



MIDAS includes the descriptions of models in use by the Commission in support to the policy cycle. MIDAS is developed and managed by the **Competence Centre on Modelling** of the European Commission.

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Factsheet

SWD/2022/96 final

COMMISSION STAFF WORKING DOCUMENT IMPACT
ASSESSMENT REPORT Accompanying the document Proposal for
a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE
COUNCIL on fluorinated greenhouse gases, amending Directive
(EU) 2019/1937 and repealing Regulation (EU) No 517/2014

Supporting model(s)

AnaFgas

Source: Commission modelling inventory and knowledge management system (MIDAS)

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Overview of model contributions to the impact assessment SWD/2022/96 final

Title

COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the document Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014

Document ID

SWD/2022/96 final

Year of publication

2022

Led by

CLIMA

Model(s) used

AnaFgas

AnaFgas

Full title

Analysis of Fluorinated greenhouse gases

Run for this impact assessment by

Öko-Recherche GmbH and Öko-Institut e.V.

Contributed to

Baseline and assessment of policy options

Helped to assess the following impacts

Impact area	Impact category	Impact subcategory
Economic impacts	Operating costs and conduct of business	Cost/availability of essential inputs (raw materials, machinery, labour, energy, ..)
Economic impacts	Competitiveness (sectoral) of business	Cost of doing business
Economic impacts	Consumers and households	Prices, quality, availability or choice of consumer goods and services
Economic impacts	Specific regions or sectors	Significant effects on sectors
Economic impacts	Specific regions or sectors	Impact on regions
Economic impacts	Specific regions or sectors	Disproportionately affected region or sector
Environmental	Climate	Emission of greenhouse gases

Overview of models

AnaFgas

Overview

Acronym AnaFgas

Full title Analysis of Fluorinated greenhouse gases

Main purpose

AnaFgas calculates demand and emissions of fluorinated greenhouse gases (F-gases) in the EU27+UK in the period of 2000 to 2050, based on a bottom-up stock model. An attached cost module allows quantification of related cost to the operators of equipment relying on F-gases or their alternatives.

Summary

The model AnaFgas (Analysis of Fluorinated greenhouse gases) is a bottom-up stock model to derive demand and emission scenarios for F-gases in relevant sectors and sub-sectors for the EU27+UK Member States. It models demand for and emissions of HFCs, PFCs and SF6 for the period 2000 to 2050 based on market data and estimates of the quantity of equipment or products sold each year containing these substances, and the amount of substances required in the EU to manufacture and/or maintain equipment and products over time.

All emission and demand estimates are derived from bottom-up approaches, i.e. by estimating demand and emissions per sector through the use of underlying driving factors. These include annual changes in equipment stock, composition and charge of the equipment, leakage during equipment lifetime and during disposal. Some of these components are driven by other factors such as population development, GDP growth or technological changes. Based on these drivers, annual emissions and banks as well as use can be calculated for each year, sub sector and EU Member State.

AnaFgas makes use of market information to build an inventory of the in-use stocks of the equipment in each of the end-uses in each country. This includes the percentage of the equipment stock that contains each F-gas. These modelled stock inventories are maintained through the annual addition of new equipment/new F-gas quantities and the retirement of equipment after an appropriate number of years. Annual leak rates, servicing emissions, and disposal emissions are estimated for each of the end-uses.

The AnaFgas cost module is based on model installations per sector and respective assumptions investment and operating expenditures for available options of used F-gases or F-gas alternatives. Specific cost at model installation level can be recalculated into total sectoral cost in the EU27+UK AnaFgas scope by means of AnaFgas data on equipment stocks.

Commission modelling inventory and knowledge management system (MIDAS)
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AnaFgas can be used to quantify the effects and costs of policy interventions to reduce emissions of fluorinated greenhouse gases by comparing different scenarios (e.g. policy options, baseline and counterfactual).

Keywords

emissions , RAC , RACHP , F-gases , refrigeration , air conditioning , foam blowing , cost

Model category (thematic)

Climate

Model home page

No information provided

Ownership & license

Ownership

Sole ownership [European Union]

Ownership details

Owned by European Union

Licence type

No information available

Details

AnaFgas structure and approach

AnaFgas derives quantities of F-gases used and emitted based on stock models of equipment in the EU27 and, optionally, the EU27+UK. The output of the model consists of two metrics, demand and emissions, that are calculated annually for the years between 2000 and 2050.

Demand is the sum of quantities of F-gases used in the initial first filling of equipment and the re-filling in the servicing of equipment during the lifetime. Emissions are the sum of emissions of F-gases during the lifetime of equipment (lifetime emissions) and F-gases that are released to the atmosphere during disposal of old equipment (disposal emissions).

To derive these quantities, the model is supplied with detailed annual stock data (mostly based on annual sales, together with disposal of equipment after a technology-specific lifetime). Sector-specific charge sizes allow for a calculation of yearly F-gas quantities, needed to supply all new and existing equipment (demand), while sector-specific emission rates allow for a calculation of yearly F-gas emissions, occurring from the use of equipment and its disposal (emissions).

AnaFgas calculates demand and emissions individually for 33 different F-gases and 12 different blends, including saturated and unsaturated HFCs, PFCs and SF6. F-gases enter the model by assumptions regarding the market share/penetration for each F-gas or blend in new equipment, for each year. F-gases in blends are individually accounted for in the calculation of demand and emissions.

