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Air quality

Complementary Impact Assessment on interactions between EU air quality policy and climate and energy policy

STUDY

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Complementary Impact Assessment
on interactions between EU air quality policy and climate and energy policy

Air quality

Commission proposal for a Directive of the European Parliament and the Council on the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC
(COM(2013)0920 final)

Study by
International Institute for Applied Systems Analysis

Abstract

This study was undertaken at the request of the European Parliament's Committee on Environment, Public Health and Food Safety. It provides a complementary impact assessment, exploring the interactions between the European Union’s air quality policy and the proposed EU climate and energy policy. It shows that reduced consumption of polluting fuels resulting from the climate and energy targets that have been put forward by the European Commission in early 2014 (i.e., a 40% reduction in GHGs, a share of 27% renewables, and a 30% improvement of energy efficiency compared to the 2007 baseline), would reduce premature mortality from fine particulate matter in the EU and make further air quality improvements less costly.

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Abbreviations

bn/yr	billion/year
CEP	Climate and Energy Policy scenario (see Table 1)
CLE	Current legislation on air pollution controls
CO_2	Carbon dioxide
ETS	(Greenhouse gas) Emission Trading System
GAINS	Greenhouse gas – Air pollution Interactions and Synergies model
GHG	Greenhouse Gas
kt	kilotons
MTFR	Maximum Technically Feasible Reductions
NEC	National Emission Ceilings
NH_3	Ammonia
NO_x	Nitrogen oxides
PJ	Petajoules
PM2.5	Fine particulate matter with an aerodynamic diameter of < 2.5 µm
PRIMES	PRIMES energy model
REF	PRIMES 2013 REFERENCE scenario (see Table 1)
SO_2	Sulphur dioxide
toe	ton of oil equivalent
TSAP	Thematic Strategy on Air Pollution
VOC	(Non-methane) Volatile organic compounds
YOLLs	Years of Life Lost

Executive summary

In late 2013, the European Commission proposed national emission ceilings that should reduce premature mortality from fine particulate matter by 52% in 2030 compared to 2005, and yield additional 2.22 million life years to the European population annually.

Climate and energy efficiency policy measures also reduce emissions of air pollutants, with immediate benefits for human health and ecosystems. At the same time, lower fuel consumption from such measures will also decrease the need and costs for installing air pollution controls.

The impact assessments supporting the Commission's proposal on the Clean Air Policy package and the Communications on the Climate and Energy Framework as well as on Energy Efficiency have referred to these interactions. However, due to the different timings of the proposals, these interactions were not comprehensively quantified, and potential savings in air pollution control costs under a possibly more stringent future climate and energy policy were not fully taken into account when setting the targets for the Clean Air Policy package.

This paper compares costs for achieving air quality improvements in a scenario that closely resembles the recently proposed climate and energy targets[1] against those presented in the Commission's air quality impact assessment that did not consider these targets.

It concludes that in 2030, under the CLIMATE AND ENERGY POLICY scenario, the 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 7% 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.

In 2025, an economically optimal ambition level would save annually 114,000 life years more compared to the level discussed in the impact assessment of the Clean Air Policy package. At costs of €1.7 bn/yr (equivalent to 0.012% of EU-28

[1] i.e., reducing GHG emissions by 40% GHG, achieving a 27% share in renewable energy, and a 30% improvement in energy efficiency by 2030.

GDP), the additional measures would yield health benefits between €6.6 bn/yr and €39.6 bn/yr.

In 2020, an economically optimal strategy would save annually 680,000 – 870,000 life years compared to the revised Gothenburg Protocol, with benefits ranging between €40 bn/yr and €300 bn/yr.

1 Introduction

1.1 Background

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.

On 18 December 2013, the European Commission adopted a proposal for a Directive of the European Parliament and the Council on the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC (EC 2013a). The proposal contains quantitative emission ceilings, informed by an analysis of the marginal costs and benefits of potential emission reduction measures, based on the PRIMES 2013 REFERENCE energy scenario. Reflecting the state of energy policies at the time when the air quality policy proposal was made, this scenario is a projection of energy and transport trends, including measures in climate, energy and transport-related areas that have been adopted by spring 2012.

On 22 January 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 and a 27% share of renewable energy 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).

The impact assessments supporting the Commission's proposal on the Clean Air Policy package (EC 2013b) and the Communications on the Climate and Energy Framework (EC 2014c) as well as on Energy Efficiency (EC 2014d), have all referred to the interactions between climate and air quality policies. However, due to the different timings of these proposals, these interactions were not comprehensively quantified, and the potential savings in air pollution control costs under a possibly more stringent future climate and energy policy were not fully taken into account when setting the proposed ambition level of the Clean Air Policy package.

For this reason, the European Parliament's Environment Committee has asked for complementary information and analysis, in particular on air pollution emission control impacts and costs that would emerge under the assumptions of the proposed 2030 Climate and Energy Framework, as set out in the Commission Communication 'A policy framework for climate and energy in the period from 2020 to 2030' (EC 2014a). Specifically, the Committee requested a scenario that explores the potential interactions between the EU's air quality and climate and energy policies, and to identify the economically optimal 'gap-closure'[2] based on an analysis of marginal costs and benefits of air quality policy measures in 2020, 2025 and 2030.

1.2 Objectives

This paper explores the interactions between the Union's air quality policy and its climate and energy policy up to the year 2030. Based on a scenario that closely resembles the recently proposed climate and energy targets[3], the paper compares the costs for achieving air quality improvements under these targets against those presented in the Commission's air quality impact assessment that relied on the so-called PRIMES 2013 REFERENCE scenario. It also identifies economically optimal ambition levels based on an analysis of marginal costs and benefits of air quality policy measures.

1.3 Structure of this paper

This report is organized as follows: Section 2 discusses briefly the methodology. Section 3 reviews the key features of the CLIMATE AND ENERGY POLICY scenario that has been developed for this study, and explores its implications on further improvements of premature mortality from air pollution in Europe. Conclusions are drawn in Section 4.

[2] As in the Commission's impact assessment on the Air Quality Policy package, 'gap closure' refers to the relative improvements in health impacts that is attained by a scenario between the 'current legislation' (business as usual) case and what could be achieved with the maximum technically feasible emission reductions.

[3] i.e., reducing GHG emissions by 40% GHG, achieving a 27% share in renewable energy, and a 30% improvement in energy efficiency by 2030.

2 Methodology

Stringent climate and energy efficiency policies will reduce the consumption of polluting fuels, which in turn will lower costs for further air pollution control measures (e.g., Barker et al. 2007; Stocker 2014). To illustrate this interplay between energy, climate and air quality policies, this paper compares air pollution control costs and health impacts of a new scenario that resembles the targets of the recent energy and climate proposals of the European Commission against the original estimates of the Clean Air Policy proposal presented in the Commission's impact assessment (EC 2013b) and in TSAP Report #11 (Amann et al. 2014a).

2.1 Approach

To facilitate full comparability with the final policy scenario documented in TSAP Report #11, the same model tool, databases and assumptions have been employed here. The only difference is the CLIMATE AND ENERGY POLICY energy scenario, which replaces the PRIMES 2013 REFERENCE scenario as an input to the GAINS model (see below). It is important to note that the CLIMATE AND ENERGY POLICY scenario employed for this study has also been developed with the same PRIMES energy modelling tool (E3MLab 2010) as the PRIMES 2013 REFERENCE scenario. This means that, here too, all methodological approaches, technological and macro-economic assumptions and input data have been maintained, with the only difference being the inclusion of the proposed new climate and energy efficiency policy measures. Based on bilateral consultations with experts from all 28 Member States, recent work in the European Council reviewed and updated the GAINS emission inventories for 2005 to reflect the 2014 national submissions (Amann et al. 2014b). However, in order to maintain consistency with the Commission impact assessment and TSAP Report #11, the analyses in this paper are based on the original version of the GAINS databases and do not reflect the latest updates.

2.2 The modelling tool

For the Clean Air Policy proposal, the comparison of marginal costs and benefits was carried out with the GAINS (Greenhouse gas – Air pollution Interactions and Synergies) model system (Amann et al. 2011). Capturing the important interactions between the various pollutants and air quality impacts, GAINS simulates the multiple impacts of policy actions that influence future driving forces (e.g., energy consumption, transport demand, agricultural activities), and of dedicated (technical) measures to reduce emissions to the atmosphere.

The GAINS model provides for all countries and economic sectors estimates of the costs of several hundred specific emission control measures. Cost data for specific technologies are taken from the international literature[4] and include up-front

[4] An in-depth documentation of the GAINS methodology and data sources is provided in

investments, capital costs and operating expenditures. Estimates for individual technologies have been adjusted for country-specific circumstances that lead to objective differences in costs (e.g., annual capacity utilization, differences in plant sizes, etc.).

GAINS represents the cause-effect chains for health impacts, vegetation damage and climate change taking into account sources, control potentials and associated costs for five air pollutants and six greenhouse gases. Most relevantly for this analysis, following advice of the World Health Organization (WHO 2013), the calculation of premature mortality from fine particulate matter (PM2.5) considers population exposure to ambient PM2.5 caused by emissions of primary particulate matter and the precursor emissions of secondary formed particles, i.e., sulphur dioxide (SO_2), nitrogen oxides (NO_x), ammonia (NH_3) and volatile organic compounds (VOC).

Following the 'impact pathway approach' (Holland et al. 2008), computed health impacts can be translated into economic loss figures based on a well-established literature of contingent valuation studies. However, in view of the prevailing uncertainties with the monetary valuation of benefits, the European Commission in its impact assessment for the Clean Air Policy proposal has adopted a deliberately cautious approach by considering only adult mortality from PM and ozone, and by applying the most conservative valuation method (median estimate of the value of a statistical life year). Thereby, monetary benefits presented in TSAP Report #11, and also in this paper, exclude infant mortality, reduced morbidity and all non-health related impacts from better air quality, such as higher protection of biodiversity, reduced crop and timber losses, lower material damage, etc.

The representation of scientific information in GAINS has been peer reviewed, and national input data have been extensively validated by experts from Member States and industrial stakeholders in bilateral consultations in 2012 (see, e.g., http://gains.iiasa.ac.at/ and www.ec4macs.eu). However, as mentioned above, in order to maintain consistency with the air quality impact assessment and TSAP Report #11, this paper does not include the recent updates of the GAINS databases following the recent bilateral consultations with experts from all 28 Member States.

2.3 Key assumptions

In the interest of comparability with the final policy scenarios presented in TSAP Report #11 (Amann et al. 2014a), as requested by the European Parliament's Environment Committee, all assumptions of the earlier analysis (listed in

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http://www.ec4macs.eu/content/report/EC4MACS_Publications/MR_Final%20in%20pdf/GAINS_Methodologies_Final.pdf

Section 3 of the TSAP Report #11) are maintained unchanged. This includes the assumptions of transposition of EU-wide air quality legislation into national laws and full compliance by all Member States according to the foreseen time schedule. The only difference in this report, compared to TSAP Report #11, is the CLIMATE AND ENERGY POLICY scenario, which has been used instead of the PRIMES 2013 REFERENCE scenario.

One important caveat is that the GAINS analysis relies mainly on the technical measures available in 2012, with no cost adjustment or other allowance for learning over time. Furthermore, estimates of emission control costs derived by GAINS do not reflect the potential for further structural changes in the energy, transport and agriculture sectors beyond what is assumed in the CLIMATE AND ENERGY POLICY scenario, nor for geographically-targeted local measures.

2.4 Comparing marginal costs and marginal benefits

According to economic theory, an optimal allocation of resources will seek to maximize net benefits, which occurs, in this context, at the point where marginal benefits of further emission reductions equal marginal costs (e.g., Pearce 1987). Along this line, the choice of ambition level by the European Commission for the proposed national emission ceilings has been informed by a comparison of the marginal health benefits delivered by the proposed emission reduction measures against their marginal costs[5].

The evolution of marginal costs of further emission reductions depends not only on the unit costs and emission removal efficiencies of the various emission reduction measures, but also on the volumes of emission generating sources that determines the potentials for applying the available measures. Thereby, marginal costs are different for different energy projections. For this study, marginal cost curves have been developed for the CLIMATE AND ENERGY POLICY scenario, and compared against those of the PRIMES 2013 REFERENCE scenario.

As for the Commission's impact assessment, cost curves have been elaborated with the GAINS optimization tool, which identifies, for a given projection of economic activities, the portfolio of emission control measures (by Member State, economic sector and pollutant) that would meet a given health target at least cost (Wagner et al. 2013). The evolution of marginal emission control costs for increasingly stringent health targets can be derived from iterative optimization analyses, ranging from the 'current legislation' case (CLE), without additional measures, to the 'maximum technically feasible reductions' (MTFR), with full implementation of all available additional measures (but excluding premature

[5] However, in the interest of a balanced distribution of costs across economic sectors, in the finally proposed set of emission ceilings the European Commission deviated from the theoretical optimum identified in the impact assessment.

scrapping of existing installations and equipment). The scenarios analyzed in this report are characterized in Table 1.

Table 1: List of scenarios considered in this paper

Acronyms in this report	Energy projection	Air pollution controls	Corresponds to TSAP Report #11
REF CLE	PRIMES 2013 REFERENCE (the 'Reference Scenario' in Table 2 of page 41 in EC 2014c)	Current legislation (CLE), (see page 6 in TSAP Report #11)	CLE (see page 6 in TSAP Report #11)
REF MTFR	PRIMES 2013 REFERENCE (the 'Reference Scenario' in Table 2 of page 41 in EC 2014c)	Maximum technically feasible reductions (MTFR)	MTFR (see page 8 in TSAP Report #11)
CEP CLE	CLIMATE AND ENERGY POLICY (the 'GHG40/EE Scenario' in Table 2 of page 41 in EC 2014c)	Current legislation (CLE) (see page 6 in TSAP Report #11)	Developed for this study
CEP MTFR	CLIMATE AND ENERGY POLICY (the 'GHG40/EE Scenario' in Table 2 of page 41 in EC 2014c)	Maximum technically feasible reductions (MTFR)	Developed for this study

2.5 The 'gap closure' as a metric for the health ambition level of a scenario

Maintaining the nomenclature of the Commission's impact assessment and TSAP Report #11, the ambition level of an emission control scenario is quantified by its 'gap closure' percentage. This term reflects the improvement in health impacts (reduced premature mortality) that is attained by a scenario relative to the space offered by all additional measures. The business as usual 'current legislation' (CLE) case represents a 0% gap closure, and the maximum technically feasible emission reductions (MTFR), i.e., what could be achieved with all additionally available technical measures, the 100% gap closure.

