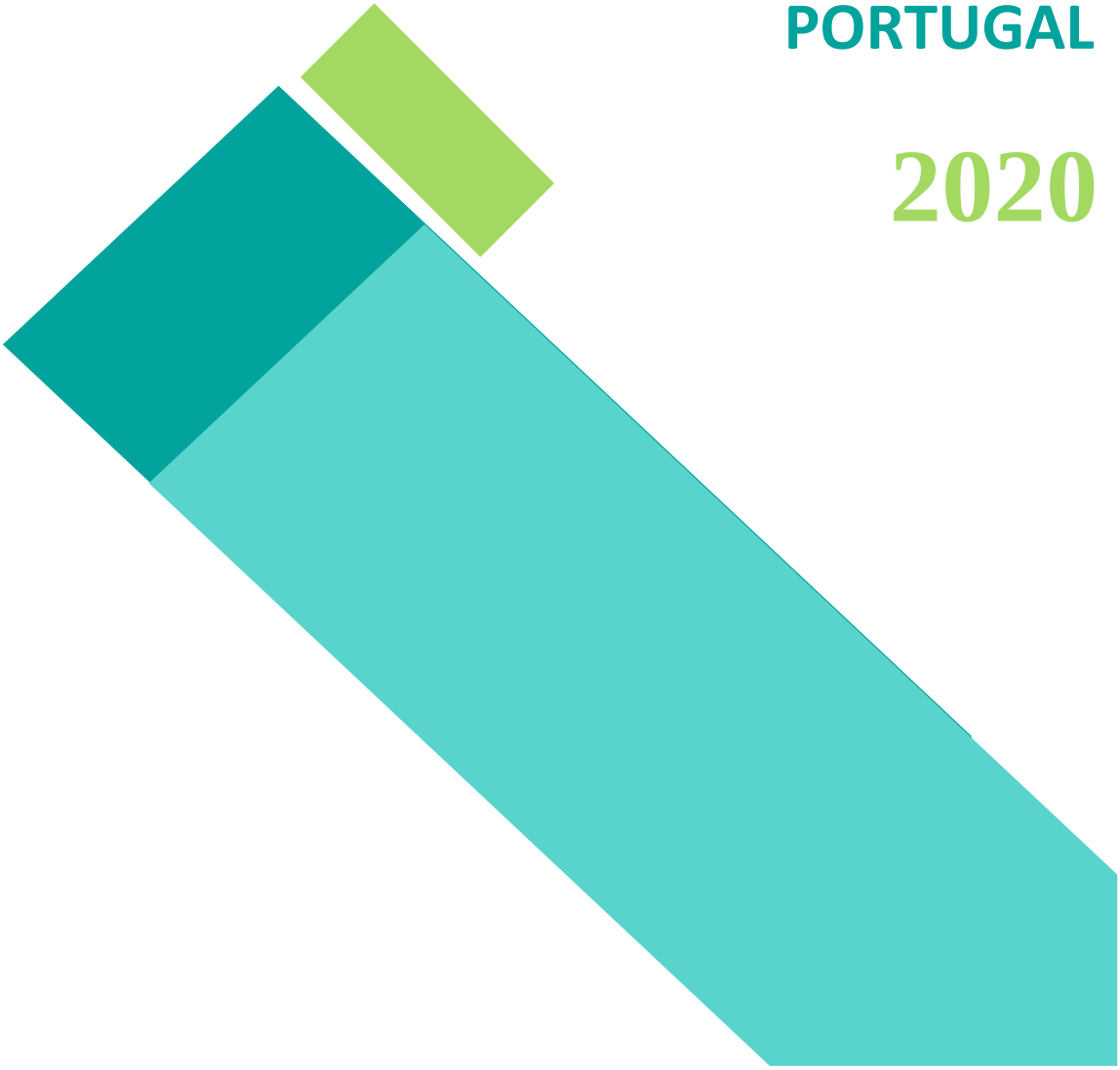
4th Biennial Report to the United Nations Framework Convention for Climate Change

PORTUGAL

2020



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Contents

ACRONYMS

AEAs	Annual Emission Allocations
APA	Portuguese Environment Agency
CA	Yellow Jersey Scenario
CC	Climate Change
CCV	Green Growth Commitment
CERs	Certified Emission Reductions
CH4	Methane
CLRTAP	Convention on Long-Range Transboundary Air Pollution
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
CPLP	Community of Portuguese Speaking Countries
CRF	Common Report Format
CRS	Creditor Reporting System
DC	Development Cooperation
DAC	Development Assistance Committee
DCLIMA	APA's Climate Change Department
ECO.AP	Action Plan for Energy Efficiency in Public Administration
EMEP	European Monitoring and Evaluation Programme
ENAAC 2020	National Strategy for Adaptation to Climate Change
ERU	Emission Reduction Units
EU	European Union
FP	Off-track Scenario
FPC	Portuguese Carbon Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GNI	Growth National Income
GWP	Global Warming Potencial
HC	High Case Scenario
HFC	Hydrofluorocarbons
INE	National Statistical Institute
INERPA	National Emissions Inventory
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Uses
LC	Low Case Scenario
LCP	Large Combustion Plant
LDC	Least Developed Countries
LULUCF	Land-Use and Land-Use Change
MAC	Mobile Air Conditioning
MoU	Memoranda of Understanding
MMR	Monitoring Mechanism Regulation
MAAC	Ministry of the Environment and Climate Action

NIR	National Inventory Report
NF3	Nitrogen Trifluoride
NFR	New Format Reporting
NMVOC	Non-methane Volatile Organic Compounds
N2O	Nitrous Oxide
NOx	Nitrogen Oxides
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
PAEC	Action Plan for Circular Economy
PALOP	Portuguese Speaking Countries of Africa
PDM	Methodological Development Plan
PEN	National Energetic Plan
PERSU 2020+	Strategic Plan for Urban Waste
PFC	Perfluorocarbons
PL	Platoon Scenario
PNAC	National Program for Climate Change
PNAEE	National Plan of Action for Energy Efficiency
PNAER	National Action Plan for Renewable Energy
PNBEPH	National Program for High Hydroelectric Potential Dams
PNCT	National Program for Territorial Cohesion
PNEC 2030	National Energy and Climate Plan 2030
PNPOT	National Program for Spatial Planning Policy
PPA	Programmes, Projects and Actions
PtC	Portuguese Cooperation
PTEN	National Plan on Emission Ceilings
ptODA	Portuguese Official Development Assistance
KP	Kyoto Protocol
RNC2050	Roadmap for Carbon Neutrality 2050
SGCIE	System for the management of energy intensive
SIDS	Small Island Developing States
SF6	Sulphur Hexafluoride
SNIERPA	National System of Inventories of Emissions and Remotions of Atmospheric Pollutants
SOx	Sulphur Oxides
SPeM	National System of Policies and Measures
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
WAM	With Additional Measures
WEM	With Existing Measures

ACKNOWLEDGEMENTS

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I. INTRODUCTION

This report constitutes the 4th Biennial Report of Portugal, as required under Decision 2/CP.17 of the Conference of the Parties under the United Nations Framework Convention on Climate Change (UNFCCC) and Article 18(1) of the Regulation (EU) No 525/2013 of the European Parliament and the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC.

The report includes an executive summary and major chapters, regarding information on greenhouse gas emission and trends, quantified economy-wide emission reduction target, progress in achievement of quantified economy-wide emission reduction targets, projections and provision of financial, technological and capacity building support to developing country Parties.

