Title: Transposition of the National Emissions Ceiling Directive **Lead department or agency:** Department for Environment, Food and Rural Affairs	Evidence base
	Date: February 2018
	Stage: Evidence base
	Source of intervention: EU
	Type of measure: Secondary legislation
Summary: Intervention and Options	**RPC Opinion: N/A**

Cost of Preferred (or more likely) Option				
Total Net Present Value:	**Business Net Present Value:**	**Net cost to business per year** (EANCB 2014 prices)	**In scope of One-In, Three-Out?**	**Measure qualifies as**
N/A	N/A	N/A	N/A	N/A

What is the problem under consideration? Why is government intervention necessary?

Air pollution is a significant environmental risk to human health and also causes long-lasting harm to the natural environment, affecting the quality of sensitive habitats and the species they sustain. Exposure to air pollutants reduces life-spans, in particular through causing cardiovascular and respiratory diseases, and causes chronic health impacts such as asthma and bronchitis, that require medical treatment and affect people's quality of life. A significant proportion of pollution is transboundary, requiring international cooperation. For this reason, the key damaging pollutants have been subject to international legislative controls. The National Emissions Ceilings Directive (NECD) sets ceilings on total emissions by 2020 for five key damaging pollutants, namely: nitrogen oxides (NO_x), sulphur dioxide (SO_2), particulate matter ($PM_{2.5}$), non-methane volatile organic compounds (NMVOC) and ammonia (NH_3). This Directive was revised in December 2016. The NECD also sets national emission reduction commitments (ERCs) for 2030. Government intervention is required for the UK to transpose the revised Directive into national legislation.

What are the policy objectives and the intended effects?

The objective of the NECD is to reduce harmful health and environmental impacts of air pollution by reducing emissions of the five key pollutants to meet specified limits for 2020 and 2030. The limits were set on the basis of analysis of what is technically achievable with available technology. The policy objective is to halve the public health impact of air pollution by 2030. This impact assessment sets out preliminary analysis of the costs and benefits of implementing the NECD emission reduction commitments. In 2018 the Government will consult on a Clean Air Strategy which will set out policy proposals for delivering the NECD commitments. The measures that need to be taken to achieve the emission reduction commitments will be set out in detail in a National Air Pollution Control Programme (NAPCP) to be published by 1st April 2019. The costs of implementing measures to achieve the NECD emissions reductions and the associated health and environmental benefits have been assessed. In all scenarios we concluded that the estimated benefits outweigh the costs. The monetised benefits in reduced public health and environmental impacts are estimated to range from £2,576 million per annum in the low scenario to £3,352 million per annum in the high scenario.

What policy options have been considered, including any alternatives to regulation? (further details in Evidence Base)

A high level assessment of the costs of measures and the resulting benefits to public health and the environment has been carried out on the basis of the emissions ceilings being reached in 2020 and 2030. The NECD does not set out a prescribed way of achieving these ceilings, and the UK has flexibility in deciding the best solutions for achieving emissions reductions. These may not always involve regulation, and current thinking envisages a range of enabling solutions to achieve the desired outcomes, backed up by regulation only where needed. More specific detailed proposals will need to be developed for a range of economic sectors and pollutants in due course. Each of these will be subject to the normal impact assessment process.

This impact assessment analyses a set of measures designed to provide an indication of the likely costs and benefits of achieving the NECD emission reduction commitments in 2030. As it does not assess a singular measure, the methodology used for the analysis differs from that used in standard impact assessments considering a single measure. The estimated benefits from improved air quality were assessed using the damage cost valuation approach as recommended by the Government's Green Book supplementary guidance. We assessed the cost of implementing measures to achieve the emissions reductions using a set of measures drawn from the Multi-Pollutant Measures Database (MPMD). The MPMD identifies abatement measures that could be implemented to abate emissions of NO_x, SO_2, $PM_{2.5}$ and NMVOC. NH_3 emission abatement measures are identified outside of the MPMD. These measures represent action beyond the measures already in place to reduce emissions. The cost of implementing the measures was assessed by varying the uptake of measures (high, central and low uptake scenarios) to meet the emission reduction commitments in order of cost effectiveness (cost per tonne of pollution reduction).

Will the policy be reviewed? If applicable, set review date: N/A					
Does implementation go beyond minimum EU requirements?			No		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro**		**Small**	**Medium**	**Large**
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:** **0.844**	**Non-traded:** **3**	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister: T. Coffey Date: 19/02/2018

Summary: Analysis & Evidence

Description: Transposition of the National Emissions Ceiling Directive

FULL ECONOMIC ASSESSMENT

Price Base Year 2016	PV Base Year	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
			Low: N/A	High: N/A	Best Estimate: N/A

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant	Total Cost (Present Value)
Low	N/A	1	N/A	**N/A**
High	N/A		N/A	**N/A**
Best Estimate	N/A		N/A	**N/A**

Description and scale of key monetised costs by 'main affected groups'

The estimated monetised costs represent the technical costs of implementing the measures. Three different scenarios are developed (high, central and low) related to the varying uptake of emission reduction measures. The scenarios assess the cost of meeting the emission reduction commitments. Moving from the high to the low scenario, the assumed level of uptake of measures falls, lowering the level of available abatement while increasing the costs of meeting the agreed ceiling. In all three scenarios, the benefits outweigh the costs. The costs range from £1.7 billion per annum in the low scenario to £249 million per annum in the high scenario. The actual cost realized will depend on the measures the Government chooses to implement in order to meet the emission reduction commitments.

Other key non-monetised costs by 'main affected groups'

The overall impact on the economy is considered to be fairly neutral. While some sectors supplying pollution abatement equipment will benefit from the ceilings over the period to 2030, other sectors may bear a cost from the implementation of emissions reduction measures.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant	Total Benefit (Present Value)
Low	**N/A**	**N/A**	**N/A**	**N/A**
High	**N/A**		**N/A**	**N/A**
Best Estimate	**N/A**		**N/A**	**N/A**

Description and scale of key monetised benefits by 'main affected groups'

Improving air quality will result in significant benefits to UK residents and the wider economy. The analysis uses the UK damage cost valuation approach to estimate the benefits as set out in the Green Book supplementary guidance for valuing changes in air quality. The damage costs used do not fully capture impacts on the environment or productivity. Consequently they are likely to under-estimate the benefits of the proposals. Notwithstanding we estimate the benefits of implementing the NECD to range from £3.4 billion per annum in the high uptake scenario to £2.6 billion per annum in the low uptake scenario.

