements (relative to 2005) remain almost constant for PMeq, there are larger reductions for PM2.5 (a 54% cut compared to a 51% decline in the original proposal). This enhanced PM2.5 reduction is a consequence of the steeper decline in baseline emissions and the larger potential for low cost measures (as explained above). Indeed, as a consequence of the higher cuts in PM2.5 emissions, emission reduction requirements for the other pollutants are softened: $NO_x$ from 69% to 65%, VOC from 50% to 46%, $NH_3$ from 27% to 25% (relative to 2005). The cut in $SO_2$ emissions does not change at the EU-28 level. Results by pollutant and Member State, together with the main reasons for differences, are presented in Part B of TSAP Report #16.

It is noteworthy that, in relation to 2005, about half of the emission reductions (in terms of PMeq) that emerge as cost-effective in 2030 have already been achieved in 2012 according to the latest reporting, and about 60% should be attained by the Gothenburg Protocol in 2020.

### 4.2.2 Emission control costs

To achieve the 52% improvement in premature mortality (equivalent to the 67% gap closure), the re-optimized scenario requires less additional emission reductions at costs of €2.2bn/yr, i.e.,0.008% of the envisaged GDP in 2030 (Table 4.2). For comparison, the original Commission proposal involved costs of €3.3bn/yr, i.e., 0.012% of GDP in 2030.

Table 4.2: Summary table for EU-28, emissions control costs

| EU28 | 2030 COM 2013 | | | 2030 WPE 2014 | | | Difference WPE-COM | | |
|---|---|---|---|---|---|---|---|---|---|
| | CLE | 67%GC | MTFR | CLE | 67%GC | MTFR | CLE | 67%GC | MTFR |
| Costs on top of CLE | | 3.3 | 50.3 | | 2.2 | 40.0 | | -1.1 | -10.3 |
| Total costs | 90.2 | 93.5 | 140.7 | 89.6 | 91.8 | 130.6 | -0.6 | -1.7 | -10.1 |

## 4.3 Implications for individual Member States

As discussed above, the new information on the structure of emission sources makes the achievement of the health target established in the Clean Air Policy Package (i.e., a 67% gap closure, equivalent to a 52% reduction in premature mortality between 2005 and 2030) less costly. Overall, largest differences occur for PM2.5 emissions (Table 7.3), where the updated structures of emission sources (mainly for industrial processes and household heating) imply in many countries a larger baseline cut in PM2.5 emissions than considered before (especially in France, the UK, Italy and Bulgaria). Although the re-optimized scenario relaxes the need for additional measures in all countries, the nominal changes (relative to 2005) in these countries are still larger than in the original Commission proposal. For other countries (e.g., Estonia, Denmark, Belgium, Austria, etc.), emission reduction requirements decline by up to 11 percentage points.

For $NO_x$, the overall reduction requirement in the EU-28 shrinks from 69% to 65%, i.e., by four percentage points (Table 7.2). Relaxations occur for all Member States, with particularly large changes for Estonia (-15 percentage points), Portugal and Slovakia (-10 percentage points), Malta and Spain (-9 percentage points) and the Netherlands (-7 percentage points). For two countries (Sweden and the UK) the updated emission reduction requirements relative to 2005 are slightly higher than in the original case, while for Luxemburg the updated emission reduction requirement is 6 percentage points higher. For Luxemburg and Sweden this is caused by larger baseline reductions from current legislation, and no additional measures for these two countries are suggested in the new scenario.

Also for VOC, reduction requirements of the re-optimized are generally lower, due to the lower marginal costs at which the 67% gap closure target can be achieved (Table 7.5). Largest relaxations occur for the Netherlands (-13 percentage points), Lithuania (-11 percentage points), Belgium, Denmark, the UK (-10 percentage points), Estonia, Luxembourg and Spain (-9 percentage points) and Austria, Germany and Slovakia (-8 percentage points). The new information on the structure of emission sources in Bulgaria and Romania, however, leads to somewhat higher emission reduction requirements in these countries, which are a direct consequence of larger reductions that are already achieved in these countries by the current legislation baseline.

Overall for the EU-28, the lower marginal costs of the re-optimized scenario relaxes the emission reduction requirements for $NH_3$ from -27% to -25%, relative to 2005 (Table 7.4). Particularly large reliefs emerge for Spain and France (-7 to -8 percentage points) caused by updated livestock data, and for Estonia (-7% due to less reductions in the baseline). In contrast, emission reduction requirements (relative to 2005) tighten by up to 10 percentage points for Bulgaria, Hungary and Lithuania, as a direct implication of sharper emission reductions from the current legislation. However, as in all other countries, there is less need for additional reductions (on top of the current legislation case).

For $SO_2$, overall reductions for the EU-28 as a whole do not change. However, emission reduction requirements tighten for a few countries as a consequence of steeper emission cuts resulting from current legislation. For Denmark, Estonia and Finland, where no need for further $SO_2$ cuts are identified in the re-optimized scenario, the changes in the baseline translate directly into modified emission reduction requirements. In the UK, additional emission cuts remain as computed before, but the lower baseline projection results in lower emissions due to a more accurate representation of industrial process emissions. For Luxemburg, Portugal and Slovakia, requirements for additional measures decrease; however, as their baseline projections decline to a larger extent, the resulting net emission reduction requirements (relative to 2005) are higher than in the original Commission proposal. Other countries see relaxed emission reduction requirements, e.g., Hungary by 15 percentage points, Austria by nine percentage points and Lithuania by seven percentage points.

## 4.4 Indicative sectoral emission reductions and instruments

The changes in emissions between 2005 and the re-optimized emission reduction requirements in 2030 are brought about through three different mechanisms:

- Activity changes between 2005 and 2030: changes in the volumes and structures of emission generating activities between 2005 and 2030 (as reflected in the PRIMES 2013 REFERENCE scenario,
- Current legislation measures: emission reductions resulting from progressing implementation of current legislation (e.g., following the turnover of capital stock), and
- Additional measures: additional emission controls beyond current legislation.

The extents at which these three mechanisms contribute to the WPE 2014 emission reduction requirements are listed in Table 4.3 to Table 4.7. These tables provide information on the cost-effective emission reductions per sector as calculated by GAINS in the re-optimized scenario. As such, these tables provide a possible pathway on how the required reductions can be achieved and should be considered as indicative. In particular, the sectorial reductions indicated should not be interpreted as sectorial emission reduction commitments.

For $SO_2$, two thirds of the emission reductions of the optimized scenario are a mere consequence of the changes in activity levels between 2005 and 2030 that are projected in the underlying energy scenario (e.g., declining use of solid fuels). Another quarter comes from the further penetration of existing emission control legislation (e.g., the current IED). Thus, the reductions in optimized scenario through additional measures account for nine percent of the total emission decline between 2005 and 2030.

For $NO_x$, changes in activity levels will deliver 18% of the required emission reductions. 78% are achieved by continuing implementation of existing legislation (e.g., EURO-6 standards), so that only four percent of the suggested reductions require additional measures.

The situation is different for PM2.5, where changes in activity levels would hardly affect emissions (less than 0.5%); 60% of the proposed reductions emerge from current legislation. Additional measures, especially for small combustion sources, will be needed to attain the remaining 40% of the total reductions (Figure 4.2).

For $NH_3$, about 30% of the emission reduction of the optimized scenario would be delivered by current legislation; additional emission cuts would involve emissions from pigs, cattle and fertilizer application to similar shares.

The major share of the decline in VOC emissions will emerge from progressing implementation of current legislation (70% of the total reduction), enhanced by structural changes of economic activities, which will deliver another 15%. More than 80% of the additional reduction would result from a ban of agricultural waste burning.

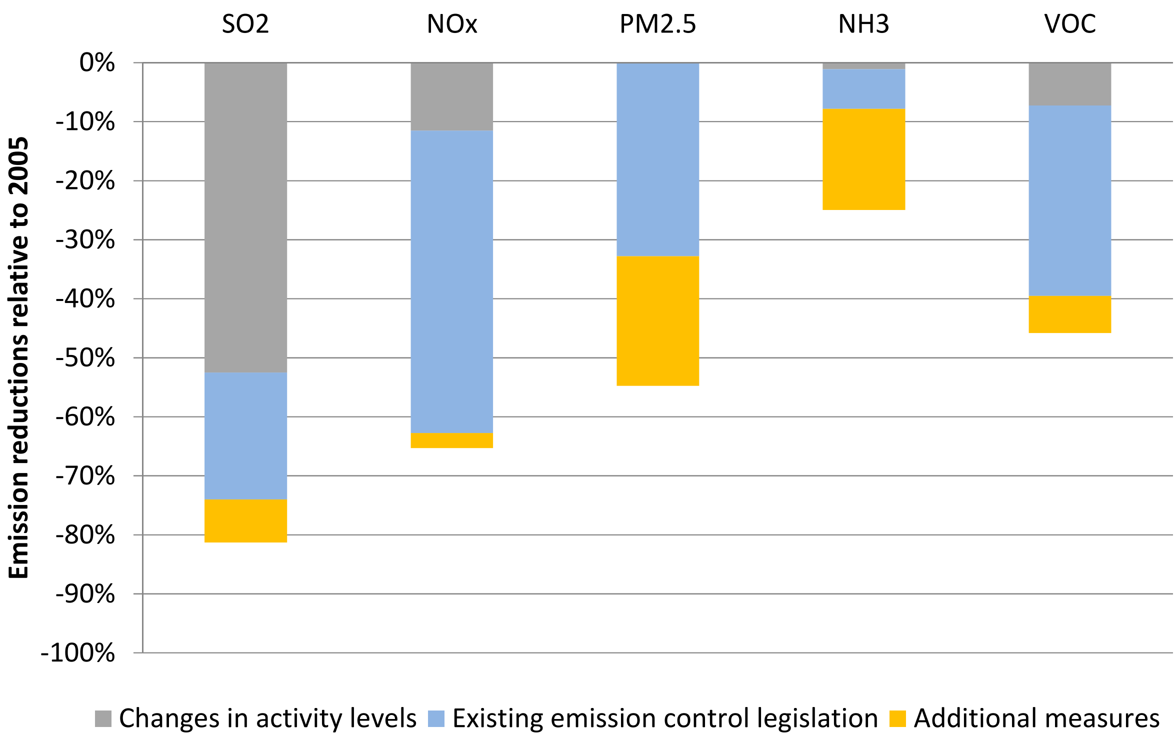


Figure 4.2: Contributions to the emission reductions of the re-optimized scenario (relative to 2005 emissions)

Especially for PM2.5, additional legislation will be essential to achieve the emission reductions of the optimized scenario. EU legislation (e.g., the IED, MCP, NRMM, Eco-design directives) is currently under discussion to offer Community-wide instruments to achieve these additional emission reductions. If agreed, it is expected that these instruments would account for more than half of the additional $SO_2$ $NO_X$ and $PM_{2.5}$ reductions of the proposal. For $SO_2$ and $NO_X$, additional required reductions would mainly be delivered by the IED,while for $PM_{2.5}$ most contribution is expected from the Eco-design directive. For $NH_3$, the additional required emission cuts can be achieved by selecting from the measures referred to in Annex III to the new proposed NEC Directive, and making use of the UNECE Guidance Document for Preventing and Abating Ammonia Emissions and the expected revised BAT conclusions under Directive 2010/75/EU as referred to in the chapeau of Annex III.