With this definition, the gap (closure) relates to the scope for further improvements under a specific (energy) scenario, and is therefore different for different scenarios. To facilitate direct comparability with the Commission's air quality impact assessment and TSAP Report #11, unless otherwise mentioned, gap closure percentages in the text and on the x-axes of the graphs of this paper refer to the PRIMES 2013 REFERENCE scenario.

3 The climate and energy policy scenario

To illustrate potential consequences of the most recent climate and energy policy proposal of the European Commission, at the time of writing, the present paper adopts as its CLIMATE AND ENERGY POLICY scenario the so-called 'GHG40/EE' scenario presented in the impact assessment of the Commission Communication on 'A policy framework for climate and energy in the period from 2020 up to 2030' (see Table 2 on page 40 of EC 2014c). Developed with the same PRIMES energy modelling tool, and based on the same technological and macro-economic assumptions as the PRIMES 2013 REFERENCE scenario, the GHG40EE scenario resembles closely the proposed climate and energy policy targets for 2030. In particular, the CLIMATE AND ENERGY POLICY scenario employed for this study provides for a 40% lower GHG emissions compared to 1990, a share of renewable energy of 26.4%, and a 29.3% improvement in energy efficiency compared to the 2007 baseline projection. This reflects a medium ambition in terms of GHG emission reductions, which is mainly enabled by explicit ambitious energy efficiency policies that ensure progress by addressing market imperfections and failures. Fuel shifts, energy savings and non-energy related emission reductions are incentivized through carbon pricing.

For the purposes of this paper, potential impacts of energy efficiency and climate measures on the agricultural sector (e.g., due to land use changes from increased biomass demand) are not considered, as no corresponding agricultural projection was readily available at the time of writing. Thus, air pollutant emissions from agriculture remain unchanged compared to the TSAP Report #11.

3.1 Energy consumption

The CLIMATE AND ENERGY POLICY scenario projects a 20% lower total primary energy consumption for the EU-28 by 2030 compared to 2005 (Figure 1). Relative to the PRIMES 2013 REFERENCE scenario, energy consumption is 10% lower in 2030, with largest differences for natural gas (-20%) and liquid fuels (−10%, see Table 2). Energy efficiency measures show largest effect in the domestic sector (inter alia, due to improved insulation of buildings), where energy consumption is 18% lower than in the REFERENCE scenario (Table 3). Although measures are assumed to kick-in before 2020, they would only fully penetrate by 2030, so that differences in 2020 and 2025 are smaller.

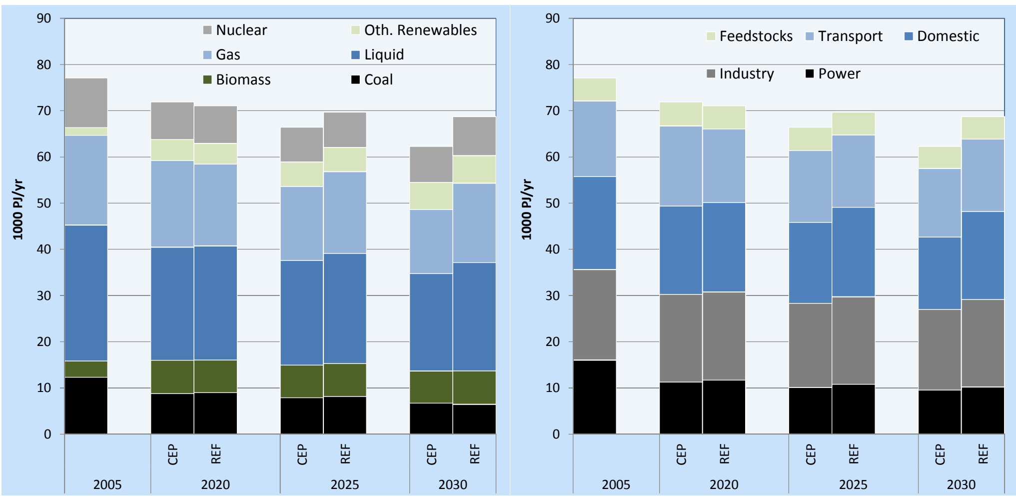
Table 2: Projections of energy consumption by fuel for the CLIMATE and ENERGY POLICY (CEP) and PRIMES 2013 REFERENCE (REF) scenarios (EU-28, 1000 PJ)

	2005	2020		2025		2030	
		CEP	REF	CEP	REF	CEP	REF
Coal	12.3	8.8	9.0	7.9	8.2	6.7	6.5
Oil	29.4	24.5	24.7	22.6	23.8	21.1	23.4
Gas	19.4	18.7	17.7	16.0	17.7	13.9	17.2
Nuclear	10.8	8.1	8.1	7.5	7.6	7.8	8.4
Biomass	3.6	7.2	7.1	7.1	7.1	6.9	7.2
Oth.renew.	1.6	4.6	4.4	5.3	5.3	5.9	6.0
Total	77.1	71.9	71.0	66.4	69.7	62.3	68.7

Table3: Projections of energy consumption by sector for the CLIMATE AND ENERGY POLICY (CEP) and PRIMES 2013 REFERENCE (REF) scenarios (EU-28, 1000 PJ)

	2005	2020		2025		2030	
		CEP	REF	CEP	REF	CEP	REF
Power sector	16.0	11.3	11.7	10.1	10.8	9.5	10.2
Households	20.1	19.1	19.4	17.5	19.3	15.7	19.1
Industry	19.6	19.0	19.1	18.2	19.0	17.4	18.9
Transport	16.4	17.4	15.9	15.5	15.7	14.8	15.7
Non-energy	5.0	5.1	5.0	5.0	4.9	4.8	4.9
Total	77.1	71.9	71.0	66.4	69.7	62.3	68.7

Figure 1: Energy consumption by fuel (left panel) and by sector (right panel) of the CLIMATE AND ENERGY POLICY (CEP) and 2030 REFERENCE (REF) scenarios



3.2 Air pollution emissions and impacts under current legislation (CLE)

As a consequence of the decarbonisation measures and energy efficiency improvements, the consumption of pollution-generating fuels will decline, with direct consequences on the emissions of air pollutants. Thus, in 2030, the CLIMATE AND ENERGY POLICY scenario – with the same (current legislation) emission controls[6] as assumed in the PRIMES 2013 REFERENCE scenario – would result in 6% less SO_2 emissions, 8% less NO_x emissions, 10% less PM2.5 emissions and 4% less VOC emissions (Table 4). Since both scenarios assume full implementation of current legislation on air pollution controls, differences result exclusively from different levels and patterns of energy consumption.

This would lead to lower human exposure to air pollution, and gain annually 138,000 life years, extending life expectancy of the European citizens by 11.5 million life years in total.

Furthermore, less combustion of fossil fuels will also reduce the need for installing emission control equipment, and thereby cut costs for implementation of such emission controls by €3.6 bn/yr (or 4%) compared to the PRIMES 2013 REFERENCE case.

Table 4: Current legislation (CLE) emissions of air pollutants (in kt), air pollution control costs (in billion €/yr) and health impacts[7] from PM of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios (EU-28). Percentage differences of the CEP case refer to the REF scenario.

	2005	Current legislation (CLE) emission projection								
		2020			2025			2030		
		CEP		REF	CEP		REF	CEP		REF
SO_2	8172	2640	*-2%*	2685	2306	*-6%*	2446	2070	*-6%*	2211
NO_x	11538	5611	*0%*	5591	4372	*-5%*	4616	3725	*-8%*	4051
PM2.5	1647	1363	*0%*	1370	1209	*-5%*	1266	1085	*-10%*	1200
NH_3	3928	3686	*0%*	3693	3656	*0%*	3658	3653	*0%*	3663
VOC	9259	5927	*-4%*	6152	5505	*-2%*	5604	5240	*-4%*	5460
Costs	47.8	80.9	*-2%*	82.7	85.7	*-3%*	88.3	86.6	*-4%*	90.2
YOLLs	358.0	237	-1%	238.2	215.4	-3%	222.3	200.9	-5%	212.4
Mio life years/yr	4.29	2.83	-1%	2.80	2.58	-3%	2.66	2.40	-5%	2.54

The energy scenario assumes deployment of the climate and energy measures from 2015 onwards, but it will take up to 2030 to fully penetrate the market and show full effects. Thus, differences to the PRIMES 2013 REFERENCE scenario are smaller in 2020 and 2025 than in 2030.

[6] See page 6 in TSAP Report #11.

[7] Totel shortening of life span of EU population living in 2030 (Years of life lost, YOLL), and life years lost annually

3.3 Costs and benefits of further emission reductions in 2030

3.3.1 The scope for further emission reductions

Implementation of the proposed climate and energy measures would not only lead to lower air pollutant emissions under 'current legislation' assumptions, but affect also the potential and costs for additional air quality improvements. In particular, the lowest emission levels that are achievable through a combination of climate policy and additional air pollution controls would decrease to a similar extent to the CLE emissions (Table 5). As a consequence, in 2030, SO_2 emissions could be reduced by up to 84% compared to 2005, NO_x by 76%, and PM2.5 and VOC by 66%. In comparison to 2005, this would increase life expectancy on average by five months, and gain an additional 211 million life years for the European population (2.5 million years annually), constituting a 59% cut of premature mortality.

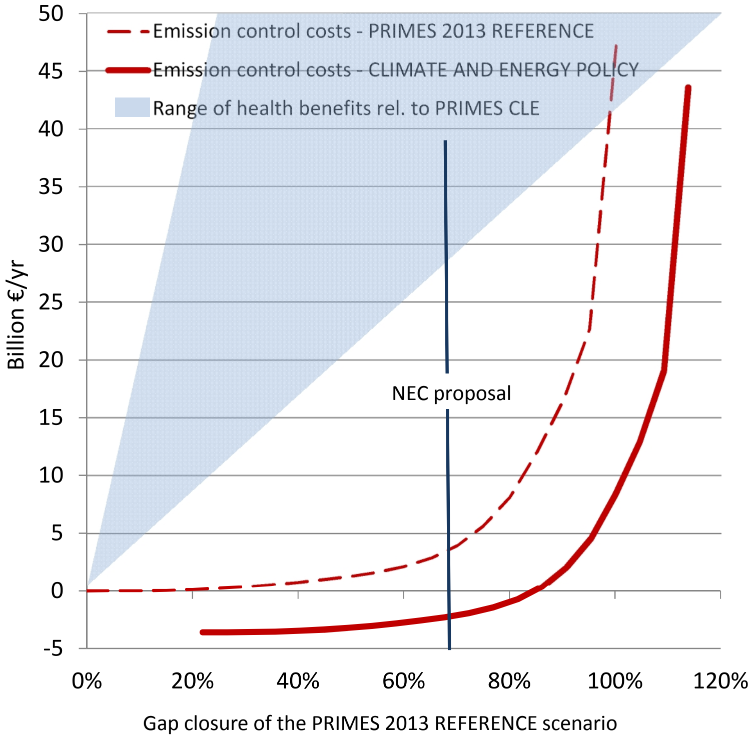
Table 5: 'Maximum Technically Feasible Reductions' (MTFR) emissions of air pollutants (in kt), air pollution control costs (in billion €/yr) and health impacts from PM of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios (EU-28). Percentage differences of the CEP case refer to 2005.

	2005	Maximum technically feasible emission reductions (MTFR)							
		2020		2025			2030		
		CEP		CEP		REF	CEP		REF
SO_2	8172	1744	*-79%*	1499	*-82%*	1589	1304	*-84%*	1382
NO_x	11538	4357	*-62%*	3361	*-71%*	3527	2726	*-76%*	2948
PM2.5	1647	814	*-51%*	664	*-60%*	693	565	*-66%*	565
NH_3	3928	2588	*-34%*	2565	*-35%*	2566	2560	*-35%*	2568
VOC	9259	3617	*-61%*	3276	*-65%*	3308	3118	*-66%*	3191
Costs	47.8	127.9		130.6		135.4	132.0		140.7
YOLLs	358.0	177.5	*-50%*	158.6	*-56%*	162.6	146.8	*-59%*	152.1
Mio life years/yr	4.28	2.12	*-50%*	1.90	*-56%*	1.943	1.76	*-59%*	1.82

With lower emissions already in the current legislation case and a less carbon-intensive composition of fuel use, also emission control costs for additional air quality improvements in the CLIMATE AND ENERGY POLICY scenario would be €8.7 bn/yr lower than in the PRIMES 2013 REFERENCE case.

Figure 2 compares the range of monetized health benefits against the air pollution control costs of the two scenarios. To facilitate direct comparisons with the Commission's impact assessment for the Clean Air Policy proposal and TSAP Report #11, health impacts (i.e., 2.54 million years of life lost annually) and emission control costs (€90.2 bn/yr) of the current legislation case of the PRIMES 2013 REFERENCE scenario are taken as benchmarks for the comparison. As the graph displays costs and health effects relative to these levels, costs for the CLIMATE AND ENERGY POLICY scenario start with negative values, reflecting the cost savings of €3.6 bn/yr for implementation of the current emission control legislation. Total benefits exceed costs for all available additional emission control measures for the CLIMATE AND ENERGY POLICY scenario.

Figure 2: Air pollution control costs and health benefits for the CLIMATE AND ENERGY POLICY and the PRIMES 2013 REFERENCE scenarios in 2030. To facilitate comparability with TSAP Report #11, the origin and the x-axis refer to costs, benefits and gap closure percentages of the current legislation case of the PRIMES 2013 REFERENCE scenario.