Other key non-monetised benefits by 'main affected groups'

These benefits are enjoyed by all UK residents.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5%

Annual costs of abatement, incremental emission reductions and cost-effectiveness of abatement measures are calculated from a number of input variables. It is recognised that there can be uncertainty in the values of these variables, more specifically projected emissions to 2030 are taken from the National Atmospheric Emissions Inventory and will have uncertainty that is related to the underlying data and assumptions related to emissions projections.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m: 0.0
Costs: N/A	Benefits: N/A	Net: N/A	

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1. Executive Summary

Poor air quality is a significant environmental risk to human health and causes long-lasting harm to the natural environment.

Long term exposure to poor air quality reduces life-expectancy through increased risk of mortality from cardiovascular and respiratory causes and from lung cancer. Short-term exposure to poor air quality carries a morbidity burden over a wide range of cardiorespiratory health conditions.[1] Harm to the natural environment includes effects such as the reduction in yields of key food crops caused by ozone damage and changes to delicate nutrient balances causing some aspects of the ecosystem to thrive at the detriment of others.[2]

The Government is firmly committed to improving air quality and reducing harmful emissions. In recognition of the damage caused by air pollution, the UK has signed up to the National Emissions Ceilings Directive (NECD) which sets ceilings on total national emissions of five key air pollutants i.e. nitrogen oxides (NO_x), sulphur dioxide (SO_2), particulate matter ($PM_{2.5}$), non-methane volatile organic compounds (NMVOC) and ammonia (NH_3) by 2020 and emission reduction commitments (ERCs) for the same pollutants for 2030. The reductions are set relative to emissions in 2005, the baseline year. The UK is meeting its current NECD targets and has done since the ceilings were first introduced in 2010.

This impact assessment sets out preliminary analysis by the UK Government on the implementation of the NECD (and the associated ERCs) as published in the Official Journal of the European Union (EC Directive 2016/2284). As the 2020 ceilings have already been agreed internationally (under the Gothenburg Protocol to the Convention on Long-range Transboundary Air Pollution), the impact assessment assesses the costs and benefits of implementing measures to achieve the 2030 ERCs. Defra has previously conducted analysis to assess the impacts of meeting the 2020 emissions ceiling. Table 1 summarises the ERCs in kilo tonnes, the percentage reductions relative to 2005 and the implied emission reductions required in kilo tonnes to meet the ERCs.

Table 1: NECD emission reductions 2030

Pollutant	Emission Reduction Commitments vs 2005 emissions	Implied ceilings in kt (2030)	Implied emission reduction needed (vs 2030 BAU), kt[3]
NO_x	73%	434	130
SO_2	88%	85	58
$PM_{2.5}$	46%	61	33
NMVOC	39%	654	28
NH_3	16%	258	41

For NO_x, SO_2, $PM_{2.5}$, and NMVOC, our assessment of meeting the ERCs is based on the updated 2015 Energy and Emissions Projection (EEP 2015), which projects future energy use and greenhouse gas emissions in the UK, and the 2014 National Atmospheric Emissions Inventory (NAEI), which estimates annual pollutants emissions. For NH_3, the analysis is based on the 2015 NAEI. Our assessment of implementing the measures required to meet the ERCs is based on the Multi-Pollutant Measures Database (MPMD) which contains a wide range of measures that could be deployed to reduce emissions of NO_X, SO_2, $PM_{2.5}$ and NMVOCs in the UK.[4] Where possible, impacts on CO_2 emissions are also quantified. Data is presented on the cost, quantity of pollutant(s) abated and future potential uptake rate of each measure. Using measures from the MPMD, the analysis assesses the least cost approach to meeting the ERCs.

Three different scenarios (high central and low) are developed to assess the cost of achieving the ERCs under varying uptake of emission reduction measures. Moving from the high to the low scenarios, the assumed level of

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[1] COMEAP (2010) The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom. Committee on the Medical Effects of Air Pollutants. Available from: https://www.gov.uk/government/publications/comeap-mortality-effects-of-long-term-exposure-to-particulate-air-pollution-in-the-uk

[2] RoTAP (2012) Review of Transboundary Air Pollution: Acidification, Eutrophication, Ground Level Ozone and Heavy Metals in the UK. Contract Report to the Department for Environment, Food and Rural Affairs. Centre for Ecology & Hydrology.

[3] For NOx, SO2, PM2.5 and NMVOC, the implied emission reduction quoted in this table are reductions *in addition* to the 2030 BAU emissions level as contained in the EEP2015-NAEI (2014) emissions projections. For NH3, the implied emission reduction is *in addition* to the 2030 BAU emissions level as contained in NAEI (2015).

[4] The Multi-Pollutant Measures Database identifies abatement measures that could be used to reduce emissions of NO_x, SO_2, $PM_{2.5}$ and NMVOC in the UK. The MPMD provides cost information for each of these measures. The measures represent action beyond what is contained within our baseline emission projections, i.e. beyond business as usual measures that reduce emissions.

uptake of measures falls, lowering the level of available abatement while increasing the costs of meeting the ERCs.[5] The ERCs are met under the high and central measure uptake scenarios for NO_x, SO_2, $PM_{2.5}$, and NMVOC at a total annualised cost of £181 million and £861 million in 2030 respectively.[6] In the low uptake scenario, the SO_2 and NO_x ceilings are not met. This scenario excludes high cost measures that would result in further reductions in NO_x emissions. The measures applied in the low uptake scenario are estimated to have an annualised cost of £1,687 million in 2030.

Measures to reduce NH_3 emissions are considered separately from the four pollutants mentioned above. This is because NH_3 emissions come mostly from agriculture (81%). As such most NH_3 emissions reductions will be sought from this sector, for which we have conducted a more in depth analysis. High, central and low emission reduction scenarios were developed for NH_3. The cost of meeting the 2030 NH_3 ERCs in the central scenario is estimated at £49 million per annum, while the cost in the high and low scenarios are estimated at £68 million and £12 million per annum respectively.

