



Using Refrigerant GWP Values – A guide to selecting the appropriate data

Introduction

The purpose of this Fact Finder is to explain from where Global Warming Potential (GWP) values for HFC refrigerants are derived.

The first two pages of this Fact Finder explain the background for using GWP data and the third page lists common and less common HFC refrigerants with their GWP value according to the IPCC 3rd Assessment Report, which is the current legal base in the EU, and the IPCC 4th Assessment Report which is shown here for information purposes only.

Please be aware that many schemes, initiatives or reporting procedures may require the use of a value that may need to be obtained by a different source.

In all situations where you have provided outcomes using a GWP value you should state the source of the GWP value.

The Global Warming Potential (GWP) of a refrigerant is a calculated value of the potential of 1kg of that refrigerant to contribute to global warming if released into the atmosphere, compared to the global warming effect of 1kg of carbon dioxide, over a given time period. It provides a simple, understandable and usable number that can be used in such calculations as TEWI (Total Environmental Warming Impact) and LCCP (Life-Cycle Climate Performance), when designing or selecting refrigerant options.

Using valid and appropriate GWP values.

GWP is not a single definitive figure but requires some definition based upon how it has been calculated; namely the time period (or time horizon) over which it has been determined. Time periods used in IPCC (Intergovernmental Panel on Climate Change) Reports are 20 years, 100 year or 500 years – appropriate to the lifetime of the substance molecules in the atmosphere. Using 20 years distorts the effects of the long lifetime of carbon dioxide, whilst 500 years significantly exceeds the atmospheric effects of shorter lived HFCs. Consequently, it has been internationally agreed that the 100yr time period is the most appropriate basis, particularly for HFC Refrigerants.

Additionally, when using GWP data, it must be validated by reference to its source. Under the Kyoto Protocol and its use of GWP, IPCC has produced regular Technical Assessments, providing the best calculated GWP values based on atmospheric science knowledge prevailing at the time. With refinements in that knowledge, IPCC published GWP data has changed between Technical Assessments, so it is important when using GWP values that the appropriate IPCC Assessment Report is used and referenced (see table).

Why does the GWP of a refrigerant change?

The first significant IPCC listing of GWP values was published in 1995 – The 2nd Technical Assessment – and was used as the basis for the Kyoto Protocol. As atmospheric science has developed, the knowledge of how and by how much, carbon dioxide and other greenhouse gases contribute to atmospheric warming, has lead IPCC to publish refined GWP values in subsequent Technical Assessment Reports – 3rd Report 2000, 4th Report 2007.

Which GWP data should be used?

Having defined the 100 year time period data as the most appropriate for HFC refrigerants, further selection of the appropriate GWP source data should be based upon the prevailing legal base and the IPCC data used by that legal based legislation. Within the EU, the F-Gas Regulation (EC) 842/2006 on Fluorinated Greenhouse Gases is, at the time of initial publication of this Factfinder, the legal basis for use of HFC Refrigerants in most applications. It uses the GWP values from the 3rd IPCC Technical Assessment Report published in 2000. Additionally, the EU Mobile Air Conditioning (MAC) Directive (EC) 40/2006 proposes a maximum limit of GWP 150 on new mobile systems from 2011,

again based upon the 3rd Technical Assessment (2000) values. The GWP values of some HFC compounds have changed by as much as 25% between IPCC Assessment Reports to date, so it is important that the sourced GWP information is referenced.

Is the use of different GWP values significant?

The change in a GWP value calculated for a refrigerant may be significantly less than the change in GWP values for specific HFC compounds between Assessment Reports, as most HFC refrigerants commonly used are blends of 2 or more substances, some, or all, of which may be HFCs. It is important that the correct GWP is used when meeting reporting obligations under the EU F-Gas Regulation, to ensure correct accounting of individual HFC compounds.

The use of a different refrigerant GWP value has very little impact on TEWI or LPPC calculations, as the most significant contribution to atmospheric warming from refrigeration or air conditioning systems comes as an indirect consequence of the energy consumption. If refrigerant selection is to be based on GWP value, those used in current legislation are preferred.

Future Changes to GWP Data

The IPCC 4th Assessment published in 2007 will probably become the source of GWP values for the future protocol to replace the Kyoto Protocol, and for future EU legislation on fluorinated greenhouse gases.

The following GWP data is valid for the legal basis within the EU and UK on the date indicated at the top of this page. Make sure you have the latest version available from the BRA website before using the GWP data.

GWP Data

The following GWP data are provided on commonly used HFC refrigerants as a guide for selection of the appropriate GWP values for use in refrigerant plant, in plant design, in TEWI and LPPC calculations, as well as for reporting requirements.

Column 2. GWP values currently used in the EU legislation applying to HFC refrigerants - EU F-Gas Regulation 842/2006 and the EU MAC Directive 40/2006 and the values that should be used to report under the EU F-Gas Regulation.

Column 3. GWP values from the IPCC 4th Assessment Report 2007 for information.

NOTE: The values for HCFC R-22 and the hydrocarbons are provided, as they have been used, or are used, as refrigerants and as components with HFCs in some refrigerant blends.

Source references are given below the Tables.

HFC Refrigerant	GWP _{100yr} ¹	GWP _{100yr} ²
R-134a	1300	1430
R-404A	3784	3922
R-407A	1990	2107
R-407C	1653	1774
R-410A	1975	2088
Less Common HFCs		
R-422A	3043	3143
R-422D	2623	2729
R-426A	1382	1508
R-427A	2013	2138
R-434A	3131	3199
R-437A	1684	1731
R-438A	2151	2265
R-507	3850	3985

For comparison only

R-22	1700	1810
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Hydrocarbons³

ethane	R-170	8.4
Propane	R-290	6.3
Butane	R-600	7.0
Ethane	R-1150	6.8
Propene	R-1270	4.9

¹ HFC refrigerant GWPs: IPCC 3rd Assessment Report 2000 as used for EU F-Gases Regulation (EC) 842/2006

² HFC refrigerant GWPs: IPCC 4th Assessment Report 2007

³ HC GWPs: The Oxidation of Organic Compounds in the Troposphere and their Global Warming Potentials - W.J. Collins, R.G. Derwent, C.E. Johnson and D.S. Stevenson Climate Change 52: 453-479, 2002