Table 4.3: $SO_2$ emission reductions of the optimized scenario by category, relative to 2005 for the EU-28 (kilotons)

| | | Activity changes 2005-2030 | Baseline control measures 2005-2030 | Additional control measures 2030 | Total reduction |
|---|---|---|---|---|---|
| **Power and heating plants** | | **-3335.7** | **-1056.1** | **-28.5** | **-4420.4** |
| **Domestic combustion** | | **-251.4** | **-44.2** | **-98.1** | **-393.7** |
| **Industry** | | **-403.6** | **-358.9** | **-379.1** | **-1141.6** |
| of which | Refineries | -239.4 | -147.5 | -128.4 | -515.3 |
| | Other industries | -164.2 | -211.5 | -250.6 | -626.3 |
| **Road transport** | | **2.8** | **-30.8** | **0.0** | **-28.0** |
| of which | Light duty | 0.2 | -16.8 | 0.0 | -16.5 |
| | Heavy duty | 2.6 | -14.1 | 0.0 | -11.5 |
| **Non-road mobile** | | **-26.3** | **-148.1** | **0.0** | **-174.4** |
| **Other sectors** | | **-19.7** | **-12.3** | **-51.7** | **-83.7** |
| **TOTAL** | | **-4033.8** | **-1650.4** | **-557.4** | **-6241.7** |

Table 4.4: $NO_x$ emission reductions of the optimized scenario by category, relative to 2005 for the EU-28 (kilotons)

| | | Activity changes 2005-2030 | Baseline control measures 2005-2030 | Additional control measures 2030 | Total reduction |
|---|---|---|---|---|---|
| **Power and heating plants** | | **-1157.1** | **-398.8** | **-88.8** | **-1644.7** |
| **Domestic combustion** | | **-136.8** | **-26.4** | **0.0** | **-163.2** |
| **Industry** | | **-44.9** | **-353.5** | **-143.6** | **-542.0** |
| of which | Refineries | -83.9 | -30.9 | -20.7 | -135.6 |
| | Other industries | 39.0 | -322.6 | -122.9 | -406.4 |
| **Road transport** | | **200.7** | **-4213.3** | **0.0** | **-4012.6** |
| of which | Light duty | -125.8 | -1479.0 | 0.0 | -1604.8 |
| | Heavy duty | 326.5 | -2734.3 | 0.0 | -2407.8 |
| **Non road mobile** | | **-189.2** | **-753.1** | **-32.8** | **-975.2** |
| **Other sectors:** | | **29.6** | **-21.8** | **-27.7** | **-20.0** |
| **TOTAL** | | **-1297.8** | **-5766.9** | **-292.9** | **-7357.7** |

Table 4.5: PM2.5 emission reductions of the optimized scenario by category, relative to 2005 for the EU-28 (kilotons)

| | | Activity changes 2005-2030 | Baseline control measures 2005-2030 | Additional control measures 2030 | Total reduction |
|---|---|---|---|---|---|
| **Power and heating plants** | | **-31.5** | **-35.5** | **-22.8** | **-89.8** |
| **Domestic combustion** | | **-37.8** | **-164.5** | **-139.1** | **-341.4** |
| **Industry** | | **11.7** | **-31.9** | **-70.9** | **-91.1** |
| of which | Refineries | -3.8 | -0.8 | -2.0 | -6.7 |
| | Other industries | 15.6 | -31.1 | -68.9 | -84.4 |
| **Road transport** | | **60.1** | **-230.6** | **0.0** | **-170.5** |
| of which | Light duty | 42.5 | -149.1 | 0.0 | -106.6 |
| | Heavy duty | 17.6 | -81.5 | 0.0 | -63.9 |
| **Non road mobile** | | **-18.0** | **-75.0** | **-3.0** | **-96.0** |
| **Other sectors:** | | **23.4** | **-8.6** | **-129.8** | **-114.9** |
| **TOTAL** | | **7.9** | **-546.1** | **-365.6** | **-903.8** |

Table 4.6: $NH_3$ emission reductions of the optimized scenario by category, relative to 2005 for the EU-28 (kilotons)

| | | Activity changes 2005-2030 | Baseline control measures 2005-2030 | Additional control measures 2030 | Total reduction |
|---|---|---|---|---|---|
| **Pigs** | | **-8.1** | **-77.4** | **-153.7** | **-239.1** |
| **Poultry** | | **40.2** | **-115.6** | **-76.1** | **-151.6** |
| **Cattle** | | **-10.4** | **-40.0** | **-218.8** | **-269.3** |
| of which | Dairy | **63.0** | **-31.0** | **-165.5** | **-133.6** |
| | Meat | **-73.4** | **-9.0** | **-53.3** | **-135.7** |
| **Other animals** | | -1.8 | -0.8 | -6.6 | -9.3 |
| **Mineral fertilizers** | | -9.8 | -11.3 | -183.9 | -205.0 |
| **Other non -agricultural sources** | | **-53.4** | **-19.2** | **-35.6** | **-108.2** |
| **TOTAL** | | **-43.3** | **-264.4** | **-674.7** | **-982.5** |

Table 4.7: VOC emission reductions of the optimized scenario by category, relative to 2005 for the EU-28 (kilotons)

| | | Activity changes 2005-2030 | Baseline control measures 2005-2030 | Additional control measures 2030 | Total reduction |
|---|---|---|---|---|---|
| **Power plants** | | **-7** | **-6** | **-25** | **-38** |
| **Domestic combustion** | | **9** | **-408** | **-270** | **-668** |
| **Industry (combustion and processes, excluding solvent use)** | | **92** | **-74** | **-6** | **12** |
| **Road transport** | | **-708** | **-886** | **0** | **-1594** |
| of which | Light duty | -737 | -714 | 0 | -1451 |
| | Heavy duty | 29 | -172 | 0 | -143 |
| **Non road mobile** | | **-10** | **-348** | **-23** | **-381** |
| **Refineries (processes)** | | **-40** | **-44** | **-7** | **-91** |
| **Production, storage and distribution of oil products** | | **-202** | **-36** | **-4** | **-242** |
| **Solvent use** | | **252** | **-1050** | **-60** | **-858** |
| **Other sectors** | | **-28** | **-2** | **-162** | **-193** |
| of which | ban of agr. waste burning | 24 | 0 | -140 | -115 |
| **TOTAL** | | **-641** | **-2856** | **-557** | **-4053** |

# 5 Sensitivity analyses

## 5.1 National activity projections

During bilateral consultations, some national experts requested that the feasibility be tested using national perspectives on economic development and energy policies that are sometimes different from the Europe-wide coherent scenario that has been employed by the Commission for its Clean Air Policy Package proposal (as well as for developing other policy initiatives such as CEP). Different national perspectives on the future evolution of emission generating activities, i.e., energy, transport, agricultural and industrial activities, were considered most relevant by national experts as these would affect baseline emissions in the future as well as the potential and costs for additional cuts in emissions.

To facilitate an analysis of potential implications of such different perspectives on the overall feasibility of the targets, alternative national projections of activity levels have been considered for 19 Member States that provided such information during the consultations to IIASA (Table 5.1).

Table 5.1: Coverage of national activity projections provided by Member States for the year 2030

| | Energy use, industrial production | Transport | Agriculture | VOC-related activities |
|---|---|---|---|---|
| AT | x | x | x | |
| BE | | | | x |
| BG | | | | |
| HR | | | | x |
| CY | x | x | x | |
| CZ | x | x | | |
| DK | | | x | |
| EE | x | x | | x |
| FI | | | | |
| FR | | | | |
| DE | x | x | x | |
| GR | | | | |
| HU | | | x | |
| IE | x | x | x | |
| IT | x | x | x | x |
| LV | | | | |
| LT | x | x | x | |
| LU | | | | |
| MT | x | x | | |
| NL | | x | x | x |
| PL | | | | |
| PT | x | x | | |
| RO | x | x | | |
| SK | | | x | |
| SI | | | x | |
| ES | | | | |
| SE | | | | |
| UK | | | x | x |

The available national projections to IIASA have been implemented into a common ‘NATIONAL PROJECTIONS’ scenario in the GAINS database. However, not all Member States have provided national projections, and in many cases the alternative projections do not cover all emission sources.

In total, alternative data have been supplied for roughly one third of the major source categories (i.e., energy, transport, agriculture and VOC-related activities). As the GAINS analysis requires full coverage of countries and emission source categories, data for missing sectors or countries have been filled with the respective data of the PRIMES 2013 REFERENCE scenario. This means that the NATIONAL PROJECTIONS scenario differs from the PRIMES 2013 REFERENCE scenario only for those sectors and countries for which national data have been supplied to IIASA.

Such an incomplete alternative scenario is not suitable as a basis for a (EU-wide) cost-effectiveness analysis, as it would introduce serious distortions across countries depending on the degree that national scenarios have been supplied. Furthermore, while IIASA has attempted to validate internal consistency of the projections (e.g., balancing demand and supply of energy) to the extent possible without contradicting supplied information, the available projections are not mutually consistent, e.g., in terms of international trade of energy and agricultural products. Furthermore, they are not always in line with established targets of EU policies. For instance, the energy patterns of the national scenarios from the 11 Member States alone that have provided data on energy use would lead in 2030 to two percent higher $CO_2$ emissions than those of the PRIMES REFERENCE scenario. This means that the $CO_2$ emissions would decline only by 25% between 2005 and 2030, compared to 27% of the PRIMES REFERENCE scenario, which in turn does not consider the recent agreements on climate and energy policy. For comparison, a scenario that would achieve these recent targets (40 % GHG reduction compared to 1990) would reduce $CO_2$ emissions by 34% in 2030 relative to 2005.

For livestock numbers, the national projections of just the 12 Member States that supplied data increase the numbers of pigs in the EU-28 by nine percent, and the number of dairy cattle by five percent compared to the Commission scenario.

Given these shortcomings in the national projections, a sensitivity analysis has been conducted that examines, for the 19 Member States that have provided national projections, the technical feasibility of the emission reduction commitments of the updated policy scenario presented above under these alternative projections.

For these countries, the current legislation case would reduce $SO_2$, $NO_x$ and VOC emissions by two percentage points less than the WPE 2014 scenario; CLE baseline reductions of $NH_3$ would be three percentage points lower, and the decline of PM2.5 would be four percentage points less (Table 5.2).

Differences for the maximum technically feasible (MTFR) reductions are significantly smaller, with a two percentage points smaller potential for $NH_3$ emissions and a one percentage point lower potential for PM2.5. These differences are not caused by differences in assumptions on the applicability of measures between the WPE 2014 scenario and the national projections scenario, but solely by differences in activity projections.

As a main finding, with the exception of the $NH_3$ targets for three countries, the re-optimized emission reduction requirements can be technically achieved in all countries that have supplied national activity projections.

