

Quarterly Air Emission Accounts

Technical Project



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1 Introduction

In recent years, the INE (National Statistics Institute) has produced seven new environmental accounts: emissions to the atmosphere, material flows, environmental taxes, waste, environmental protection expenditure, energy, and environmental goods and services.

These accounts complement the traditional statistics that the INE has been conducting in the environmental field for years, in terms of waste generation and treatment, water, and environmental protection expenditure.

From the mentioned statistics and accounts, it is possible to have a broad set of highly relevant environmental indicators for users and decision-making in the field of ecological transition.

It is, however, a demand to improve the periodicity and timeliness of the information in environmental statistics. In particular, it is recommended by the *National Statistical Plan 2025-2028* that "as an experimental statistic or as a study, possible indicators for various aspects of the environment should be discussed: Climate Change, Emissions to the Atmosphere and Circular Economy, among others".

In order to keep track of this Climate Change objective and to improve the timeliness and monitoring of greenhouse gas emissions, this experimental statistic is presented. This project includes statistical and econometric methods developed from the National Accounts approach, in order to obtain quarterly data on greenhouse gas emissions consistent with the annual publication, providing more timely data (t+4 months) on the evolution of greenhouse gas emissions.

2 International and European Context

Europe is recognised as a pathfinder in the transition to climate neutrality and the reduction of the ecological footprint, through the adoption of policies such as the European Green Pact, the European Climate Legislation, the REPowerEU Plan, the "Fit for 55" initiative and numerous strategies and roadmaps at regional, national and local level.

The following presents the international and European framework that motivates this project.

2.1 EUROPEAN GREEN DEAL

Beyond the proposals and results of the Paris Agreement, adopted in December 2015, the European Commission presented the European Green Deal in 2019¹. Here are some key points:

- A higher level of EU climate ambition for 2030 and 2050.
- Provision of clean, affordable, and secure energy.

¹ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_es

- Efficient use of energy and resources in building and renovation.
- Accelerating the transition to sustainable and smart mobility.
- Aspiring to zero pollution for a toxic-free environment.

The 8th Environment Action Programme² (the 8th EAP) builds on the objectives of the European Green Pact to achieve a climate-neutral, resource-efficient, non-toxic, resilient and competitive circular economy in a fair and inclusive manner. The programme is also fundamental to achieving climate and environmental objectives within the framework of the United Nations 2030 Agenda, its Sustainable Development Goals (SDGs), and multilateral environmental and climate agreements.

This project's proposed Quarterly Greenhouse Gas (GHG) Atmospheric Emissions Account is positioned in line with the European-level indicators that form the basis of the monitoring framework for measuring progress towards the climate change mitigation objective.

2.2 ENERGY STRATEGY

The energy strategy of the EU is based on a several key goals and principles that seek to ensure a secure, sustainable and competitive energy supply for all member countries. The production and use of energy accounts for more than 75% of the EU's GHG emissions.

These objectives align with the EU's broader efforts to address climate change and promote sustainable economic development, in particular the commitment to decarbonise its economy and achieve carbon neutrality by 2050. This involves the drastic reduction of greenhouse gas emissions.

2.3 SUSTAINABLE DEVELOPMENT GOALS (SDGS)

The Sustainable Development Goals³ (SDGs) are a universal call to action to end poverty, protect the planet, and improve the lives and prospects of people worldwide. In 2015, the 193 Member States of the United Nations adopted 17 Goals and 169 specific targets as part of the 2030 Agenda for Sustainable Development. This Agenda outlines a plan to achieve the Goals over 15 years through the action of all societal actors.

Climate change is affecting every country on all continents. It is changing national economies and affecting lives. The SDGs include indicators to monitor the problem. Notably: SDG 13 (Climate Action), SDG 11 (Sustainable Cities and Communities), SDG 7 (Affordable and Clean Energy).

² https://ec.europa.eu/commission/presscorner/detail/es/IP_22_4667

³ <https://sdgs.un.org/2030agenda>

2.4 THE EUROPEAN CLIMATE LAW

One of the main objectives of the European Green Deal is a higher level of climate ambition for 2030 and 2050, specifically aiming to achieve climate neutrality in the EU by 2050.

In this experimental statistic, the 'Climate Change' action axis is introduced, one of the main international initiatives, in response to the need to measure the objectives set out in the Paris Agreement and the European Climate Law.