Portugal has shown results in climate policy over the past decades, having exceeded the targets set in the first commitment period of the Kyoto Protocol and being on track to meet the goals set for 2020 of GHG emission reduction, energy efficiency and promotion of renewable energy sources. Since 2005, the national economy has shown a trend of decoupling between GDP and GHG emissions.

In 2016, the government committed to achieve carbon neutrality by 2050, outlining a clear vision of decarbonisation of the national economy and contributing to the most ambitious objectives under the Paris Agreement. To support this commitment, the government decided to draw up a 2050 Carbon Neutrality Roadmap (RNC2050) with the aim of exploring the feasibility of trajectories that lead to carbon neutrality, identifying the main decarbonisation vectors and estimating the carbon reduction potential of various sectors of the national economy, such as energy and industry, mobility and transport, agriculture, forests and other land uses, and waste and waste water.

Decarbonisation of the economy is an ambitious goal that demands the broad engagement and participation of society as a whole, which is why RNC 2050 motivated an unprecedented participatory process of involvement of the main sectors and mobilisation of Portuguese society.

A new national target was established to reduce GHG emissions in Portugal by 85% to 90% by 2050, compared to 2005 levels and to offset the remaining emissions through land use and forests, to be achieved through a trajectory of emissions reduction between 45% and 55% by 2030, and between 65% and 75% by 2040, compared to 2005.

This new strategy and roadmap (RNC2050) was approved by the Portuguese Council of Ministers Resolution 107/2019 of 1 July.

RNC 2050 is also the national strategy for long-term low-GHG development submitted to the United Nations Framework Convention on Climate Change (UNFCCC) under the Paris Agreement[1].

In line with this vision and developed in conjunction with the RNC2050, Portugal's Integrated National Energy and Climate Plan (PNEC 2030) will be the main energy and climate policy instrument for the 2021-2030 decade.

This National Energy and Climate Plan is based on a strategic vision for the 2030 horizon of "Promoting the decarbonisation of the economy and the energy transition towards carbon neutrality in 2050 as an opportunity for the country, based on a democratic and fair model of territorial cohesion that enhances wealth generation and the efficient use of resources", being its decisive contribution to the definition of

[1] https://unfccc.int/

priority action lines for the next decade. Thus, we can affirm that since the last biennial report (BR3BR) some significant achievements have taken place.

II. EXECUTIVE SUMMARY

GHG emissions and trends

Emissions included in this Biennial Report are those relevant to the National target under the UNFCCC, the Kyoto Protocol and the Paris Agreement, and the data is taken from the latest submission of the National inventory to the UNFCCC, reported in 2019.

Total greenhouse gas (GHG) emissions in Portugal increased by 19.5% between 1990 and 2017 (+11.5 million tonnes CO2 equivalent). These emissions exclude Land Use, Land-Use Change and Forestry (LULUCF), exclude international bunkers and include indirect CO2.

The most important GHG by far is CO2, which accounted for 78% of total Portuguese emissions in 2017, excluding LULUCF.

The energy sector accounted for most of the national GHG emissions in 2017 (72.5%), followed by industrial processes and product use (11.1%) and agriculture (9.8%) .

Per capita emissions rose from 6 tonnes/inh. in 1990 to 6.9 tonnes/inh. in 2017. The ratio of GHG emissions to GDP decreased significantly (approx.-17%) thanks to steady progress on decoupling economic activity from GHG emissions since 1990.

Information concerning the National System and the Greenhouse Gases Inventory

In 2017, total national GHG emissions, including indirect CO2, without land-use, land-use change and forestry (LULUCF) were estimated at about 70.7 Mt CO2e, representing an increase of 19.5 % compared to 1990 and 7% compared to the previous year (2016).

After the -2.7% decrease of the national emissions registered in 2016 compared to 2015, the total emissions in 2017 increased significantly (7%) as compared to 2016, reflecting the particular unfavourable hydrologic conditions which contributed to a greater use of coal and natural gas in the electricity production sector. Effectively, meteorological parameters such as rainfall, which have high inter-annual variability in Portugal, have a significant impact in hydroelectric production, which influences very significantly the variation of the emissions.

The steady increase of emissions during the 90s, was followed by a more moderate rate and started to stagnate in the early 2000s, registering thereafter, in particular after 2005, a decrease.

These trends reflect largely the evolution of the Portuguese economy which was characterized by a strong growth associated to the increase of energy demand and mobility in the 90's, the large investment in renewable energy sources, increased efficiency in energy use and to the more recent situation of stagnation or later recession of the Portuguese economy, which has begun recovering afterwards. In 2017, GDP registered a positive variation of 2.4%, accentuating the growing tendency verified since 2014.

Energy is by far the most important sector, accounting for 73 % of total emissions in 2017, followed by Industrial Use of Products (11%), Agriculture (10%) and Waste (7%). The largest GHG gas emitted - CO2 - is mainly generated from fossil fuel combustion in energy-related activities. The increase of CO2 emissions since 1990 is driven by the growth of energy industries and transport that have registered, respectively, a 27% and 68% growth from 1990 to 2017.

The main key drivers that explain the emissions reduction since 2005 include: (i) use in "cruising speed" of natural gas, (ii) the penetration of renewable energy, (iii) the beginning of scale penetration of biofuels in transport, (iv) energy efficiency in sectors covered by the EU ETS (v) and the "green" tax reform on vehicles.

Transports, largely dominated by road traffic, represent a major source of GHG emissions and is one of the sectors that has risen faster, due to the steady growth of vehicle fleets (in particular with more powerful engines) and road travel from 1990 to the early 2000s, reflecting the increase in family income and the strong investment in the road infrastructure of the country in the 1990s. The situation seems however to have stabilized in the early 2000s and then started to decline since 2005. An inversion of this tendency is registered in the most recent years, with an increase in transport emissions of 8.4 % from 2013 to 2017.

The analysis of greenhouse gases emissions per unit of GDP shows that the process of decoupling between GDP and emissions started in 2005, with the beginning of the "decarbonisation" of the economy, i.e., an economy with less GHG emissions per unit of produced wealth.

Quantified Economy-Wide Emission Reduction Target (QEWERT)

In 2010, the EU submitted a pledge to reduce its GHG emissions by 2020 by 20 % compared to 1990 levels. Portugal as an EU Member State is a part of the EU 2020 emission reduction target. The implementation of this target is ensured by EU legislation adopted under the "2020 climate and energy package" (2013-2020). The package introduced a clear approach to achieving the EU's 20 % reduction of total GHG emissions from 1990 levels, which is equivalent to a 14 % reduction compared to 2005 levels. This 14 % reduction objective is divided between the ETS and ESD sectors.

While the EU ETS target is to be achieved by the EU as a whole, the Effort Sharing Decision (ESD) target was divided into national targets to be achieved individually by each Member State. Under the ESD, national emission targets for 2020 are set, expressed as percentage changes from 2005 levels. For Portugal this means a +1% target compared to 2005 levels. These changes have been transferred into binding quantified annual emission limits for the period from 2013 to 2020, denominated in Annual Emission Allocations (AEAs).

Furthermore, a 2030 target has been pledged by the EU through its Nationally Determined Contribution submitted under the Paris Agreement, and has been adopted by the EU under the 2030 Climate and Energy Framework (2021-2030). The emission reduction target is a pledge to reduce emissions by at least 40% (compared to 1990 levels) by 2030. Similarly to the 2020 target, under the new Effort Sharing Regulation (ESR), national emission targets for 2030 are set, expressed as percentage changes from 2005 levels. For Portugal this means a -17% target compared to 2005 levels. Separate targets on renewable energy and energy efficiency have been set under the 2030 Climate and Energy Framework and updated. For renewable energy a binding target of at least 32% of final energy consumption by 2030 has been set (Portugal committed to a 47% share of renewables in its final energy consumption).