On average (for these 19 countries), the margin of the re-optimized emission reduction commitment to MTFR under the national projections scenario for $SO_2$ is four percent; for $NO_x$ the margin is nine percent, for PM2.5 10 percent, for $NH_3$ 17 percent, and for VOC 26 percent. Details for individual Member States are provided in Part B of TSAP Report #16.

Table 5.2: The re-optimized emission reduction commitments (relative to 2005) of the 19 Member States that supplied national activity projections[1)], compared to the current legislation (CLE) and maximum technically feasible reduction (MTFR) scenarios, for the NATIONAL PROJECTIONS and the WPE 2014 scenarios

| | WPE 2014 | NATIONAL PROJECTIONS | | | WPE 2014 | | |
|---|---|---|---|---|---|---|---|
| | Re-optimized | CLE | MTFR | Average margin of the re-optimized scenario to MTFR | CLE | MTFR | Average margin of the re-optimized scenario to MTFR |
| $SO_2$ | -78% | -68% | -82% | +4% | -70% | -82% | +5% |
| $NO_x$ | -66% | -61% | -73% | +9% | -63% | -73% | +9% |
| PM2.5 | -55% | -30% | -62% | +10% | -34% | -63% | +12% |
| $NH_3$ | -27% | -6% | -33% | +17% | -9% | -35% | +22% |
| VOC | -43% | -36% | -59% | +26% | -38% | -59% | +27% |
| PMeq | -61% | -45% | -66% | +8% | -48% | -67% | +9% |

[1]) Not all 19 Member States provided projections for all sectors and pollutants. For this table, lacking sectorial projections have been filled with the PRIMES 2013 REFERENCE scenario

As mentioned above, while on average there is a reasonable margin for feasibility of the re-optimized emission reduction requirements under the assumptions of the national activity projections, exceptions occur for the $NH_3$ targets of Hungary, Slovakia and the UK, although only for Hungary the MTFR level under national assumptions exceeds the re-optimized emission level for the WPE 2014 scenario significantly.

The main factor responsible for the difficulties with achieving the proposed emission reductions emissions relates to strong increases in livestock numbers that are assumed in many national scenarios. Particularly large increases have been provided by Hungary and Slovakia, where cattle and pig numbers, after their decline in the 1990s, are assumed to recover in the coming years to the pre-2000 levels. In contrast, the Europe-wide scenario, based on livestock projections of the CAPRI agricultural model, foresees only slight recovery from today onwards, constrained inter alia by international competition on the agricultural market. In 2030, total livestock numbers in the national projections are for Hungary 71% and for Slovakia 41% higher than the corresponding CAPRI projections.

Also the UK national projection suggests strong growth of dairy cows (+20%) and pig (+28%) numbers, while the CAPRI projection anticipates a slight decline. Thereby, national livestock projections for dairy cattle, pigs, and sheep are about 20%, 36%, and 25% higher than in the EU-wide CAPRI scenario. Under these high growth assumptions, the emission reduction requirements for $NH_3$ optimized for the WPE 2014 scenario would not be achievable with the measures currently considered in the GAINS model.

It should be mentioned that also many other countries provided national agricultural projections with substantial increases in livestock numbers. As explained above, projections of just the 12 Member States that supplied national projections would increase in 2030 the overall livestock numbers in the EU-28 for pigs by nine percent and for dairy cattle by five percent (assuming no differences for the countries that have not supplied national projections). However, despite these increases, the emission reduction requirements of the optimized scenario are still achievable in all other countries.

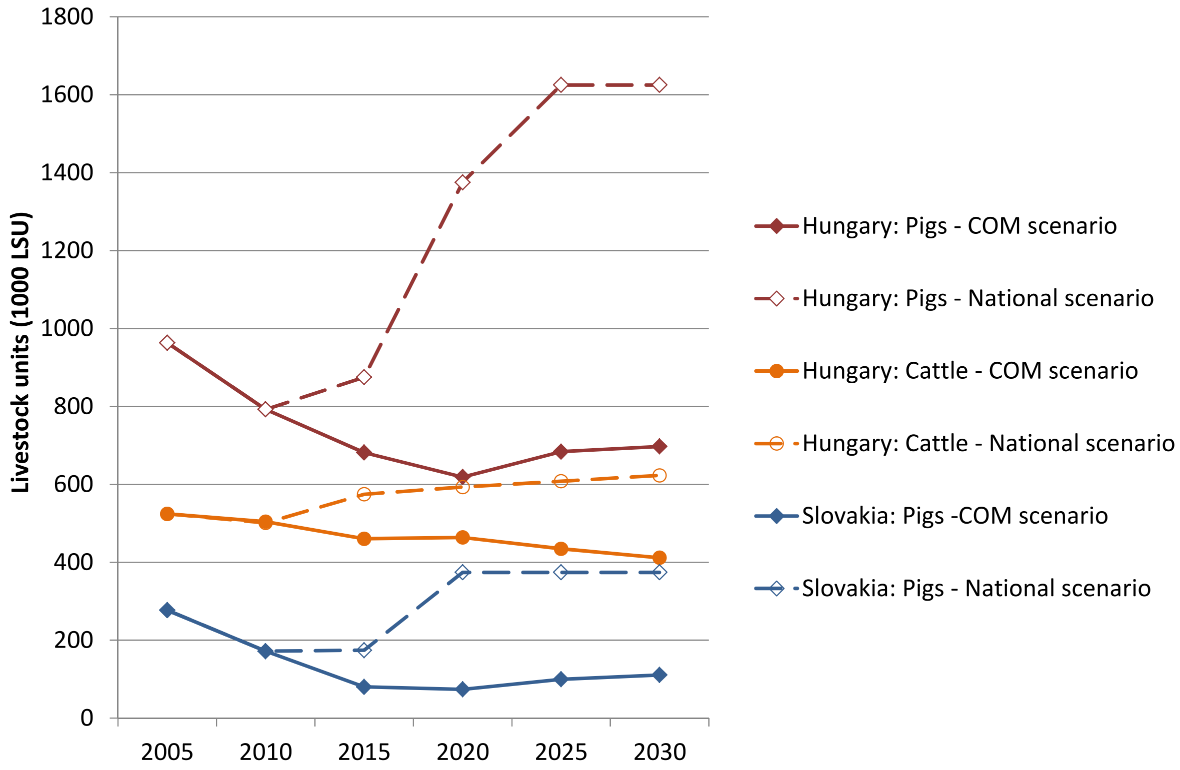


Figure 5.1: Livestock projections for Hungary and Slovakia, the NATIONAL PROJECTIONS (dashed lines) against the PRIMES 2013 REFERENCE scenario (solid lines)

## 5.2 Impacts of the 2014 Climate and Energy Policy Package

There are important interactions between climate and air quality policies (e.g., Barker et al. 2007). In particular, stringent climate and energy efficiency policies will reduce the consumption of polluting fuels, which in turn will alleviate air pollution damage for human health and the environment, and lower the costs for further air pollution control measures.

In 2014, the European Commission adopted its Communication 'A policy framework for climate and energy in the period 2020-2030', setting out climate and energy policy targets based on a 40% reduction in GHG emissions in 2030 (EC 2014a). Furthermore, on 23 July 2014, the European Commission adopted a Communication on 'Energy efficiency and its contribution to energy security and the 2030 Framework for Climate and Energy policy', in which it proposed an additional target on energy efficiency. In 2030, gross final energy consumption should be 30% lower than expected under the business-as-usual projection made in 2007 (EC 2014b).

Obviously, the lower energy consumption and the decarbonisation of the energy system that is necessary to achieve these targets will also affect air pollutant emissions. The implications of the new Climate and Energy policy on the Clean Air Policy Package have been explored in a study performed on request of the European Parliament's Environment Committee (Amann 2014). Specifically, the Committee asked to identify the economically optimal 'gap-closure' based on an analysis of marginal costs and benefits of air quality policy measures in 2020, 2025 and 2030.

As mentioned above, a scenario that closely resembles the targets established in the Climate and Energy Policy Package would reduce $CO_2$ emissions in the EU-28 between 2005 and 2030 by 34%. For comparison, in the PRIMES 2013 REFERENCE scenario that provided the starting point for all analyses for the Commission proposal on the Clean Air Policy Package, $CO_2$ emissions decline by 27% in the same period, and by 25% in the national projections on energy use that have been supplied by 11 Member States.

The study found that in 2030, under the CLIMATE AND ENERGY POLICY scenario, the originally proposed emission ceilings could be achieved at €5.5 bn/yr (or 5.7%) lower air pollution control costs than estimated in the Commission proposal. Thereby, the EU would spend €2.2 bn/yr less on air pollution controls than otherwise just for implementation of the current air pollution legislation. At the same time, cleaner air would provide an additional 2.2 million life years annually to the European population and increase statistical life expectancy by 4.4 months compared to 2005.

An economically optimal ambition would aim for a seven percent more stringent health target compared to the Commission proposal, which could be achieved at 66% lower air pollution control costs. In 2030, this would save an additional 140,000 life years annually, corresponding to monetized health benefits between €8.4 bn/yr and €50.8 bn/yr.

The analysis for the European Parliament was conducted on the original GAINS database that did not yet include the new statistical information that emerged during the bilateral consultations with Member States. While the quantitative findings might change for the updated data set, it is clear that the new climate and energy policy will significantly affect baseline emissions of $SO_2$, $NO_x$ and PM. This will also affect the emission levels that could be achieved through the additionally available measures. For the particular version of the database, the CLIMATE AND ENERGY POLICY scenario would allow for PM2.5 emissions to decline by three percentage points more than the PRIMES 2013 REFERENCE scenario. $NO_x$ could be lower by two percentage points, and $SO_2$ by one percentage point. It is likely that these features would apply for the updated GAINS dataset as well, so that the margin of the re-optimized emission reduction requirements to the feasibility limits would increase to similar extents compared to what is computed for the PRIMES 2013 REFERENCE scenario.

Table 5.3: Current legislation emissions (CLE) and Maximum technically feasible emission reductions (MTFR) for the CLIMATE AND ENERGY POLICY and the PRIMES REFERENCE scenarios in 2030 (emission changes relative to 2005). These estimates refer to the GAINS database employed for the Commission proposal, and do not consider new information that has emerged in the course of the bilateral consultations.

| | Current legislation baseline (CLE) | | Maximum technically feasible reductions (MTFR) | |
|---|---|---|---|---|
| | CLIMATE AND ENERGY POLICY scenario | PRIMES 2013 REFERENCE scenario | CLIMATE AND ENERGY POLICY scenario | PRIMES 2013 REFERENCE scenario |
| $SO_2$ | -75% | -73% | -84% | -83% |
| $NO_x$ | -68% | -65% | -76% | -74% |
| PM2.5 | -34% | -27% | -66% | -63% |
| $NH_3$ | -7% | -7% | -35% | -35% |
| VOC | -43% | -41% | -66% | -66% |

# 6 Summary

With the new information that has been provided by Member States in the course of the bilateral consultations, an updated emission control scenario has been developed that achieves the same relative reduction in premature mortality as the original Commission proposal (52% compared to 2005) with the same gap closure of 67%.