3.3.2 Achieving NECs in 2030

In its Clean Air Policy package, the European Commission suggested for 2030 a '67% gap closure'[8] target for premature mortality from PM.[9] This would save annually 2.2 million life years in Europe and increase statistical life expectancy by 4.4 months compared to 2005. In absolute terms, this target still implies annually 2.06 million life years lost due to exposure to fine particulate matter. Compared to the current legislation case of the PRIMES 2013 REFERENCE scenario (2.54 million life years lost annually), the CLIMATE AND ENERGY POLICY scenario – without further air pollution controls – would reduce health impacts to 2.4 million life years lost annually, and thereby yield as a co-benefit already 29% of the additional health improvements that are suggested in the Clean Air Policy package (Table 6).

[8] I.e., to aim for 67% of the potential improvements in health impacts that are offered by the additionally available measures, between the current legislation (CLE) and the maximum technically feasible reduction (MTFR) cases of the PRIMES 2013 REFERENCE scenario.
[9] Scenario B7 in TSAP Report #11

Table 6: Proposed emission ceilings, current legislation (CLE) baseline emissions, additional reductions (kt), emission control costs (€ bn/yr) and premature mortality (Years of Life Lost, YOLL) for achieving the proposed national emission ceilings (NEC) in 2030

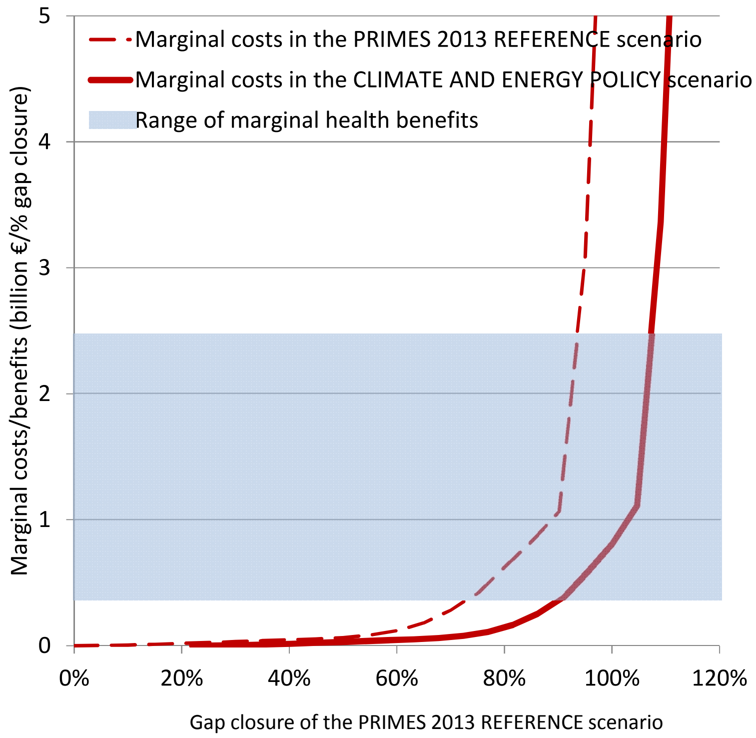
	NEC	CLIMATE AND ENERGY POLICY			PRIMES 2013 REFERENCE	
	Commission proposal for 2030 (Scenario B7 in TSAP Report #11)	CLE	Additional reductions to meet NECs	Reduced need for additional reductions comp. to REF	CLE	Additional reductions to meet NECs
SO_2	1530	2070	540	*-21%*	2211	681
NO_x	3599	3725	126	*-72%*	4051	452
PM2.5	804	1085	281	*-29%*	1200	396
NH_3	2871	3653	783	*-1%*	3663	792
VOC	4598	5240	642	*-26%*	5460	862
Costs		86.6	1.4		90.2	3.3
YOLL	172.0	200.9	28.9	*-29%*	212.4	40.4
Mio life years/yr	2.06	2.40	0.35	*-29%*	2.54	0.48

For achieving the proposed emission ceilings, the remaining need for additional emission reductions would shrink by 72% for NO_x, by 29% for PM2.5, by 26% for VOC and by 21% for SO_2. This would reduce costs for additional measures from €3.3 bn/yr to €1.4 bn/yr. Because costs for the implementation of current pollution control legislation are also lower, total air pollution control costs for attaining the proposed NECs would decline from €93.5 bn/yr to €88.0 bn/yr, i.e., by €5.5 bn/yr or 5.7%. Thus, costs for achieving the proposed NECs would be €2.2 bn/yr below the costs for the current legislation case of the PRIMES 2013 REFERENCE scenario, which have been used as the benchmark for the cost analysis in the Commission's air quality impact assessment and in the TSAP Report #11.

3.3.3 The economically optimal ambition level in 2030

Although total benefits exceed (total) costs for the full range of emission controls in the CLIMATE AND ENERGY POLICY scenario (Figure 2), according to economic theory an optimal allocation of resources will seek to maximize net benefits. This occurs at the point where marginal benefits of further emission reductions equal marginal costs.

Figure 3: Marginal air pollution control costs and marginal health benefits for the CLIMATE AND ENERGY POLICY and the PRIMES 2013 REFERENCE scenarios in 2030.



While marginal health impacts remain the same, in the CLIMATE AND ENERGY POLICY scenario, current air pollution legislation would result in lower emissions. Additional measures would then start from a lower level of health impacts (corresponding to a 29% gap closure of the PRIMES scenario), and extend up to a 115% gap closure on the CLE – MTFR scale of the PRIMES 2013 REFERENCE scenario.

For the PRIMES 2013 REFERENCE case, a comparison of the marginal costs of increasingly stringent gap closure targets for human health with their marginal benefits reveals a range for the optimal ambition level between a 75% and 92% gap closure, depending on the choice of the methodology for the benefit assessment (Figure 3). Based on other considerations (e.g., the distribution of costs across sectors and Member States), the European Commission proposed a 67% gap closure as the ambition level for 2030.

In the CLIMATE AND ENERGY POLICY scenario, the economically optimal level would shift to a range between a 92% and 106% gap closure of the REFERENCE scenario. This corresponds to a 75% - 92% gap closure of the CLE - MTFR range of the CLIMATE AND ENERGY POLICY scenario, or to a range between 1.79 and 1.91 million years of life lost annually[10].

Employing the most conservative monetization of premature mortality, for the CLIMATE AND ENERGY POLICY scenario a target of 1.79 million YOLLs (i.e., a 75% gap closure for this scenario) emerges then as the economically rational ambition level in 2030. This would reduce premature mortality by 55% compared to 2005. Thereby, the

[10] Health benefits are expressed in avoided premature mortality, i.e., years of life lost (YOLLs).

remaining health damage would be 7% lower, saving annually 140,000 life years, compared to what is implied by the proposed national emission ceilings.

At the same time, these larger health improvements could be achieved at lower costs than what has been estimated for the emission ceilings proposed by the European Commission (Table 7). On top of current legislation (€86.6 bn/yr), costs for additional measures would amount to €4.7 bn/yr, totaling €91.3 bn/yr. This is €2.2 bn/yr bn lower than the €93.5 bn/yr of the original proposal, composed of €90.2 bn/yr for current legislation and €3.3 bn/yr for additional measures. Relative to the reference point in the Commission's air quality impact assessment and the TSAP Report #11[11], i.e., the costs of current legislation in the PRIMES 2013 REFERENCE scenario, additional costs for achieving the economically optimal level in the CLIMATE AND ENERGY POLICY scenario (€1.1 bn/yr) would be two-thirds lower than costs for the original NEC proposal (€3.3 bn/yr).

This scenario would gain an additional 140,000 life years annually compared to the proposed emission ceilings, which in monetary terms would amount to €8.4 - €50.8 bn/yr.

Table 7: Emission control costs in 2030 by sector (million €/yr), for the CLIMATE AND ENERGY POLICY (CEP) and PRIMES 2013 REFERENCE (REF) scenarios

	Current legislation		75% gap closure for the CEP scenario			Commission proposal
	CEP	REF	absolute costs	additional to CLE of CEP	additional to CLE of REF	(67% gap cl.) additional to CLE of REF
Power generation	7728	7124	8225	498	1101	228
Domestic sector	6805	8928	8449	1644	-479	1372
Ind. combust.	2396	2567	3067	671	500	499
Ind. processes	4945	5032	5282	338	250	280
Fuel extraction	602	619	607	5	-12	0
Solvent use	1147	1147	1205	59	59	39
Road transport	50921	52633	50921	0	-1712	0
Non-road mobile	10248	10331	10412	164	81	127
Waste treatment	1	1	10	9	9	9
Agriculture	1784	1784	3121	1336	1336	779
Total costs	86576	90165	91299	4723	1133	3331

Notwithstanding the lower emission control costs, the corresponding emission levels would also be clearly below the ceilings proposed by the European Commission. For the EU-28 as a whole, SO_2 emissions would be 8% below the NEC proposal, NO_x emissions 11%, emissions of primary PM2.5 13%, and NH_3 and VOC approximately 4% below (Table 8). This is due to (a) the lower mitigation costs in the CLIMATE AND ENERGY POLICY scenario, and (b) the deviation, in the Commission proposal, from the economically optimal ambition level.

[11] The 'Current legislation' (CLE) scenario for 2030 in TSAP Report #11.

Table 8: Emissions of the 75% gap closure scenario in 2030, for the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios (kilotons and rel. to 2005)

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal (B7 in TSAP #11)	
		CEP		REF					
SO_2	8172	2070	*-75%*	2211	*-73%*	1413	*-83%*	1530	*-81%*
NO_x	11538	3725	*-68%*	4051	*-65%*	3212	*-72%*	3599	*-69%*
PM2.5	1647	1085	*-34%*	1200	*-27%*	700	*-58%*	804	*-51%*
NH_3	3928	3653	*-7%*	3663	*-7%*	2749	*-30%*	2871	*-27%*
VOC	9259	5240	*-43%*	5460	*-41%*	4394	*-53%*	4598	*-50%*

3.4 Costs and benefits of further emission reductions in 2025

While the Commission proposal specifies emission ceilings for 2030, the ambition level of these ceilings has been derived from extensive cost-benefit analyses for 2025, for the PRIMES 2013 REFERENCE scenario. Obviously, the CLIMATE AND ENERGY POLICY scenario would change the cost basis for such an analysis, although to a lesser extent than in 2030 as the additional climate policy measures would not fully unfold in 2025. With current air pollution control legislation, SO_2 emissions would be 6% lower than in the PRIMES 2013 REFERENCE scenario, NO_x and PM2.5 5% lower and VOC 2% lower (see Table).

3.4.1 Costs and benefits of further health improvements

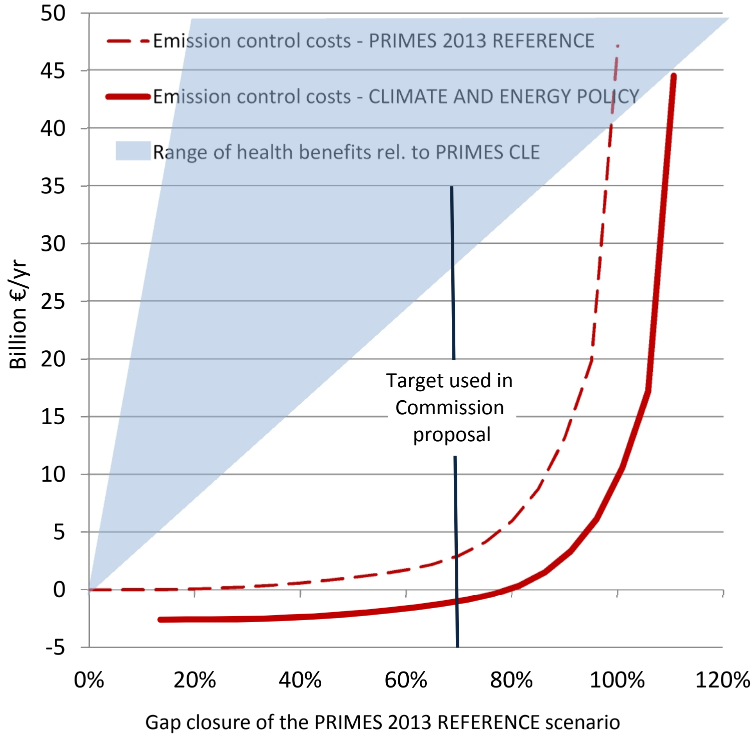
As in 2030, the modified structure and level of energy consumption in the CLIMATE AND ENERGY POLICY scenario would lower the costs for reducing health impacts from fine particulate matter compared to the PRIMES 2013 REFERENCE scenario (Figure 4). Without further air pollution controls beyond what is already laid down in current legislation, the climate and energy policy measures would save additional 82,000 life years (3.1%) annually compared to the PRIMES 2013 REFERENCE scenario. These co-benefits of the climate and energy policy make up for a 14% gap closure of the reference case. At the same time, implementation costs of current air pollution control legislation would decrease by €2.6 bn/yr, i.e., by almost 3% (Table 9).

This different starting point would also reduce costs for achieving further health improvements. For example, additional air pollution control costs for the ambition level that has been chosen by the European Commission[12] (i.e., a 70% gap closure in 2025) would decline from €3.0 bn/yr to €1.8 bn/yr. Together with the cost savings for the current legislation (i.e., €2.6 bn/yr), total air pollution control costs in the CLIMATE AND ENERGY POLICY scenario would be €0.8 bn/yr lower than in the current legislation case of the PRIMES 2013 REFERENCE

[12] Scenario B6 (page 24) in TSAP Report #11

scenario, which was taken as the reference point for the cost assessment in the Commission proposal.

Figure 4: (Total) air pollution control costs and health benefits for the CLIMATE AND ENERGY POLICY and the PRIMES 2013 REFERENCE scenarios in 2025, relative to the current legislation case of the PRIMES scenario that has been used as the benchmark in the Commission analysis.