Progress in achievement of quantified economy-wide emission reduction targets and relevant information

In response to the commitment assumed by Portugal in 2016 to ensure the neutrality of its emissions by the end of 2050, the Roadmap for Carbon Neutrality 2050 (RNC 2050) was approved by the Council of Ministers, through the Resolution n.º 107/2019 of July 1st.

RNC 2050 is the national strategy for long-term low-GHG development and has already been submitted on the 20th of September 2019, to the United Nations Framework Convention on Climate Change (UNFCCC) in accordance with the Paris Agreement.

The main sectoral policy instruments at national level that are currently in force or being finalized and contribute to the achievement of energy and climate targets and objectives, while contributing to the Energy Union dimensions - decarbonisation, energy efficiency, security of supply, internal energy market and research, innovation and competitiveness - are identified in the report.

Sector Policies and measures related to Cross-Cutting, Energy, Waste and wastewater, Agriculture and Forest, Mobility and transport, F-gases and Research and Innovation are described in the present report in detail, namely its framework, scope, objectives and expected results. For 2030 the most significant policies and measures are already identified in the NECP 2030.

Emissions recorded in 2017 confirm a path towards meeting national and European emission reduction targets for 2020 and well on track for 2030 targets, thus fullfiling Portugal's contribution to the EU's targets under the Convention, Kyoto Protocol and Paris Agreement.

In particular, Portugal is in compliance with its Effort Sharing target which is also its contribution for the EU's 20% reduction target by 2020. National emissions in non-ETS sectors are consistently below the annual targets (AEA) set for all years from 2013-2017.

Projections

The projections described were prepared during the elaboration of the National Energy and Climate Plan (PNEC 2030) and of the 2050 Carbon Neutrality Roadmap (RNC 2050), which constitutes the Portuguese Long-Term low GHG emissions development Strategy submitted to the UNFCCC on the 20th of September 2019.

As there is no single model for projecting emissions for all sectors and gases in an integrated manner, a methodologically separate approach was adopted for each of the four major sectors, as follows:

1) Energy system: GHG emissions were estimated based on the TIMES_PT optimisation model which includes, in an integrated manner, the entire Portuguese energy system.
2) Agriculture, forests and other land uses: GHG emissions were estimated based on different assumptions aligned with the narratives of the socioeconomic scenarios, from which the respective evolutionary trends of the crop and animal sector, and their emissions, were established.
3) Waste and wastewater: GHG emissions were estimated based on projections of the volume of municipal waste and domestic wastewater generated each year, considering the resident population, and the impact of the policies already adopted.
4) Fluorinated gases: GHG emissions were estimated based on the implications of implementation of the Kigali Agreement and the European Regulations that foresee the phasing out of some of these gases over coming decades.

Estimated GHG emissions for each sector were subsequently aggregated to calculate national total emissions.

In all sectors, GHG emissions estimation follows the methodologies presented in the national emissions inventories, which comply with the emissions calculation guidelines of the 2006 Intergovernmental Panel on Climate Change and relevant UNFCCC decisions for calculation of emissions and reporting emissions projections.

The sectorial analysis of emissions trajectories confirms that all sectors have significant GHG emission reduction potential in the different analysed scenarios.

Provision of financial, technological and capacity building support to developing countries

Portugal as a country part of the Organisation for Economic Cooperation and Development (OCDE) tracks development financing according to the Creditor Reporting System directives and provides information on

climate financial flows based on the OCDE 'Rio markers' methodology for climate change mitigation and adaptation.

Portugal's Official Development Assistance (ptODA) focuses mainly in the lusophone developing countries, in particular the Portuguese Speaking African Countries (PALOP), in line with the geographical priorities set out in the Strategic Concept of Portuguese Cooperation for 2014-2020.

Although cooperation and finance activities continued to be prioritized by Portugal towards its partner countries, new beneficiary countries and regions have been added in the last years. In fact, in 2017, 98,8% of the total of Portuguese Bilateral ODA was dedicated to Portuguese Speaking African countries, a share decreasing to 89,2% in 2018 due to the opening to new geographical areas for support (Cuba).

Regarding the Bilateral ODA on projetcs (principal objective) in 2017 the total amount disbursed was USD 2 444 753,69 and in 2018 the total amount disbursed was USD 1 937 971,20.

For Multilateral Cooperation, the total amount disbursed reached in 2017 the amount of USD 60 742 591,59 largely due to three major transfers to the World Bank, the African Development Bank and the Inter-American Development Bank. In 2018, the total amount disbursed was USD 40 048 551,87 and this value was distributed by several international organizations, such as: World Bank; African Development Bank; Asian Development Bank; Inter-American Development Bank and Asian Infrastructure Investment Bank

III. INFORMATION ON GREENHOUSE GAS EMISSIONS AND TRENDS

1. National Inventory

1.1 General Information

Parties to the Convention (Article 4(1)(a)) "*…shall develop, periodically update, publish and make available to the COP, …. national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies*".

Portugal, as a Party to the Convention, is required to produce and regularly update National Greenhouse Gas Inventories. Furthermore Parties shall submit a National Inventory Report (NIR) containing detailed and complete information on their inventories, in order to ensure the transparency of the inventory.

The inventory covers the six greenhouse gases included in Annex A to the KP: Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N2O), Hydrofluorocarbons (HFC), Perfluorocarbons (PFCs), Sulphur Hexafluoride (SF_6), and Nitrogen Trifluoride (NF_3), as well as estimates for indirect GHG's, including Carbon Monoxide (CO), Nitrogen Oxides (NOx), and Non-methane Volatile Organic Compounds (NMVOC). Data are also reported for Sulphur Oxides (SOx). Emissions are estimated for each civil year since 1990.

As a general rule the inventory covers emissions occurring in the whole Portuguese territory, i.e., Portugal Mainland and the two Autonomous Regions of Madeira and Azores Islands. Emissions from air traffic and maritime navigation realized between places in territorial Portugal, including movements between mainland and islands, are also include in national emission total.

The economic sectors covered are the following: energy production and transformation, combustion in industry, domestic, agriculture, fisheries, institutional and commerce sectors, transportation (road, rail, maritime and air), industrial production and use of solvents, waste production, disposition and treatment (urban, industrial and hospitals solid wastes, and domestic and industrial waste water), agriculture, animal husbandry emissions, as well as emissions and removals from forestry and land use change.

1.2 History of inventory

Air emission inventories in Portugal were only initiated in the late 80's, early 90's when the first estimates of NOx, SOx and VOC emissions from combustion where made under the development of the National Energetic Plan (PEN[2]), and emissions from combustion and industrial processes were made under OECD inventory and under CORINAIR85 programme. A major breakthrough occurred during the CORINAIR90 inventory realized during 1992 and 1993 by General-Directorate of Environment[3]. This inventory exercise, aiming also the European Monitoring and Evaluation Programme (EMEP) and OECD/ IPCC, extended the range of the pollutants (SOx, NOx, NMVOC, CH_4, CO, CO_2, N_2O and NH_3) and emission sources covered, including not only combustion activities but also storage and distribution of fossil duels, production processes, use of solvents, agriculture, urban and industrial wastes and nature (forest fires and NMVOC from forest).