While the overall reduction of PM precursor emissions (primary $PM_{2.5}$, $NO_X$, $SO_2$, VOC and $NH_3$) converted into 'PM equivalent emission quantities' remains the same compared to 2005, the costs for implementation of current legislation and emission reductions beyond current legislation are lower than previously estimated. This is due to a shift in emission reductions across pollutants, with more reductions from primary $PM_{2.5}$, and less from other pollutants compared to 2005. For the EU-28 as a whole, the cuts of primary $PM_{2.5}$ relative to 2005 increase to -54% from –51%, with much of the increase coming from current legislation (in fact the additional reductions on top of current legislation in 2030 are actually two percentage points lower than in the original proposal).

The cut in $SO_2$ emissions does not change at the EU-28 level, but emission reduction requirements for $NO_X$, VOC and $NH_3$ are softened: $NO_x$ from 69% to 65%, VOC from 50% to 46% and $NH_3$ from 27% to 25% (all relative to 2005). About half of the PM equivalent emission reductions that emerge as cost-effective in 2030 have already been achieved in 2012 according to the latest reporting, and about 60% should be attained by the time the 2020 (Gothenburg Protocol) targets are met. In 2030, current emission control legislation and projected activity changes in the baseline should achieve almost 90% of the required $SO_2$ reductions, and more than 95% of the $NO_x$ reductions. Implementation of new EU-wide legislation (i.e., new BAT conclusions, MCP and NRMM directives) would result in additional reductions beyond what is expected to be delivered by current legislation that would largely fill the remaining gap towards the required reductions for $SO_2$ and $NO_X$. For PM, current legislation is expected to deliver 60% of the required emission reduction, and the IED, MCP, NRMM and Ecodesign directives would further deliver a large part of the additional reductions required. With respect to $NH_3$ and VOC, current emission control legislation and projected activity changes resulting from the revised baseline would deliver about 30% of the reduction for $NH_3$ and 85% for VOC.

As agreed, some further sensitivity analysis has also been done based on national perspectives on economic development and energy policies, which sometimes differ from the Europe-wide coherent scenario used for the above analysis. National projections of activity levels were provided by 19 Member States, although most projections did not cover all emission sources. Furthermore, the alternative projections were not mutually consistent, were not always in line with established targets of EU policies, and led to less $CO_2$ emission reduction than the PRIMES reference scenario used for the Commission' proposal. However, a sensitivity analysis was conducted to examine - for the Member States that provided national projections - the technical feasibility of the emission reduction commitments of the updated policy scenario presented in this report, under the alternative national projections.

The outcome is that, with very few exceptions, the updated emission reduction requirements are also technically feasible under the alternative national projections. The only situations where the updated reduction requirement would not be attainable with the available technical emission control measures are the $NH_3$ targets for Hungary, Slovakia and the UK. Of these, UK and Slovakia are marginal, and the only substantive issue is with Hungary, due to the national scenario estimating total livestock number in 2030 at 71% higher than the corresponding EU (CAPRI) projection.

National scenarios are also less optimistic about the effects of climate policies and imply for 2030 higher $CO_2$ emissions than the baseline scenario that has been used by the Commission for the original proposal in 2013. The Climate and Energy Policy Package that has been agreed upon in 2014 envisages substantially lower $CO_2$ emissions in the future, and would result as a co-benefit in lower $SO_2$, $NO_x$ and $PM_{2.5}$ emissions compared to what has been assumed for the Clean Air Policy Package. Thus, the recent agreement on climate and energy policy offers an additional margin for the attainability of the emission reduction requirements.

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# 7 Annex: Results by Member State

## 7.1 Emission reduction requirements relative to 2005

Table 7.1: $SO_2$ emission reductions relative to 2005. 2012: reported in 2014, 2020: Gothenburg Commitment, 2030 numbers computed by GAINS, relative to GAINS 2005 estimates

| | 2005[1] | 2012 | 2020 | 2030 Commission 2013 | | | 2030 WPE 2014 | | | Difference WPE-COM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GP | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR |
| EU | 7710 | -48% | -59% | -73% | -81% | -83% | -74% | -81% | -84% | +1% | 0% | +1% |
| AT | 27 | -36% | -26% | -47% | -50% | -55% | -38% | -41% | -52% | -9% | -9% | -3% |
| BE | 144 | -66% | -43% | -59% | -68% | -68% | -58% | -66% | -68% | -1% | -2% | 0% |
| BG | 776 | -58% | -78% | -87% | -94% | -94% | -87% | -93% | -94% | -1% | -1% | 0% |
| HR | 64 | -60% | -55% | -70% | -87% | -91% | -72% | -86% | -91% | +2% | -1% | 0% |
| CY | 38 | -57% | -83% | -95% | -95% | -98% | -94% | -95% | -99% | 0% | 0% | 0% |
| CZ | 219 | -28% | -45% | -64% | -72% | -73% | -68% | -73% | -75% | +3% | +1% | +2% |
| DK | 25 | -49% | -35% | -56% | -58% | -63% | -62% | -62% | -68% | +6% | +4% | +5% |
| EE | 76 | -47% | -32% | -67% | -71% | -78% | -72% | -72% | -89% | +5% | +2% | +11% |
| FI | 69 | -26% | -30% | -29% | -30% | -35% | -34% | -34% | -42% | +5% | +5% | +8% |
| FR | 460 | -50% | -55% | -74% | -78% | -79% | -71% | -77% | -80% | -2% | -1% | +1% |
| DE | 460 | -7% | -21% | -46% | -53% | -55% | -49% | -57% | -62% | +2% | +4% | +7% |
| GR | 541 | -55% | -74% | -90% | -92% | -95% | -90% | -92% | -95% | 0% | 0% | 0% |
| HU | 43 | -26% | -46% | -79% | -88% | -88% | -57% | -73% | -75% | -22% | -15% | -13% |
| IE | 72 | -68% | -65% | -80% | -83% | -85% | -80% | -82% | -87% | 0% | -1% | +2% |
| IT | 405 | -56% | -35% | -63% | -75% | -81% | -61% | -71% | -79% | -2% | -4% | -2% |
| LV | 7 | -64% | -8% | -40% | -46% | -54% | -38% | -42% | -49% | -2% | -4% | -5% |
| LT | 43 | -16% | -55% | -41% | -72% | -77% | -47% | -65% | -77% | +6% | -7% | 0% |
| LU | 2 | -18% | -34% | -21% | -44% | -56% | -42% | -45% | -75% | +21% | +1% | +19% |
| MT | 11 | -32% | -77% | -97% | -98% | -99% | -95% | -95% | -98% | -2% | -3% | -1% |
| NL | 64 | -47% | -28% | -54% | -59% | -63% | -55% | -58% | -63% | +1% | -1% | 0% |
| PL | 1217 | -30% | -59% | -64% | -78% | -79% | -66% | -77% | -79% | +2% | -1% | 0% |
| PT | 177 | -75% | -63% | -56% | -77% | -84% | -73% | -83% | -90% | +16% | +6% | +6% |
| RO | 643 | -60% | -77% | -86% | -93% | -94% | -84% | -92% | -93% | -2% | -1% | 0% |
| SK | 89 | -34% | -57% | -50% | -79% | -80% | -73% | -82% | -85% | +23% | +3% | +5% |
| SI | 41 | -75% | -63% | -85% | -89% | -89% | -86% | -88% | -90% | +1% | -1% | +1% |
| ES | 1252 | -69% | -67% | -83% | -89% | -90% | -83% | -87% | -90% | 0% | -1% | 0% |
| SE | 36 | -23% | -22% | -16% | -16% | -19% | -14% | -14% | -18% | -2% | -2% | -1% |
| UK | 709 | -40% | -59% | -75% | -84% | -85% | -80% | -89% | -91% | +5% | +5% | +6% |

[1] Excluding emissions outside the EMEP region (e.g., Canary Islands)

Table 7.2: $NO_x$ emission reductions relative to 2005. 2012: reported in 2014, 2020: Gothenburg Commitment, 2030 numbers computed by GAINS, relative to GAINS 2005 estimates

| | 2005 | 2012 | 2020 | 2030 Commission 2013 | | | 2030 WPE 2014 | | | Difference WPE-COM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GP | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR |
| EU | 11531 | -27% | -42% | -65% | -69% | -74% | -63% | -65% | -73% | -2% | -3% | -2% |
| AT | 237 | -24% | -37% | -72% | -72% | -76% | -71% | -71% | -77% | -1% | -1% | 0% |
| BE | 290 | -33% | -41% | -55% | -63% | -68% | -56% | -59% | -67% | +2% | -4% | -1% |
| BG | 154 | -20% | -41% | -64% | -65% | -75% | -62% | -63% | -74% | -1% | -3% | -1% |
| HR | 81 | -27% | -31% | -56% | -66% | -81% | -50% | -62% | -79% | -6% | -4% | -3% |
| CY | 21 | -1% | -44% | -70% | -70% | -81% | -69% | -70% | -80% | -1% | 0% | 0% |
| CZ | 278 | -24% | -35% | -62% | -66% | -72% | -61% | -64% | -71% | -1% | -2% | -1% |
| DK | 186 | -38% | -56% | -66% | -69% | -75% | -64% | -66% | -73% | -2% | -3% | -2% |
| EE | 37 | -12% | -18% | -61% | -61% | -74% | -46% | -46% | -71% | -15% | -15% | -3% |
| FI | 169 | -14% | -35% | -51% | -51% | -59% | -47% | -47% | -58% | -3% | -3% | -1% |
| FR | 1404 | -30% | -50% | -67% | -70% | -75% | -67% | -69% | -74% | 0% | -1% | -1% |
| DE | 1565 | -19% | -39% | -62% | -69% | -73% | -60% | -64% | -71% | -2% | -5% | -2% |
| GR | 417 | -38% | -31% | -69% | -72% | -77% | -68% | -69% | -75% | -1% | -3% | -2% |
| HU | 165 | -26% | -34% | -66% | -69% | -77% | -62% | -66% | -75% | -5% | -4% | -2% |
| IE | 129 | -43% | -49% | -71% | -75% | -82% | -70% | -71% | -79% | -1% | -4% | -2% |
| IT | 1214 | -30% | -40% | -65% | -69% | -72% | -62% | -68% | -71% | -3% | -1% | -1% |
| LV | 42 | -15% | -32% | -44% | -44% | -58% | -40% | -41% | -54% | -4% | -4% | -4% |
| LT | 62 | -8% | -48% | -54% | -55% | -65% | -49% | -51% | -63% | -5% | -5% | -3% |
| LU | 62 | -26% | -43% | -79% | -79% | -80% | -85% | -85% | -86% | +6% | +6% | +6% |
| MT | 9 | -7% | -42% | -89% | -89% | -92% | -79% | -79% | -86% | -9% | -9% | -6% |
| NL | 365 | -27% | -45% | -62% | -68% | -72% | -59% | -61% | -67% | -3% | -7% | -6% |
| PL | 851 | -4% | -30% | -52% | -55% | -65% | -49% | -51% | -63% | -3% | -4% | -2% |
| PT | 256 | -37% | -36% | -65% | -71% | -79% | -59% | -61% | -75% | -6% | -10% | -4% |
| RO | 309 | -27% | -45% | -59% | -67% | -74% | -55% | -62% | -71% | -4% | -5% | -3% |
| SK | 102 | -20% | -36% | -51% | -59% | -67% | -44% | -48% | -63% | -6% | -10% | -4% |
| SI | 48 | -6% | -39% | -69% | -71% | -75% | -64% | -65% | -70% | -4% | -6% | -6% |
| ES | 1311 | -36% | -41% | -71% | -75% | -80% | -65% | -66% | -74% | -7% | -9% | -6% |
| SE | 175 | -25% | -36% | -65% | -65% | -70% | -66% | -66% | -70% | +1% | +1% | 0% |
| UK | 1592 | -33% | -55% | -70% | -73% | -79% | -72% | -74% | -80% | +2% | +1% | +2% |

