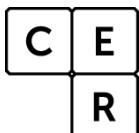
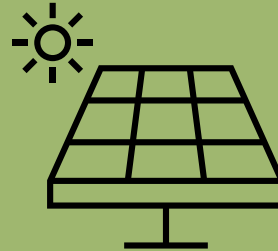
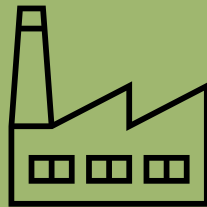
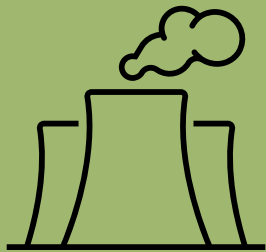


# Reporting hydrofluorocarbons and sulphur hexafluoride gases guideline

July 2023





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## Definitions and Abbreviations

Term	Meaning
<b>CO<sub>2</sub></b>	Carbon dioxide
<b>CO<sub>2</sub>-e</b>	Carbon dioxide equivalence
<b>EERS</b>	The Clean Energy Regulator’s Emissions and Energy Reporting System which is used for NGER Reporting
<b>Facility</b>	Has the meaning given by section 9 of the NGER Act. For more information on defining a facility under the NGER scheme, see <a href="#">What is a Facility</a> <sup>1</sup>
<b>GWP</b>	Global Warming Potential is defined by the UNFCCC as an index representing the combined effect of the differing times greenhouse gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation.
<b>HFC</b>	Hydrofluorocarbon
<b>Hydrofluorocarbons</b>	Any of the hydrofluorocarbons listed in the table in subsection 7A(2) of the NGER Act.
<b>NGER</b>	National Greenhouse and Energy Reporting
<b>NGER Act</b>	<i>National Greenhouse and Energy Reporting Act 2007</i>
<b>NGER Legislation</b>	NGER Act, NGER Regulations, NGER Measurement Determination
<b>NGER Measurement Determination</b>	National Greenhouse and Energy Reporting (Measurement) Determination 2008
<b>NGER Regulations</b>	National Greenhouse and Energy Reporting Regulations 2008
<b>Scope 1 emissions</b>	Means the release of greenhouse gas into the atmosphere as a direct result of an activity or series of activities (including ancillary activities) that constitute the facility.
<b>SF<sub>6</sub></b>	Sulphur hexafluoride
<b>t CO<sub>2</sub>-e</b>	Tonnes carbon dioxide equivalence

Please refer to Division 2 of the NGER Act, 1.03 of the NGER Regulations and Division 1.1.2 of the NGER Measurement Determination for defined terms in NGER legislation.

<sup>1</sup> <https://www.cleanenergyregulator.gov.au/NGER/Reporting-cycle/Assess-your-obligations/Reporting-thresholds#n3-1>



## Disclaimer

This guideline has been developed by the Clean Energy Regulator (CER) to assist entities to comply with their reporting obligations under the [National Greenhouse and Energy Reporting Act 2007](#)<sup>2</sup> (NGER Act) and associated legislation.

This guideline only applies to the 2022–23 NGER reporting year and should be read in conjunction with the NGER Act, [National Greenhouse and Energy Regulations 2008](#)<sup>3</sup> (NGER Regulations), and [National Greenhouse and Energy Reporting \(Measurement\) Determination 2008](#)<sup>4</sup> (NGER Measurement Determination), as in force for this reporting period. These laws and their interpretation are subject to change, which may affect the accuracy of the information contained in the guideline.

The guidance provided in this document is not exhaustive, nor does it consider all circumstances applicable to all entities. This guidance is not intended to comprehensively deal with its subject area, and it is not a substitute for independent legal advice. Although entities are not bound to follow the guidance provided in this document, they must ensure they meet their obligations under the [National Greenhouse and Energy Reporting \(NGER\) Scheme](#)<sup>5</sup> at all times. CER encourages all users of this guidance to seek independent legal advice before taking any action or decision based on this guidance.

CER and the Australian Government will not be liable for any loss or damage from any cause (including negligence) whether arising directly, incidentally, or as consequential loss, out of or in connection with, any use of this guideline or reliance on it, for any purpose.