The Paris Agreement⁴ is an international treaty on climate change, adopted by world leaders at the United Nations Climate Change Conference (COP21) in Paris. The Agreement sets long-term goals as a guide:

- Substantially reduce greenhouse gas emissions to limit the global temperature increase this century to 2 °C, preferably to just 1.5 °C.
- Review country commitments every five years.
- Provide funding to developing countries to help them in mitigating climate change and improving their capacity to adapt to its impacts.

Currently, 192 countries, in addition to the European Union, have signed the Paris Agreement. The agreement includes commitments from all countries to reduce their emissions and collaborate on adapting to the impacts of climate change, as well as calls for these countries to increase their commitments over time. It also provides a framework for transparent monitoring and reporting on the climate targets of developed countries, and its implementation is crucial for achieving the Sustainable Development Goals.

This includes the adoption by the European Commission in 2021 of the European Climate Act⁵, which sets and defines the objective of climate neutrality in the EU by 2050 and provides a framework for advancing efforts to adapt to the impacts of climate change. All member states must implement adaptation strategies and plans.

The Law also sets a binding target for the EU to reduce net GHG emissions (net emissions after removals) by at least 55% by 2030 compared to 1990 levels. To ensure sufficient measures are taken to reduce and avoid emissions by 2030, the Climate Law introduces a limit of 225 million tonnes of CO₂ equivalent as the contribution of absorptions to this target.

Under this Law, the 'Fit for 55' plan (Objective 55%) has also been agreed upon, which is a package of measures aimed at reviewing and updating EU legislation and launching new initiatives to ensure EU policies align with agreed climate targets.

Therefore, it is essential to add a line of action that can monitor improvements related to climate change. This project is designed to provide more frequent and detailed statistical data that can provide support to policy makers, researchers and the general public to better understand trends in GHG emissions and to take more effective action to reduce them.

⁴ <https://www.un.org/es/climatechange/paris-agreement>

⁵ <https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX%3A32021R1119>

2.5 QUARTERLY EUROPEAN AIR EMISSION ACCOUNT

On 29 November 2021, Eurostat released for the first time estimates of quarterly GHG emissions for the whole of the European Union. This is a result of the need for up-to-date, high-frequency climate indicators that can be integrated and analysed alongside economic data. Enhanced timeliness of information is one of the key objectives of the European Strategy on Environmental Accounts.

Since the existing annual GHG emissions data do not fully meet this need, Eurostat decided to produce quarterly estimates of GHG emissions accounts. These estimates can be valuable for discussion of policies, as they allow economic decision-makers to preliminarily monitor climate policy responses in near real time.

The quarterly estimates approach is primarily aimed at economic decision-makers who require short-term information. In addition, institutions such as the European Central Bank and other financial institutions are becoming increasingly interested in understanding environmental aspects that may affect economic performance, trends in the market, sustainable investments and environmental consequences related to economic production and the employment market.

It is important to mention that Eurostat's work on quarterly GHG emissions estimates is coordinated at the international level with organisations such as the IMF, OECD, IEA and UNSD⁶, through a joint task force.

3 Research areas

3.1 POPULATION SCOPE

The data on emissions present in these experimental statistics are related to the Spanish economy as a whole, in other words, resident economic units and households as defined in the System of Environmental and Economic Accounting 2012 (SCAE CF 2012) and the National Accounts.

For information on emissions, the breakdown by activity according to the National Classification of Economic Activities (CNAE) and GHGs will be relevant.

3.2 GEOGRAPHICAL SCOPE

The reference area is the economic territory as defined in the SCAE CF 2012 and the National Accounts (ESA 2010). Units considered as resident units of a country are those that have a centre of economic interest in the economic territory of that country, i.e. when they are engaged for an extended period of time (1 year or more) in economic activities in that territory.

According to this residence basis, the Atmospheric Emission Accounts record emissions from the activities of resident units, no matter where they take place. This is the main

⁶ International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD), International Energy Agency (IEA) and United Nations Statistics Division (UNSD).

difference in conceptual terms with the GHG Emission Inventories that are reported to the United Nations Framework Convention on Climate Change (UNFCCC).

3.3 TIME SCOPE

The data are quarterly. The estimates will be released from the first quarter of 2010 onwards.

The information for each quarter is updated in every publication, so that the whole series is consistent and comparable.

3.4 STUDY AND CLASSIFICATION VARIABLES

The data include air emissions of GHGs from both economic activities and households (resident units).