[1] Excluding emissions outside the EMEP region (e.g., Canary Islands)

Table 7.3: PM2.5 emission reductions relative to 2005. 2012: reported in 2014, 2020: Gothenburg Commitment, 2030 numbers computed by GAINS, relative to GAINS 2005 estimates

| | 2005 | 2012 | 2020 | 2030 Commission 2013 | | | 2030 WPE 2014 | | | Difference WPE-COM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GP | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR |
| EU | 1414 | -12% | -22% | -27% | -51% | -63% | -32% | -54% | -62% | +5% | +3% | -1% |
| AT | 22 | -16% | -20% | -34% | -55% | -62% | -38% | -49% | -60% | +4% | -6% | -2% |
| BE | 36 | -11% | -20% | -33% | -47% | -53% | -15% | -41% | -51% | -18% | -6% | -2% |
| BG | 27 | 10% | -20% | -30% | -64% | -75% | -41% | -66% | -72% | +11% | +2% | -3% |
| HR | 11 | -10% | -18% | -28% | -66% | -82% | -26% | -62% | -75% | -2% | -4% | -7% |
| CY | 3 | -39% | -46% | -70% | -72% | -75% | -69% | -78% | -80% | -1% | +5% | +5% |
| CZ | 21 | -4% | -17% | -25% | -51% | -65% | -28% | -50% | -56% | +3% | -2% | -8% |
| DK | 26 | -14% | -33% | -53% | -64% | -75% | -53% | -56% | -69% | 0% | -9% | -7% |
| EE | 20 | -14% | -15% | -41% | -52% | -85% | -35% | -41% | -76% | -6% | -11% | -9% |
| FI | 41 | -10% | -30% | -30% | -39% | -62% | -28% | -34% | -48% | -2% | -5% | -14% |
| FR | 246 | -26% | -27% | -38% | -48% | -61% | -48% | -56% | -63% | +11% | +8% | +3% |
| DE | 125 | -10% | -26% | -32% | -43% | -49% | -33% | -42% | -47% | +1% | -1% | -2% |
| GR | | | -35% | -51% | -71% | -77% | -51% | -71% | -75% | 0% | 0% | -2% |
| HU | 27 | 13% | -13% | -37% | -63% | -73% | -38% | -64% | -70% | 0% | +1% | -3% |
| IE | 11 | -27% | -18% | -33% | -35% | -49% | -37% | -39% | -48% | +5% | +4% | -1% |
| IT | 142 | -11% | -10% | -19% | -45% | -53% | -35% | -54% | -59% | +16% | +9% | +5% |
| LV | 29 | -5% | -16% | -34% | -45% | -80% | -40% | -46% | -78% | +6% | 0% | -2% |
| LT | 23 | 7% | -20% | -28% | -54% | -75% | -32% | -48% | -74% | +3% | -5% | -1% |
| LU | 4 | -27% | -15% | -43% | -48% | -54% | -40% | -43% | -48% | -4% | -5% | -6% |
| MT | 1 | -38% | -25% | -76% | -80% | -83% | -72% | -76% | -79% | -4% | -4% | -3% |
| NL | 19 | -33% | -37% | -30% | -38% | -45% | -32% | -40% | -46% | +2% | +1% | +1% |
| PL | 141 | -2% | -16% | -12% | -40% | -56% | -11% | -46% | -53% | 0% | +6% | -3% |
| PT | 69 | -19% | -15% | -35% | -70% | -74% | -39% | -68% | -71% | +4% | -1% | -3% |
| RO | 106 | 7% | -28% | -25% | -65% | -80% | -39% | -69% | -76% | +14% | +5% | -4% |
| SK | 37 | -21% | -36% | -38% | -64% | -78% | -36% | -63% | -73% | -1% | 0% | -5% |
| SI | 16 | 9% | -25% | -40% | -70% | -76% | -23% | -76% | -77% | -17% | +7% | +1% |
| ES | 90 | -22% | -15% | -20% | -61% | -68% | -19% | -62% | -68% | -1% | +1% | -0% |
| SE | 30 | -10% | -19% | -19% | -23% | -56% | -16% | -17% | -48% | -3% | -6% | 7% |
| UK | 93 | -17% | -30% | -6% | -47% | -56% | -28% | -53% | -57% | +22% | +7% | +2% |

[1] Excluding emissions outside the EMEP region (e.g., Canary Islands)

Table 7.4: $NH_3$ emissions relative to 2005. 2012: reported in 2014, 2020: Gothenburg Commitment, 2030 numbers computed by GAINS, relative to GAINS 2005 estimates

| | 2005 | 2012 | 2020 | 2030 Commission 2013 | | | 2030 WPE 2014 | | | Difference WPE-COM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GP | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR |
| EU | 3878 | -5% | -6% | -7% | -27% | -35% | -8% | -25% | -35% | +1% | -2% | 0% |
| AT | 63 | -1% | -1% | +8% | -19% | -26% | +12% | -18% | -31% | -4% | -1% | +5% |
| BE | 72 | -6% | -2% | -1% | -16% | -19% | 0% | -13% | -22% | -1% | -3% | +3% |
| BG | 48 | -21% | -3% | -1% | -10% | -12% | -6% | -18% | -25% | +5% | +8% | +13% |
| HR | 44 | -6% | -1% | +2% | -24% | -36% | +3% | -23% | -38% | -1% | -1% | +2% |
| CY | 6 | -17% | -10% | -4% | -18% | -31% | -6% | -21% | -41% | +2% | +3% | +10% |
| CZ | 68 | -6% | -7% | -22% | -35% | -36% | -20% | -38% | -42% | -2% | +3% | +6% |
| DK | 88 | -13% | -24% | -31% | -37% | -47% | -27% | -32% | -46% | -4% | -5% | -1% |
| EE | 10 | 11% | -1% | +9% | -8% | -29% | +15% | -1% | -26% | -6% | -7% | -3% |
| FI | 38 | -3% | -20% | -8% | -15% | -29% | -9% | -15% | -29% | +1% | 0% | 0% |
| FR | 686 | -1% | -4% | -5% | -29% | -37% | -8% | -23% | -32% | +3% | -6% | -5% |
| DE | 572 | -5% | -5% | -5% | -39% | -50% | -7% | -38% | -47% | +2% | -1% | -3% |
| GR | 68 | -9% | -7% | -16% | -26% | -32% | -21% | -31% | -38% | +5% | +5% | +6% |
| HU | 78 | -16% | -10% | -13% | -34% | -38% | -23% | -43% | -50% | +10% | +9% | +12% |
| IE | 110 | -5% | -1% | -3% | -7% | -18% | -6% | -10% | -25% | +3% | +3% | +7% |
| IT | 416 | -3% | -5% | -8% | -26% | -29% | -8% | -22% | -29% | 0% | -4% | 0% |
| LV | 17 | 9% | -1% | +19% | 6% | -3% | +15% | 3% | -10% | +4% | +3% | +7% |
| LT | 39 | -3% | -10% | +15% | 7% | -26% | +9% | -2% | -23% | +6% | +9% | -3% |
| LU | 7 | -3% | -1% | -11% | -24% | -27% | -9% | -24% | -28% | -2% | 0% | +1% |
| MT | 2 | -4% | -4% | -8% | -24% | -35% | -8% | -24% | -37% | 0% | 0% | +2% |
| NL | 143 | -16% | -13% | -24% | -25% | -25% | -19% | -21% | -22% | -5% | -4% | -3% |
| PL | 272 | -3% | -1% | -3% | -26% | -33% | +1% | -22% | -37% | -4% | -4% | +4% |
| PT | 50 | -9% | -7% | +3% | -16% | -29% | -5% | -19% | -35% | +8% | +3% | +6% |
| RO | 199 | -20% | -13% | -12% | -24% | -31% | -13% | -28% | -34% | +1% | +4% | +3% |
| SK | 29 | -12% | -15% | -16% | -37% | -42% | -22% | -43% | -48% | +6% | +6% | +6% |
| SI | 19 | -8% | -1% | -12% | -24% | -28% | -10% | -26% | -32% | -2% | +2% | +4% |
| ES | 376 | 0% | -3% | -5% | -29% | -43% | -6% | -21% | -42% | +1% | -8% | -1% |
| SE | 56 | -8% | -15% | -9% | -17% | -27% | -10% | -17% | -33% | +1% | 0% | +6% |
| UK | 302 | -8% | -8% | -7% | -21% | -22% | -8% | -24% | -27% | +1% | +3% | +5% |

[1] Excluding emissions outside the EMEP region (e.g., Canary Islands)

Table 7.5: VOC emission reductions relative to 2005. 2012: reported in 2014, 2020: Gothenburg Commitment, 2030 numbers computed by GAINS, relative to GAINS 2005 estimates