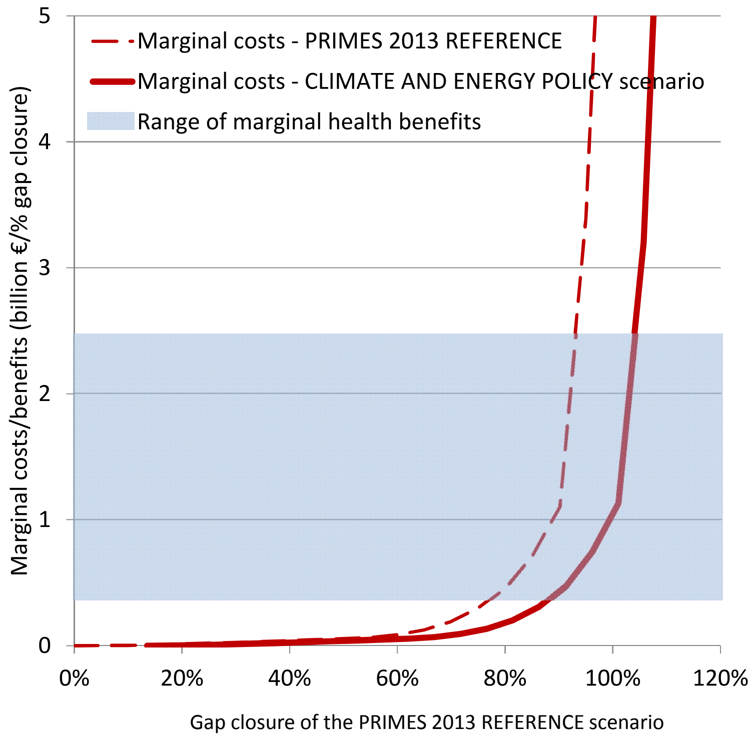
3.4.2 The economically optimal ambition level in 2025

Even in the most conservative assessment of health benefits, in 2025, benefits exceed costs in the CLIMATE AND ENERGY POLICY scenario for all technically available emission control measures that are considered in GAINS (Figure 4). However, the economically optimal ambition level is determined by the balance of marginal benefits and marginal costs (Figure 4).

For the CLIMATE AND ENERGY POLICY scenario, the maximization of net benefits occurs at between 88% and 103% of the gap closure of the PRIMES 2013 REFERENCE scenario[13]. For comparison, the optimal level for the PRIMES 2013 REFERENCE scenario ranges between 76% and 92%, and the national emission ceilings proposed by the European Commission are derived from a 70% gap closure in 2025.

[13] If measured against the gap between the CLE and MTFR cases of the CLIMATE AND ENERGY POLICY scenario, the optimal range also emerges between 75% and 92%.

Figure 5: Marginal air pollution control costs and marginal health benefits for the CLIMATE AND ENERGY POLICY and the PRIMES 2013 REFERENCE scenarios in 2025.



With the most conservative assumption on the monetization of health benefits, the economically optimal ambition level would cut premature mortality by 51% compared to 2005, although the European population would still lose annually 2.12 million life years due to the exposure to fine particulate matter. At this level, this target would save annually 114,000 life years compared to the level discussed in the impact assessment of the Clean Air Policy package.

To meet these targets, additional air pollution control measures would need to be implemented, involving costs of €4.3 bn/yr on top of the costs of the current legislation case of the CLIMATE AND ENERGY POLICY scenario (Table 9). However, as mentioned before, in this case costs for implementing current legislation are €2.6 bn/yr lower than for the PRIMES 2013 REFERENCE case, so that net costs amount to €1.7bn/yr relative to the benchmark used in the Commission analysis and the TSAP Report #11 (i.e., the current legislation case of the PRIMES 2013 REFERENCE scenario). These costs constitute about 0.012% of the envisaged GDP in 2025. At the same time, monetized health benefits are between €6.9 bn/yr and €39.6 bn/yr higher than in the Commission proposal.

In terms of emission reductions, the cost-optimal allocation of measures would cut SO_2 emissions by 80% compared to 2005, NO_x by 66%, PM2.5 by 51%, NH_3 by 29% and VOC by 50%.

Table 9: Emissions of the current legislation baseline scenarios and a 75% gap closure CEP case (kt), emission control costs (€ bn/yr) and premature mortality (Years of Life Lost, YOLL) in 2025

	2005	Current legislation 2030				75% gap closure for CEP	
		CEP		REF			
SO_2	8172	2306	-72%	2446	-70%	1600	-80%
NO_x	11538	4372	-62%	4616	-60%	3891	-66%
PM2.5	1647	1209	-27%	1266	-23%	808	-51%
NH_3	3928	3656	-7%	3658	-7%	2771	-29%
VOC	9259	5505	-41%	5604	-39%	4599	-50%
Costs	47.8	85.7		88.3		90.0	
YOLLs	358	215	-40%	222	-38%	180	-50%
Mio life years/yr	4.28	2.57	-40%	2.66	-38%	2.12	-50%

3.5 Costs and benefits of further emission reductions in 2020

The measures that are assumed in the CLIMATE AND ENERGY POLICY scenario to kick in as of 2015 would deliver co-benefits on air quality, human health and air pollution control costs already in 2020, although to a lesser extent than in later years. As requested by the European Parliament's Environment Committee, this section presents an indicative analysis of the scope for further air quality improvements in 2020. This analysis is derived from the current databases of the GAINS model, for which however an extensive validation is not available to the same degree as for the databases for 2025 and 2030. Thus, results presented here should be understood to only indicate the potential order of magnitude of interactions, but do not allow drawing firm conclusions about individual sectors or countries.

Due to the lead time for full implementation of the climate and energy efficiency measures, their impact on air pollutant emissions is much smaller in 2020 than in later years. Under current legislation assumptions, the largest differences from the CLIMATE AND ENERGY POLICY scenario emerge for VOC (−4%) and SO_2 (-2%), and health damage (annually 2.83 million years of life lost) would be one per cent lower than in the PRIMES 2013 REFERENCE case (Table 10).

Table 10: 2020 emissions (kt) and health impacts (YOLLs) implied by the emission ceilings of the Gothenburg Protocol, and from the current legislation cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios. Percentage changes refer to 2005.

	2005	Gothenburg Protocol ceilings 2020		Current legislation 2020				Economically optimal reductions 2020	
				CEP		REF			
SO_2	8172	3361	-59%	2641	-68%	2685	-67%	1882	-77%
NO_x	11538	6664	-42%	5611	-51%	5591	-52%	5156	-55%
PM2.5	1647	1279	-22%	1364	-17%	1370	-17%	962	-42%
NH_3	3928	3693	-6%	3686	-6%	3693	-6%	2878	-27%
VOC	9259	6641	-28%	5927	-36%	6152	-34%	5076	-45%
YOLLs	358	253	-29%	237	-34%	238	-34%	194	-46%
Mio life years/yr	4.28	3.02	-29%	2.83	-34%	2.84	-34%	2.32	--46%

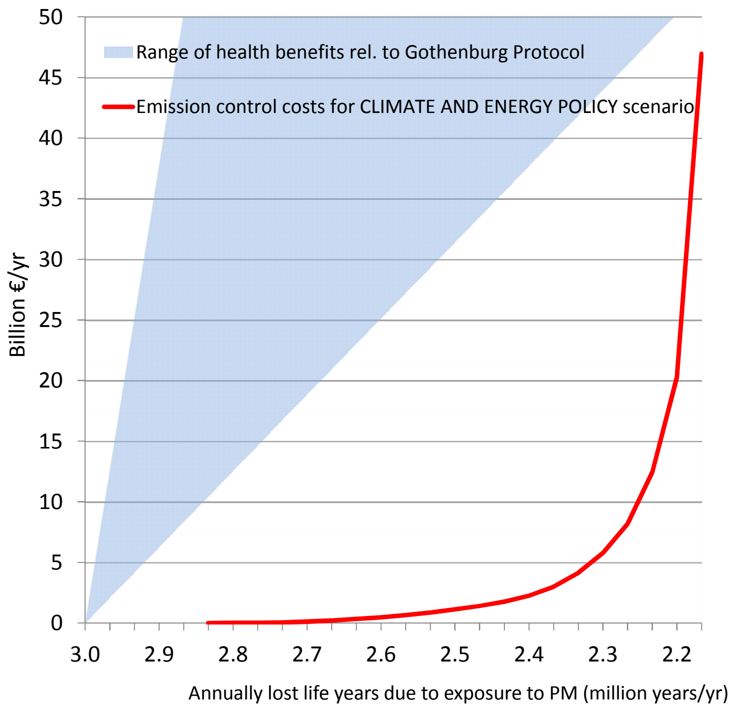
While the Commission in its Clean Air Policy package did not propose (new) emission ceilings for 2020, it suggested ratification of the revised Gothenburg Protocol, which specifies emission ceilings for 2020 (in form of emission reduction commitments relative to 2005).

For both energy scenarios, achieving the emission ceilings of the Gothenburg Protocol would require additional cuts only of the newly included primary PM2.5 emissions (-22% instead of -17% relative to 2005). The current legislation cases – without additional measures for emission controls - would significantly over-achieve the ceilings for SO_2, NO_x and VOC, and emissions would be up to 20% below the ceilings. Most importantly, remaining health damage implied by the Gothenburg ceilings are 6.7% higher (annually 710,000 life years) than what could be expected from full implementation of the measures that are already laid down in current legislation.

While this projection might provide a comforting perspective on the need for further air pollution policies, it clearly reveals an untapped potential for significant improvements of human health that could be attained by further interventions whose benefits exceed their costs by a wide margin.

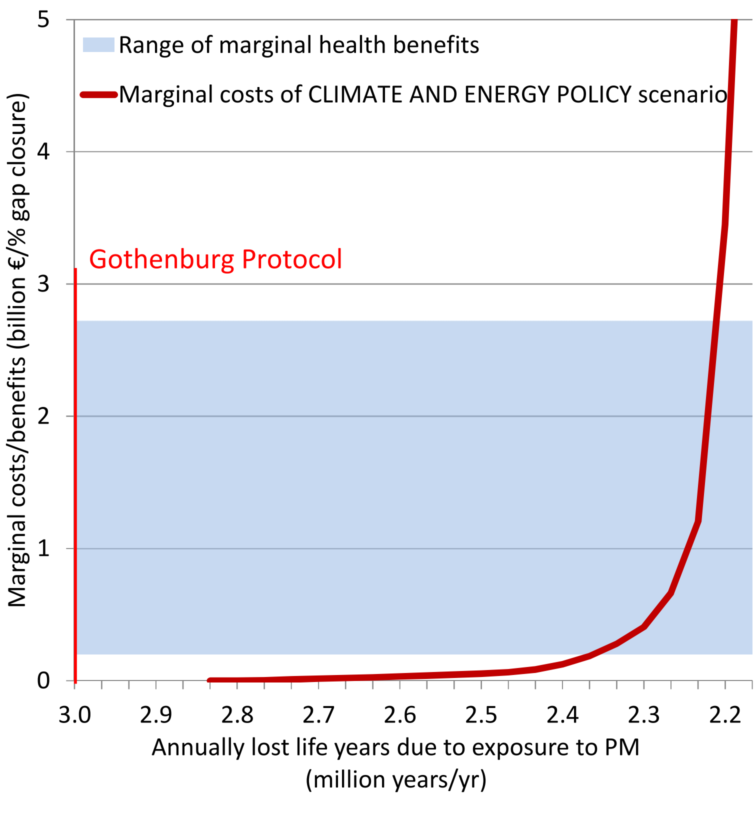
Figure 6 compares costs against benefits of further emission reductions beyond what is implied by the revised Gothenburg Protocol. While the protocol ceilings would result in 3.02 million life years lost annually, the CLIMATE AND ENERGY POLICY current legislation baseline, without further policy interventions and at no additional air pollution control costs, would reduce health damage to 2.83 million years. Considering additional technical measures which are available, health damage could be further reduced down to 2.12 million YOLLs annually in 2020.

Figure 6: (Total) air pollution control costs and health benefits for the CLIMATE AND ENERGY POLICY scenario in 2020



As mentioned above, the economically optimal ambition level for further air quality improvements emerges at the point where marginal costs equal marginal benefits. For 2020, the preliminary analysis indicates that an optimal level would save 680,000-870,000 life years annually compared to the revised Gothenburg Protocol, or 510,000-680,000 life years compared to the current legislation case, depending on the assumptions made on the valuation of human life (Figure 7, Table 10). This corresponds to health benefits between €40 bn/yr and €300 bn/yr. Matching the most conservative estimate of health benefits would involve air pollution control costs of €3.4 bn/yr (0.025% of GDP) on top of current legislation. SO_2 emissions would then be lower by 77% relative to 2005 (compared to 59% in the Gothenburg Protocol), NO_x by 55% instead of 42%, PM by 42% instead of 22%, NH_3 by 27% instead of 6%, and VOC by 45% instead of 28%. These are indicative results that should illustrate the order of magnitude for economically optimal targets in 2020. More specific analyses based on validated databases for the year 2020 would be required for more robust findings.

Figure 7: Marginal air pollution control costs and marginal health benefits for the CLIMATE AND ENERGY POLICY scenario in 2020, relative to the Gothenburg Protocol



4 Conclusions

There are important interactions between climate, energy efficiency and air quality policies

Climate and energy efficiency policies will reduce the consumption of polluting fuels, which in turn will lower air pollutant emissions and costs for further air quality improvements.

This report compares air pollution control costs and health impacts of a new scenario that closely resembles the targets of the recent energy and climate proposals of the European Commission[14] against the original estimates of the Clean Air Policy proposal presented in the Commission's impact assessment (EC 2013b) and in TSAP Report #11 (Amann et al. 2014a). To facilitate full comparability with the final policy scenario documented in TSAP Report #11, the same model tool, databases and assumptions have been employed here.