Reductions in air pollution yield benefits in terms of improvements to human health and the eco-systems. The benefits associated with the improvements in air quality from meeting the ERCs are estimated using the UK damage cost approach (as set out in the Green Book supplementary guidance for valuing changes in air quality).[7] This consists of multiplying total reductions in emissions of each air pollutant by the associated damage cost. We use the latest available damage costs figures, accounting for the most recent recommendations of the Committee on the Medical Effects of Air Pollutants (COMEAP). The benefits of abating emissions from the five pollutants range from £2,576 million in the low scenario to £3,352 million in the high scenario in 2030. These quantified benefits are based primarily on reductions in $PM_{2.5}$, for which we have the most developed understanding of quantified attributable mortality. In all three scenarios, the benefits of achieving the ERCs are assessed to be greater than the cost of implementing measures required to meet them. In the central scenario the benefits outweigh the costs by a factor of 4.

The estimated costs and benefits are outlined in Table 2.

Table 2: Costs and benefits of emissions reduction in the high, central and low scenarios

Scenarios	Costs (£ million pa)	Benefits (£ million pa)
High	249	3,352
Central	909	3,583
Low	1,699	2,576

More detailed assessments of the measures required to meet the NECD ERCs will be outlined as part of the Government's Clean Air Strategy and the National Air Pollution Control Programme (NAPCP). Other wider impacts assessed include possible reductions in emissions of greenhouse gases (GHGs), impacts on small and micro businesses, energy prices, and bills and to devolved administrations.

[5] For NH_3, the scenarios consider different levels of emissions abatement, keeping the rate of uptake constant.

[6] Costs reflect both upfront capital costs and operating costs. In order to make measures/investments of different lifespans comparable, their respective capital costs are distributed over their entire lifetime (expressed in years), i.e. they are *annualised*.

[7] The damage costs mainly reflect the mortality effects of air pollution and some of its impacts on morbidity and ecosystems. They exclude the impacts of eutrophication and acidification on ecosystems, which are assessed separately. We anticipate the damage costs will be revised to take into account a fuller assessment of the morbidity impacts from air pollution and hence will likely increase.

2. Introduction

Poor air quality is a significant environmental risk to human health, exacerbating the impact of pre-existing health conditions, especially for the elderly and children. Some of the health effects caused by exposure to elevated levels of pollution are outlined in Table 3. It also causes long-lasting harm to the natural environment, affecting the quality of sensitive habitats and the species they sustain.

Air pollution is measured and regulated in two different ways: by concentrations and total emissions. The Ambient Air Quality Directive (AAQD) sets limits for both short term and annual pollution concentrations. The AAQD is already transposed into law in England by the Air Quality Standards Regulations. Total emissions were first regulated by the 1999 Gothenburg Protocol, under which Parties agreed to cap their annual emissions of certain pollutants by 2010 as a reduction from 1990 levels. The Protocol amendment of May 2012 set more stringent targets for reducing emissions and added new limits for other airborne pollutants, as a percentage of 2005 levels by 2020.

Air quality has improved significantly over recent decades through action taken by successive governments and the development of cleaner technologies. Total emissions for SO_x and NO_x have fallen from just over 6000 kilo tonnes and 3000 kilo tonnes respectively in 1970, to under 500 and 1300 kilo tonnes respectively in 2015 (NAEI 2015). Emissions of $PM_{2.5}$ and NMVOCs have declined by 37% and 76% over the same period.

Notwithstanding these improvements, further action is required to address the continuing harm to human health and the environment from air pollution. The NECD is the European legislation that implements the emission limits agreed under The Gothenburg Protocol. The Directive initially set annual ceilings for each pollutant, including NO_x, which Member States had to achieve by 2010. It was amended in 2016, with the revised NECD setting the 2020 ceilings (in accordance with the revision to the Gothenburg Protocol) and emission reduction commitments (ERCs) for 2030. The objective of the amendments were to reduce the significant negative impacts air pollution can have by reducing domestic and transboundary emissions.

The NECD introduces specific emissions reduction requirements (expressed as percentage reduction from 2005 emission levels). It does not specify which abatement measures should be implemented to achieve the ERCs. This impact assessment assesses the benefits associated with meeting the ERCs and the cost of abatement measures that could be implemented to meet them. These measures are considered in order of cost-effectiveness. The Government's Clean Air Strategy will outline which measures the Government plans to implement to meet the ERCs with supporting impact assessments of the identified measures provided in due course. The document proceeds as follows. Chapters 3 to 5 set out the problem under consideration, the rationale for intervention and the policy objective; chapter 6 introduces the methodology used to assess the associated costs and benefits while chapter 7 presents the results of the analysis; chapters 8 and 9 discuss sectoral and wider socioeconomic impacts while chapter 10 considers the risks and uncertainties linked to the analysis. Finally, chapter 11 provides a summary of the analysis.

Table 3: Effects for key air pollutants

Pollutant	Effects
Particulates (PM, which includes PM_{10} and $PM_{2.5}$)	Fine particulate matter can penetrate deep into the lungs and other tissues, including the brain. Research in recent years has strengthened the evidence that both short-term and long-term exposure to $PM_{2.5}$ are linked with a range of negative health outcomes including shortening the lives of susceptible individuals through cardiovascular disease, stroke, cancers, respiratory and other diseases. COMEAP estimated that the burden of anthropogenic particulate air pollution in the UK in 2008 was an effect on mortality equivalent to nearly 29,000 deaths. The burden can also be represented as a loss of life expectancy from birth of approximately six months.
Nitrogen Dioxide (NO_2)	Collated research by COMEAP into the health impacts of NO_2 has shown that it is reasonable to associate NO_2 in outdoor air with adverse effects on health, including reduced life expectancy. As part of this report, it was established that there were likely to be short term and long term effects as short-term exposure to NO_2 has been linked to some direct effects on respiratory morbidity, while studies of long-term exposure to NO_2 report associations with all-cause, respiratory and cardiovascular mortality, children's respiratory symptoms and lung function.

