

Key-features:

- Carbon dioxide (CO₂) is the most important greenhouse gas now and will increase in importance over this century, both absolutely and relative to the other greenhouse gases. As a consequence, energy efficiency remains of paramount importance.
- Greenhouse gases whose emissions are controlled under the Kyoto Protocol comprise carbon dioxide, methane, nitrous oxide and the fluorinated gases - HFCs, PFCs and SF₆.
- The relative position of HFCs, PFCs and SF₆ has remained about the same. Even after taking into account their high Global Warming Potentials (GWPs) (2).
- They are currently very minor contributors to climate change (their total effect is a small fraction of a percent) and
- Their combined contributions are predicted to reach only two or three percent of the total "radiative forcing" from all greenhouse gases by the end of this century.
- By far the largest "halocarbon" contribution comes from the CFCs present in the atmosphere. The concentrations of these will decline as a consequence of the Montreal Protocol.
- The GWPs of greenhouse gases have not changed markedly between the SAR and the TAR. For example, the value assigned to HFC-134a, the fluorocarbon refrigerant most widely used, has remained at 1300. For the most abundant PFC, carbon tetrafluoride emitted principally from aluminium smelting, the value has fallen from 6500 to 5700 and for SF₆, the reduction is from 23900 to 22200.
- None of these changes is significant; uncertainty in GWP is stated to be ±35% (for both the SAR and TAR values), which covers the range of changes more than adequately. The TAR carries a more complete listing on pages 388-391.
- A table of GWPs of some of the more common greenhouse gases is attached. For the purposes of the Kyoto Protocol, the GWPs given in the Second Assessment Report must be used.

(April 2003)

| Name | Compound Formula | GWP at 100 years (3) | |
|---------------|-----------------------------------|-------------------------------------------------------|------------|
| | | SAR (4)(1995) (valid for use in Kyoto Protocol) | TAR(1)2000 |
| Methane | CH ₄ | 21 | 23 |
| Nitrous oxide | N ₂ O | 310 | 296 |
| HFC-23 | CHF ₃ | 11700 | 12000 |
| HFC-32 | CH ₂ F ₂ | 650 | 550 |
| HFC-125 | CF ₃ CHF ₂ | 2800 | 3400 |
| HFC-134a | CF ₃ CH ₂ F | 1300 | 1300 |
| HFC-143a | CF ₃ CH ₃ | 3800 | 4300 |

| | | | |
|-----------------------|-----------------------------------------------------------------|-------|-------|
| HFC-152a | CH ₃ CHF ₂ | 140 | 120 |
| HFC-227ea | CF ₃ CHF ₂ CF ₃ | 2900 | 3500 |
| HFC-236cb | CF ₃ CF ₂ CH ₂ F | | 1300 |
| HFC-236ea | CF ₃ CHFCHF ₂ | | 12 |
| HFC-236fa | CF ₃ CH ₂ CF ₃ | 6300 | 9400 |
| HFC-245ca | CH ₂ FCF ₂ CHF ₂ | 560 | 640 |
| HFC-245fa | CHF ₂ CH ₂ CF ₃ | | 950 |
| HFC-365mfc | CF ₃ CH ₂ CF ₂ CH ₃ | | 890 |
| HFC-43-10mee | CF ₃ CHFCHF ₂ CF ₃ | 1300 | 1500 |
| Sulphurhexafluoride | SF ₆ | 23900 | 22200 |
| Carbontetrafluoride | CF ₄ | 6500 | 5700 |
| Perfluoroethane | C ₂ F ₆ | 9200 | 11900 |
| Perfluoropropane | C ₃ F ₈ | 7000 | 8600 |
| Perfluorobutane | C ₄ F ₁₀ | 7000 | 8600 |
| Perfluoro-cyclobutane | c-C ₄ F ₈ | 8700 | 10000 |
| Perfluoropentane | C ₅ F ₁₂ | 7500 | 8900 |
| Perfluorohexane | C ₆ F ₁₄ | 7400 | 9000 |

Quotes

1. Houghton J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell and C.A. Johnson, Climate Change 2001: The Scientific Basis, contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK, 2001.
2. Global Warming Potential of a material is defined as the integrated radiative forcing over 100 years following an assumed release of 1kg divided by the integrated radiative forcing over the same period from release of 1 kg of carbon dioxide. Radiative forcing is the specific increase in infrared absorption in Wm²ppb⁻¹ (Watts per square metre at the Earth's surface per part per billion concentration of the material). All effects beyond 100 years are disregarded; thus Global Warming Potential captures all of the effect of an HFC but less than 40% of the total effect from CO₂.
3. Uncertainty in GWP is stated to be ±35% for both the SAR and TAR values.
4. The Second Assessment Report - Climate Change 1995: The Science of Climate Change, ed. Houghton et al., Cambridge University Press, 1996. The values in this report have been

adopted for use in the Kyoto Protocol for its first commitment period (2008-2012).