| | 2005 | 2012 | 2020 | 2030 Commission 2013 | | | 2030 WPE 2014 | | | Difference WPE-COM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GP | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR |
| EU | 8775 | -24% | -28% | -41% | -50% | -66% | -40% | -46% | -61% | -2% | -5% | -5% |
| AT | 165 | -18% | -21% | -40% | -48% | -70% | -38% | -40% | -65% | -2% | -8% | -5% |
| BE | 146 | -28% | -21% | -37% | -44% | -57% | -25% | -35% | -46% | -12% | -10% | -12% |
| BG | 85 | -4% | -21% | -51% | -62% | -77% | -59% | -69% | -77% | +7% | +7% | 0% |
| HR | 101 | -32% | -34% | -39% | -48% | -68% | -45% | -50% | -73% | +6% | +2% | +4% |
| CY | 14 | -35% | -45% | -53% | -54% | -69% | -47% | -50% | -65% | -6% | -4% | -4% |
| CZ | 182 | -29% | -18% | -44% | -57% | -72% | -43% | -50% | -68% | -1% | -7% | -5% |
| DK | 114 | -31% | -35% | -51% | -59% | -73% | -48% | -49% | -68% | -3% | -10% | -6% |
| EE | 40 | -16% | -10% | -31% | -37% | -75% | -24% | -28% | -66% | -6% | -9% | -10% |
| FI | 136 | -23% | -35% | -44% | -46% | -72% | -47% | -48% | -67% | +3% | +1% | -5% |
| FR | 1261 | -44% | -43% | -47% | -50% | -65% | -51% | -52% | -64% | +4% | +2% | -1% |
| DE | 1124 | -15% | -13% | -32% | -43% | -59% | -31% | -35% | -56% | -1% | -8% | -3% |
| GR | 220 | -31% | -54% | -59% | -67% | -79% | -56% | -64% | -75% | -3% | -3% | -4% |
| HU | 124 | -16% | -30% | -44% | -59% | -69% | -44% | -58% | -71% | 0% | -1% | +2% |
| IE | 57 | -23% | -25% | -32% | -32% | -65% | -32% | -32% | -56% | 0% | 0% | -9% |
| IT | 1204 | -29% | -35% | -48% | -54% | -68% | -43% | -49% | -60% | -5% | -5% | -7% |
| LV | 56 | -3% | -27% | -46% | -49% | -77% | -39% | -42% | -78% | -7% | -7% | +1% |
| LT | 68 | -13% | -32% | -53% | -57% | -78% | -41% | -47% | -76% | -11% | -11% | -2% |
| LU | 13 | -32% | -29% | -55% | -58% | -67% | -47% | -49% | -65% | -7% | -9% | -1% |
| MT | 3 | -5% | -23% | -30% | -31% | -64% | -26% | -27% | -59% | -4% | -4% | -5% |
| NL | 174 | -16% | -8% | -31% | -34% | -50% | -19% | -22% | -37% | -12% | -13% | -12% |
| PL | 575 | 10% | -25% | -34% | -56% | -69% | -34% | -55% | -67% | -1% | 0% | -2% |
| PT | 207 | -19% | -18% | -40% | -46% | -60% | -40% | -44% | -56% | 0% | -2% | -3% |
| RO | 425 | -16% | -25% | -48% | -64% | -79% | -54% | -67% | -80% | +6% | +4% | +1% |
| SK | 73 | -16% | -18% | -31% | -40% | -65% | -22% | -32% | -57% | -9% | -8% | -8% |
| SI | 48 | -17% | -23% | -33% | -63% | -75% | -31% | -59% | -68% | -2% | -4% | -7% |
| ES | 802 | -28% | -22% | -36% | -48% | -62% | -29% | -39% | -54% | -7% | -9% | -8% |
| SE | 198 | -6% | -25% | -37% | -38% | -53% | -39% | -39% | -54% | +2% | +2% | 0% |
| UK | 1160 | -28% | -32% | -37% | -49% | -62% | -37% | -39% | -52% | 1% | -10% | -10% |

[1] Excluding emissions outside the EMEP region (e.g., Canary Islands)

Table 7.6: PMeq emission reductions relative to 2005. 2012: reported in 2014, 2020: Gothenburg Commitment, 2030 numbers computed by GAINS, relative to GAINS 2005 estimates

| | 2005 | 2012 | 2020 | 2030 Commission 2013 | | | 2030 WPE 2014 | | | Difference WPE-COM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GP | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR | CLE | 67% GC | MTFR |
| EU | 5315 | -29% | -38% | -49% | -63% | -69% | -50% | -63% | -69% | +1% | 0% | 0% |
| AT | 60 | -18% | -22% | -37% | -51% | -58% | -36% | -47% | -57% | 0% | -4% | 0% |
| BE | 113 | -35% | -30% | -43% | -54% | -57% | -36% | -50% | -56% | -7% | -4% | -1% |
| BG | 279 | -48% | -68% | -77% | -86% | -88% | -77% | -86% | -89% | 0% | 0% | 0% |
| HR | 45 | -33% | -32% | -46% | -70% | -80% | -43% | -65% | -76% | -3% | -4% | -4% |
| CY | 17 | -46% | -68% | -82% | -83% | -88% | -81% | -84% | -90% | 0% | +1% | +1% |
| CZ | 120 | -21% | -34% | -47% | -61% | -66% | -52% | -62% | -66% | +4% | +1% | 0% |
| DK | 64 | -23% | -38% | -51% | -58% | -67% | -50% | -53% | -64% | -1% | -6% | -3% |
| EE | 47 | -29% | -23% | -51% | -58% | -78% | -51% | -54% | -80% | 0% | -4% | +1% |
| FI | 82 | -14% | -30% | -32% | -36% | -49% | -31% | -35% | -47% | -1% | -1% | -3% |
| FR | 621 | -27% | -32% | -43% | -54% | -62% | -48% | -55% | -62% | +5% | +2% | 0% |
| DE | 488 | -10% | -23% | -36% | -50% | -56% | -37% | -50% | -56% | +1% | 0% | 0% |
| GR | 204 | -49% | -45% | -75% | -82% | -86% | -76% | -82% | -86% | +1% | 0% | 0% |
| HU | 67 | -8% | -23% | -54% | -69% | -74% | -42% | -61% | -67% | 12% | -8% | -7% |
| IE | 63 | -35% | -33% | -45% | -48% | -56% | -45% | -48% | -58% | +1% | 0% | +1% |
| IT | 436 | -26% | -22% | -38% | -54% | -60% | -42% | -55% | -61% | +4% | +1% | +1% |
| LV | 38 | -7% | -16% | -31% | -40% | -69% | -36% | -41% | -70% | +5% | +1% | +1% |
| LT | 48 | -2% | -30% | -26% | -47% | -64% | -31% | -46% | -66% | +5% | -1% | +2% |
| LU | 10 | -23% | -27% | -51% | -56% | -60% | -55% | -59% | -64% | +5% | +3% | +4% |
| MT | 6 | -29% | -57% | -87% | -89% | -91% | -84% | -85% | -90% | -3% | -3% | -1% |
| NL | 92 | -29% | -29% | -41% | -46% | -50% | -39% | -43% | -47% | -2% | -3% | -3% |
| PL | 618 | -19% | -42% | -41% | -59% | -67% | -41% | -60% | -66% | 0% | +1% | -1% |
| PT | 150 | -40% | -37% | -41% | -66% | -72% | -51% | -69% | -76% | +11% | +3% | +3% |
| RO | 360 | -34% | -54% | -60% | -77% | -83% | -59% | -76% | -80% | -1% | -1% | -3% |
| SK | 76 | -25% | -42% | -42% | -67% | -75% | -49% | -67% | -74% | +7% | 0% | 0% |
| SI | 35 | -24% | -37% | -58% | -72% | -75% | -48% | -74% | -76% | -11% | +2% | +1% |
| ES | 632 | -49% | -48% | -60% | -75% | -79% | -58% | -72% | -78% | -2% | -3% | -2% |
| SE | 65 | -15% | -22% | -27% | -30% | -48% | -25% | -27% | -45% | -2% | -3% | -3% |
| UK | 480 | -30% | -45% | -53% | -67% | -71% | -58% | -70% | -74% | +5% | +3% | +2% |

[1] Excluding emissions outside the EMEP region (e.g., Canary Islands)

## 7.2 Emissions (kilotons)

Table 7.7: $SO_2$ emissions of the WPE 2014 analyses compared with the calculations for the COM 2013 proposal

| | 2005[1)] | WPE 2014 GAINS analysis | | | | | | COM 2013 GAINS analysis | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PRIMES 2013 REFERENCE scenario | | | | NATIONAL PROJECTIONS | | PRIMES 2013 REFERENCE scenario | | | |
| | | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 | CLE 2030 | MTFR 2030 | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 |
| EU | 7710 | 7681 | 1996 | 1439 | 1200 | 2064 | 1214 | 8172 | 2211 | 1530 | 1382 |
| AT | 27 | 27 | 17 | 16 | 13 | 22 | 16 | 25 | 13 | 12 | 11 |
| BE | 144 | 140 | 59 | 48 | 45 | 59 | 45 | 140 | 58 | 45 | 44 |
| BG | 776 | 762 | 101 | 51 | 43 | 101 | 43 | 890 | 112 | 53 | 52 |
| HR | 64 | 65 | 19 | 9 | 6 | 19 | 6 | 68 | 20 | 9 | 6 |
| CY | 38 | 38 | 2 | 2 | 1 | 2 | 1 | 38 | 2 | 2 | 1 |
| CZ | 219 | 221 | 71 | 59 | 56 | 82 | 58 | 208 | 74 | 59 | 56 |
| DK | 25 | 24 | 9 | 9 | 8 | 9 | 8 | 21 | 9 | 9 | 8 |
| EE | 76 | 76 | 21 | 21 | 9 | 29 | 12 | 66 | 22 | 19 | 15 |
| FI | 69 | 69 | 46 | 45 | 40 | 46 | 40 | 90 | 64 | 63 | 59 |
| FR | 460 | 465 | 134 | 108 | 92 | 134 | 92 | 444 | 117 | 97 | 92 |
| DE | 460 | 457 | 234 | 195 | 173 | 234 | 173 | 549 | 295 | 258 | 246 |
| GR | 541 | 529 | 51 | 42 | 25 | 51 | 25 | 505 | 50 | 38 | 25 |
| HU | 43 | 43 | 18 | 12 | 11 | 18 | 11 | 129 | 27 | 16 | 15 |
| IE | 72 | 71 | 14 | 13 | 9 | 15 | 9 | 71 | 14 | 12 | 11 |
| IT | 405 | 407 | 160 | 119 | 85 | 194 | 90 | 382 | 142 | 94 | 73 |
| LV | 7 | 7 | 4 | 4 | 3 | 4 | 3 | 5 | 3 | 3 | 2 |
| LT | 43 | 41 | 22 | 14 | 9 | 26 | 10 | 42 | 25 | 12 | 10 |
| LU | 2 | 3 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 |
| MT | 11 | 11 | 1 | 1 | 0 | 0 | 0 | 11 | 0 | 0 | 0 |
| NL | 64 | 65 | 29 | 27 | 24 | 29 | 24 | 70 | 32 | 29 | 26 |
| PL | 1217 | 1207 | 410 | 274 | 249 | 410 | 249 | 1256 | 453 | 276 | 261 |
| PT | 177 | 179 | 49 | 30 | 18 | 49 | 18 | 111 | 49 | 26 | 17 |
| RO | 643 | 642 | 100 | 51 | 44 | 107 | 45 | 706 | 99 | 51 | 45 |
| SK | 89 | 90 | 24 | 16 | 14 | 24 | 14 | 92 | 46 | 19 | 19 |
| SI | 41 | 39 | 5 | 5 | 4 | 5 | 4 | 40 | 6 | 5 | 4 |
| ES | 1252 | 1245 | 216 | 156 | 126 | 216 | 126 | 1328 | 232 | 152 | 130 |
| SE | 36 | 36 | 31 | 31 | 30 | 31 | 30 | 38 | 32 | 32 | 31 |
| UK | 709 | 721 | 146 | 79 | 63 | 146 | 63 | 850 | 214 | 138 | 124 |