Information received under the Large Combustion Plant (LCP) directive was also much helpful to improve inventory quality and the individualization of Large Point Sources, as well as statistical information received from the National Statistical Institute (INE) allowing the full coverage of activity data for most emission sources. The CORINAIR90 Default Emission Factors Handbook (2nd edition), updating the 1st edition from

[2] Plano Energético Nacional.
[3] DGA presently the Portuguese Environment Agency/ Agência Portuguesa do Ambiente (APA).

CORINAIR85 was used extensively in the development of the current inventory and it was also a key point in the amelioration of the inventory.

The fulfilment of international commitments under conventions UNFCCC and Convention on Long-Range Transboundary Air Pollution (CLRTAP), together with the publication of the IPCC Draft Guidelines for National Greenhouse Gas Inventories (IPPC, 1995) and latter of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1997), has resulted in substantial improvement of the methodologies that are used in the inventory, particularly for agriculture and waste, and that were included for the first time in the 1st National Communication in 1994.

The inventory that resulted from CORINAIR90 (CEC, 1992) and subsequent modifications from IPCC methodology still structures the present day methodology in what concerns activity data and methodology. Under the evaluation of the 1st Communication the inventory was subjected to a review made by an international team. The 2nd, 3rd, 4th and 5th Communications were also reviewed by international experts. These exercises had an important role in problem detection and contribute to overall improvement.

Since its 1st compilation, the Portuguese inventory has been continuously amended mainly from the use of more detailed methodologies, better access to underlying data allowing the development of the comprehensiveness of the inventory, and better database storage and calculation structure. Changes in methodology, source coverage or scope of the data were reflected in the estimation of the emissions for the different years considered (1990-2011), i.e., the inventory is internally consistent. Some major studies have contributed to the improvement of the inventory:

- Study of VOC emissions in Portugal (1995): made in collaboration with FCT[4] led to an important improvement in emission estimates from solvent sector and still used as a basic information source;
- Study of Emission and Control of GHG in Portugal (Seixas et al, 2000): this project aimed the first development of projections toward 2010 and the identification of control measures to accomplish the KP. This also led to improvements in the inventory: extension of the inventory including for the first time also carbon dioxide sinks (forest); a first attempt to estimate solid waste methane emissions from urban solid waste using a Tier2 approach and, in general terms, a better insight into additional parameters used in the inventory methodologies, and that has resulted from interaction with several institutional agents[5];
- Study for the quantification of carbon sinks in Portugal (Pereira *et al.*,2002): made under the development of PNAC and PTEN programmes;
- Revision of the Energy Balances with comparison of information collected at APA (LCP Directive) and Statistical Information received at DGEG: Energy Balances. The 1990's – DGE (2003);
- PNAC 2004[6]: approved by Ministers Council and published recently in the NOJ[7];
- PNAC 2006[8]: approved by Ministers Council and published in the NOJ[9];
- Sectorial Studies and Proposal for the PTEN[10];
- PNALE[11] 2005-2007[12]: adopted by Ministers Council[13] and published in the NOJ[14];
- Bilateral meetings (APA/UE) for the determination of the Baseline Scenario under the CAFE program (APA, 2004);
- Methodological Development Plan under the implementation of the National Inventory System;
- UNFCCC reviews, in particular the in-depth review (September/October 2004), and the centralised reviews (October of 2005 and September of 2008);

[4] Science and Technology Colledge of the New University of Lisbon/ Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa.
[5] General Directorate of Energy, Ministry of Agriculture; and the inter-ministerial transport group.
[6] National Plan for Climate Change (2004).
[7] National Official Journal (NOJ): OJ nº 179, 31 July 2004, I Série B/ Resolução do Conselho de Ministros nº 119/2004.
[8] National Plan for Climate Change (2006).
[9] National Official Journal (NOJ): OJ nº 162, 23 August 2006, I Série B/ Resolução do Conselho de Ministros nº 104/2006.
[10] National Plan on Emission Ceilings (PTEN).
[11] National Plan for Allocation of Emissions.
[12] Portuguese PNALE I.
[13] Resolução do Conselho de Ministros n.o 53/2005.
[14] National Official Journal (NOJ): OJ nº 44, 3 March 2005, I Série B.

- UNFCCC in-depth review of the Initial Report in May 2007 which fixed the Assigned Amount for the 1st Commitment Period;
- 2012's Technical Review of the GHG's Emission Inventory of Portugal to support the determination of annual emission allocations under Decision 406/2009/EC;
- UNFCCC in-depth review of the 2012 GHG's emission inventory in September 2012;
- UNFCCC centralised review of the 2013 and 2014 GHG's emission inventory[15];
- 2016 EU comprehensive review of national GHG's inventory data pursuant to Article 19(1) of Regulation (EU) No 525/2013;
- UNFCCC centralised review of the 2015 and 2016 GHG's emission inventory in September 2016;
- 2017 and 2018 Comprehensive Technical Reviews of National Emission Inventories pursuant to the Directive on the Reduction of National Emissions of Certain Atmospheric Pollutants[16];
- UNFCCC in-depth review of the 2018 GHG's emission inventory in September 2018.

1.3 Global Warming Potencials

A Global Warming Potential (GWP) is defined as the cumulative radiative forcing over a specified time horizon resulting from the emission of a unit mass of gas relative to some reference gas (IPCC, 1997). The reference gas used is CO_2. The mass emission of each gas multiplied by its GWP gives the equivalent emission of the gas as carbon dioxide equivalents (CO_{2e}). The parties to the UNFCCC have agreed to use GWP's based on a 100-year time horizon.

The former GWP considered (IPCC 2nd Assessment Report[17]), have been replaced by the values proposed by the IPCC 4th Assessment Report[18] (AR4), as required by the revised UNFCCC's reporting guidelines.

Table I.1
Global Warming Potentials (100-year time horizon).

GHG	SAR	AR4
CO2	1	1
CH4	21	25
N2O	310	298
HFC-23	11 700	14800
HFC-32	650	675
HFC-43-10mee	1 300	1640
HFC-125	2 800	3500
HFC-134[a]	1 300	1430
HFC-152[a]	140	124
HFC-143[a]	3 800	4470

GHG	SAR	AR4
HFC-227ea	2 900	3220
HFC-236fa	6 300	9810
CF4	6 500	7390
C2F6	9 200	12200
C3F8	7000	8830
C4F10	7000	8860
C6F14	7400	9300
SF6	23 900	22800
NF3	NA	17200

1.4 Institutional Arrangements for Inventory Preparation

1.4.1 National Inventory System

No major changes occurred in the national inventory system and the institutional arrangements since the 2018 submission.

The newest legal national arrangement for a National Inventory System was adopted in 2015 (Council of Ministers Resolution no. 20/2015). It builds on the previous version (Council of Ministers Resolution no. 68/2005), which has been revised and reorganized to take into account the developments at international level relating to the UNFCCC and the KP, and the monitoring and reporting requirements provided at the

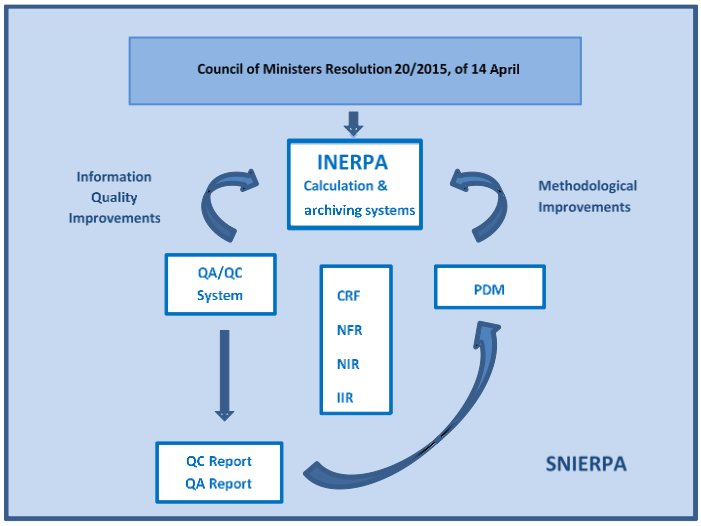
[15] September of 2013 and 2014.
[16] Directive (EU) 2016/2284.
[17] IPCC (1996).
[18] IPCC (2007).