The paper adopts as its CLIMATE AND ENERGY POLICY scenario the so-called 'GHG40/EE' scenario presented in the impact assessment of the Commission's Communication on 'A policy framework for climate and energy in the period from 2020 up to 2030'[15]. In 2030, decarbonisation measures and energy efficiency improvements would reduce primary energy consumption by 20% compared to 2005, or by 10% relative to the reference scenario used for the Clean Air Policy package. Largest differences occur for natural gas (-20%) and liquid fuels (-10%).

The effects of the recently proposed climate and energy efficiency targets on air pollution are sizeable and would result in considerable co-benefits on air quality management.

As a co-benefit of the proposed climate and energy targets, these changes in energy consumption would also lead to lower air pollutant emissions. Without additional air pollution controls beyond what is laid down in current legislation, in 2030, PM2.5 emissions would be 10% lower than in the reference scenario, SO_2 emissions 6%, NO_x emissions 8%, and VOC emissions 4%. This would reduce population exposure to fine particulate matter by 5.5%, and gain 138,000 life years annually, extending life expectancy of the European citizens by 11.5 million life years in total. At the same time, less combustion of fossil fuels will also reduce the volume of required air pollution control equipment, and thereby cut control costs by €3.6 bn/yr (or 4%) compared to the reference scenario.

Under the CLIMATE AND ENERGY POLICY scenario, the proposed emission ceilings could be achieved at €2.2 bn/yr lower costs than what would be necessary for just implementing current air pollution legislation under the REFERENCE scenario.

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[14] 40% lower GHG emissions compared to 1990, a share of renewable energy of 27%, and a 30% improvement in energy efficiency compared to the 2007 baseline projection.

[15] See Table 2 on page 40 of EC 2014c

The CLIMATE AND ENERGY POLICY efficiency scenario, without further air pollution controls, would attain 27% of the health improvements that have been established by the European Commission as a target for 2030. To achieve the proposed emission ceilings, the remaining need for additional emission reductions would shrink by 72% for NO_x, by 29% for PM2.5, by 26% for VOC and by 21% for SO_2. This would reduce air pollution control costs by €5.5 bn/yr or 5.7% compared to the Commission proposal. Air pollution control costs would then be €2.2 bn/yr below the benchmark used in the Commission impact assessment and in the TSAP Report #11[16], while the health targets of the proposal (additional 40 million life years compared to the benchmark) would be fully achieved.

Under the CLIMATE AND ENERGY POLICY scenario, in 2030 an economically rational ambition would aim for a 7% more stringent health target compared to the Commission proposal, which could be achieved at 66% lower air pollution control costs. Additional health benefits would range between €8.4 bn/yr and €50.8 bn/yr.

According to economic theory, an optimal allocation of resources will seek to maximize net benefits. This occurs at the point where marginal benefits of further emission reductions equal marginal costs. With the most conservative monetization of premature mortality, in the CLIMATE AND ENERGY POLICY scenario, a target of a 75% 'gap closure' emerges as the economically optimal rational ambition level in 2030. This would reduce premature mortality by 55% compared to 2005. Remaining health damage would be 7% lower, saving annually 140,000 life years, compared to what is implied by the proposed national emission ceilings. In monetary terms, these additional health benefits would range between €8.4 bn/yr and €50.8 bn/yr.

At the same time, air pollution control costs would be €2.2 bn/yr lower than those of the Commission proposal. Compared to the benchmark in the impact assessment and TSAP Report #11, additional costs (€1.1 bn/yr) would be two-thirds lower than costs of the original NEC proposal (€3.3 bn/yr).

In 2025, an economically optimal ambition level would save annually 114,000 life years more than the level discussed in the impact assessment of the Clean Air Policy package. With costs of €1.7 bn/yr on top of the reference level of the Commissions air quality impact assessment (0.012% of GDP), the additional measures would yield health benefits between €6.6 bn/yr and €39.6 bn/yr.

Although it will take up to 2030 for the climate and energy efficiency measures to fully penetrate the market and make their full impact, co-benefits would be felt at an earlier stage.

While the Commission proposal does not contain an explicit target for 2025, an economically optimal ambition level would call for a gap closure of at least 75% in 2025. Premature mortality would be cut by 51% relative to 2005, while the

[16] I.e., costs of the current legislation case of the PRIMES 2013 REFERENCE scenario.

current legislation for the reference case would only deliver a 38% improvement. The European population would save annually 114,000 life years more than the level discussed in the impact assessment of the Clean Air Policy package, and corresponding health benefits range between €6.6 bn/yr and €39.6 bn/yr. Costs for additional air pollution control measures amount to €1.7bn/yr relative to the benchmark used in the Commission analysis and in TSAP Report #11. This constitutes about 0.012% of the envisaged GDP in 2025.

In 2020, an economically optimal strategy would save annually 680,000 – 870,000 life years compared to the revised Gothenburg Protocol, with benefits ranging between €40 bn/yr and €300 bn/yr.

For 2020, the analysis indicates that the optimum level would save 680,000 - 870,000 life years annually compared to the revised Gothenburg Protocol, or 510,000 – 680,000 million life years compared to the current legislation case. This corresponds to health benefits between €40 bn/yr and €300 bn/yr. Matching the most conservative estimate of health benefits would increase air pollution control costs by €3.4 bn/yr (4.2%) compared to current legislation.

KEY FINDINGS

- Climate and energy efficiency policy measures also reduce emissions of air pollutants, with immediate benefits for human health and ecosystems. At the same time, lower fuel consumption from such measures will also reduce costs for installing air pollution controls.
- The recent Commission proposals on climate and energy efficiency targets have significant impacts on the earlier adopted Clean Air Policy package.
- To achieve the proposed emission ceilings under the climate and energy efficiency scenario, the EU would spend €2.2 bn/yr less for air pollution controls compared to the 'current legislation' baseline, which however will fail to achieve the health targets of the Clean Air Policy proposal.
- Under the CLIMATE AND ENERGY POLICY scenario, in 2030 an economically rational ambition would aim for a 7% more stringent health target compared to the Commission proposal, which could be achieved at 66% lower air pollution control costs. The EU population would gain an additional 12 million years of life expectancy, corresponding to monetized health benefits between €8.4 bn/yr and €50.8 bn/yr.
- In 2025, an economically rational ambition level would save an additional 140,000 life years annually, compared to the current legislation situation. While additional costs for air pollution controls would amount to €1.7 bn/yr, health benefits would range between €35 and €115 bn/yr.
- Compared to the emission ceilings of the revised Gothenburg Protocol, an economically optimal strategy would save 680,000 – 870,000 life years annually in 2020, with benefits ranging between €40 bn/yr and €300 bn/yr.

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Annex A: Energy consumption by country

Table 2: Energy consumption of the CLIMATE AND ENERGY POLICY (CEP) scenario by country (PJ)

	2005	2010	2015	2020	2025	2030
Austria	1422	1450	1497	1441	1411	1383
Belgium	2561	2669	2556	2471	2252	2209
Bulgaria	849	766	754	754	761	722
Croatia	376	360	367	368	363	366
Cyprus	109	115	118	110	110	113
Czech Rep.	1875	1863	1793	1796	1777	1834
Denmark	853	856	808	763	740	746
Estonia	216	222	221	208	204	195
Finland	1462	1576	1715	1688	1719	1776
France	11646	11354	11241	10573	10319	10187
Germany	14770	14494	13498	12302	11504	10889
Greece	1341	1242	1182	1157	1084	1039
Hungary	1157	1089	1081	1059	1132	1179
Ireland	686	637	651	648	637	652
Italy	7977	7508	7303	7228	7113	7095
Latvia	192	202	208	214	217	220
Lithuania	367	288	295	299	333	361
Luxembourg	197	197	199	198	199	201
Malta	44	38	38	29	28	28
Netherlands	3451	3430	3651	3502	3377	3325
Poland	3890	4282	4622	4z811	4964	4988
Portugal	1148	1034	1019	1018	978	966
Romania	1643	1486	1533	1582	1571	1580
Slovakia	803	761	790	828	848	872
Slovenia	305	305	318	317	320	323
Spain	5968	5391	5612	5624	5882	5978
Sweden	2218	2156	2280	2296	2331	2318
UK	9673	8887	8741	7802	7566	7307
EU-28	77199	74658	74091	71085	69741	68852

Annex B: Future emissions: Current legislation and Maximum Technically Feasible Reduction cases

Emissions by sector

Table 3: Future SO_2 emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CEP	CEP	REF	CEP	REF	CEP	REF	CEP	REF
Power sector	5445	937	774	824	567	604	678	637	466	435
Domestic	623	467	340	399	214	250	222	336	144	213
Ind. combust.	1100	616	577	600	343	357	557	610	322	355
Ind. processes	743	577	563	570	340	344	562	575	338	345
Fuel extract.	0	0	0	0	0	0	0	0	0	0
Solvent use	0	0	0	0	0	0	0	0	0	0
Road transp.	36	5	5	5	5	5	5	5	5	5
Non-road	215	71	37	37	29	29	37	37	29	29
Waste	2	2	2	2	1	1	2	2	1	1
Agriculture	7	9	9	9	0	0	9	9	0	0
Sum	8172	2685	2306	2446	1499	1589	2070	2211	1304	1382

Table 4: Future NO_x emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CEP	CEP	REF	CEP	REF	CEP	REF	CEP	REF
Power sector	2879	1172	974	1055	609	638	864	906	528	517
Domestic	632	532	447	506	369	417	347	471	288	389
Ind. combust.	1253	884	872	899	476	490	877	928	475	503
Ind. processes	213	174	167	171	133	137	165	172	131	137
Fuel extract.	0	0	0	0	0	0	0	0	0	0
Solvent use	0	0	0	0	0	0	0	0	0	0
Road transp.	4905	1890	1143	1210	1143	1210	795	887	795	887
Non-road	1630	914	743	748	628	632	652	661	508	513
Waste	8	6	5	5	1	1	5	5	1	1
Agriculture	16	21	21	21	1	1	21	21	1	1
Sum	11538	5591	4372	4616	3361	3527	3725	4051	2726	2948

Table 5: Future PM2.5 emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CEP	CEP	REF	CEP	REF	CEP	REF	CP	REF
Power sector	132	63	63	60	30	28	61	53	27	21
Domestic	573	597	470	523	204	230	351	465	114	156
Ind. combust.	85	75	69	71	36	36	71	75	37	37
Ind. processes	213	199	198	199	137	138	200	201	138	139
Fuel extract.	9	7	4	7	4	7	3	6	3	6
Solvent use	0	0	0	0	0	0	0	0	0	0
Road transp.	270	115	103	104	103	104	101	102	101	102
Non-road	123	53	40	41	33	33	34	35	26	27
Waste	88	89	90	90	64	64	90	90	64	64
Agriculture	155	171	172	172	53	53	172	172	54	54
Sum	1647	1370	1209	1266	664	693	1085	1200	565	607

Table 6: Future NH_3 emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CEP	CP	REF	CP	REF	CP	REF	CP	REF
Power sector	14	25	22	24	21	22	21	23	20	20
Domestic	19	22	18	20	17	20	14	19	13	18
Ind. combust.	4	5	5	5	7	8*)	5	6	7	8*)
Ind. processes	78	75	75	75	28	28	75	75	28	28
Fuel extract.	0	0	0	0	0	0	0	0	0	0
Solvent use	0	0	0	0	0	0	0	0	0	0
Road transp.	128	54	51	48	51	48	44	46	44	46
Non-road	2	2	2	2	1	1	2	2	1	1
Waste	166	174	173	173	173	173	173	173	173	173
Agriculture	3518	3338	3311	3311	2267	2267	3319	3319	2274	2274
Sum	3928	3693	3656	3658	2565	2566	3653	3663	2560	2568

Table 7: Future VOC emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, by SNAP sector, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CEP	CEP	REF	CEP	REF	CEP	REF	CEP	REF
Power sector	176	181	159	172	129	132	149	162	119	117
Domestic	987	911	737	813	176	195	572	736	119	156
Ind. combust.	53	69	73	77	73	77	76	85	76	85
Ind. processes	943	884	809	815	655	659	808	819	654	663
Fuel extract.	538	332	300	305	250	254	278	289	234	242
Solvent use	3600	2795	2584	2584	1364	1364	2603	2603	1375	1375
Road transp.	2047	392	355	293	355	293	305	257	305	257
Non-road	657	355	256	314	201	259	219	281	163	223
Waste	133	89	86	86	74	74	84	84	74	74
Agriculture	125	146	146	146	0	0	146	146	0	0
Sum	9259	6152	5505	5604	3276	3308	5240	5460	3118	3191

Emissions by country

Table 8: Future SO_2 emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CEP	CEP	REF	CEP	REF	CEP	REF	CEP	REF
Austria	25	16	13	14	11	12	12	13	10	11
Belgium	140	62	56	59	44	46	54	58	42	44
Bulgaria	890	121	116	137	61	80	106	112	48	52
Croatia	68	21	21	21	8	7	20	20	7	6
Cyprus	38	2	2	2	1	1	2	2	1	1
Czech Rep.	208	92	76	81	59	62	67	74	52	56
Denmark	21	11	9	10	8	8	8	9	7	8
Estonia	66	23	23	23	18	18	22	22	15	15
Finland	90	65	62	64	57	59	58	64	54	59
France	444	137	117	124	94	100	109	117	86	92
Germany	549	348	321	333	280	291	288	295	243	246
Greece	505	95	60	66	34	35	47	50	29	25
Hungary	129	27	27	28	16	17	25	27	14	15
Ireland	71	25	15	18	11	13	13	14	10	11
Italy	382	164	137	142	72	75	136	142	70	73
Latvia	5	4	3	3	2	2	3	3	2	2
Lithuania	42	27	24	24	9	9	23	25	9	10
Luxembourg	2	2	1	2	1	1	1	2	1	1
Malta	11	1	0	0	0	0	0	0	0	0
Netherlands	70	35	34	34	29	28	31	32	25	26
Poland	1256	568	479	528	289	319	372	453	218	261
Portugal	111	52	48	49	19	19	46	49	16	17
Romania	706	106	100	101	51	50	95	99	47	45
Slovakia	92	44	43	45	18	19	44	46	18	19
Slovenia	40	5	5	6	4	5	5	6	4	4
Spain	1328	254	216	228	129	133	220	232	123	130
Sweden	38	33	31	32	30	31	31	32	29	31
UK	850	304	265	274	145	150	232	214	126	124
EU-28	8172	2641	2306	2446	1499	1589	2070	2211	1304	1382