Sulphur Dioxide (SO_2)	A respiratory irritant that can cause constriction of the airways. People with asthma are considered to be particularly sensitive. Health effects can occur very rapidly, meaning short-term exposure to peak concentrations can have significant effects.
Ozone (O_3)	High ambient concentrations can occur in hot weather conditions as a result of the chemical conversion of primary pollutants such as NOx and NMVOCs. Ozone can cause inflammation of the respiratory tract and irritation of the eyes, nose, and throat. High levels may exacerbate asthma or trigger asthma attacks in susceptible people and some non-asthmatic individuals may also experience chest discomfort whilst breathing. Evidence is also emerging of negative health effects due to long-term exposure.
Ammonia (NH_3)	Ammonia in the environment comes from both natural and manmade sources. It occurs naturally at low levels throughout the environment, released from the breakdown of organic waste matter. Local concentrations may be elevated where there is a lot of animal waste, such as in intensive farming environments for cattle, pigs and chickens. Non-agricultural sources include sewage sludge, industry, and petrol vehicles fitted with catalytic converters. Human exposure to ammonia will occur at very low levels throughout the environment. While exposure to ammonia in concentrated forms will cause potentially serious health effects, exposure to ammonia from the environment is not considered to pose a risk to human health. Ammonia gas does not remain in the environment for long; it rapidly reacts to form ammonium compounds, including particulates ($PM_{2.5}$) which contribute to background levels considerable distances away from the original source. These secondary particulates can contribute to public health impacts. Finally, ammonia emissions from agriculture are a key source of nitrogen deposition on sensitive natural habitats. This causes long term adverse environmental consequences, causing loss of plant species that are sensitive to too much nitrogen in the soil, resulting in loss of biodiversity and damage to many protected and designated habitats in the UK.
Non Methane Volatile Organic Compounds (NMVOCs)	NMVOCs are a large group of chemical compounds emitted to air as combustion products, or as vapour arising from petrol, solvents, perfumes and numerous other sources, often when products are used at work or in the home. When released into the atmosphere, these emissions react with other air pollutants in the presence of sunlight to produce ground level ozone (see above). NMVOCs and the chemicals formed by their conversion in the air also form a significant component of indoor air pollution. For example they may react in the presence of chemicals produced when natural gas is burned in cookers and boilers to form formaldehyde, a potential carcinogen which can cause skin irritation and exacerbates symptoms of respiratory conditions.

3. Problem under consideration

As outlined in the previous chapter, there are significant human health and environmental reasons why we should reduce emissions of pollution to the air and improve air quality.

For these reasons, the emissions of NO_x, SO_2, $PM_{2.5}$, NMVOC and NH_3 have been subject to EU level legislative controls through the National Emissions Ceilings Directive. The NECD, as revised in December 2016, sets emission ceilings for 2020 and ERCs for 2030 as compared to a 2005 baseline year.

In recognition of the benefits of improved air quality, the UK has signed up to the NECD, wherein the European Union has set national ERCs for five key pollutants to protect its citizens and environment from the effects of air pollution. Over the next 12 years, the UK will need to reduce emissions for the five key pollutants to achieve its national emission reduction commitments.

4. Rationale for intervention

The aim of the Directive is to limit air pollution, which has a negative impact on human health and causes significant environmental damage. This is wholly consistent with the aim of the UK Government to improve air quality and bring about a cleaner, healthier environment that benefits people and the economy.

It is estimated that air pollution contributes to 30,000 premature deaths a year, with an annual cost of £30bn. While the impacts of current levels of air pollution on productivity in the UK are less certain, its burden is estimated at around £1.7bn per year. Improving air quality and reducing harmful emissions is therefore a top priority for the UK, and work is being undertaken across all levels of government to bring this about. The most immediate challenge is to tackle hotspots of NO_2 around roads mostly as a result of emissions from transport; this is part of a bigger picture of harmful emissions from farming, industry, energy, and households, which make a significant contribution to air pollution in the UK.

The UK played an active role in negotiations on the new agreement and supported the deal, which reduced the costs for the UK from £1.2-1.9bn to £0.2-1.7bn per year. As part of the negotiations, the Government also secured a number of other UK objectives such as excluding methane from the scope of the Directive, ensuring that there will be no binding interim ceilings in 2025, and ensuring the inventory adjustment mechanism (a provision in the Gothenburg Protocol which allows inventories to be adjusted if unexpected scientific developments lead to an exceedance) also applies to the 2030 ERCs.

Defra's 25 Year Environment Plan sets out the Government's clear commitment to ensure a cleaner and healthier environment, including cleaner air. In July 2017 the Government published "The UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations". The rationale for intervention is reflected by the drive to deliver human health and environmental benefits through cost-effective improvements to air quality. Implementing the NECD is a further step towards meeting a key Defra objective of creating a better place for living.

5. Policy objective

The policy objective is to improve air quality across the UK in order to halve the public health impact of air pollution by 2030. This assists in meeting both the requirements of the Ambient Air Quality Directive, which is already transposed into law in England by the Air Quality Standards Regulations, and the revised NECD.

The ERCs set challenging emission reductions and meeting these will require action across all relevant economic sectors. Action to improve air quality will bring significant opportunities for innovation and cleaner growth. Taking decisive action now will not only improve the health of working people, but should also support the development and uptake of new greener technologies in the UK. Efforts will be made at all stages of the process to minimise costs to business.

We are legally obliged to put in place provisions to transpose this Directive into national law. While we intend to transpose the specific objectives to be achieved, i.e. the national emission ceilings and 2030 ERCs, the Directive leaves the form and methods to achieve those objectives to the discretion of each Member State. Where possible the Government will explore alternatives to implementing regulation in the interest of keeping burdens to a minimum. Effective transposition of the Directive will also reduce the risk of infraction.

6. Methodology

This section describes the approach taken in estimating the costs of implementing the ERCs and the resultant benefits. The estimates represent the annualised costs and benefits of meeting the ERCs.

6.1. Emission projections

The UK National Atmospheric Emissions Inventory (NAEI) projections (Ricardo E&E, 2016, 2017) provides estimates of projected atmospheric releases of NO_X, SO_2, $PM_{2.5}$, NMVOCs, NH_3 and other pollutants up to 2030, as summarised in the tables below.