If an entity chooses to meet their obligations under the NGER scheme in a manner that is inconsistent with the guidance provided in this document, CER, or an independent auditor, may require the entity to demonstrate that they are compliant with requirements of the NGER Act, NGER Regulations, and/or the NGER Measurement Determination. Entities are responsible for determining their obligations under the law and for applying the law to their individual circumstances.

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<sup>2</sup> <https://www.legislation.gov.au/Series/C2007A00175>

<sup>3</sup> <https://www.legislation.gov.au/Series/F2008L0223>

<sup>4</sup> <https://www.legislation.gov.au/Series/F2008L02309>

<sup>5</sup> <http://www.cleanenergyregulator.gov.au/NGER/Pages/default.aspx>



## 2022–23 updates

Changes in this document for the 2022–23 reporting year:

- Minor stylistic and formatting changes have been made throughout this guidance document
- Page 3 – added meaning of hydrofluorocarbons
- Page 6 – added table for Global Warming Potential values for hydrofluorocarbons and SF<sub>6</sub>
- Page 8 – added hydrofluorocarbons HFC-32, HFC-41, HFC-143, HFC152a, HFC-245ca to the list of hydrocarbons that are reportable under division 2.2 of the NGER Regulations
- Page 8 – updated example on reporting refrigerant blends
- Page 8 – added example for a refrigerant with Global Warming Potential under 1000
- Page 10 – removed reference to Appendix A of the ENA Industry Guideline.

## 1. Available methods for reporting hydrofluorocarbons and sulphur hexafluoride

Methods available for estimating emissions from hydrofluorocarbon (HFC) and sulphur hexafluoride (SF<sub>6</sub>) gases are listed in the below table:

Method	Hydrofluorocarbons	Sulphur hexafluoride
1	Section 4.102 of the NGER Measurement Determination	Section 4.102 of the NGER Measurement Determination
2	Section 4.103 of the NGER Measurement Determination	Section 4.103 of the NGER Measurement Determination
3	Section 4.104(1) of the NGER Measurement Determination	Section 4.104(2) of the NGER Measurement Determination
4	Not available	Not available
Incidental	A method consistent with Section 1.13 of the NGER Measurement Determination	A method consistent with Section 1.13 of the NGER Measurement Determination

See the [Aggregated facility reporting, percentage estimates and incidental emissions and energy guideline](http://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/Aggregated-facility-reporting-percentage-estimates-and-incident-emissions-and-energy-guideline)<sup>6</sup> for more information about the incidental method.

All these methods require the quantity of emitted gas to be converted from mass (in metric tonnes) to tonnes of carbon dioxide equivalence (t CO<sub>2</sub>-e). This is done by multiplying the mass of a gas (tonnes) by its

<sup>6</sup> <http://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/Aggregated-facility-reporting-percentage-estimates-and-incident-emissions-and-energy-guideline.aspx>



Global Warming Potential (GWP). The value of the GWP mentioned in the following table, specified in 2.02 of the NGER Regulations, must be used for determining the CO<sub>2</sub>-e for HFCs and SF<sub>6</sub>. The GWP figures represent the findings published by the Intergovernmental Panel on Climate Change in its Fifth Assessment Report.

Table 1: Global warming potentials as per 2.02 of the NGER Regulations.

Greenhouse gas	Chemical formula	Global Warming Potential (GWP)
Sulphur hexafluoride	SF <sub>6</sub>	23,500
HFC-23	CHF <sub>3</sub>	12,400
HFC-32	CH <sub>2</sub> F <sub>2</sub>	677
HFC-41	CH <sub>3</sub> F	116
HFC-43-10mee	C <sub>5</sub> H <sub>2</sub> F <sub>10</sub>	1,650
HFC-125	C <sub>2</sub> HF <sub>5</sub>	3,170
HFC-134	C <sub>2</sub> H <sub>2</sub> F <sub>4</sub> (CHF <sub>2</sub> CHF <sub>2</sub> )	1,120
HFC-134a	C <sub>2</sub> H <sub>2</sub> F <sub>4</sub> (CH <sub>2</sub> FCF <sub>3</sub> )	1,300
HFC-143	C <sub>2</sub> H <sub>3</sub> F <sub>3</sub> (CHF <sub>2</sub> CH <sub>2</sub> F)	328
HFC-143a	C <sub>2</sub> H <sub>3</sub> F <sub>3</sub> (CF <sub>3</sub> CH <sub>3</sub> )	4,800
HFC-152a	C <sub>2</sub> H <sub>4</sub> F <sub>2</sub> (CH <sub>3</sub> CHF <sub>2</sub> )	138
HFC-227ea	C <sub>3</sub> HF <sub>7</sub>	3,350
HFC-236fa	C <sub>3</sub> H <sub>2</sub> F <sub>6</sub>	8,060
HFC-245ca	C <sub>3</sub> H <sub>3</sub> F <sub>5</sub>	716