EU level by Regulation (EU) 525/2013 of the European Parliament and of the Council of 21 May 2013, on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to CC and repealing Decision No 280/2004/EC, and the Commission Implementing Regulation (EU) 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council, and the requirements under the CLRTAP and the NECD.

The new Council of Ministers Resolution, restructures and elaborates the previous legal framework on the National System (SNIERPA), specifying its four different components:

a) A calculation and archiving system of the national inventory;
b) The QA\QC System;
c) The Methodological development Plan (PDM);
d) The Archiving System.

Figure I.1
SNIERPA's main elements relations



Furthermore, it identifies the several outputs and formats of reporting to the international bodies, and specifies the functions of the entities making part of SNIERPA:

a) the coordinating entity;
b) the sectorial Focal Points;
c) the Entities Involved.

The APA, is the Responsible Body responsible for: the overall coordination and updating of the National Emissions Inventory (INERPA); the inventory's approval, after consulting the Focal Points and the involved entities; and its submission to EC and international bodies to which Portugal is associated, in the several communication and information formats, thus ensuring compliance with the adopted requirements and directives.

APA´s Climate Change Department (DCLIMA) is the unit responsible for the general administration of the inventory and for all aspects related to its compilation, reporting and quality management. Data from different sources is collected and processed by the inventory team, who is also responsible for the application of QA/QC procedures, the assessment of uncertainty and key category analysis, the compilation of the CRF tables and the preparation of the NIR, the response to the review processes and data archiving and documentation.

The sectorial Focal Points work with APA/ DCLIMA in the preparation of INERPA, and are responsible for fostering intra and inter-sectorial cooperation to ensure a more efficient use of resources. Their main task

includes coordinating the work and participation of the relevant sectorial entities over which it has jurisdiction. It is also the Focal Points duty to provide expert advice on methodological choice, emission factor determination and accuracy of the activity data used. Focal Points play a vital role in sectorial quality assurance and methodological development. They are also responsible for the production of statistical information and data publication that are used in the inventory estimates.

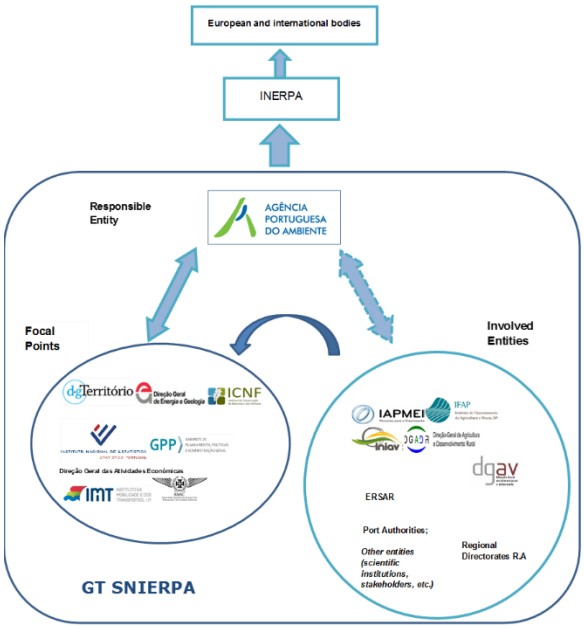
The involved entities are public or private bodies which generate or hold information which is relevant to the INERPA, and which actions are subordinate to the Focal Points or directly to the Responsible Body.

All governmental entities have the responsibility to ensure, at a minimum, co-funding of the investment needed to ensure the accuracy, completeness and reliability of the emissions inventory.

Following the publication of the new Council of Ministers Resolution No. 20/2015 of 14 April, which restructured the SNIERPA, a set of implementing procedures were agreed within SNIERPA to facilitate the good functioning of the national system, defining in more detail some competences, such as the regularity of the meetings and the deadlines for the information transmission, among other issues.

Next figure presents the main entities that are part of the national system.

Figure III.2
Main bodies of national system (SNIERPA).



1.4.2 Overview of inventory planning

All the participating organizations represented in SNIERPA support the annual production of the national inventories and the fulfilment of the reporting requirements.

Future planned improvements are compiled annually for each sector by the relevant inventory experts and the inventory coordinator, having as a basis the issues raised and the recommendations from the annual review processes and the problems identified from the application of QA/QC procedures, as well as future new reporting obligations. All identified items are gathered in a Methodological Development Plan (PDM) which is updated every year. A priority level is attributed to each issue identified, considering their importance in terms of the contribution to total GHG emissions, the level of uncertainty associated and the economic and technical resources available.

Each year, according to the agreed calendar of INERPA, APA, as coordinator of SNIERPA, organizes a kick-off meeting to plan and launch, in coordination with the sectoral focal points and the involved entities, the work for the following inventory submission(s). Bilateral meetings occur as necessary as consequence of this meeting aiming at discussing the specific issues related to each sector and to agree on the actions to be implemented in the framework of SNIERPA during this inventory compilation regarding the next submission.

The following table presents the overall calendar of the INERPA's elaboration process, which includes four main phases: planning, compilation, QA/QC verification and improvement (PDM activities).

Table III.2
Calendar for the inventory process.

Date	Task	Process	Tasks
May - June	- Elaboration of QA/QC plan - Definition/update of inventory development priorities (PDM)	Inventory Planning	- setting of quality objectives - identification of priorities taking into account the latest reviews and QA/QC checks
June	Kick-off meeting of SNIERPA WG for the launch of the annual inventory work	Inventory Planning	- discussion of the QA/QC plan - discussion and of the inventory development priorities (PDM)
June - December	- end September: deadline for rotine data collection/ delivery by FP and/or IE to the APA - end October: deadline for the implementation of Methodological Development Plan (PDM) improvements	Inventory Compilation/ Improvement/ Verification	- approval of the QA/QC plan and of the PDM - collection of activity data and EFs update - implementation of methodological improvements - estimation of emissions/ removals - aplication of QA/QC checks - uncertainty and KC assessment - archiving of information - preparation of submissions by the inventory team
15 January	*Preliminary CRF and Short NIR submission to EC (DG CLIMA) [Monitoring Mech. of GHG under EU]*	*Reporting*	-
	Preparation of NFR submission	Inventory Verification/ Improvement	- aplication of QA/QC checks - implementation of corrections and late data updates
14 February	*Official consideration/approval of the NFR submission to UNECE [CLRTAP]*	*Approval*	*Approval by President of APA*
15 February	*Official NFR submission to NECD [EU] and UNECE [CLRTAP]*	*Reporting*	-
	- Revision of CRF submission - Preparation of NIR and IIR - Circulation of NIR and IIR comments among FP and/or IE	Inventory Verification/ Improvement	- aplication of QA/QC checks - implementation of corrections and late data updates
9 March	- Deadline for NIR and IIR comments from FP and/or IE	Inventory Verification	-
14 March	*Official consideration/approaval of the CRF and NIR submission to EC (DG CLIMA) [Monitoring Mech. of GHG under EU]*	*Approval*	*Approval by President of APA*
15 March	*Submission of CRF and NIR (final versions) to the EC (DG CLIMA) [Monitoring Mech. of GHG under EU]*	*Reporting*	-
15 March	*Submission of IIR to NECD [EU] and UNECE [CLRTAP]*	*Reporting*	-
	- Implementation of QA/QC checks	Inventory Verification	- aplication of QA/QC checks including the NIR
15 April	*Submission of CRF and NIR (final version) to the UNFCCC [UNFCCC and Kyoto Protocol]*	*Reporting*	-
8/27 May	*Resubmission (if needed) of CRF and NIR (final version) to the EC and UNFCCC [UNFCCC and Kyoto Protocol]*	*Reporting*	-