Table 4: BAU emission projections (kt) for sources covered under the NECD (excludes road transport) [8]

Year	NO_X (kt)	SO_2 (kt)	$PM_{2.5}$ (kt)	NMVOC (kt)	NH_3 (kt)
2014	648	307	91	689	281
2020	552	190	85	657	288
2025	469	149	84	660	294
2030	451	143	83	668	302

Source: EEP2015 NAEI (2014)

The emission projections are based on the 2014 NAEI developed by Ricardo and the ‘Energy Emissions Projections 2015’ developed by BEIS (formerly DECC) combined with a series of assumptions for each sector. Further information on the basis of the projections is presented in the UK Informative Inventory Report (Ricardo, (2016) and Updated Energy and Emissions Projections (DECC, 2015).[9]

In general, emission reductions with specific measures have been estimated based on the emission projections above without change. However, in some cases it has been necessary to adjust the counterfactual emissions projections provided in the NAEI, in order to account for policies or plant closures which have not been taken into account in their formulation. This includes, for example, the impact of the Best Available Technology conclusions under the Industrial Emissions Directive and the Medium Combustion Plant Directive. A baseline adjustment has also been implemented in the power sector to account for more recent electricity generation forecasts provided by BEIS (2017) which differ from EEP2015 underlying the NAEI projections.

6.2. Costs

The Multi-Pollutant Measures Database (MPMD) identifies abatement measures that could be implemented to reduce emissions of NO_x, SO_2, $PM_{2.5}$ and NMVOC in the UK. The measures represent action beyond what is contained within our baseline emission projections, i.e. measures already in place to reduce emissions. In total, 170 separate measures (or variations around a single measure) have been developed and are presented in the database.[10] The measures are grouped together into sectors (there are 24 sub-sectors in total). Measures for reducing NH_3 emissions are developed outside of the MPMD.

Adjustments to the measures are applied to standardize the costs and develop single-pollutant cost curves. We model the take-up of these measures in order of cost-effectiveness (cost per tonne of emission reduction) to assess the cost of achieving the ERCs for all pollutants. The resultant analysis illustrates the total costs that would be incurred by the UK with the implementation of the set of measures. The measures are applied in order of cost-effectiveness to produce scenarios for how a given level of emission reductions could be achieved. *Three different scenarios have been developed to reflect which measures might be feasible under differing levels of uptake:*

- **High uptake scenario**: this scenario is based on what is considered the maximum technically feasible abatement with no constraints on feasibility. It is the scenario with the measures of potential abatement applied at the greatest levels of uptake and is the lowest cost scenario of meeting the ERCs.

- **Central uptake scenario**: this scenario includes all of the measures in the high uptake scenario but adjusts the level of uptake to less than the maximum technically possible. This is designed to begin to reflect non-

[8] See Annex B for emission projections for sources covered under the NECD road transport.

[9] For NH_3, the emission projections are based on the NAEI 2015.

[10] This includes 20 baseline adjustments that have been developed and presented alongside these measures.

technical barriers to uptake which could limit the extent to which abatement options are applied in practice. The scenario represents around 75% of the maximum technically feasible abatement. With lower uptake assumed for each measure, it requires implementing more measures to meet a given ceiling and as such it is more expensive to meet the ERCs under this scenario than under the high scenario.

- **Low uptake scenario**: under this scenario the uptake of measures is restricted even further and a small number of measures are excluded entirely due to their high cost (per tonne of emission abated) and limited emission reduction potential, i.e. less than 0.1% of total emissions of a particular pollutant. The scenario reflects around 50% of the maximum technically feasible abatement. With the lowest uptake of measures, more measures are required to be implemented to meet the ERCs, increasing the cost.

The approach taken to assess NH_3 emissions ceiling and abatement measures differs from that used for the other four pollutants. This is because NH_3 is not included in the MPMD and NH_3 emissions reductions will be mainly sought from the agricultural sector, which accounted for 81% of total UK NH_3 emissions in 2015. Three different scenarios (high, central and low) are developed for the NH_3 analysis. The scenarios are combinations of different measures with the rate of uptake for each measure kept constant across them.[11] The NH_3 scenarios consider different levels of emissions reduction, which increases as we move from the low to the high scenario, in contrast to the other four pollutants. Measures considered for NH_3 emissions abatement are also applied in order of cost-effectiveness.

6.3. Benefits to human health and the environment

Monetised benefits

Benefits for each of these scenarios are also estimated. The beneficial impact is considered in terms of the damage avoided if emissions reductions are achieved. The analysis uses the UK damage cost valuation approach as set out in the Green Book supplementary guidance for valuing changes in air quality.

Damage costs are a simple way to value changes in air pollution. They estimate the cost to society of a change in emissions of different pollutants. This 'damage' avoided is calculated in money terms using a damage cost. The IGCB damage cost functions form official Government Green Book guidance on valuing impacts from Air Quality.[12] They predominantly capture the health benefits from reduced emissions. The analysis in this impact assessment is based on forthcoming updated damage costs which reflect the latest COMEAP advice and takes a consistent approach to that used in support of the Government's recently published 'UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations'.

As damage costs are sensitive to factors such as geographic location of emission sources and meteorology, there are damage cost functions for particulate matter (PM) and NO_x that are categorised by geographic area. For the purpose of this analysis we use a weighted average damage cost specific to each pollutant. These are as presented in annex A and are calculated based on forthcoming damage cost estimates, which are expressed in 2015 prices. Therefore, for consistency with the other figures presented in this analysis, the damage costs are converted to 2016 prices using a GDP deflator from the Office of National Statistics. Finally, following IGCB guidance, these are uplifted by 2% a year until 2030 to reflect Willingness to Pay (WTP) for environmental quality in that year.

Total benefits are computed by multiplying avoided emissions by the aforementioned damage costs. In this analysis, avoided emissions are emission reductions undertaken to meet the NECD ERCs. The required emission reductions implied by the ERCs are estimated with respect to the 2030 Business As Usual (BAU) emissions projection. The UK NAEI projections provides estimates of projected atmospheric releases of NO_x, SO_2, $PM_{2.5}$, NMVOCs, NH_3 and other pollutants up to 2030. We use the NAEI projections of emissions of these pollutants in 2030 as the BAU baseline.

Non-monetised Benefits

It is important to note when applying and interpreting damage cost functions that a number of impacts are not taken into account in the quantification. The damage costs largely exclude morbidity impacts arising from air pollution Hence the monetised air quality health impacts do not include all benefits to human health. The damage costs do not include impacts on ecosystems and cultural heritage. For example, they do not include impacts of acidification and eutrophication on ecosystems. These impacts are quantified (but not monetised) separately.

For these reasons, the benefits estimated through the application of damage cost functions may be underestimated.