## 2. Hydrofluorocarbons and sulphur hexafluoride reporting thresholds

Section 4.101 of the NGER Determination details the thresholds for reporting synthetic gas generation activities for emission of hydrofluorocarbons and sulphur hexafluoride gases.

Item	Provision in NGER Determination	Threshold
Hydrofluorocarbons	Subparagraph 4.100(1)(a)(ii)	100 kilograms of refrigerants for each unit from use of commercial air conditioning, commercial refrigeration, and industrial refrigeration
SF <sub>6</sub>	Subsection 4.100(2)	Any emission from insulated switch gear and circuit breaker

## 3. Hydrofluorocarbons reporting requirements

According to section 4.100(1)(b) of the NGER Measurement Determination, only registered corporations with operational control over a facility with the principal activity attributed to any of the following ANZSIC industry classifications must report synthetic gas generating activities for emissions from hydrofluorocarbons:

- food product manufacturing (ANZSIC classification, Subdivision 11)
- beverage and tobacco product manufacturing (ANZSIC classification, Subdivision 12)
- retail trade (ANZSIC classification, Division G)
- warehousing and storage services (ANZSIC classification number 530)
- wholesale trade (ANZSIC classification, Division F)
- rental, hiring and real estate services (ANZSIC classification, Division L).

Synthetic gas generating activities for emissions of hydrofluorocarbons are activities of the facility that emit hydrofluorocarbons from the use of the following equipment as specified in 4.16(1)(a) to 4.16(1)(c) of the NGER Regulations:

- commercial air conditioning
- commercial refrigeration
- industrial refrigeration.

A facility with a principal activity that is attributable to any one of the ANZSIC industry classifications mentioned in section 3 of this guidance must report the emissions of HFCs from the use of equipment listed above when both of the following thresholds are met:

- the equipment contains a refrigerant charge of more than 100 kilograms (kg) of refrigerants for each unit (see section 4.100(1)(a)(ii) NGER Measurement Determination); and
- the refrigerant is a greenhouse gas with a GWP of more than 1000 [2.02 of the NGER Regulations and 4.100 (1)(a)(iii) of the NGER Measurement Determination section].



In this context, the term 'charge' refers to the total volume of the gas contained within the equipment.

Note: The 100 kg refrigerant charge criteria and GWP of more than 1000 applies to the entire quantity of refrigerant gas contained, not an individual gas.

## 4. Which hydrofluorocarbon gases are reportable?

In accordance with Division 2 (7A) of the NGER Act and 2.02 of the NGER Regulations, there are 13 hydrofluorocarbon gases that are reportable under the NGER Legislation. These are:

1. HFC-23
2. HFC-32
3. HFC-41
4. HFC-43-10mee
5. HFC-125
6. HFC-134
7. HFC-134a
8. HFC-143
9. HFC-143a
10. HFC-152a
11. HFC-227ea
12. HFC-236fa.
13. HFC-245ca

For example, if equipment contains a refrigerant charge of more than 100 kg of refrigerant blend R-410A, which is made up of 50% R-32 and 50% R-125 and has a global warming potential of 2088, then the whole refrigerant is reportable under the NGER Legislation. The total stock of R-410A (in t CO<sub>2</sub>-e) should be entered into the Emissions and Energy Reporting System (EERS). In case of a blend where a component of the HFC gases is not listed in NGER Legislation, then only the listed component is reportable.

If the refrigerant in a commercial air conditioner with a charge of more than 100 kg for each unit is 100% R-32 with a GWP of 675, below the 1000 threshold, then the use of R-32 is not reportable under the NGER Legislation.

