IP RESEARCH REPORT

NON-CO_2 GREENHOUSE GAS EMISSIONS FROM OIL REFINERIES

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April 2006

Published by
ENERGY INSTITUTE, LONDON
The Energy Institute is a professional membership body incorporated by Royal Charter 2003
Registered charity number 1097899

The Energy Institute gratefully acknowledges the financial contributions towards the scientific and technical programme from the following companies:

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Total E&P UK plc
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ISBN 978 0 85293 459 3
Published by the Energy Institute

Further copies can be obtained from Portland Customer Services, Commerce Way,
Whitehall Industrial Estate, Colchester CO2 8HP, UK. Tel: +44 (0) 1206 796 351
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SUMMARY

Actions to reduce emissions of greenhouse gases (GHGs) from oil refineries have focused on carbon dioxide (CO_2). This Report reviews the sources and magnitude of emissions of the other five greenhouse gases listed in the Kyoto Protocol – methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride - within the UK refining sector.

The contribution to the total emissions from the UK of these gases from oil refineries has been estimated and is shown in the Table below.

Gas	**Contribution of oil refineries to emissions from UK in 2003 % wt**	**Overall contribution to global warming due to emissions from UK oil refineries in 2003 % (CO_2 eq)**
Methane	0,04	0,0024
Nitrous Oxide	0,27	0,016
Hydrofluorocarbons	0,002	0,000032
Perfluorocarbons	-	0
Sulphur Hexafluoride	<0,015	<0,000035
TOTAL		0,018

The greatest impact is from nitrous oxide (N_2O) emissions, which are solely due to combustion of refinery fuels. These emissions in 2003, however, were only 0,27% of the total UK N_2O from anthropogenic sources. The emissions of all of the other pollutants can be considered negligible.

The overall contribution to global warming due to non-CO_2 GHG emissions from the refining sector is very small at 0,018%. Nitrous oxide makes up over 85% of that contribution, with the balance being almost all methane. The contributions of HFCs and SF_6 are extremely small, and no emissions of PFCs can be considered to occur within refineries.

Nitrous oxide emissions from combustion sources in the energy industries, primarily from the power generation sector, were a minor source in 2003 at 6,9% of the UK total. There is no direct abatement technology available to reduce N_2O emissions from combustion. However, these emissions, as well as those of methane, will be further reduced as CO_2 emissions are cut due to the EU Emission Trading Scheme (ETS).

One proposal to reduce the non-CO_2 GHG emissions is to include these gases in the second phase of the EU ETS. This Report, however, establishes that the emissions from refineries of these gases make a very small contribution to the UK total. Moreover, there is no potential to reduce emissions of the greatest contributor (N_2O) further than being achieved through the initial phase of the ETS.

A study has been commissioned by Defra to identify those sources and sectors in the UK which should be included in any such extension to the EU ETS. Overall, the Defra study found that no source, in any sector, was suitable for inclusion and recommended that non-CO_2 GHGs should not be included in the second phase of the EU ETS.

ACKNOWLEDGEMENTS

The Energy Institute wishes to record its appreciation of the work carried out by Brian Smithers as the author of this report, and also the Energy Institute's Emissions Working Group for steering this project through to completion. Members of the Steering Committee for this project include:

Martin Chapman	BP
Martin Maeso	EI
Graham Neal	ExxonMobil
Alison Walker	ConocoPhillips
John Wormald	Total

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OVERVIEW

1.1 BACKGROUND

The world's climate is dependent upon the amount of solar radiation which is prevented from being re-radiated by the gases in the atmosphere. These 'greenhouse' gases are the result of both natural and man-made emissions. Life on earth would be impossible without the greenhouse effect, but the concentrations of these gases in the atmosphere are increasing with the resultant potential for long-term adverse global warming.

In 1992 the United Nations Framework Convention on Climate Change (UNFCCC)[1] was agreed at the Earth Summit in Rio de Janeiro. Under the Convention, all developed countries agreed the aim of reducing by the year 2000 the amount of greenhouse gases emitted back to the levels in 1990.

To permit changes to be tracked, national inventories of greenhouse gas emissions due to the activities of mankind (anthropogenic) and sinks had to be developed and submitted. To ensure consistent reporting, estimation methodologies were established by the Intergovernmental Panel on Climate Change (IPCC)[2].

Climate modelling, however, indicated that the commitments made under the UNFCCC would not be adequate to avoid the worst effects of global warming. The outcome in 1997 was the Kyoto Protocol[3] under which developed countries agreed to legally binding targets that will reduce the overall emissions of a basket of six greenhouse gases by 5,2% below 1990 levels over the period 2008 to 2012.

The basket of greenhouse gases comprises carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

The EU Member States agreed to a reduction of 8% across the European Union. The target has been redistributed across the Member States to reflect the ability of each country to achieve an emission reduction. The UK has agreed a reduction in greenhouse gas emissions of 12,5%. There is a range in national targets: from reductions of 21% in Germany and Denmark to an increase of 27% for Portugal. The UK also has a domestic goal to reduce CO_2 emissions by 20% below 1990 levels by 2010. Indeed, the main focus worldwide on reducing greenhouse gas emissions has been on CO_2.

These targets are very demanding, as most countries anticipate that their emissions, if uncontrolled, are forecast to be significantly higher than 1990 levels by 2010. The UK has a Climate Change Programme[4] that, if successfully implemented, will deliver the UK target under the Kyoto Protocol. The programme is estimated to achieve a reduction in greenhouse gas emissions of 23% (including CO_2 by 19%) below the 1990 level by 2010.

Included in the strategy is the implementation of the EU emissions trading scheme for CO_2[5]. As part of the second phase of this scheme (covering 2008 – 2012), the inclusion of non-CO_2 greenhouse gases in the scheme will be considered.

1.2 GREENHOUSE GASES

There are a number of gases which contribute to the