[11] NH3 can be released into the atmosphere at various stages of the slurry/manure management process. Abating total NH3 emissions from the agriculture sector requires that they be controlled at each of these stages, which will influence the measures adopted. The NH3 emissions abatement scenarios have been developed to take this into account.

[12] Note that the damage costs values presented in the guidance have been updated.

7. Results: costs and benefits of implementing the ERCs

The total cost of achieving the ERCs varies across the three scenarios of measures. This is because each measure achieves a different emission reduction level under each scenario. A measure has the greatest emission reduction potential in the high scenario, which is what is considered technically feasible. As the uptake of the measure is reduced for the central and low scenarios, less abatement is attributed to that measure. To achieve the same overall emission reduction it is necessary to use more measures, moving further along the cost curve. The low scenario is therefore the one with the highest cost of meeting a given emission ceiling.[13]

Care has been taken to avoid double counting of cost. Where measures affect multiple pollutants the cost is assigned to the pollutant for which the measure is most significant to meeting its target. This means that care is also required in interpreting the presentation of costs when split by pollutant.[14]

The annualised costs in 2030 of meeting the NO_x, SO_2, $PM_{2.5}$ and NMVOC ERCs are estimated to be £181 million and £861 million in the high and central uptake of measures scenarios, respectively. In the low uptake scenario not all of the ERCs are achieved. It is possible to implement measures that further reduce NO_x and SO_2 emissions in the low scenario. However, these measures have been assessed as too costly to be implemented.

Table 4: Summary of emission reductions and provisional costs under high, central and low scenarios[15]

		NO_x	SO_2	$PM_{2.5}$	NMVOC	NH_3	Total costs (£ million pa 2016)[16]
	Reduction to meet ceiling (kt)	**130**	**58**	**33**	**32**	**41**	
HIGH SCENARIO	Reductions achieved[17] (kt)	Met	Met	Met	Met	Met	
	Total annualised cost (£ million pa)	138.2	43.153	-	-	68.16	249
CENTRAL SCENARIO	Reductions achieved (kt)	Met	Met	Met	Met	Met	
	Total annualised cost[1] (£ million pa)	795.41	43.15	21.15	1.24	48.59	909
LOW SCENARIO	Reductions achieved (kt)	120	53	Met	Met	36	
	Total annualised cost[1] (£ million pa)	1,366.11	57.93	231.66	30.76	12.09	1,699

For NH_3, the variation in cost across scenarios reflects the increased number of measures taken to achieve higher levels of abatement (see section 6.2). In the high scenario, NH_3 emissions are reduced by about 60kt. In the central and low scenarios, emissions are reduced by 49kt and 35kt respectively. Only in the low scenario would the emission reductions be insufficient to meet the NH_3 ceiling. In the high and central scenarios, the NH_3 ceiling is surpassed.

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[13] This holds for all air pollutants except for NH_3 for which emission abatement increases as you move from the low to the high scenario.

[14] Action to tackle the full range of pollutants is therefore more cost-effective than action that targets pollutants singly.

[15] This analysis is based upon our central forecast of emissions in 2030. Figures may not sum due to rounding.

[16] Assuming zero cost where saving; costs are attributed to pollutant for which the measure is most significant.

[17] These figures include emission reductions achieved through "baseline adjustments" (NO_x: 42 kt, SO_2: 25.3 kt, $PM_{2.5}$: 10.3, NMVOC: 1.4 kt, NH_3: 21kt). These baseline adjustments reduce emission reductions to be achieved through the introduction of additional abatement measures and are the same across all the scenarios. The subsequent analysis focuses on the costs and benefits of emissions reductions *net* of these baseline adjustments. Therefore, emission reduction figures presented in Annex A do not directly match those presented in this table. In addition, although scenarios are designed to meet the NECD ERCs, those are usually slightly surpassed.

The benefits, on the other hand, are presented in Table 5. The central estimates range from £2,576 million to £3,583 million in 2030.[18] These arise primarily from the reduction in $PM_{2.5}$, which is the most harmful of all pollutants. The range is based on the different measure uptake scenarios, and the low end represents the benefits under the low uptake scenario where not all the ERCs are met. These figures include the health impacts of chronic bronchitis. Excluding such impacts would yield benefits between £1,690 and £2,225 million in 2030.[19]

Table 5: Benefits of emissions reductions for all pollutants in 2030

Scenario	Benefits (£ million per year)
High	3,352
Central	3,583
Low	2,576

The eutrophication and acidification impacts on the ecosystems are assessed separately. Ecosystem impacts are notable and derive mainly from the reductions in NH_3.While we cannot currently monetise the environmental benefits, we have been able to quantify some of them. Table 6 below shows how the measures are expected to affect the area of critical load exceedance for eutrophication and acidification in 2030. Areas expected to exceed their critical loads for eutrophication are forecast to reduce by up to 6.2 percentage points. Areas expected to exceed their critical loads for acidification are forecast to reduce by up to 4.2 percentage points.

Table 6: Percentage area exceedance of all broad habitats in the UK in 2030

	Percentage (%) area exceedance			
	Baseline	**Low**	**Central**	**High**
Eutrophication	29.7	27.3	26	23.5
Acidification	17.7	15.8	14.9	13.5

The Biodiversity 2020 Strategy has a priority action to reduce air pollution impacts on Sites of Special Scientific Interest (SSSIs) and measures to achieve future NECD limits will contribute to this commitment. Ecosystems analysis suggests that the number of fully protected sites will increase and the number of sites exceeding their critical load will decrease as the level of uptake of measures increases.

Reducing the negative impacts of air pollution may also increase the benefits associated with ecosystem services if other environmental pressures are also reduced. The natural environment is a valuable source of materials and provides all other supporting services necessary for plants and animals to survive and maintain a genetic diversity. Ecosystems also play an important part in regulating different natural processes, including water purification, flood defences and nutrient cycling. There are also additional non-material benefits obtained from cultural services, such as recreation and aesthetic appreciation of the environment.

[18] The highest benefits are achieved in the central scenario (rather than the high scenario) because some measures that reduce NO_x and SO_2 emissions in that scenario produce more 'incidental' reduction of $PM_{2.5}$ emissions (which is the pollutant with the highest damage cost) than those included in the high scenario.

[19] See Annex A for a detailed presentation of the benefits including and excluding the impact of chronic bronchitis.

