

Global warming potential

By Lennart Kiil

A measure of how much a [greenhouse gas](#) contributes to [global warming](#).

The global warming potential (GWP) of a gas is measured relative to the same mass of [carbon dioxide \(CO₂\)](#), which by definition has a GWP of 1.

The global warming potential is calculated over a certain time span, which always has to be given for the GWP to have any meaning. This has to be included since different gases remain in the [atmosphere](#) for different time spans, before they break down or are removed. [Methane \(CH₄\)](#), for instance, has a relatively short life time in the atmosphere and has a GWP of 72 over 20 years, but one of 25 over 100 years. The time-span of 100 years is usually used in official reports.

The GWP of a gas depends on the following physical factors.

The [absorption of infrared radiation](#). This gives a direct measure of the amount of heat that a given gas can absorb and, therefore, of how much it will heat the atmosphere.

The [spectrum of absorbing wavelengths](#). It matters which wavelength of the [sunlight](#) that the gas is absorbing most of. If it absorbs most in wavelengths where the atmosphere already absorbs much light then its GWP is not so high. On the contrary, a gas has a high GWP if it absorbs light at a wavelength that would otherwise normally pass almost fully through the atmosphere.

The [atmospheric life time](#). The length of time that the gas stays in the atmosphere is, of course, important in determining how much heat it absorbs during its life time.

The GWP is officially calculated by the [IPCC](#) and is used to convert greenhouse gases into [CO₂ equivalents](#) when estimating [sources and sinks](#).

Other important greenhouse gases, beside CO_2 and CH_4 , are hydrofluorocarbons (HFC) which are used as cooling gases, for example, in refrigerators and for some chemical production. HFC is a byproduct in the production of Teflon and has a GWP as high as 14,800 over 100 years. However, one of the most potent gases is sulfur hexafluoride (SF_6) which has a GWP of 22,800 over 100 years. Sulfur hexafluoride is mainly used in the electrical industry, but also as a filling in some window frames. Both sulphur hexafluoride and HFCs are present in so small concentrations in the atmosphere that their importance is insignificant compared to CO_2 .

Although water-vapor is also an important greenhouse gas it is not given a GWP. This is because its concentration depends on air temperature and cannot be directly influenced by man.

How to cite this entry

Lennart Kiil: "Global warming potential". Climate Encyclopedia, climate-encyclopedia.com/global-warming-potential, retrieved 25 October 2026.

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