## 5. Reporting sulphur hexafluoride (SF<sub>6</sub>) gases

All emissions of sulphur hexafluoride (SF<sub>6</sub>) are reportable from the operation of facilities across all industry sectors (see NGER Measurement Determination sections 4.100 and 4.101), when any of the activities of the facility require the use of gas insulated switch gear and circuit breaker applications (paragraph 4.16 (1)(d) of the NGER Regulations).





## 6. Is R-22 a reportable gas?

R-22 is not listed in 2.02 of the NGER Regulations and is not considered a greenhouse gas for the purposes of Australia's international reporting obligations.

## 7. Entering data into EERS

### Using Method 1

The estimation of emissions of SF<sub>6</sub> and HFC gases using Method 1 is performed using the equation listed within section 4.102 of the NGER Measurement Determination.

Reporters are required to apply the GWP value to their stock of gas to determine the stock in carbon dioxide equivalence (CO<sub>2</sub>-e) tonnes and then enter this figure into the EERS. EERS then will apply the applicable leakage rate to obtain the emissions in t CO<sub>2</sub>-e.

For example, if the equipment used for commercial refrigeration contains 7.2048 tonnes of HFC-143a, which has a GWP of 4800 (2.02 of the NGER Regulations), then the calculation of stock of CO<sub>2</sub>-e is:

- Stock x GWP = 7.2048 x 4800 = 34,583 t CO<sub>2</sub>-e

Enter the 34,583 tonnes stock CO<sub>2</sub>-e in the EERS data entry screen shown in Figure 1 below.

Figure 1: EERS data entry screen.

The screenshot shows the 'Activity Attributes' form in the EERS system. The form includes the following fields and values:

- Activity Description:** (Empty text box)
- Source Category:** Industrial processes
- Source:** Emissions of hydrofluorocarbons and sulphur hexafluoride gases
- Activity:** Emissions of hydrofluorocarbons from commercial refrigeration
- State:** Australian Capital Territory
- Incidental Emissions:** No
- Scope 1 (tCO<sub>2</sub>-e):** 7,954

**HFC<sup>s</sup> Hydro fluoro carbons**

- Method:** Method 1 (4.102)
- Gas contained in equipment (tCO<sub>2</sub>-e):** 34583
- Result:** 7,954

Buttons: Hide Corporate Structure, Calculate, Save, Exit.



## Using Method 2

The estimation of emissions of SF<sub>6</sub> and HFC gases using Method 2 is performed using a mass balance calculation. Until the 2020–21 reporting year, the method was described in Appendix A of the ENA Industry Guideline for SF<sub>6</sub> Management - ENA DOC 022-2008 (ENA Industry Guideline). From 2022–23 onwards, the method is described in section 4.103 of the NGER Measurement Determination.

The mass balance calculation uses the opening stock of gas, transfers into the facility from additions of gas from purchases of new equipment, and replenishments and transfers out of the facility from disposal of equipment or gas. Stock of gas may be estimated from the nameplate capacities of the relevant cylinders or equipment.

The method described in section 4.103 of the NGER Measurement Determination is based on the following:

**Storage at the beginning of the year**, in kg, minus

**Storage at the end of the year**, in kg, plus

**‘Storage’ means all equipment, cylinders and other containers which hold HFCs or SF<sub>6</sub> not in use and which meet the requirements of Section 4.100 and 4.101 of the NGER Measurement Determination.**

**Additions** (from purchases, including inside equipment, and returned to site after recycling), in kg, minus

**Subtractions** (from sales, returns to suppliers, destructions and recycling), in kg, minus

**Changes to nameplate capacity** (taking into account new and retiring equipment), in kg.

A separate mass balance calculation should be conducted for each type of reportable greenhouse gas, with the estimated emissions converted into CO<sub>2</sub>-e using the GWP for the relevant gas. Where a refrigerant blend is used, the calculations for that refrigerant blend should be completed and a weighted average of the GWPs for each type of HFC in the blend should be used to convert to CO<sub>2</sub>-e.

When entering your estimation into EERS for SF<sub>6</sub> activities, you will be prompted to include the total quantity of gas contained in the equipment in t CO<sub>2</sub>-e. Once all fields are completed, press the ‘Calculate’ button to display the estimated emissions.



Figure 2: Method 2 sulphur hexafluoride EERS data entry screen.