8. Sectoral impacts

Measures in the MPMD can be categorised in one of seven sectors (including a miscellaneous sector ‘Other’ which covers public sector and commercial combustion measures). As shown in Table 7, the transport sector was the largest contributor to NO_x emissions (57%) while the power sector was the main source of SO_2 emissions (32%) and the domestic sector was the primary source of $PM_{2.5}$ emissions (42%). An overwhelming share of NH_3 emissions (81%) came from agricultural activities.

Table 7: Summary of 2015 emission shares

	NO_X	SO_2	$PM_{2.5}$	NMVOC	NH_3
Agriculture	2.24%	0.08%	6.08%	12.93%	81.14%
Domestic	3.91%	15.47%	41.57%	5.37%	0.73%
Industry, including energy industries (combustion + processes)	23.26%	29.17%	29.12%	60.39%	9.85%
Oil and Gas	1.90%	13.43%	0.94%	16.22%	0.01%
Power	20.47%	38.09%	2.78%	0.26%	0.04%
Transport (including domestic and international aviation)	43.39%	1.73%	16.56%	4.48%	1.76%
Other	4.82%	2.02%	2.95%	0.35%	6.47%

Source: UK National Atmospheric Emissions Inventory (2015).

The sources of emissions provide some insight into which sectors are likely to provide emission reductions for each pollutant. Cheaper emissions reduction measures are likely to be achieved in sectors which represent the largest share of total emissions. However, low cost emissions reduction measures could also be available in sectors that represent a small share of total emissions.

As a result, the cost of emission reductions to each sector (as a share of total emissions reduction costs) will not necessarily be aligned with their respective share of emissions for each pollutant. Moreover, emissions reductions from the assorted sectors are likely to vary according to the set of measures implemented. The Government will ensure that proportionate burden sharing is achieved.

The methodology used allows us to provide some insight in to the sectoral breakdown of the costs of achieving the ERCs. The share of total cost to each sector varies significantly across the scenarios considered.[20] This variation reflects the fact that costs and benefits differ depending on the level of uptake which in turn influences the extent of new measures required. The distribution of the total cost across sectors is therefore strongly responsive to the policy choices that are made about how, where and when to prioritise action within different sectors.

The analysis shows that, depending on the scenario considered, the share of costs borne by a single sector could vary between 0% and 86%. This range represents the breadth of policy options available to the Government. It does not indicate the burden sharing that will result from the implemented measures. The Government will work closely with the affected sectors to develop proportionate, evidence based policies that distribute costs equitably, in line with the principles of better regulation. All new policies will be subject to a separate regulatory impact assessment through the normal policy clearance process.

[20] Note that these ranges are based on the total cost of reducing NO_x, SO_2, $PM_{2.5}$ and NMVOC.

9. Wider impacts

A range of wider impacts were also considered, including impacts on SMEs and large firms, employment and competition. We also assessed secondary impacts such as electricity prices and the impact on devolved administrations. The headline impacts are that:

- **Large firms:** Taking abatement costs as a proportion of Gross Operating Surplus (GOS) suggests that impacts on large enterprises are expected to be negligible. To the extent that emissions reduction measures may involve significant capital expenditures, these are likely to be somewhat more easily absorbed by large firms. Such considerations will be important when considering the implementation of specific measures.
- **Small and Medium-sized Enterprises (SMEs):** Measures with potential to affect small and medium-sized enterprises will be considered in light of the Government's Better Regulation framework which constrains measures that have a disproportionate cost impact on SMEs. The cost of emission reduction measures is likely to affect SMEs mostly in the water transport, agricultural and non-metallic mineral products sectors:
  - Many agricultural businesses are micro businesses and SMEs; this will be taken into consideration in the design of the abatement measures.
  - Manufacturers of other non-metallic mineral products consist of a large number of SMEs some of which could bear the cost of emission reduction measures. On the other hand, many micro and small enterprises active in the UK in the manufacturing of basic metals are likely to remain largely unaffected since the measures applied in the analysis primarily affect iron and steel production which is dominated by large companies.
- **Employment impacts:** These are difficult to assess as they depend on the policy instruments used. The Commission's assessment, which considered more stringent ERCs than those we have adopted here, concluded that employment impacts are likely to be limited. They noted that positive impacts are possible in the environmental goods and services sector producing abatement equipment. Our assessment indicates that although a number of sectors will incur abatement costs in most cases the costs are small enough that businesses should be able to absorb such costs without having to make large reductions in their workforce. Domestic energy efficiency measures could have positive employment impacts for the installers of the equipment.
- **Competitiveness:** Assessment indicates that the abatement measures assumed in the high uptake scenario could cause some limited impacts on competitiveness in some sectors or industries through indirectly limiting the number or range of suppliers. This may affect those sectors where the abatement costs make up a large proportion of their GOS and are subject to international competition from outside of the EU. Competitiveness impacts will vary according to the measures implemented.
- **Devolved Administrations:** The percentage breakdown of costs based on the apportionment of emission sources is set out in Table 9. Data limitations meant that the estimates are only an indication of how costs could be split based on the scenarios of measures developed in this analysis. The actual shares will depend on the specific measures and policies that end up being applied. The costs are based on the updated modelling not including the disproportionate NO_x measures. They do not include costs of NH_3 abatement.

Table 8: **Total costs per devolved administration (% of total cost)**

	Low	Central	High
England	65.18%	75.64%	55.13%
Scotland	15.57%	12.98%	32.35%
Wales	8.31%	6.27%	9.58%
Northern Ireland	10.94%	5.11%	2.94%

- **Impact on GHG emissions:** A change in greenhouse gas emissions was also calculated from a change in fuel consumption. The analysis shows that in the high uptake scenario measures introduced to achieve the ERCs might reduce GHG emissions by 0.49Mt CO2e. In the low and central scenarios, GHG emissions might increase by 1.79 Mt CO2e and 3.85 Mt CO2e, respectively. However, these figures represent a small share of projected 2030 GHG emissions (358 Mt CO2e, BEIS Energy and Emissions Projections 2017): 0.5% and 1.1%, respectively.

Table 9: GHG emissions (Mt CO2 equivalent)

	Low	Central	High
Traded	-0.05	0.844	1.175
Non-traded	1.837	3	-1.67
Total	**1.787**	**3.852**	**-0.494**

10. Risks and uncertainties

The measures that have been applied in the scenarios are solely intended to provide an indication of the likely scale of the overall cost of achieving the ERCs in 2030. Their inclusion does not necessarily mean that they will be adopted in practice. This analysis is to inform the implementation of the Directive and does not represent a commitment to particular measures.