Table 9: Future NO_x emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CEP	CEP	REF	CEP	REF	CEP	REF	CEP	REF
Austria	230	100	72	77	62	65	58	65	48	54
Belgium	295	171	138	146	105	111	123	134	86	95
Bulgaria	167	73	63	68	47	52	57	60	39	41
Croatia	76	42	35	36	16	17	31	33	13	14
Cyprus	21	8	7	7	5	5	6	6	4	4
Czech Rep.	296	152	123	130	94	98	102	112	75	83
Denmark	182	86	67	70	53	55	57	61	42	46
Estonia	40	22	18	18	12	13	15	16	10	10
Finland	201	126	106	110	89	92	93	99	76	82
France	1351	635	468	502	371	393	397	441	302	332
Germany	1397	726	568	608	437	460	484	530	355	380
Greece	407	185	132	150	102	110	108	126	85	92
Hungary	155	69	56	59	40	42	47	52	32	35
Ireland	150	84	57	63	45	49	40	43	25	28
Italy	1306	629	492	514	401	418	424	456	336	360
Latvia	36	28	23	24	18	19	19	20	14	15
Lithuania	62	36	30	31	24	25	26	28	20	22
Luxembourg	47	18	12	13	11	12	9	10	8	9
Malta	10	2	1	1	1	1	1	1	1	1
Netherlands	380	187	151	158	114	119	130	143	95	105
Poland	797	497	412	438	321	343	345	379	251	280
Portugal	268	123	99	103	64	68	86	92	53	57
Romania	311	158	137	140	92	95	122	127	76	81
Slovakia	95	54	48	50	33	35	43	47	29	31
Slovenia	50	24	17	18	14	15	14	16	11	12
Spain	1513	662	476	496	353	365	399	434	273	300
Sweden	216	100	80	82	70	72	72	76	61	64
UK	1480	614	483	504	367	380	417	441	306	316
EU-28	11538	5611	4372	4616	3361	3527	3725	4051	2726	2948

Table 10: Future PM2.5 emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CEP	CEP	REF	CEP	REF	CEP	REF	CEP	REF
Austria	24	18	16	17	10	10	15	16	9	9
Belgium	28	20	19	19	13	14	18	19	13	13
Bulgaria	35	28	25	26	10	11	21	24	8	9
Croatia	15	12	11	11	3	3	10	11	3	3
Cyprus	3	1	1	1	1	1	1	1	1	1
Czech Rep.	43	33	31	34	16	18	28	32	13	15
Denmark	28	17	15	15	8	8	12	13	7	7
Estonia	20	13	12	13	4	4	10	12	3	3
Finland	29	23	20	21	12	13	17	20	10	11
France	271	201	175	184	120	124	157	169	104	107
Germany	123	90	84	87	65	67	80	84	60	62
Greece	62	32	30	32	16	16	28	30	14	14
Hungary	29	21	18	19	9	9	17	18	8	8
Ireland	13	11	9	9	7	8	8	9	6	7
Italy	147	153	125	128	73	75	108	119	63	69
Latvia	19	16	13	14	5	5	10	12	3	4
Lithuania	15	13	11	12	4	4	10	11	3	4
Luxembourg	3	2	2	2	2	2	2	2	2	2
Malta	1	0	0	0	0	0	0	0	0	0
Netherlands	24	17	17	17	13	14	16	17	13	13
Poland	225	240	198	216	113	124	154	198	77	98
Portugal	63	43	41	41	17	17	39	41	16	16
Romania	113	99	85	91	28	29	77	84	22	23
Slovakia	32	21	20	20	8	8	19	20	7	7
Slovenia	9	6	5	6	2	2	5	6	2	2
Spain	156	127	122	124	51	52	119	125	48	50
Sweden	31	25	25	25	14	14	24	25	13	14
UK	87	83	80	82	41	41	79	82	37	38
EU-28	1647	1364	1209	1266	664	693	1085	1200	565	607

Table 11: Future NH_3 emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CEP	CEP	REF	CEP	REF	CEP	REF	CEP	REF
Austria	63	66	67	67	46	46	68	68	46	47
Belgium	74	75	74	74	60	60	73	73	60	60
Bulgaria	65	64	64	64	57	57	64	64	57	57
Croatia	29	29	29	29	18	18	30	30	19	19
Cyprus	6	6	6	6	4	4	6	6	4	4
Czech Rep.	80	64	63	63	52	52	62	62	51	51
Denmark	73	51	51	51	39	39	50	51	39	39
Estonia	12	12	13	13	8	8	13	13	8	8
Finland	34	31	31	31	24	24	31	31	24	24
France	675	649	638	638	425	425	638	639	423	424
Germany	593	584	569	570	299	299	562	565	293	294
Greece	57	48	47	48	38	38	48	48	38	39
Hungary	78	69	67	67	48	48	67	67	48	48
Ireland	104	100	100	101	85	85	101	101	86	86
Italy	422	386	386	386	296	296	388	389	298	299
Latvia	13	14	15	15	12	12	15	15	13	13
Lithuania	44	48	49	49	32	32	51	51	33	33
Luxembourg	6	6	6	6	5	5	6	6	5	5
Malta	2	2	2	2	1	1	2	2	1	1
Netherlands	146	113	112	112	110	110	110	111	109	109
Poland	344	336	330	331	227	227	331	332	227	228
Portugal	71	69	71	71	49	49	73	73	50	50
Romania	161	143	142	142	112	112	141	141	111	112
Slovakia	28	24	24	24	17	17	24	24	16	17
Slovenia	19	17	17	17	14	14	17	17	14	14
Spain	366	355	353	352	212	211	349	349	209	209
Sweden	54	47	48	48	39	39	49	49	39	39
UK	308	279	282	282	236	236	286	287	238	239
EU-28	3928	3686	3656	3658	2565	2566	3653	3663	2560	2568

Table 12: Future VOC emissions for the Current Legislation (CLE) and Maximum Technically Feasible Reductions (MTFR) cases of the CLIMATE AND ENERGY POLICY (CEP) and the PRIMES 2013 REFERENCE (REF) scenarios, EU-28 (kilotons)

	2005	2020	2025				2030			
		CLE	CLE		MTFR		CLE		MTFR	
		CP	CEP	REF	CEP	REF	CEP	REF	CEP	REF
Austria	171	112	104	107	53	54	97	102	50	52
Belgium	158	100	97	99	67	68	97	99	66	67
Bulgaria	139	78	70	73	34	36	63	67	31	32
Croatia	79	55	50	51	27	27	47	48	25	25
Cyprus	9	4	4	4	3	3	4	4	3	3
Czech Rep.	251	150	142	143	73	73	134	140	68	69
Denmark	130	69	63	65	36	37	60	63	34	35
Estonia	38	30	27	29	10	10	22	27	9	9
Finland	173	108	96	102	52	53	83	96	46	48
France	1117	664	605	616	410	413	574	591	389	396
Germany	1235	878	837	850	512	514	816	840	494	502
Greece	283	134	118	121	65	66	110	116	59	60
Hungary	144	90	81	83	47	47	76	81	44	45
Ireland	63	46	43	44	23	24	42	43	21	22
Italy	1237	710	660	667	404	409	626	646	387	400
Latvia	69	44	38	40	16	16	34	37	15	16
Lithuania	84	48	42	43	19	19	38	40	18	18
Luxembourg	13	6	6	6	4	4	6	6	4	4
Malta	4	3	3	3	1	1	3	3	1	1
Netherlands	205	146	140	142	105	106	137	141	100	103
Poland	615	440	397	412	202	210	355	403	180	192
Portugal	227	140	136	137	91	92	133	137	91	92
Romania	460	281	244	256	102	104	223	238	93	96
Slovakia	77	56	53	54	29	29	52	53	27	27
Slovenia	41	30	28	30	10	11	24	28	10	10
Spain	934	662	597	597	365	363	586	596	353	358
Sweden	210	143	137	138	103	103	128	132	96	98
UK	1093	700	685	694	414	419	668	684	404	410
EU-28	9259	5927	5505	5604	3276	3308	5240	5460	3118	3191

Annex C: Emissions in 2030

Emissions by sector

Table 13: SO_2 emissions of the 75% gap closure scenario in 2030, kilotons and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Power generation	5445	678	-88%	637	-88%	544	-90%	532	-90%
Domestic sector	623	222	-64%	336	-46%	145	-77%	219	-65%
Ind. combust.	1100	557	-49%	610	-44%	349	-68%	392	-64%
Ind. processes	743	562	-24%	575	-23%	341	-54%	349	-53%
Fuel extraction	0	0		0		0		0	
Solvent use	0	0		0		0		0	
Road transport	36	5	-87%	5	-86%	5	-87%	5	-86%
Non-road mobile	215	37	-83%	37	-83%	30	-86%	31	-85%
Waste treatment	2	2	-10%	2	-10%	1	-79%	1	-79%
Agriculture	7	9	24%	9	24%	0	-100%	0	-100%
Sum	8172	2070	-75%	2211	-73%	1413	-83%	1530	-81%

*) Scenario B7 in TSAP Report #11

Table 14: NO_x emissions of the 75% gap closure scenario in 2030, kilotons and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Power generation	2879	864	-70%	906	-69%	706	-75%	766	-73%
Domestic sector	632	347	-45%	471	-25%	346	-45%	471	-25%
Ind. combust.	1253	877	-30%	928	-26%	619	-51%	702	-44%
Ind. processes	213	165	-23%	172	-19%	161	-25%	167	-21%
Fuel extraction	0	0		0		0		0	
Solvent use	0	0		0		0		0	
Road transport	4905	795	-84%	887	-82%	795	-84%	887	-82%
Non-road mobile	1630	652	-60%	661	-59%	584	-64%	604	-63%
Waste treatment	8	5	-34%	5	-35%	1	-89%	1	-89%
Agriculture	16	21	25%	21	25%	1	-95%	1	-95%
Sum	11538	3725	-68%	4051	-65%	3212	-72%	3599	-69%

*) Scenario B7 in TSAP Report #11

Table 15: PM2.5 emissions of the 75% gap closure scenario in 2030, kt and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Power generation	132	61	*-54%*	53	-59%	29	*-78%*	28	*-79%*
Domestic sector	573	351	*-39%*	465	-19%	225	*-61%*	317	*-45%*
Ind. combust.	85	71	*-16%*	75	-12%	40	*-53%*	46	*-46%*
Ind. processes	213	200	*-6%*	201	-5%	148	*-30%*	150	*-30%*
Fuel extraction	9	3	*-62%*	6	-33%	3	*-62%*	6	*-33%*
Solvent use	0	0		0		0		0	
Road transport	270	101	*-63%*	102	-62%	101	*-63%*	102	*-62%*
Non-road mobile	123	34	*-72%*	35	-72%	31	*-75%*	32	*-74%*
Waste treatment	88	90	*3%*	90	3%	64	*-27%*	64	*-27%*
Agriculture	155	172	*11%*	172	11%	58	*-63%*	58	*-63%*
Sum	1647	1085	*-34%*	1200	-27%	700	*-58%*	804	*-51%*

*) Scenario B7 in TSAP Report #11

Table 16: NH_3 emissions of the 75% gap closure scenario in 2030, kilotons and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Power generation	14	21	*51%*	23	*65%*	16	*12%*	15	*9%*
Domestic sector	19	14	*-26%*	19	*0%*	14	*-26%*	19	*0%*
Ind. combust.	4	5	*44%*	6	*63%*	4	*27%*	5	*43%*
Ind. processes	78	75	*-4%*	75	*-4%*	67	*-15%*	74	*-5%*
Fuel extraction	0	0		0		0		0	
Solvent use	0	0		0		0		0	
Road transport	128	44	*-66%*	46	*-64%*	44	*-66%*	46	*-64%*
Non-road mobile	2	2	*10%*	2	*11%*	1	*-40%*	1	*-39%*
Waste treatment	166	173	*4%*	173	*4%*	173	*4%*	173	*4%*
Agriculture	3518	3319	*-6%*	3319	*-6%*	2431	*-31%*	2538	*-28%*
Sum	3928	3653	*-7%*	3663	*-7%*	2749	*-30%*	2871	*-27%*

*) Scenario B7 in TSAP Report #11

Table 17: VOC emissions of the 75% gap closure scenario in 2030, kilotons and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Power generation	176	149	*-15%*	162	*-8%*	119	*-32%*	117	*-34%*
Domestic sector	987	572	*-42%*	736	*-25%*	245	*-75%*	356	*-64%*
Ind. combust.	53	76	*44%*	85	*59%*	76	*44%*	85	*59%*
Ind. processes	943	808	*-14%*	819	*-13%*	772	*-18%*	786	*-17%*
Fuel extraction	538	278	*-48%*	289	*-46%*	265	*-51%*	289	*-46%*
Solvent use	3600	2603	*-28%*	2603	*-28%*	2354	*-35%*	2384	*-34%*
Road transport	2047	305	*-85%*	257	*-87%*	305	*-85%*	257	*-87%*
Non-road mobile	657	219	*-67%*	281	*-57%*	185	*-72%*	249	*-62%*
Waste treatment	133	84	*-37%*	84	*-37%*	74	*-44%*	75	*-43%*
Agriculture	125	146	*17%*	146	*17%*	0	*-100%*	0	*-100%*
Sum	9259	5240	*-43%*	5460	*-41%*	4394	*-53%*	4598	*-50%*