[1)] National submission as of 2014, adjusted to the GAINS source coverage

Table 7.8: $NO_x$ emissions of the WPE 2014 analyses compared with the calculations for the COM 2013 proposal

| | 2005[1)] | WPE 2014 GAINS analysis | | | | | | COM 2013 GAINS analysis | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PRIMES 2013 REFERENCE scenario | | | | NATIONAL PROJECTIONS | | PRIMES 2013 REFERENCE scenario | | | |
| | | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 | CLE 2030 | MTFR 2030 | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 |
| EU | 11316 | 11263 | 4198 | 3905 | 3081 | 4303 | 3134 | 11538 | 4051 | 3599 | 2948 |
| AT | 232 | 230 | 67 | 66 | 54 | 77 | 61 | 230 | 65 | 64 | 54 |
| BE | 303 | 303 | 133 | 124 | 100 | 133 | 99 | 295 | 134 | 108 | 95 |
| BG | 154 | 161 | 61 | 60 | 42 | 61 | 42 | 167 | 60 | 58 | 41 |
| HR | 80 | 80 | 40 | 30 | 17 | 40 | 17 | 76 | 33 | 26 | 14 |
| CY | 21 | 21 | 7 | 6 | 4 | 17 | 6 | 21 | 6 | 6 | 4 |
| CZ | 278 | 294 | 115 | 107 | 85 | 115 | 77 | 296 | 112 | 101 | 83 |
| DK | 186 | 177 | 63 | 60 | 48 | 63 | 48 | 182 | 61 | 57 | 46 |
| EE | 36 | 37 | 20 | 20 | 11 | 26 | 14 | 40 | 16 | 16 | 10 |
| FI | 169 | 184 | 97 | 97 | 77 | 97 | 77 | 201 | 99 | 99 | 82 |
| FR | 1404 | 1399 | 460 | 433 | 358 | 460 | 355 | 1351 | 441 | 401 | 332 |
| DE | 1453 | 1430 | 568 | 520 | 414 | 586 | 429 | 1397 | 530 | 439 | 380 |
| GR | 416 | 402 | 130 | 124 | 99 | 130 | 99 | 407 | 126 | 112 | 92 |
| HU | 154 | 150 | 57 | 52 | 37 | 57 | 37 | 155 | 52 | 48 | 35 |
| IE | 129 | 136 | 41 | 39 | 28 | 48 | 32 | 150 | 43 | 38 | 28 |
| IT | 1214 | 1188 | 453 | 383 | 345 | 485 | 383 | 1306 | 456 | 405 | 360 |
| LV | 42 | 41 | 25 | 24 | 19 | 25 | 19 | 36 | 20 | 20 | 15 |
| LT | 62 | 50 | 25 | 25 | 19 | 28 | 19 | 62 | 28 | 28 | 22 |
| LU | 61 | 56 | 8 | 8 | 8 | 8 | 8 | 47 | 10 | 10 | 9 |
| MT | 9 | 10 | 2 | 2 | 1 | 2 | 2 | 10 | 1 | 1 | 1 |
| NL | 361 | 362 | 149 | 140 | 120 | 144 | 111 | 380 | 143 | 122 | 105 |
| PL | 786 | 774 | 392 | 378 | 289 | 392 | 289 | 797 | 379 | 358 | 280 |
| PT | 256 | 246 | 100 | 96 | 62 | 98 | 61 | 268 | 92 | 76 | 57 |
| RO | 308 | 309 | 139 | 118 | 89 | 158 | 90 | 311 | 127 | 102 | 81 |
| SK | 91 | 91 | 51 | 47 | 34 | 51 | 34 | 95 | 47 | 39 | 31 |
| SI | 47 | 50 | 18 | 17 | 15 | 18 | 15 | 50 | 16 | 14 | 12 |
| ES | 1298 | 1366 | 482 | 468 | 349 | 482 | 349 | 1513 | 434 | 380 | 300 |
| SE | 175 | 200 | 68 | 68 | 60 | 68 | 60 | 216 | 76 | 76 | 64 |
| UK | 1592 | 1516 | 427 | 390 | 296 | 427 | 295 | 1480 | 441 | 397 | 316 |

[1)] National submission as of 2014, adjusted to the GAINS source coverage

Table 7.9: PM2.5 emissions of the WPE 2014 analyses compared with the calculations for the COM 2013 proposal

| | 2005 [1)] | WPE 2014 GAINS analysis | | | | | | COM 2013 GAINS analysis | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PRIMES 2013 REFERENCE scenario | | | | NATIONAL PROJECTIONS | | PRIMES 2013 REFERENCE scenario | | | |
| | | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 | CLE 2030 | MTFR 2030 | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 |
| EU | 1473 | 1665 | 1127 | 761 | 628 | 1158 | 636 | 1647 | 1200 | 804 | 607 |
| AT | 22 | 22 | 13 | 11 | 9 | 12 | 8 | 24 | 16 | 11 | 9 |
| BE | 36 | 37 | 32 | 22 | 18 | 32 | 18 | 28 | 19 | 15 | 13 |
| BG | 27 | 39 | 23 | 13 | 11 | 23 | 11 | 35 | 24 | 13 | 9 |
| HR | 11 | 15 | 11 | 6 | 4 | 11 | 4 | 15 | 11 | 5 | 3 |
| CY | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| CZ | 21 | 34 | 24 | 17 | 15 | 25 | 15 | 43 | 32 | 21 | 15 |
| DK | 26 | 27 | 13 | 12 | 9 | 13 | 9 | 28 | 13 | 10 | 7 |
| EE | 20 | 20 | 13 | 12 | 5 | 15 | 5 | 20 | 12 | 10 | 3 |
| FI | 41 | 35 | 25 | 23 | 18 | 25 | 18 | 29 | 20 | 17 | 11 |
| FR | 248 | 245 | 127 | 107 | 90 | 127 | 90 | 271 | 169 | 141 | 107 |
| DE | 125 | 122 | 82 | 71 | 64 | 82 | 64 | 123 | 84 | 70 | 62 |
| GR | | 61 | 29 | 18 | 15 | 29 | 15 | 62 | 30 | 18 | 14 |
| HU | 27 | 32 | 20 | 12 | 10 | 21 | 10 | 29 | 18 | 11 | 8 |
| IE | 11 | 11 | 7 | 7 | 6 | 8 | 5 | 13 | 9 | 9 | 7 |
| IT | 142 | 141 | 92 | 65 | 58 | 114 | 64 | 147 | 119 | 80 | 69 |
| LV | 29 | 30 | 18 | 16 | 7 | 18 | 7 | 19 | 12 | 10 | 4 |
| LT | 23 | 22 | 15 | 11 | 6 | 15 | 6 | 15 | 11 | 7 | 4 |
| LU | 4 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 |
| MT | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| NL | 20 | 24 | 16 | 14 | 13 | 16 | 13 | 24 | 17 | 15 | 13 |
| PL | 141 | 219 | 195 | 119 | 102 | 195 | 102 | 225 | 198 | 135 | 98 |
| PT | 63 | 59 | 36 | 19 | 17 | 36 | 17 | 63 | 41 | 19 | 16 |
| RO | 106 | 145 | 89 | 45 | 35 | 94 | 37 | 113 | 84 | 40 | 23 |
| SK | 37 | 35 | 22 | 13 | 10 | 22 | 10 | 32 | 20 | 12 | 7 |
| SI | 16 | 15 | 11 | 4 | 3 | 11 | 3 | 9 | 6 | 3 | 2 |
| ES | 90 | 144 | 117 | 54 | 47 | 117 | 47 | 156 | 125 | 61 | 50 |
| SE | 30 | 32 | 27 | 26 | 17 | 27 | 17 | 31 | 25 | 24 | 14 |
| UK | 93 | 93 | 67 | 43 | 40 | 67 | 40 | 87 | 82 | 46 | 38 |

[1)] National submission as of 2014, adjusted to the GAINS source coverage

Table 7.10: $NH_3$ emissions of the WPE 2014 analyses compared with the calculations for the COM 2013 proposal

| | 2005[1)] | WPE 2014 GAINS analysis | | | | | | COM 2013 GAINS analysis | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PRIMES 2013 REFERENCE scenario | | | | NATIONAL PROJECTIONS | | PRIMES 2013 REFERENCE scenario | | | |
| | | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 | CLE 2030 | MTFR 2030 | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 |
| EU | 3868 | 3938 | 3631 | 2956 | 2558 | 3708 | 2602 | 3928 | 3663 | 2871 | 2568 |
| AT | 63 | 62 | 69 | 51 | 43 | 70 | 44 | 63 | 68 | 51 | 47 |
| BE | 73 | 72 | 71 | 62 | 56 | 71 | 56 | 74 | 73 | 62 | 60 |
| BG | 48 | 39 | 37 | 32 | 29 | 37 | 29 | 65 | 64 | 59 | 57 |
| HR | 44 | 40 | 41 | 31 | 25 | 41 | 25 | 29 | 30 | 22 | 19 |
| CY | 6 | 6 | 6 | 5 | 4 | 6 | 4 | 6 | 6 | 5 | 4 |
| CZ | 68 | 71 | 57 | 44 | 41 | 58 | 42 | 80 | 62 | 52 | 51 |
| DK | 77 | 77 | 56 | 52 | 42 | 69 | 51 | 73 | 51 | 46 | 39 |
| EE | 10 | 10 | 12 | 10 | 8 | 12 | 8 | 12 | 13 | 11 | 8 |
| FI | 38 | 40 | 36 | 34 | 28 | 36 | 28 | 34 | 31 | 29 | 24 |
| FR | 686 | 694 | 638 | 537 | 469 | 638 | 469 | 675 | 639 | 476 | 424 |
| DE | 572 | 588 | 545 | 364 | 313 | 564 | 324 | 593 | 565 | 362 | 294 |
| GR | 57 | 58 | 46 | 40 | 36 | 46 | 36 | 57 | 48 | 42 | 39 |
| HU | 78 | 79 | 60 | 45 | 39 | 80 | 52 | 78 | 67 | 51 | 48 |
| IE | 110 | 111 | 104 | 99 | 83 | 118 | 94 | 104 | 101 | 97 | 86 |
| IT | 416 | 435 | 399 | 339 | 310 | 382 | 295 | 422 | 389 | 311 | 299 |
| LV | 17 | 15 | 17 | 15 | 13 | 17 | 13 | 13 | 15 | 14 | 13 |
| LT | 39 | 35 | 38 | 34 | 27 | 42 | 30 | 44 | 51 | 47 | 33 |
| LU | 7 | 6 | 6 | 5 | 4 | 6 | 4 | 6 | 6 | 5 | 5 |
| MT | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 |
| NL | 143 | 144 | 117 | 114 | 113 | 115 | 110 | 146 | 111 | 110 | 109 |
| PL | 272 | 329 | 332 | 257 | 207 | 332 | 207 | 344 | 332 | 255 | 228 |
| PT | 50 | 54 | 51 | 44 | 35 | 51 | 35 | 71 | 73 | 60 | 50 |
| RO | 199 | 186 | 162 | 134 | 122 | 162 | 122 | 161 | 141 | 123 | 112 |
| SK | 29 | 29 | 23 | 16 | 15 | 27 | 17 | 28 | 24 | 18 | 17 |
| SI | 19 | 19 | 17 | 14 | 13 | 18 | 14 | 19 | 17 | 14 | 14 |
| ES | 379 | 377 | 354 | 298 | 219 | 354 | 219 | 366 | 349 | 258 | 209 |
| SE | 56 | 54 | 49 | 45 | 36 | 49 | 36 | 54 | 49 | 44 | 39 |
| UK | 310 | 310 | 286 | 235 | 227 | 305 | 238 | 308 | 287 | 245 | 239 |