The GHGs under consideration are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and the fluorinated gases (HFCs, PFCs and SF₆). To produce the required aggregation of the gases into a single GHG value, emissions are converted to their carbon dioxide equivalent (CO₂e) value by multiplying the mass of the gas in question by its global warming potential (AR5) as set by the UNFCCC (Annex I).

Emissions are separated by NAPC-related categories of emitters. The quarterly estimates are based on economic-environmental accounting data.

4. Processing of information: Description and Method of Preparation

The methodology used to produce the quarterly estimates is characterised by following an econometric-statistical approach, which is commonly applied for Quarterly National Accounts. It is based mainly on the IMF's Quarterly National Accounts Manual (2017) and Eurostat's Quarterly National Accounts Manual (2013).

The quarterly estimates are based on annual data from the Atmospheric Emissions Account (AEA) which publishes data on GHGs evolved into the atmosphere as a result of economic activities of resident units. Such information is a statistical synthesis operation that follows the methodology of the System of Environmental and Economic Accounting developed by the United Nations (SEEA). The common concepts, definitions, classifications and accounting rules established by Regulation (EU) No 691/2011 of the European Parliament and of the Council of 6 July 2011 on European environmental economic accounts are used to provide the necessary framework.

Using the basic methodological principle for the quarterly estimates is to disaggregate the annual EAA series into quarterly values and to extrapolate for those quarters for which annual data are not yet available.

For the 'target' variables that are estimated quarterly three dimensions are relevant: gas, reference year and economic activity (CNAE). The measurement unit used will be the tonne of carbon dioxide equivalent.

The purpose of the mix of dimensions is to reduce the errors in the estimates to a minimum while allowing sufficient disaggregation of the information. To achieve these two objectives, the quarterly GHG emission accounts use two levels of aggregation:

- -The estimation level: number of target variables that are fed into the estimation model (annex II).
- -The dissemination level: number of aggregates that are released (annex III).

The estimation level is more detailed than the dissemination level. Those aggregations by activity and gas that make the most significant contribution to atmospheric emissions are selected. For each one of them ("target" variables) we do the following:

- -Temporal disaggregation: the available annual values into quarterly values ensuring their equality.
- -Anticipated estimates (extrapolation): the quarters after the last annual value are extrapolated up to the last quarter for which an estimate is needed.

For this purpose, it will use predictors that carry auxiliary information. A predictor is a sub-annual (monthly or quarterly) indicator that aims at providing the (unknown) quarterly behaviour of the target variable. To assess the suitability of a predictor the relevant characteristics are: the correspondence with the target variable, the availability and the time coverage of the data.

For these cases, a number of different statistical methods of temporal disaggregation and benchmarking can be used, the most relevant of which are the Denton, Chow-Lin, Fernandez and Litterman methods. This process is followed in the Quarterly National Accounts Manual (Eurostat, 2013) and in the Guidelines on temporal disaggregation, benchmarking and reconciliation (Eurostat, 2018).

Some target variables do not have any predictor selected due to the specificities of the variable, or because of the unavailability of suitable predictors.

In these cases, we apply the method of Boot, Feibes and Lisman (1967) in the temporal disaggregation and for extrapolation we use other information if available or a weighted average of the quarterly exchange rates of the last three observations as set out in the Quarterly National Accounts Manual (IMF 2017).

The time additivity constraint is included in the process for all these methods, the sum of the four quarters is always equal to the annual value.

The predictors, a high frequency series, come from different sources of information such as the National Institute of Statistics, the Ministry of Ecological Transition and the Demographic Challenge, the Ministry of Industry and Tourism, Eurostat and the OECD. This data is available in the necessary time and periodicity (quarterly/monthly):

- Gross value added by economic activity, in interlinked volumes (2015)
- Industrial production indices by economic activity in Volume
- Gross generation of electricity from fossil fuels
- Gross inland supply (observed) of motor gasoline and on-road diesel fuels
- Gross refinery production

- Clinker production
- Employment in resident maritime transport
- CO2 emissions from air transport
- Average number of days with temperatures below a threshold (degrees)
- Turnover index deflated for wholesale and retail trade

The information is elaborated using the computer application *SoftwareAjuste* created in the National Institute of Statistics in the S.G. of Information and Communication Technologies. As support, the Jdemetra tools will be used, as well as the R package "tempdisagg". Through the Working Group on temporal disaggregation and benchmarking coordinated by the S.G. for Methodology and Sample Design and the support of the S.G. for Information and Communications Technologies, the data will be processed using the Jdemetra tools as well as the R package "tempdisagg".