*) Scenario B7 in TSAP Report #11

Emissions by country

Table 18: SO_2 emissions of the 75% gap closure scenario in 2030, kilotons and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Austria	25	12	-51%	13	-47%	11	-57%	12	-50%
Belgium	140	54	-61%	58	-59%	42	-70%	45	-68%
Bulgaria	890	106	-88%	112	-87%	50	-94%	53	-94%
Croatia	68	20	-70%	20	-70%	9	-87%	9	-87%
Cyprus	38	2	-95%	2	-95%	1	-97%	2	-95%
Czech Rep.	208	67	-68%	74	-64%	54	-74%	59	-72%
Denmark	21	8	-60%	9	-56%	7	-64%	9	-58%
Estonia	66	22	-66%	22	-67%	19	-71%	19	-71%
Finland	90	58	-35%	64	-29%	58	-36%	63	-30%
France	444	109	-76%	117	-74%	90	-80%	97	-78%
Germany	549	288	-48%	295	-46%	251	-54%	258	-53%
Greece	505	47	-91%	50	-90%	37	-93%	38	-92%
Hungary	129	25	-81%	27	-79%	15	-88%	16	-88%
Ireland	71	13	-81%	14	-80%	10	-86%	12	-83%
Italy	382	136	-64%	142	-63%	87	-77%	94	-75%
Latvia	5	3	-43%	3	-40%	3	-50%	3	-46%
Lithuania	42	23	-44%	25	-41%	11	-75%	12	-72%
Luxembourg	2	1	-26%	2	-21%	1	-48%	1	-44%
Malta	11	0	-97%	0	-97%	0	-99%	0	-98%
Netherlands	70	31	-55%	32	-54%	27	-61%	29	-59%
Poland	1256	372	-70%	453	-64%	233	-81%	276	-78%
Portugal	111	46	-58%	49	-56%	22	-80%	26	-77%
Romania	706	95	-86%	99	-86%	51	-93%	51	-93%
Slovakia	92	44	-52%	46	-50%	18	-80%	19	-79%
Slovenia	40	5	-88%	6	-85%	4	-90%	5	-89%
Spain	1328	220	-83%	232	-83%	142	-89%	152	-89%
Sweden	38	31	-20%	32	-16%	30	-20%	32	-16%
United Kingdom	850	232	-73%	214	-75%	130	-85%	138	-84%
EU-28	8172	2070	-75%	2211	-73%	1413	-83%	1530	-81%

*) Scenario B7 in TSAP Report #11

Table 19: NO_x emissions of the 75% gap closure scenario in 2030, kilotons and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Austria	230	58	-75%	65	-72%	53	-77%	64	-72%
Belgium	295	123	-58%	134	-55%	97	-67%	108	-63%
Bulgaria	167	57	-66%	60	-64%	54	-68%	58	-65%
Croatia	76	31	-59%	33	-56%	23	-70%	26	-66%
Cyprus	21	6	-73%	6	-70%	6	-73%	6	-70%
Czech Rep.	296	102	-65%	112	-62%	89	-70%	101	-66%
Denmark	182	57	-69%	61	-66%	51	-72%	57	-69%
Estonia	40	15	-62%	16	-61%	15	-63%	16	-61%
Finland	201	93	-54%	99	-51%	92	-54%	99	-51%
France	1351	397	-71%	441	-67%	346	-74%	401	-70%
Germany	1397	484	-65%	530	-62%	401	-71%	439	-69%
Greece	407	108	-73%	126	-69%	106	-74%	112	-72%
Hungary	155	47	-70%	52	-66%	41	-74%	48	-69%
Ireland	150	40	-73%	43	-71%	31	-79%	38	-75%
Italy	1306	424	-67%	456	-65%	359	-72%	405	-69%
Latvia	36	19	-47%	20	-44%	19	-49%	20	-44%
Lithuania	62	26	-58%	28	-54%	25	-60%	28	-55%
Luxembourg	47	9	-82%	10	-79%	9	-82%	10	-79%
Malta	10	1	-90%	1	-89%	1	-90%	1	-89%
Netherlands	380	130	-66%	143	-62%	108	-72%	122	-68%
Poland	797	345	-57%	379	-52%	305	-62%	358	-55%
Portugal	268	86	-68%	92	-65%	68	-75%	76	-71%
Romania	311	122	-61%	127	-59%	91	-71%	102	-67%
Slovakia	95	43	-55%	47	-51%	35	-63%	39	-59%
Slovenia	50	14	-71%	16	-69%	13	-75%	14	-71%
Spain	1513	399	-74%	434	-71%	339	-78%	380	-75%
Sweden	216	72	-67%	76	-65%	71	-67%	76	-65%
United Kingdom	1480	417	-72%	441	-70%	366	-75%	397	-73%
EU-28	11538	3725	-68%	4051	-65%	3212	-72%	3599	-69%

*) Scenario B7 in TSAP Report #11

Table 20: PM2.5 emissions of the 75% gap closure scenario in 2030, kilotons and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Austria	24	15	-38%	16	-34%	10	-59%	11	-55%
Belgium	28	18	-37%	19	-33%	14	-50%	15	-47%
Bulgaria	35	21	-38%	24	-30%	10	-70%	13	-64%
Croatia	15	10	-32%	11	-28%	4	-71%	5	-66%
Cyprus	3	1	-71%	1	-70%	1	-74%	1	-72%
Czech Rep.	43	28	-36%	32	-25%	17	-59%	21	-51%
Denmark	28	12	-57%	13	-53%	9	-67%	10	-64%
Estonia	20	10	-52%	12	-41%	5	-74%	10	-52%
Finland	29	17	-39%	20	-30%	15	-48%	17	-39%
France	271	157	-42%	169	-38%	130	-52%	141	-48%
Germany	123	80	-35%	84	-32%	67	-46%	70	-43%
Greece	62	28	-54%	30	-51%	17	-73%	18	-71%
Hungary	29	17	-42%	18	-37%	10	-66%	11	-63%
Ireland	13	8	-38%	9	-33%	7	-44%	9	-35%
Italy	147	108	-26%	119	-19%	64	-56%	80	-45%
Latvia	19	10	-44%	12	-34%	7	-63%	10	-45%
Lithuania	15	10	-34%	11	-28%	5	-65%	7	-54%
Luxembourg	3	2	-46%	2	-43%	2	-50%	2	-48%
Malta	1	0	-76%	0	-76%	0	-81%	0	-80%
Netherlands	24	16	-33%	17	-30%	14	-42%	15	-38%
Poland	225	154	-32%	198	-12%	106	-53%	135	-40%
Portugal	63	39	-38%	41	-35%	18	-71%	19	-70%
Romania	113	77	-32%	84	-25%	35	-69%	40	-65%
Slovakia	32	19	-40%	20	-38%	11	-66%	12	-64%
Slovenia	9	5	-49%	6	-40%	2	-77%	3	-70%
Spain	156	119	-24%	125	-20%	57	-64%	61	-61%
Sweden	31	24	-25%	25	-19%	17	-44%	24	-23%
United Kingdom	87	79	-9%	82	-6%	43	-50%	46	-47%
EU-28	1647	1085	-34%	1200	-27%	700	-58%	804	-51%

*) Scenario B7 in TSAP Report #11

Table 21: NH_3 emissions of the 75% gap closure scenario in 2030, kilotons and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Austria	63	68	7%	68	8%	51	-19%	51	-19%
Belgium	74	73	-1%	73	-1%	62	-17%	62	-16%
Bulgaria	65	64	-1%	64	-1%	59	-10%	59	-10%
Croatia	29	30	2%	30	2%	21	-29%	22	-24%
Cyprus	6	6	-4%	6	-4%	5	-21%	5	-18%
Czech Rep.	80	62	-22%	62	-22%	51	-36%	52	-35%
Denmark	73	50	-32%	51	-31%	45	-38%	46	-37%
Estonia	12	13	8%	13	9%	11	-10%	11	-8%
Finland	34	31	-8%	31	-8%	28	-17%	29	-15%
France	675	638	-5%	639	-5%	462	-32%	476	-29%
Germany	593	562	-5%	565	-5%	312	-47%	362	-39%
Greece	57	48	-16%	48	-16%	41	-28%	42	-26%
Hungary	78	67	-13%	67	-13%	48	-38%	51	-34%
Ireland	104	101	-3%	101	-3%	89	-14%	97	-7%
Italy	422	388	-8%	389	-8%	300	-29%	311	-26%
Latvia	13	15	18%	15	19%	13	4%	14	6%
Lithuania	44	51	14%	51	15%	44	-1%	47	7%
Luxembourg	6	6	-10%	6	-11%	5	-25%	5	-24%
Malta	2	2	-8%	2	-8%	1	-28%	1	-24%
Netherlands	146	110	-24%	111	-24%	108	-26%	110	-25%
Poland	344	331	-4%	332	-3%	244	-29%	255	-26%
Portugal	71	73	3%	73	3%	57	-20%	60	-16%
Romania	161	141	-13%	141	-12%	121	-25%	123	-24%
Slovakia	28	24	-16%	24	-16%	17	-41%	18	-37%
Slovenia	19	17	-12%	17	-12%	14	-26%	14	-24%
Spain	366	349	-5%	349	-5%	255	-30%	258	-29%
Sweden	54	49	-9%	49	-9%	44	-18%	44	-17%
United Kingdom	308	286	-7%	287	-7%	242	-22%	245	-21%
EU-28	3928	3653	-7%	3663	-7%	2749	-30%	2871	-27%

*) Scenario B7 in TSAP Report #11

Table 22: VOC emissions of the 75% gap closure scenario in 2030, kilotons and rel. to 2005

	2005	Current legislation 2030				75% gap closure for CEP		Commission proposal*)	
		CEP		REF					
Austria	171	102	-40%	102	-40%	86	-50%	89	-48%
Belgium	158	99	-37%	99	-37%	86	-46%	88	-44%
Bulgaria	139	67	-51%	67	-51%	50	-64%	52	-62%
Croatia	79	48	-39%	48	-39%	35	-56%	41	-48%
Cyprus	9	4	-53%	4	-53%	4	-56%	4	-54%
Czech Rep.	251	140	-44%	140	-44%	106	-58%	108	-57%
Denmark	130	63	-51%	63	-51%	52	-60%	53	-59%
Estonia	38	27	-31%	27	-31%	13	-65%	24	-37%
Finland	173	96	-44%	96	-44%	79	-54%	92	-46%
France	1117	591	-47%	591	-47%	541	-52%	556	-50%
Germany	1235	840	-32%	840	-32%	695	-44%	708	-43%
Greece	283	116	-59%	116	-59%	86	-70%	93	-67%
Hungary	144	81	-44%	81	-44%	58	-60%	60	-59%
Ireland	63	43	-32%	43	-32%	38	-39%	43	-32%
Italy	1237	646	-48%	646	-48%	539	-56%	570	-54%
Latvia	69	37	-46%	37	-46%	28	-60%	35	-49%
Lithuania	84	40	-53%	40	-53%	30	-64%	36	-57%
Luxembourg	13	6	-55%	6	-55%	5	-59%	5	-58%
Malta	4	3	-30%	3	-30%	3	-32%	3	-31%
Netherlands	205	141	-31%	141	-31%	130	-37%	134	-34%
Poland	615	403	-34%	403	-34%	252	-59%	273	-56%
Portugal	227	137	-40%	137	-40%	121	-47%	123	-46%
Romania	460	238	-48%	238	-48%	157	-66%	167	-64%
Slovakia	77	53	-31%	53	-31%	45	-42%	46	-40%
Slovenia	41	28	-33%	28	-33%	15	-65%	15	-63%
Spain	934	596	-36%	596	-36%	477	-49%	484	-48%
Sweden	210	132	-37%	132	-37%	128	-39%	131	-38%
United Kingdom	1093	684	-37%	684	-37%	536	-51%	562	-49%
EU-28	9259	5460	-41%	5460	-41%	4394	-53%	4598	-50%

*) Scenario B7 in TSAP Report #11

Annex D: Emissions in 2025

Emissions by country

Table 23: SO_2 emissions of the 75% gap closure scenario in 2025, kilotons rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Power generation	5445	678	-88%	637	-88%	544	-90%
Domestic sector	623	222	-64%	336	-46%	145	-77%
Ind. combust.	1100	557	-49%	610	-44%	349	-68%
Ind. processes	743	562	-24%	575	-23%	341	-54%
Fuel extraction	0	0		0		0	
Solvent use	0	0		0		0	
Road transport	36	5	-87%	5	-86%	5	-87%
Non-road mobile	215	37	-83%	37	-83%	30	-86%
Waste treatment	2	2	-10%	2	-10%	1	-79%
Agriculture	7	9	24%	9	24%	0	-100%
Sum	8172	2070	-75%	2211	-73%	1413	-83%

Table 24: NO_x emissions of the 75% gap closure scenario in 2025, kilotons and rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Power generation	2879	974	-66%	906	-69%	706	-75%
Domestic sector	632	447	-29%	471	-25%	346	-45%
Ind. combust.	1253	872	-30%	928	-26%	619	-51%
Ind. processes	213	167	-22%	172	-19%	161	-25%
Fuel extraction	0	0		0		0	
Solvent use	0	0		0		0	
Road transport	4905	1143	-77%	887	-82%	795	-84%
Non-road mobile	1630	743	-54%	661	-59%	584	-64%
Waste treatment	8	5	-31%	5	-35%	1	-89%
Agriculture	16	21	25%	21	25%	1	-95%
Sum	11538	4372	-62%	4051	-65%	3212	-72%

Table 25: PM2.5 emissions of the 75% gap closure scenario in 2025, kilotons rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Power generation	132	63	-52%	53	-59%	29	-78%
Domestic sector	573	470	-18%	465	-19%	225	-61%
Ind. combust.	85	69	-18%	75	-12%	40	-53%
Ind. processes	213	198	-7%	201	-5%	148	-30%
Fuel extraction	9	4	-60%	6	-33%	3	-62%
Solvent use	0	0		0		0	
Road transport	270	103	-62%	102	-62%	101	-63%
Non-road mobile	123	40	-67%	35	-72%	31	-75%
Waste treatment	88	90	3%	90	3%	64	-27%
Agriculture	155	172	11%	172	11%	58	-63%
Sum	1647	1209	-27%	1200	-27%	700	-58%