1.5 Institutional Arrangements in Place

1.5.1 Responsibility

As previously referred, the APA/ DCLIMA is the national entity responsible for the overall coordination of the Portuguese inventory of air pollutants emissions. According to these attributions, APA makes an annual compilation of the Portuguese Inventory of air emissions which includes GHG's sources and sinks, acidifying substances as well as other pollutants. The reporting obligations to the EU and the international instances are also under the responsibility of APA.

The designated representative is:

Portuguese Environment Agency[19]
Climate Change Department[20] (DCLIMA)
Address: Rua da Murgueira, 9/9A, 2610-124 Amadora, Portugal
Telephone: +351 214 728 293
Fax: + 351 214 719 074
Contact Person: Eduardo Santos (Head of Department of DCLIMA)
Email Address: eduardo.santos@apambiente.pt

1.5.2 Calculation, data archiving and documentation system

The emissions calculations have been performed by APA/ DCLIMA. However many other institutions and agencies contributed to the inventory process, providing activity data, sectorial expert judgment, technical support and comments. All calculation and reporting rely in a set of different Excel spreadsheet workbooks which had been developed in order that all information and calculations occur automatically. The structure of the information system is outlined in figure below.

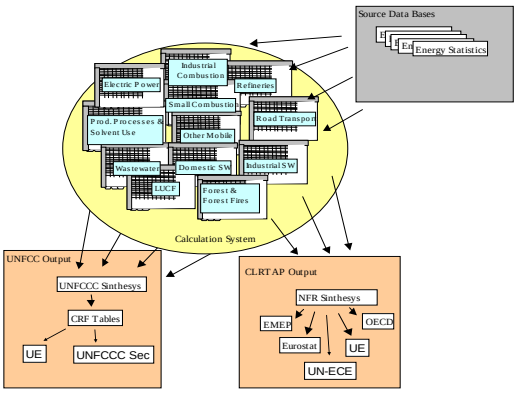
The information received from the several data suppliers is stored in its original format (paper or digital). A copy of this data is converted into the working workbooks, where data is further processed, linkage made and calculations performed, maintaining hence the integrity of the original data sources.

The IT system has been developed to answer to several international obligations and national needs. At present, the different demands refer to: UNFCCC[21]; UNECE/ CLRTAP[22]; LCP Directive[22]; as well as national needs such as the State of Environment Reports. There is independency between emission calculations and the required structure necessary for each obligation which allows flexibility in the INERPA.

Regarding the preservation of INERPA's documentation, the data is archived in a way that enables each inventory estimate to be fully documented and reproduced if necessary. When major changes are done in methodology and emission factors, particularly after a reporting cycle, the older spreadsheets are frozen and the work restarts with copies of those spreadsheets, making a clear reference to the period when they were used. Minor corrections, which do not affect the estimations, are not stored due to storage limitations.

[19] Agência Portuguesa do Ambiente.
[20] Departamento de Alterações Climáticas.
[21] CRF format.
[22] NFR format.

Figure III.3
Electronic System Structure of the estimation and reporting system.



All the inventory material, calculation files and reported tables, as well as the underlying data, the scientific documentation and studies used are stored and archived electronically on a data server located at the APA premises where the inventory team key is located. All data are backed up daily. Hence, the present system existing in APA is considered to ensure the basic requirements/ functions of an IT system: centralized data processing and storage.

The archiving system includes also the documentation related to the explanation of the inventory compilation and calculation process. In the latest years an effort has been made by the inventory team in order to better document and explain the calculation process and data sources used and procedures applied during an annual cycle for each sector. The several documents produced are stored in the inventory IT area, enabling a smoother transmission of knowledge and facilitation the continuity of the inventory compilation process in case of changes within the inventory team.

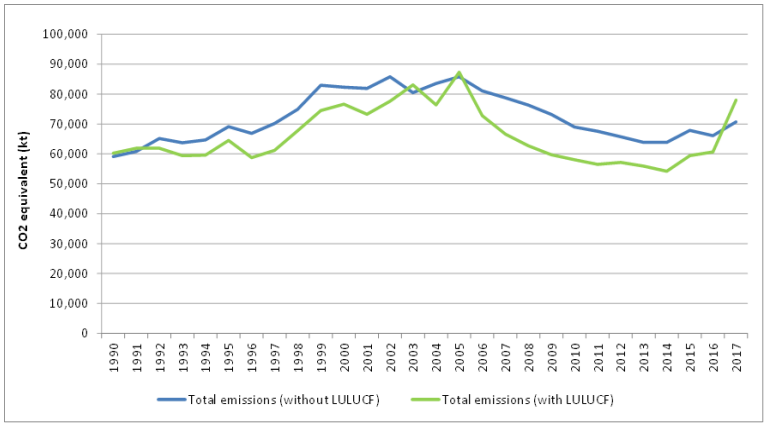
2. Emissions Trends

2.1 Trends of Total Emissions

In 2017, total Portuguese GHG emissions, including indirect CO2, without land-use, land-use change and forestry (LULUCF) were estimated at about 70.7 Mt CO2e, representing an increase of 19.5 % compared to 1990 levels and an increase of 7.0 % compared to the previous year (2016).

Emissions values are presented in CO2e using IPCC AR4 GWP values. The reference to "total emissions" is meant to refer to "total emissions without LULUCF, including CO2 indirect emissions".