For the projections of activity data including charges and F-gas split, and emission factors until 2050, AnaFgas generally distinguishes between three different time periods:

- Near past (5-10 years) is calculated by adjusting the stock model using data reported under Article 19 of the F-gas Regulation (reporting on supply of F-gases) and the National Inventory Reports (NIRs) submitted by the EU under the United Nations Framework Convention on Climate Change (UNFCCC, reporting on emissions and partially on first fill quantities). It must be noted, however, that the reported data is not equivalent to the modelled metrics. Under the F-gas Regulation, supply of F-gases is reported, which does not directly translate to demand. Further, the NIRs only contain data based on estimates that are not frequently changed to reflect market developments. Thus, deviations between the reported and modelled data are to be expected.
- Near future (5-10 years) is modelled on known policies and measures, technological changes, substitution patterns and expected changes in use patterns.
- Distant future (until 2050) is based on a continuation of trends observed, external projections of driving forces such as GDP and population and follows a business-as-usual trend as the model does not consider changes in technologies which are likely to happen within such a long timeframe.

In the model structure of AnaFgas, it is assumed that emissions from leakage during a year are replaced in the same year, irrespective of the age of the equipment. In reality, it can be assumed that leakage rates increase over the course of the lifetime of equipment. AnaFgas uses the average leakage rate over the entire lifetime of equipment for each year. This can lead to deviations from observed emissions for specific years but should even out when looking at longer time periods.

For projections in the distant future, results are necessarily uncertain, since novel developments in technology or other areas cannot be foreseen for such an extended time period.

The AnaFgas cost module is based on model installations per sector and respective assumptions investment and operating expenditures for available options of used F-gases or F-gas alternatives. Specific cost at model installation level can be recalculated into total sectoral cost in the EU27+UK AnaFgas scope by means of AnaFgas data on equipment stocks.

Input and parametrization

Key inputs used for the model.

- Lifetime emission rates
- Disposal emission rates
- Sales of equipment
- Disposal of equipment
- Market penetration rate of F-gases and blends in new equipment
- Prices for F-gases and their alternatives
- Investment cost for model installations
- Operating cost for model installations (energy and servicing)

Main output

Key outputs produced by the model.

- Yearly demand for 33 different F-gases in the EU27/EU27+UK from 2000 to 2050
- Yearly emissions of 33 different F-gases in the EU27/EU27+UK from 2000 to 2050
- Equipment operators' total expenditures under different scenarios / policy options

Spatial - temporal extent

The output has the following spatial-temporal resolution and extent:

Parameter	Description
Spatial Extent / Country Coverage	EU Member states 27 and UK

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(Spatial) resolution	National
Temporal extent	Long-term (more than 15 years)
Temporal resolution	Years

Quality & transparency

Quality

Question	Answer	Details
Models are by definition affected by uncertainties (in input data, input parameters, scenario definitions, etc.). Have the model uncertainties been quantified? Are uncertainties accounted for in your simulations?	no	The model is based on market fluctuations/decisions, which are highly volatile. Quantification of uncertainties cannot be properly conducted.
Sensitivity analysis helps identifying the uncertain inputs mostly responsible for the uncertainty in the model responses. Has the model undergone sensitivity analysis?	no	Too demanding.
Has the model undergone external peer review by a panel of experts, or have results been published in peer-reviewed journals?	no	
Has model validation been done? Have model predictions been confronted with observed data (ex-post)?	yes	Demand has been compared to total supply reported under the F-gas Regulation and emissions have been compared to data on emissions reported under UNFCCC.

References related to external peer-review and publication in scientific journals:

- No references provided in MIDAS

Transparency

Question	Answer	Details
Is the model underlying database (i.e. the database the model runs are based on) publicly available?	no	Input data are based on both publicly available and restricted-access sources. The full model database as such is not available to external users.
Can model outputs be made publicly available?	yes	Output datasets have been made publicly available.
Is the model transparently documented (including underlying data, assumptions and equations, architecture, results) and are these documents available to the general public?	no	An older version of the model was described in the IA report but no additional dedicated reports or manuals were published.
Is the model source code publicly accessible or open for inspection?	no	

References related to documentation:

- No references provided in MIDAS

The model's policy relevance and intended role in the policy cycle

The model is designed to contribute to the following policy areas

- Climate action

The model is designed to contribute to the following phases of the policy cycle

- Formulation
- Evaluation

The model's potential

AnaFgas is used to estimate emissions of fluorinated greenhouse gases from their use in the EU under different scenarios, e.g. baseline and counterfactual. This allows to evaluate the environmental effect of policy measures ex-post and assess the potential impact of policy measures ex-ante.

In the past, the model was used to evaluate Regulation (EC) No 842/2006 on F-gases and assess the impact of further measures that resulted in Regulation (EU) No 517/2014. It is currently used to evaluate Regulation (EU) No 517/2014 and assess the impact of further measures that will result in a new F-gas Regulation.

Previous use of the model in ex-ante impact assessments of the European Commission

Use of the model in ex-ante impact assessments since July 2017.

In the Year	AnaFgas contributed to the Impact assessment called	Led by	By providing input to the	The model was run by	Details of the contribution
2022	COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the document Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014	CLIMA	Baseline and assessment of policy options	Öko-Recherche GmbH and Öko-Institut e.V.	The model helped to assess the following impacts: - Cost/availability of essential inputs (raw materials, machinery, labour, energy, ..) - Cost of doing business - Prices, quality, availability or choice of consumer goods and services - Significant effects on sectors - Impact on regions - Disproportionately affected region or sector - Emission of greenhouse gases

Bibliographic references

- *No references provided in MIDAS*