5 Dissemination of Information

The European Commission's European Green Pact has specified awareness-raising and information dissemination as a priority to monitor progress towards achieving each of the climate change objectives and the pursuit of climate neutrality.

The decision on publication categories has taken into account criteria of quality and relevance of the information. This is subject to revision as more information becomes available or as new indicators become available. The aggregation is as follows:

- Greenhouse Gases: Total of the different gases.
- Breakdown by economic activity (Annex III).

For each quarterly estimation cycle, the full time series since the first quarter of 2010 is recalculated. This means that all of the time series are re-produced in each release. This makes it possible to incorporate any changes in the historical data of the series (both target and predictor variables) and to ensure the internal comparability of the data over time.

5.1 DISSEMINATION SCHEDULE

The first release of the experimental statistics is scheduled between the end of 2024 and the beginning of 2025. The regularity will be quarterly, with the results tables released around 4 and a half months after the end of the reference quarter t ($t+4$), about one month after the dissemination of the Quarterly National Accounts data.

6 Implementation Schedule

6.1 FIRST PHASE

During this first phase, quarterly data will be published with the breakdown indicated in the previous section. The information will be released with the relevant metadata and a press release to facilitate the interpretation and visualisation of the data.

This information will be sent to Eurostat, so that it can be included in the quarterly European greenhouse gas estimates, so that both statistics are aligned.

After this first publication, the data will be disseminated every quarter with the necessary updates.

6.2 SECOND PHASE

The data of the seasonally adjusted series will be incorporated into the information. This will make it easier to understand the data, as well as to compare them with other series of physical or economic variables.

Also the possibility of new breakdowns at the economic activity level will be analysed, in an attempt to incorporate better auxiliary data sources. More precise econometric models will be adjusted, based on the developments of the econometric-statistical approach of temporal disaggregation and benchmarking.

This inclusion of new indicators is expected to be carried out in the year following the first publication of quarterly data, gathering the information compiled after the first annual publication cycle.

6.3 FUTURE OF THE OPERATION

The aim is for this operation to become part of the INE's current production, including new breakdowns of economic activities as soon as the basic information is available, as soon as stability in its production and dissemination is achieved.

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8 Annexes

8.1 ANNEX I. GREENHOUSE GASES - GLOBAL WARMING POTENTIAL

Greenhouse gases taken into account and values of the 100-year global warming potentials for calculating the carbon dioxide equivalence of anthropogenic GHG emissions as set out in Table 8.A.1 of the Working Group 1 contribution to the IPCC Fifth Assessment Report (AR5)⁷

Acronym, common name or chemical name	PCG values
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	28
Nitrous oxide (N ₂ O)	265
Sulphur hexafluoride (SF ₆)	23,500
<i>Hydrofluorocarbons or hydrogen-fluorocarbon compounds (HFCs):</i>	
HFC-23 CHF ₃	12,400
HFC-32 CH ₂ F ₂	677
HFC-41 CH ₃ F	116
HFC-125 CHF ₂ CF ₃	3,170
HFC-134 CHF ₂ CHF ₂	1,120
HFC-134a CH ₂ FCF ₃	1,300
HFC-143 CH ₂ FCHF ₂	328
HFC-143a CH ₃ CF ₃	4,800
HFC-152 CH ₂ FCH ₂ F	16
HFC-152a CH ₃ CHF ₂	138
HFC-161 CH ₃ CH ₂ F	4
HFC-227ea CF ₃ CHFCF ₃	3,350
HFC-236cb CF ₃ CF ₂ CH ₂ F	1,210
HFC-236ea CF ₃ CHFCHF ₂	1,330
HFC-236fa CF ₃ CH ₂ CF ₃	8,060
HFC-245fa CHF ₂ CH ₂ CF ₃	858
HFC-245ca CH ₂ FCF ₂ CHF ₂	716
HFC-365mfc CH ₃ CF ₂ CH ₂ CF ₃	804
HFC-43-10mee CF ₃ CHFCHFCF ₂ CF ₃ or (C ₅ H ₂ F ₁₀)	1,650
<i>Perfluorocarbons or polyfluorocarbon compounds (PFCs):</i>	
PFC-14, Perfluoromethane, CF ₄	6,630
PFC-116, Perfluoromethane, C ₂ F ₆	11,100
PFC-218, Perfluoropropane, C ₃ F ₈	8,900
PFC-318, Perfluorobutane, c-C ₄ F ₈	9,540
Perfluorocyclopropane, c-C ₃ F ₆	9,200