The key uncertainties within the analysis relate to emission projections in 2030, the cost and potential of new greener technologies coming online, and the uncertainty around the abatement measures contained in the MPMD.

Changes in expected 2030 emissions projections will affect the level of emission reductions implied by the ERCs. In particular, an upward revision of projected 2030 emissions would require the introduction of additional measures to meet the ERCs. In contrast, if projected 2030 emissions are revised downward, fewer additional abatement measures are required to achieve the ERCs. This could be the case if, for example, new and cheaper technologies are taken up by sectors without government intervention, which would allow for a more rapid reduction of emissions of air pollutants.

The abatement measures contained in the MPMD are based on the best available evidence. Some of which were added/updated in 2016. There is some risk that we do not capture the latest sector positions on available abatement technologies, which may mean that costs are likely to be overestimated.

For each sector the potential uptake of measures has been estimated based on published information and/or consultation with sector experts, and adjusted for each of the different uptake scenarios. The estimated uptake of additional abatement measures is subject to uncertainty due to variations across the sector in site-specific factors or unforeseen technological developments.

The damage costs used mainly reflect the mortality effects of air pollution and some of its impacts on morbidity and ecosystems. They do not fully capture the impacts of air pollution on health (morbidity) and the environment. Public Health England/COMEAP are reviewing research on the impacts of air pollution that are currently not captured by the damage costs used. We anticipate that the damage costs are likely to be revised upwards in the near future, which would impact the estimated benefits used in this analysis.

11. Summary

Air pollution has harmful effects on human health and also damages the natural environment, affecting our waterways, biodiversity and crop yields. Long term exposure to poor air quality has been found to reduce life-expectancy, mainly through increased risk of mortality from cardiovascular and respiratory diseases. Short term exposure to poor air quality can result in increased morbidity, placing a strain on public resources through increased expenditure on health care and reduced productivity.

The Government is firmly committed to improving the UK's air quality. Signing up to the NECD and the resulting emission reduction commitments is fully in line with this objective.

We assessed the costs and benefits of achieving the commitments contained in the NECD. The costs were assessed based on a set of measures drawn from the Multi-Pollutant Measures Database (MPMD) and, for NH_3, detailed information about emissions reduction measures in the agricultural sector. These measures represent action beyond the measures already being implemented to reduce emissions. To account for uncertainty around the rate of uptake of the emission reduction measures, three scenarios were developed. In all scenarios, a least cost approach to achieve the emission reduction commitments was taken.

Based on the methodology used, the Government is forecast to meet the 2030 ERCs for all five pollutants in the high and central uptake scenarios. The ERCs for NO_x, SO_2 and NH_3 are not achieved in the low illustrative scenario.

The costs of achieving the NO_x, SO_2, $PM_{2.5}$, NMVOC, and NH_3 emission reduction commitments range from £249 million in the high uptake scenario to 1.7 billion per year in the low uptake scenario. These estimates are based on technology costs so do not capture possible policy costs.

Reducing emissions of air pollutants will bring significant benefits to UK residents. The damage cost valuation approach is used to estimate the benefits of improvements in air quality as a result of the reduction in emissions. Using this approach the benefits from implementing the NECD are estimated to range from £2.6 billion in the low scenario to £3.4 billion in the high scenario. The damage costs used to compute this benefits include impacts from chronic bronchitis. It should be noted that the damage costs are currently being reviewed and may be subject to revision over the course of the next year.

Measures to achieve the NECD ERCs will be outlined in the National Air Pollution Control Programme to be published in April 2019.

12. Annex

12.1. Annex A – Damage costs and the estimated benefits

Including cost of chronic bronchitis

		Damage cost (£2016/tonne)	Emission reductions (kt)	Total benefits (£ million)
High	**NO_x**	£3,658.40	87.6	320.48
	SO_2	£4,897.05	37.8	185.11
	$PM_{2.5}$	£88,292.98	30.2	2666.45
	NMVOC	£130.74	29.2	3.82
	NH_3	£4,436.50	39.64	175.86
	All gases			**3351.71**
Central	**NO_x**	£3,658.40	87.6	320.48
	SO_2	£4,897.05	37.7	184.62
	$PM_{2.5}$	£88,292.98	33.4	2948.99
	NMVOC	£130.74	21.9	2.86
	NH_3	£4,436.50	28.51	126.48
	All gases			**3583.43**
Low	**NO_x**	£3,658.40	78.1	285.72
	SO_2	£4,897.05	27.7	135.65
	$PM_{2.5}$	£88,292.98	23.6	2083.71
	NMVOC	£130.74	30.5	3.99
	NH_3	£4,436.50	15.14	67.17
	All gases			**2576.24**

Excluding cost of chronic bronchitis

		Damage cost (£2016/tonne)	Emission reductions (kt)	Total benefits (£ million)
High	**NO_x**	£3,187.22	87.6	279.20
	SO_2	£3,315.14	37.8	125.31
	$PM_{2.5}$	£52,911.06	30.2	1597.91
	NMVOC	£130.74	29.2	3.82
	NH_3	£2,541.74	39.64	100.75
	All gases			**2107.00**
Central	**NO_x**	£3,187.22	87.6	279.20
	SO_2	£3,315.14	37.7	124.98
	$PM_{2.5}$	£52,911.06	33.4	1767.23
	NMVOC	£130.74	21.9	2.86
	NH_3	£2,541.74	28.51	72.47
	All gases			**2246.74**
Low	**NO_x**	£3,187.22	78.1	248.92
	SO_2	£3,315.14	27.7	91.83
	$PM_{2.5}$	£52,911.06	23.6	1248.70
	NMVOC	£130.74	30.5	3.99
	NH_3	£2,541.74	15.14	38.48
	All gases			**1631.92**

12.2. Annex B - BAU emission projections (kt) for sources covered under the NECD (road transport)

Year	NO_X (kt)	SO_2 (kt)	$PM_{2.5}$ (kt)	NMVOC (kt)
2014	N/A	N/A	N/A	N/A
2020	233	0.5	11	14
2025	156	0.5	10	13
2030	113	0.5	10	14