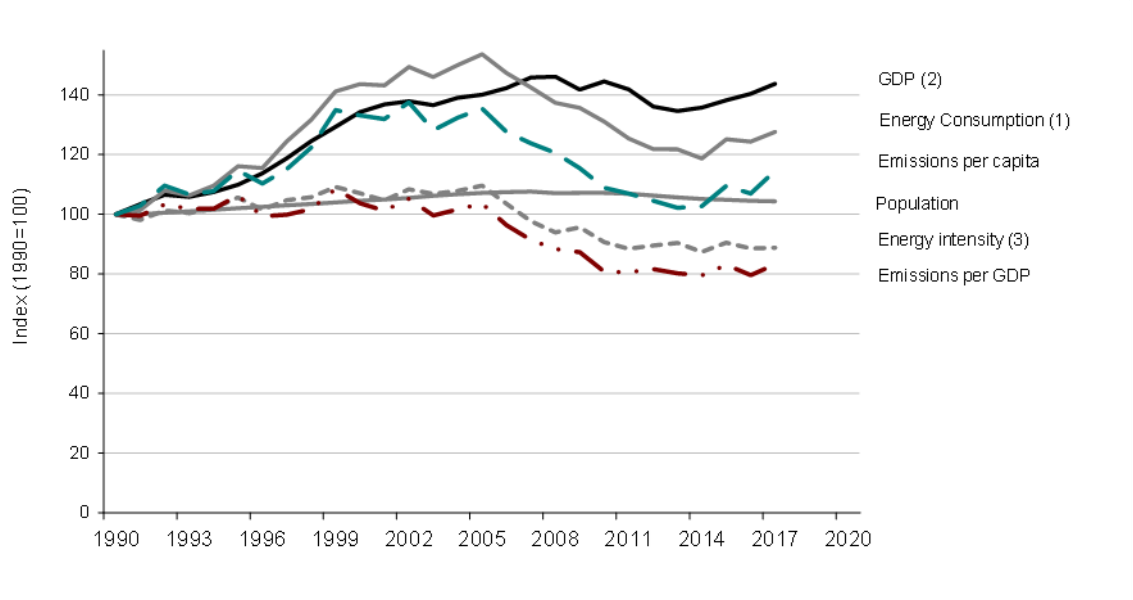
Figure I.4
GHG emissions



Considering the LULUCF sector, total emissions in 2017 are estimated at 78.0 MtCO2e, corresponding to 29.2% increase over 1990 and an increase of 28.5% over 2016. This growth had origin on the extremely large area of forest fires in the tragic year 2017, associated with a particularly dry year, high temperatures that occurred outside summer (the largest forest fires occurred in June and October), and unusually high winds. LULUCF sector has been a carbon sink from 1992 onwards, with exceptions in the years 2003 and 2005 due to the severe forest wildfires events registered in these years.

After a steady increase of the Portuguese emissions during the 90s, the growth of emissions has been more moderate and started to stagnate in the early 2000s, registering thereafter, in particular after 2005, a decrease. These trends reflect largely the evolution of the Portuguese economy which was characterized by a strong growth associated to the increase of energy demand and mobility in the 90's, the large investment in renewable energy sources, increased efficiency in energy use and to the more recent situation of stagnation or later recession of the Portuguese economy, which has begun recovering afterwards. In 2017, GDP registered a positive variation of 2.4%, accentuating the growing tendency verified since 2014.

Figure III.5
GHG emissions per capita, per unit of GDP and energy consumption.

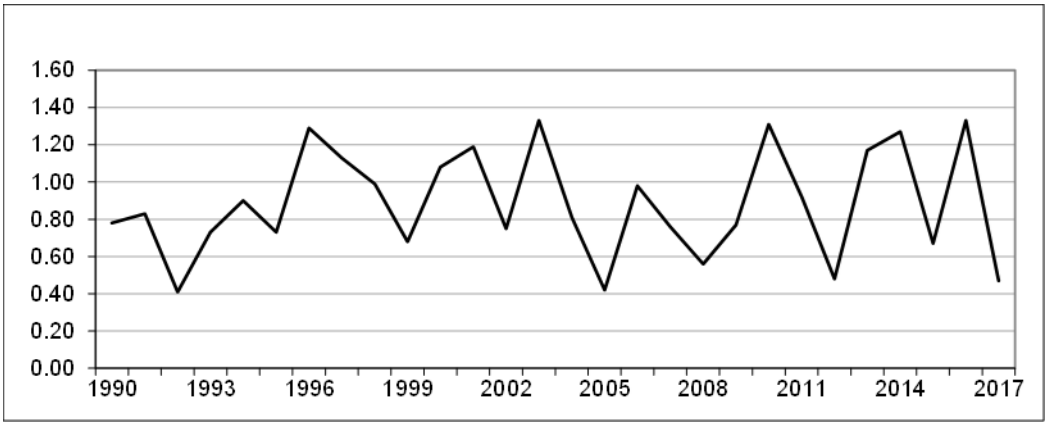


Notes: (1) Primary Energy Consumption; (2) GDP at 2011 prices; (3) Energy Consumption per GDP.
Sources: INE, DGEG.

The trends registered in the most recent years reflect, to a certain extent, the decoupling of emissions growth from the economic activity. The decrease of carbon intensity (GHG emissions per GDP unit) observed in the more recent years (see previous figure), is in part related to the implementation of some important measures that had a positive effect in the emissions levels, such as the expansion of renewable energy in electricity production, the introduction of natural gas (1997), the installation of combined cycle thermoelectric plants using natural gas (1999), the progressive installation of co-generation units, the amelioration of energetic and technologic efficiency of industrial processes, the improvement in car efficiency and the improvement of fuels quality. Another fact to note is the introduction of the use of high-performance catalysts and optimization of the ratio ammonia / air in the production of nitric acid which had an influence in the decrease of emissions. Furthermore, in most recent years there has been an expressive development and installation of equipment for the use of renewable energy sources with a particular expansion of windmills.

After the -2.7% fall of the national emissions registered in 2016 compared to 2015, the total emissions in 2017 increased significantly 7.0% as compared to 2016.
The level of emissions shows significant inter-annual variations, which are mostly occurring in the power sector and are related to the pronounced fluctuations of hydroelectric power generation that is highly affected by annual variations in precipitation.

Figure III.1
GHG emissions per capita, per unit of GDP and energy consumption.

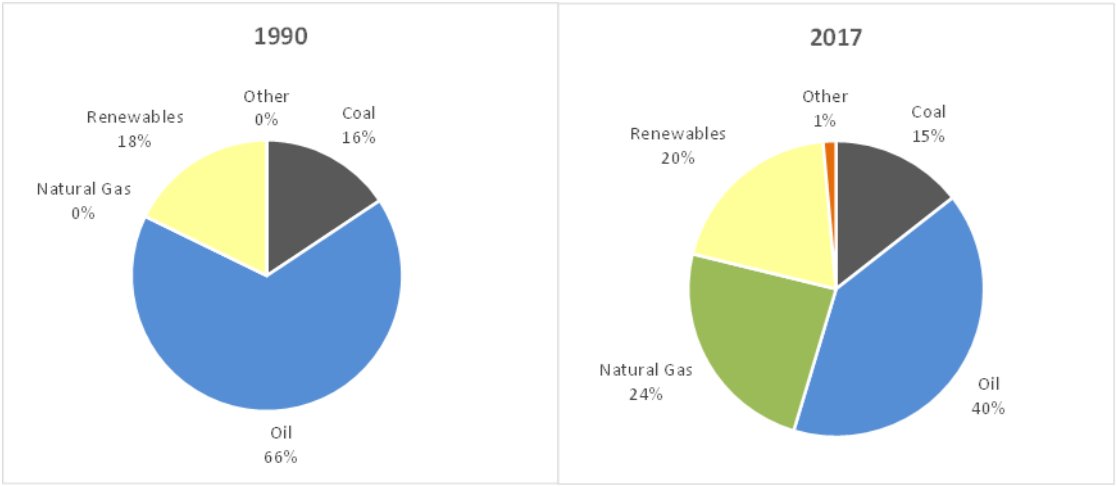


Note: HI = 1 corresponds to the average hydrologic availability.
Sources: EDP, REN

The increase that occurred in 2017 refer to the majority of sectors, and particularly to the "energy industries", which registered a sharp growth of 20.0% as compared to 2016. This fact is in majority explained by the reduction of the hydropower production in 2017 due to a very unfavorable year in terms of water availability (HPI = 0.47), contributing to the increment of the use of coal in the electro producer sector and consequently to the growth of emissions.

The analysis of the consumption of different energy sources in 2017, shows that Oil remains the main primary energy supply, due in majority to the transport sector. Nevertheless the weight of Oil has declined in recent years (66% in 1990 vs. 40% in 2016), whereas the importance of Renewables (depending on the meteorological conditions) and natural gas (non-existing in 1990) increased considerably.