⁷ https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf

PFC-3-1-10, Perfluorobutane, C4F10	9,200
PFC-4-1-12, Perfluoropentane, C5F12	8,550
PFC-5-1-14, Perfluorohexane, C6F14	7,910
PFC-9-1-18, C10F18	7910
Mix of HFC-PFCs	936

8.2 ANNEX II. VARIABLES - ESTIMATION LEVEL -

Code	Variable
CO2_A	Carbon Dioxide - Agriculture, livestock, forestry and fishing
CH4_A	Methane - Agriculture, livestock, forestry and fishing
N2O_A	Nitrous oxide - Agriculture, Livestock, Forestry and Fishing
FGAS_A	Fluorinated gases - Agriculture, Livestock, Forestry and Fishing
CO2_B	Carbon Dioxide - Extractive Industries
CH4_B	Methane - Extractive industries
N2O_B	Nitrous oxide - Extractive industries
FGAS_B	Fluorinated gases - Extractive industries
CO2_C_EXC	Carbon dioxide - Manufacturing industry excluding cnrs C19, C20, C23 and C24
CH4_C	Methane - Manufacturing industry
N2O_C	Nitrous oxide - Manufacturing industry
FGAS_C	Fluorinated gases - Manufacturing industry
CO2_C19	Carbon Dioxide - Coke and Oil Products and Refineries
CO2_C20	Carbon Dioxide - Chemical Industry
CO2_C23	Carbon dioxide - Manufacture of other non-metallic mineral products
CO2_C24	Carbon Dioxide - Metallurgy, manufacture of iron, steel and ferro-alloy products
CO2_D	Carbon Dioxide - Electricity, gas, steam and air conditioning supply
CH4_D	Methane - Electricity, gas, steam and air conditioning supply
N2O_D	Nitrous oxide - Electricity, gas, steam and air-conditioning supply
FGAS_D	Fluorinated gases - Electricity, gas, steam and air-conditioning supply
CO2_E	Carbon Dioxide - Energy, water and waste sector
CH4_E	Methane - Energy, water and waste sector
N2O_E	Nitrous Oxide - Energy, water and waste sector
FGAS_E	Fluorinated Gases - Energy, water and waste sector
CO2_F	Carbon Dioxide - Construction
CH4_F	Methane - Construction
N2O_F	Nitrous oxide - Construction
FGAS_F	Fluorinated gases - Construction
CO2_G	Carbon Dioxide - Wholesale and retail trade; repair of vehicles
CH4_G	Methane - Wholesale and retail trade; repair of vehicles
N2O_G	Nitrous oxide - Wholesale and retail trade; repair of vehicles

FGAS_G	Fluorinated gases - Wholesale and retail trade; repair of vehicles
CO2_H49	Carbon Dioxide - Transportation by land and pipelines
CO2_H50	Carbon Dioxide - Maritime and Inland Water Transportation
CO2_H51	Carbon Dioxide - Air Transportation
CO2_H_EXC_H49_H50_H51	Carbon dioxide - Transport and storage services excluding cnrs H49, H50 and H51
CH4_H	Methane - Transport and storage services
N2O_H	Nitrous oxide - Transport and storage services
FGAS_H	Fluorinated gases - Transport and storage services
CO2_I_U	Carbon Dioxide - Other services
CH4_I_U	Methane - Other services
N2O_I_U	Nitrous oxide - Other services
FGAS_I_U	Fluorinated gases - Other services
CO2_HH_HEAT_OTR	Carbon Dioxide - Households. Heating/Cooling and Others
CO2_HH_TRA	Carbon Dioxide - Households. Transportation
CH4_HH	Methane - Households
N2O_HH	Nitrous oxide - Households
FGAS_HH	Fluorinated gases - Households

8.3 ANNEX III. VARIABLES - DIFFUSION LEVEL -

Code (division CNAE)	Literal
01-03	Agriculture, livestock, forestry and fishing
05-39	Industry
10--33	Manufacturing industry
35	Electricity, gas, steam and air conditioning supply
41-43	Construction
45-99	Service Sector
49-52	Transport and storage services
HH	Households