Table 26: NH_3 emissions of the 75% gap closure scenario in 2025, kilotons and rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Power generation	14	22	*59%*	23	*65%*	16	*12%*
Domestic sector	19	18	*-4%*	19	*0%*	14	*-26%*
Ind. combust.	4	5	*39%*	6	*63%*	4	*27%*
Ind. processes	78	75	*-4%*	75	*-4%*	67	*-15%*
Fuel extraction	0	0		0		0	
Solvent use	0	0		0		0	
Road transport	128	51	*-60%*	46	*-64%*	44	*-66%*
Non-road mobile	2	2	*10%*	2	*11%*	1	*-40%*
Waste treatment	166	173	*4%*	173	*4%*	173	*4%*
Agriculture	3518	3311	*-6%*	3319	*-6%*	2431	*-31%*
Sum	3928	3656	*-7%*	3663	*-7%*	2749	*-30%*

Table 27: VOC emissions of the 75% gap closure scenario in 2025, kilotons and rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Power generation	176	159	*-10%*	162	*-8%*	119	*-32%*
Domestic sector	987	737	*-25%*	736	*-25%*	245	*-75%*
Ind. combust.	53	73	*37%*	85	*59%*	76	*44%*
Ind. processes	943	809	*-14%*	819	*-13%*	772	*-18%*
Fuel extraction	538	300	*-44%*	289	*-46%*	265	*-51%*
Solvent use	3600	2584	*-28%*	2603	*-28%*	2354	*-35%*
Road transport	2047	355	*-83%*	257	*-87%*	305	*-85%*
Non-road mobile	657	256	*-61%*	281	*-57%*	185	*-72%*
Waste treatment	133	86	*-36%*	84	*-37%*	74	*-44%*
Agriculture	125	146	*17%*	146	*17%*	0	*-100%*
Sum	9259	5505	*-41%*	5460	*-41%*	4394	*-53%*

Emissions by country

Table 28: SO_2 emissions of the 75% gap closure scenario in 2025, kilotons and rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Austria	25	13	*-46%*	14	*-43%*	11	*-53%*
Belgium	140	56	*-60%*	59	*-58%*	44	*-69%*
Bulgaria	890	116	*-87%*	137	*-85%*	61	*-93%*
Croatia	68	21	*-70%*	21	*-70%*	10	*-86%*
Cyprus	38	2	*-95%*	2	*-95%*	1	*-97%*
Czech Rep.	208	76	*-64%*	81	*-61%*	62	*-70%*
Denmark	21	9	*-55%*	10	*-53%*	9	*-58%*
Estonia	66	23	*-66%*	23	*-66%*	20	*-70%*
Finland	90	62	*-31%*	64	*-29%*	61	*-32%*
France	444	117	*-74%*	124	*-72%*	97	*-78%*
Germany	549	321	*-42%*	333	*-39%*	285	*-48%*
Greece	505	60	*-88%*	66	*-87%*	48	*-91%*
Hungary	129	27	*-79%*	28	*-78%*	17	*-87%*
Ireland	71	15	*-78%*	18	*-75%*	12	*-84%*
Italy	382	137	*-64%*	142	*-63%*	90	*-76%*
Latvia	5	3	*-42%*	3	*-39%*	3	*-50%*
Lithuania	42	24	*-43%*	24	*-42%*	11	*-74%*
Luxembourg	2	1	*-23%*	2	*-20%*	1	*-46%*
Malta	11	0	*-96%*	0	*-96%*	0	*-98%*
Netherlands	70	34	*-52%*	34	*-52%*	30	*-57%*
Poland	1256	479	*-62%*	528	*-58%*	302	*-76%*
Portugal	111	48	*-57%*	49	*-56%*	23	*-79%*
Romania	706	100	*-86%*	101	*-86%*	55	*-92%*
Slovakia	92	43	*-53%*	45	*-51%*	19	*-79%*
Slovenia	40	5	*-88%*	6	*-85%*	4	*-90%*
Spain	1328	216	*-84%*	228	*-83%*	146	*-89%*
Sweden	38	31	*-18%*	32	*-15%*	31	*-18%*
United Kingdom	850	265	*-69%*	274	*-68%*	148	*-83%*
EU-28	8172	2306	*-72%*	2446	*-70%*	1600	*-80%*

Table 29: NO_x emissions of the 75% gap closure scenario in 2025, kilotons and rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Austria	230	72	*-69%*	77	*-67%*	67	*-71%*
Belgium	295	138	*-53%*	146	*-50%*	116	*-61%*
Bulgaria	167	63	*-62%*	68	*-59%*	60	*-64%*
Croatia	76	35	*-54%*	36	*-52%*	26	*-65%*
Cyprus	21	7	*-69%*	7	*-67%*	7	*-69%*
Czech Rep.	296	123	*-58%*	130	*-56%*	108	*-63%*
Denmark	182	67	*-63%*	70	*-62%*	61	*-66%*
Estonia	40	18	*-55%*	18	*-55%*	17	*-57%*
Finland	201	106	*-47%*	110	*-45%*	106	*-47%*
France	1351	468	*-65%*	502	*-63%*	429	*-68%*
Germany	1397	568	*-59%*	608	*-56%*	492	*-65%*
Greece	407	132	*-68%*	150	*-63%*	124	*-69%*
Hungary	155	56	*-64%*	59	*-62%*	50	*-68%*
Ireland	150	57	*-62%*	63	*-58%*	49	*-67%*
Italy	1306	492	*-62%*	514	*-61%*	429	*-67%*
Latvia	36	23	*-37%*	24	*-34%*	22	*-38%*
Lithuania	62	30	*-52%*	31	*-50%*	29	*-53%*
Luxembourg	47	12	*-76%*	13	*-73%*	11	*-76%*
Malta	10	1	*-86%*	1	*-86%*	1	*-86%*
Netherlands	380	151	*-60%*	158	*-58%*	127	*-67%*
Poland	797	412	*-48%*	438	*-45%*	379	*-52%*
Portugal	268	99	*-63%*	103	*-62%*	81	*-70%*
Romania	311	137	*-56%*	140	*-55%*	109	*-65%*
Slovakia	95	48	*-49%*	50	*-47%*	41	*-57%*
Slovenia	50	17	*-65%*	18	*-63%*	16	*-68%*
Spain	1513	476	*-69%*	496	*-67%*	421	*-72%*
Sweden	216	80	*-63%*	82	*-62%*	80	*-63%*
United Kingdom	1480	483	*-67%*	504	*-66%*	431	*-71%*
EU-28	11538	4372	*-62%*	4616	*-60%*	3891	*-66%*

Table 30: PM2.5 emissions of the 75% gap closure scenario in 2025, kilotons and rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Austria	24	16	*-33%*	17	*-31%*	11	*-56%*
Belgium	28	19	*-35%*	19	*-33%*	15	*-48%*
Bulgaria	35	25	*-29%*	26	*-24%*	12	*-64%*
Croatia	15	11	*-28%*	11	*-26%*	5	*-67%*
Cyprus	3	1	*-70%*	1	*-70%*	1	*-73%*
Czech Rep.	43	31	*-27%*	34	*-21%*	21	*-51%*
Denmark	28	15	*-46%*	15	*-47%*	11	*-61%*
Estonia	20	12	*-40%*	13	*-36%*	10	*-51%*
Finland	29	20	*-30%*	21	*-25%*	17	*-41%*
France	271	175	*-35%*	184	*-32%*	146	*-46%*
Germany	123	84	*-32%*	87	*-29%*	71	*-42%*
Greece	62	30	*-51%*	32	*-49%*	18	*-71%*
Hungary	29	18	*-38%*	19	*-35%*	11	*-63%*
Ireland	13	9	*-33%*	9	*-29%*	9	*-35%*
Italy	147	125	*-15%*	128	*-12%*	82	*-44%*
Latvia	19	13	*-32%*	14	*-26%*	8	*-56%*
Lithuania	15	11	*-26%*	12	*-23%*	6	*-57%*
Luxembourg	3	2	*-43%*	2	*-42%*	2	*-48%*
Malta	1	0	*-75%*	0	*-75%*	0	*-80%*
Netherlands	24	17	*-30%*	17	*-29%*	15	*-40%*
Poland	225	198	*-12%*	216	*-4%*	141	*-37%*
Portugal	63	41	*-35%*	41	*-34%*	19	*-70%*
Romania	113	85	*-24%*	91	*-19%*	40	*-64%*
Slovakia	32	20	*-37%*	20	*-36%*	12	*-63%*
Slovenia	9	5	*-42%*	6	*-35%*	2	*-76%*
Spain	156	122	*-22%*	124	*-20%*	58	*-63%*
Sweden	31	25	*-21%*	25	*-19%*	20	*-35%*
United Kingdom	87	80	*-8%*	82	*-6%*	45	*-48%*
EU-28	1647	1209	*-27%*	1266	*-23%*	808	*-51%*

Table 31: NH_3 emissions of the 75% gap closure scenario in 2025, kilotons and rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Austria	63	67	*6%*	67	*7%*	51	*-20%*
Belgium	74	74	*0%*	74	*0%*	62	*-16%*
Bulgaria	65	64	*-2%*	64	*-2%*	58	*-11%*
Croatia	29	29	*0%*	29	*0%*	21	*-27%*
Cyprus	6	6	*-6%*	6	*-6%*	5	*-21%*
Czech Rep.	80	63	*-21%*	63	*-21%*	52	*-35%*
Denmark	73	51	*-31%*	51	*-31%*	46	*-37%*
Estonia	12	13	*7%*	13	*7%*	11	*-10%*
Finland	34	31	*-8%*	31	*-8%*	28	*-17%*
France	675	638	*-5%*	638	*-5%*	463	*-31%*
Germany	593	569	*-4%*	570	*-4%*	318	*-46%*
Greece	57	47	*-17%*	48	*-16%*	41	*-28%*
Hungary	78	67	*-13%*	67	*-13%*	48	*-38%*
Ireland	104	100	*-4%*	101	*-4%*	92	*-11%*
Italy	422	386	*-9%*	386	*-9%*	298	*-29%*
Latvia	13	15	*15%*	15	*16%*	13	*3%*
Lithuania	44	49	*12%*	49	*12%*	46	*4%*
Luxembourg	6	6	*-10%*	6	*-10%*	5	*-25%*
Malta	2	2	*-7%*	2	*-7%*	1	*-25%*
Netherlands	146	112	*-23%*	112	*-23%*	111	*-24%*
Poland	344	330	*-4%*	331	*-4%*	247	*-28%*
Portugal	71	71	*0%*	71	*0%*	55	*-22%*
Romania	161	142	*-12%*	142	*-12%*	122	*-25%*
Slovakia	28	24	*-16%*	24	*-16%*	17	*-41%*
Slovenia	19	17	*-13%*	17	*-12%*	14	*-25%*
Spain	366	353	*-3%*	352	*-4%*	260	*-29%*
Sweden	54	48	*-10%*	48	*-10%*	44	*-18%*
United Kingdom	308	282	*-9%*	282	*-8%*	240	*-22%*
EU-28	3928	3656	*-7%*	3658	*-7%*	2771	*-29%*

Table 32: VOC emissions of the 75% gap closure scenario in 2025, kilotons and rel. to 2005

	2005	Current legislation 2025				75% gap closure for CEP	
		CEP		REF			
Austria	171	104	*-39%*	107	*-38%*	89	*-48%*
Belgium	158	97	*-38%*	99	*-37%*	87	*-45%*
Bulgaria	139	70	*-49%*	73	*-47%*	54	*-61%*
Croatia	79	50	*-36%*	51	*-36%*	38	*-52%*
Cyprus	9	4	*-53%*	4	*-52%*	4	*-54%*
Czech Rep.	251	142	*-44%*	143	*-43%*	113	*-55%*
Denmark	130	63	*-51%*	65	*-50%*	55	*-58%*
Estonia	38	27	*-29%*	29	*-24%*	25	*-35%*
Finland	173	96	*-44%*	102	*-41%*	91	*-47%*
France	1117	605	*-46%*	616	*-45%*	566	*-49%*
Germany	1235	837	*-32%*	850	*-31%*	717	*-42%*
Greece	283	118	*-58%*	121	*-57%*	91	*-68%*
Hungary	144	81	*-44%*	83	*-42%*	62	*-57%*
Ireland	63	43	*-32%*	44	*-31%*	42	*-34%*
Italy	1237	660	*-47%*	667	*-46%*	565	*-54%*
Latvia	69	38	*-45%*	40	*-42%*	29	*-58%*
Lithuania	84	42	*-50%*	43	*-49%*	34	*-60%*
Luxembourg	13	6	*-54%*	6	*-54%*	5	*-58%*
Malta	4	3	*-31%*	3	*-31%*	3	*-32%*
Netherlands	205	140	*-31%*	142	*-31%*	133	*-35%*
Poland	615	397	*-35%*	412	*-33%*	278	*-55%*
Portugal	227	136	*-40%*	137	*-40%*	121	*-47%*
Romania	460	244	*-47%*	256	*-44%*	166	*-64%*
Slovakia	77	53	*-31%*	54	*-30%*	46	*-40%*
Slovenia	41	28	*-33%*	30	*-27%*	15	*-64%*
Spain	934	597	*-36%*	597	*-36%*	488	*-48%*
Sweden	210	137	*-35%*	138	*-34%*	136	*-35%*
United Kingdom	1093	685	*-37%*	694	*-37%*	546	*-50%*
EU-28	9259	5505	*-41%*	5604	*-39%*	4599	*-50%*

This study was undertaken at the request of the European Parliament's Committee on Environment, Public Health and Food Safety. It provides a complementary impact assessment, exploring the interactions between the European Union's air quality policy and the proposed EU climate and energy policy. It shows that reduced consumption of polluting fuels resulting from the climate and energy targets that have been put forward by the European Commission in early 2014 (i.e., a 40% reduction in GHGs, a share of 27% renewables, and a 30% improvement of energy efficiency compared to the 2007 baseline), would reduce premature mortality from fine particulate matter in the EU and make further air quality improvements less costly.

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