Method \* Method 2 (4.103)

Gas contained in equipment (tCO<sub>2</sub>-e)

Emissions released during the year (CO<sub>2</sub>-e tonnes)

Result Calculate

For HFCs, only the ‘Emissions released during the year (CO<sub>2</sub>-e tonnes)’ field needs to be completed.

### Using Method 3

Alternatively, emissions may be estimated from data on replenishments of SF<sub>6</sub> and HFC gases in equipment as a proxy for leakage, and using an assumption that the stock levels of gases within the equipment are maintained at constant levels in order to maintain constant operating efficiency levels. Method 3 uses this aggregate loss estimation approach to estimate emissions. Until the 2021–22 reporting year, the required approach was described in the table in Appendix B of the ENA Industry Guidelines. From 2022–23 onwards, the required approach is described in section 4.104 of the NGER Measurement Determination

The aggregate loss at emissions source accounting method described in section 4.104 of the NGER Measurement Determination includes, but is not limited to, the following potential loss vectors:

- top up of gas for leaking equipment
- complete loss of containment of equipment
- losses during filling of new (or refurbished) equipment
- complete loss of containment of cylinders
- leakage of gas from cylinders
- losses during decanting between cylinders
- losses during manual handling including handling equipment failure or accidental venting
- leakage from equipment spares in storage
- leakage from decommissioned equipment awaiting disposal
- determinations of gas loss from sealed equipment at point of disposal
- losses during reprocessing, recycling or rebottling of gas
- losses due to gas sampling and analysis.

Separate calculations should be completed for each type of gas if the refrigerant blend also contains one or more gases that are not reportable under NGER Legislation. This list may not include all the point sources of losses for both SF<sub>6</sub> and HFCs and may be modified to include more point sources where they have been identified by the reporter.



Note the total annual loss of each type of gas should be converted into CO<sub>2</sub>-e using the relevant GWP. Where a refrigerant blend is used that also contain one or more gases that are not reportable under NGER Legislation, calculations for that refrigerant blend should be completed and the weighted average of the GWPs for each type of HFC in the blend should be used to convert to CO<sub>2</sub>-e.

‘Storage’ means all equipment, cylinders and other containers which hold HFCs or SF<sub>6</sub> not in use and which meet the requirements of Section 4.100 and 4.101 of the NGER Measurement Determination.

When entering your estimation into EERS for SF<sub>6</sub> activities, you will be prompted to include the total quantity of gas contained in the equipment in t CO<sub>2</sub>-e. Once all fields are completed, press the ‘Calculate’ button to display the estimated emissions.

Figure 3: Method 3 sulphur hexafluoride EERS data entry screen.

Method \* Method 3 (4.104)

Gas contained in equipment (tCO<sub>2</sub>-e)

Emissions released during the year (CO<sub>2</sub>-e tonnes)

Result Calculate

For HFCs, only the ‘Emissions released during the year (CO<sub>2</sub>-e tonnes)’ field needs to be completed.

## 8. Using incidental reporting provisions

Subsection 4.98(2) of the NGER Measurement Determination allows for estimates of emissions to be made using the incidental reporting provisions available within 4.27 of the NGER Regulations, provided that the method used is consistent with the principles set out in section 1.13 of the NGER Measurement Determination. See the Aggregated Facility Reporting, Percentage Estimates, and Incidental Emissions and Energy guideline<sup>7</sup> for more information.

<sup>7</sup> <https://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/Aggregated-facility-reporting-percentage-estimates-and-incident-emissions-and-energy-guideline.aspx>



## More information and references

This guideline has been provided by CER to assist in the consistent accounting and reporting of greenhouse gas emissions, energy consumption and energy production using the NGER Legislation.

### More information

For more information, please contact CER:

Email: [reporting@cleanenergyregulator.gov.au](mailto:reporting@cleanenergyregulator.gov.au)

Phone: 1300 553 542 within Australia

Website: [www.cleanenergyregulator.gov.au](http://www.cleanenergyregulator.gov.au)

### References

See [Guidelines<sup>8</sup>](#) for information on:

- defining a facility
- methods and measurement criteria
- reporting energy production and consumption
- reporting blended fuels, other fuel mixes, bitumen, and explosives guideline
- petroleum-based oils and greases
- reporting uncertainty.

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<sup>8</sup> <https://www.cleanenergyregulator.gov.au/NGER/Forms-and-resources/Guidelines>