[1)] National submission as of 2014, adjusted to the GAINS source coverage

Table 7.11: VOC emissions of the WPE 2014 analyses compared with the calculations for the COM 2013 proposal

| | 2005[1)] | WPE 2014 GAINS analysis | | | | | | COM 2013 GAINS analysis | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PRIMES 2013 REFERENCE scenario | | | | NATIONAL PROJECTIONS | | PRIMES 2013 REFERENCE scenario | | | |
| | | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 | CLE 2030 | MTFR 2030 | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 |
| EU | 8599 | 8846 | 5350 | 4793 | 3486 | 5425 | 3512 | 9259 | 5460 | 4598 | 3191 |
| AT | 164 | 170 | 105 | 102 | 60 | 103 | 61 | 171 | 102 | 89 | 52 |
| BE | 147 | 151 | 114 | 99 | 82 | 114 | 82 | 158 | 99 | 88 | 67 |
| BG | 67 | 128 | 53 | 40 | 30 | 53 | 30 | 139 | 67 | 52 | 32 |
| HR | 101 | 101 | 56 | 51 | 28 | 56 | 28 | 79 | 48 | 41 | 25 |
| CY | 12 | 11 | 6 | 6 | 4 | 6 | 4 | 9 | 4 | 4 | 3 |
| CZ | 202 | 196 | 112 | 98 | 63 | 127 | 63 | 251 | 140 | 108 | 69 |
| DK | 113 | 112 | 58 | 57 | 36 | 58 | 36 | 130 | 63 | 53 | 35 |
| EE | 36 | 37 | 28 | 27 | 13 | 29 | 13 | 38 | 27 | 24 | 9 |
| FI | 136 | 118 | 62 | 62 | 39 | 62 | 39 | 173 | 96 | 92 | 48 |
| FR | 1261 | 1216 | 593 | 578 | 442 | 593 | 442 | 1117 | 591 | 556 | 396 |
| DE | 1124 | 1185 | 818 | 771 | 523 | 831 | 536 | 1235 | 840 | 708 | 502 |
| GR | 220 | 263 | 117 | 94 | 65 | 117 | 65 | 283 | 116 | 93 | 60 |
| HU | 124 | 130 | 73 | 55 | 38 | 73 | 38 | 144 | 81 | 60 | 45 |
| IE | 57 | 59 | 40 | 40 | 26 | 41 | 26 | 63 | 43 | 43 | 22 |
| IT | 1204 | 1165 | 670 | 597 | 460 | 711 | 470 | 1237 | 646 | 570 | 400 |
| LV | 55 | 56 | 34 | 32 | 12 | 34 | 12 | 69 | 37 | 35 | 16 |
| LT | 68 | 80 | 47 | 43 | 19 | 49 | 19 | 84 | 40 | 36 | 18 |
| LU | 12 | 14 | 7 | 7 | 5 | 7 | 5 | 13 | 6 | 5 | 4 |
| MT | 3 | 4 | 3 | 3 | 2 | 4 | 2 | 4 | 3 | 3 | 1 |
| NL | 174 | 172 | 139 | 134 | 108 | 158 | 123 | 205 | 141 | 134 | 103 |
| PL | 575 | 605 | 403 | 270 | 201 | 403 | 201 | 615 | 403 | 273 | 192 |
| PT | 207 | 223 | 134 | 124 | 98 | 134 | 98 | 227 | 137 | 123 | 92 |
| RO | 340 | 394 | 179 | 129 | 80 | 179 | 79 | 460 | 238 | 167 | 96 |
| SK | 73 | 71 | 56 | 48 | 31 | 56 | 31 | 77 | 53 | 46 | 27 |
| SI | 42 | 45 | 31 | 18 | 14 | 31 | 14 | 41 | 28 | 15 | 10 |
| ES | 802 | 871 | 615 | 532 | 405 | 615 | 405 | 934 | 596 | 484 | 358 |
| SE | 198 | 205 | 125 | 125 | 95 | 125 | 95 | 210 | 132 | 131 | 98 |
| UK | 1082 | 1063 | 673 | 651 | 509 | 657 | 496 | 1093 | 684 | 562 | 410 |

[1)] National submission as of 2014, adjusted to the GAINS source coverage

Table 7.12: PMeq emissions of the WPE 2014 analyses compared with the calculations for the COM 2013 proposal

| | 2005[1)] | WPE 2014 GAINS analysis | | | | | | COM 2013 GAINS analysis | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PRIMES 2013 REFERENCE scenario | | | | NATIONAL PROJECTIONS | | PRIMES 2013 REFERENCE scenario | | | |
| | | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 | CLE 2030 | MTFR 2030 | 2005 GAINS | CLE 2030 | Optimized | MTFR 2030 |
| EU | 5356 | 5552 | 2756 | 2068 | 1720 | 2829 | 1744 | 5701 | 2890 | 2099 | 1744 |
| AT | 60 | 59 | 37 | 31 | 25 | 38 | 25 | 61 | 39 | 30 | 26 |
| BE | 114 | 115 | 73 | 57 | 50 | 73 | 50 | 106 | 60 | 48 | 45 |
| BG | 278 | 285 | 65 | 39 | 32 | 65 | 32 | 325 | 74 | 44 | 38 |
| HR | 45 | 48 | 27 | 17 | 12 | 27 | 12 | 47 | 25 | 14 | 9 |
| CY | 17 | 17 | 3 | 3 | 2 | 4 | 2 | 17 | 3 | 3 | 2 |
| CZ | 120 | 135 | 65 | 51 | 46 | 70 | 46 | 142 | 75 | 56 | 48 |
| DK | 62 | 62 | 31 | 30 | 22 | 34 | 24 | 62 | 30 | 26 | 20 |
| EE | 47 | 48 | 24 | 22 | 10 | 28 | 11 | 45 | 22 | 19 | 10 |
| FI | 82 | 76 | 53 | 50 | 41 | 53 | 41 | 77 | 52 | 49 | 39 |
| FR | 624 | 622 | 326 | 278 | 236 | 326 | 236 | 635 | 363 | 294 | 243 |
| DE | 480 | 479 | 303 | 241 | 209 | 308 | 212 | 506 | 324 | 253 | 222 |
| GR | 264 | 259 | 63 | 47 | 37 | 63 | 37 | 253 | 64 | 46 | 36 |
| HU | 66 | 72 | 42 | 28 | 23 | 46 | 26 | 94 | 44 | 29 | 25 |
| IE | 63 | 63 | 34 | 33 | 27 | 39 | 29 | 65 | 36 | 34 | 29 |
| IT | 436 | 437 | 253 | 197 | 171 | 285 | 178 | 441 | 273 | 201 | 176 |
| LV | 38 | 38 | 24 | 22 | 12 | 24 | 12 | 26 | 18 | 15 | 8 |
| LT | 48 | 45 | 31 | 24 | 15 | 33 | 16 | 41 | 30 | 22 | 15 |
| LU | 10 | 9 | 4 | 4 | 3 | 4 | 3 | 8 | 4 | 4 | 3 |
| MT | 6 | 5 | 1 | 1 | 1 | 1 | 1 | 5 | 1 | 1 | 0 |
| NL | 93 | 97 | 59 | 55 | 51 | 58 | 50 | 101 | 59 | 54 | 50 |
| PL | 614 | 700 | 411 | 279 | 238 | 411 | 238 | 724 | 427 | 294 | 241 |
| PT | 144 | 141 | 69 | 44 | 34 | 69 | 34 | 130 | 77 | 45 | 36 |
| RO | 359 | 397 | 161 | 95 | 78 | 170 | 81 | 379 | 152 | 87 | 64 |
| SK | 76 | 74 | 37 | 24 | 19 | 38 | 20 | 72 | 42 | 24 | 18 |
| SI | 35 | 34 | 18 | 9 | 8 | 18 | 8 | 29 | 12 | 8 | 7 |
| ES | 631 | 688 | 288 | 195 | 154 | 288 | 154 | 733 | 296 | 186 | 153 |
| SE | 65 | 69 | 51 | 50 | 37 | 51 | 37 | 69 | 50 | 48 | 36 |
| UK | 480 | 479 | 201 | 144 | 127 | 205 | 129 | 509 | 237 | 167 | 147 |

1) National submission as of 2014, adjusted to the GAINS source coverage

## 7.3 Emissions control costs

Table 7.13: Emission control costs (on top of current legislation) of the WPE 2014 analyses compared with the calculations for the COM 2013 proposal (€ million/year)

| | WPE 2014 GAINS analysis | | COM 2013 GAINS analysis | | Difference | |
|---|---|---|---|---|---|---|
| | Optimized | MTFR | Optimized | MTFR | Optimized | MTFR |
| EU | 2232 | 40996 | 3331 | 50575 | -1098 | -9579 |
| AT | 16 | 813 | 66 | 1099 | -50 | -286 |
| BE | 87 | 793 | 110 | 853 | -23 | -60 |
| BG | 45 | 485 | 67 | 752 | -22 | -267 |
| HR | 22 | 365 | 26 | 440 | -5 | -76 |
| CY | 0 | 54 | 0 | 47 | 0 | 7 |
| CZ | 43 | 975 | 106 | 1269 | -63 | -294 |
| DK | 2 | 677 | 18 | 814 | -16 | -137 |
| EE | 1 | 291 | 4 | 363 | -3 | -72 |
| FI | 3 | 799 | 5 | 1035 | -2 | -237 |
| FR | 132 | 6373 | 289 | 7828 | -158 | -1455 |
| DE | 316 | 5531 | 489 | 5702 | -173 | -170 |
| GR | 40 | 936 | 51 | 1142 | -10 | -206 |
| HU | 50 | 556 | 72 | 697 | -21 | -140 |
| IE | 3 | 530 | 8 | 518 | -5 | 12 |
| IT | 299 | 3382 | 418 | 3967 | -119 | -585 |
| LV | 1 | 473 | 2 | 613 | -1 | -140 |
| LT | 7 | 539 | 14 | 664 | -7 | -125 |
| LU | 1 | 46 | 2 | 45 | -1 | 1 |
| MT | 0 | 16 | 0 | 17 | 0 | -1 |
| NL | 22 | 907 | 47 | 965 | -26 | -58 |
| PL | 557 | 4909 | 638 | 6849 | -82 | -1939 |
| PT | 40 | 620 | 67 | 922 | -27 | -303 |
| RO | 160 | 2033 | 180 | 3010 | -20 | -977 |
| SK | 52 | 674 | 78 | 852 | -27 | -177 |
| SI | 32 | 130 | 34 | 147 | -2 | -17 |
| ES | 128 | 4483 | 231 | 5130 | -102 | -647 |
| SE | 1 | 521 | 4 | 635 | -3 | -114 |
| UK | 173 | 3084 | 303 | 4199 | -130 | -1116 |