Figure III.7
Primary energy consumption by energy source

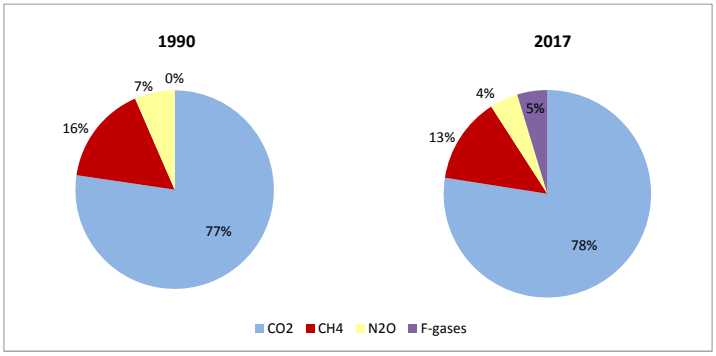


Source: DGEG.

2.2 Greenhouse Gas Emissions by Gas

The figure below illustrates the relative contribution of direct GHG to the total emissions for 1990 and 2017, showing CO_2 as the primary GHG, accounting for about 78% of Portuguese emissions on a carbon equivalent basis in 2017 (LULUCF excluded). The second most important gas is CH_4, representing 13% of total emissions in 2017. Portugal has chosen 1995 as the base year for fluorinated gases. In 2017, these gases represented about 5% of total GHG's emissions. NF_3 emissions are non-occurring in Portugal.

Figure III.8
GHG emissions by gas.



Over the 1990-2017 period, CO_2 is the gas having registered the biggest increase (20%) and N_2O decreased by about 19%. F-gases are excluded from the figure as they are accounted since 1995, but they have been increasing importance particularly in latest years, representing 5% in 2017 of the total emissions.

Figure III.9
Change of GHG emissions by gas over the period 1990-2017

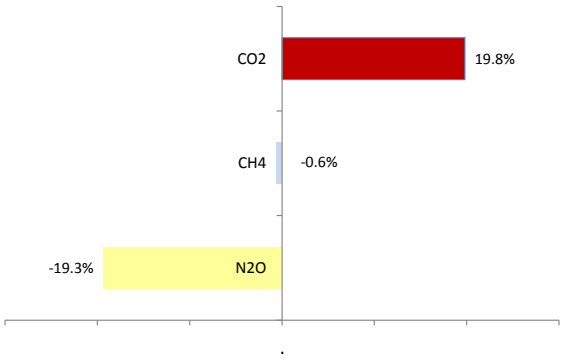


Table III.3
GHG emissions and removals in Portugal by gas.

GHGs EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)													
CO2 emissions without net CO2 from LULUCF	45,631	47,246	51,516	50,130	50,883	54,854	52,159	55,177	59,669	67,300	66,128	65,760	69,604	64,487
CO2 emissions with net CO2 from LULUCF	45,909	47,357	47,652	45,208	45,135	49,308	43,414	45,672	51,534	58,226	59,623	56,403	60,704	65,558
CH4 emissions without CH4 from LULUCF	9,606	9,726	9,778	9,828	9,957	10,108	10,295	10,492	10,695	10,950	11,162	11,171	11,200	11,222
CH4 emissions with CH4 from LULUCF	9,906	10,129	9,906	9,938	10,132	10,481	10,487	10,566	11,146	11,111	11,496	11,434	11,490	12,167
N2O emissions without N2O from LULUCF	3,855	3,823	3,793	3,711	3,695	3,846	4,051	4,066	4,041	4,147	4,349	4,207	4,111	3,736
N2O emissions with N2O from LULUCF	4,432	4,401	4,297	4,193	4,177	4,364	4,531	4,519	4,565	4,611	4,842	4,682	4,587	4,336
HFCs	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	106	133	193	260	344	426	532	665	797
PFCs	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	0	0	1	1	2	2	2
Unspecified mix of HFCs and PFCs	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA
SF6	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	14	14	15	16	17	17	18	18	22
NF3	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
Total (without LULUCF)	**59,092**	**60,796**	**65,086**	**63,670**	**64,536**	**68,927**	**66,652**	**69,943**	**74,682**	**82,758**	**82,082**	**81,690**	**85,601**	**80,266**
Total (with LULUCF)	**60,247**	**61,887**	**61,855**	**59,339**	**59,444**	**64,273**	**58,579**	**60,965**	**67,522**	**74,308**	**76,404**	**73,070**	**77,466**	**82,882**
Total (without LULUCF, with indirect)	**59,207**	**60,905**	**65,211**	**63,791**	**64,717**	**69,150**	**66,861**	**70,182**	**74,910**	**82,989**	**82,304**	**81,896**	**85,797**	**80,482**
Total (with LULUCF, with indirect)	**60,362**	**61,996**	**61,980**	**59,461**	**59,626**	**64,495**	**58,788**	**61,204**	**67,750**	**74,539**	**76,625**	**73,276**	**77,663**	**83,098**

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	% change
	CO_2 equivalent (Gg)														1990-2017
CO2 emissions without net CO2 from LULUCF	67,275	69,554	64,829	62,329	59,975	57,139	52,937	51,737	49,915	48,113	47,984	52,169	50,368	54,658	**19.8**
CO2 emissions with net CO2 from LULUCF	59,364	69,669	55,970	49,744	45,958	43,108	41,327	40,160	40,647	39,428	37,921	43,196	44,105	60,061	**30.8**
CH4 emissions without CH4 from LULUCF	11,247	11,199	11,113	10,927	10,707	10,536	10,348	10,265	10,041	9,818	9,693	9,491	9,431	9,477	**-1.3**
CH4 emissions with CH4 from LULUCF	11,517	12,040	11,301	10,999	10,745	10,696	10,643	10,418	10,334	10,160	9,740	9,632	9,882	10,736	**8.4**
N2O emissions without N2O from LULUCF	3,888	3,751	3,628	3,799	3,705	3,394	3,370	3,098	3,117	3,121	3,246	3,132	3,038	3,112	**-19.3**
N2O emissions with N2O from LULUCF	4,353	4,314	4,052	4,178	4,057	3,770	3,774	3,475	3,521	3,536	3,603	3,499	3,457	3,680	**-17.0**
HFCs	910	1,077	1,253	1,484	1,734	1,924	2,103	2,279	2,443	2,616	2,748	2,907	3,059	3,257	**100.0**
PFCs	3	3	4	5	6	7	8	9	10	11	13	14	15	17	**100.0**
Unspecified mix of HFCs and PFCs	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	**0.0**
SF6	27	27	28	31	30	33	35	29	30	31	26	23	23	25	**100.0**
NF3	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	**0.0**
Total (without LULUCF)	**83,349**	**85,610**	**80,855**	**78,575**	**76,157**	**73,032**	**68,801**	**67,417**	**65,556**	**63,711**	**63,709**	**67,735**	**65,936**	**70,546**	**19.4**
Total (with LULUCF)	**76,173**	**87,130**	**72,608**	**66,441**	**62,529**	**59,538**	**57,890**	**56,370**	**56,985**	**55,782**	**54,050**	**59,270**	**60,542**	**77,777**	**29.1**
Total (without LULUCF, with indirect)	**83,570**	**85,820**	**81,066**	**78,789**	**76,345**	**73,203**	**68,999**	**67,596**	**65,743**	**63,878**	**63,867**	**67,901**	**66,092**	**70,737**	**19.5**
Total (with LULUCF, with indirect)	**76,394**	**87,340**	**72,818**	**66,655**	**62,717**	**59,709**	**58,089**	**56,549**	**57,172**	**55,950**	**54,208**	**59,436**	**60,698**	**77,967**	**29.2**

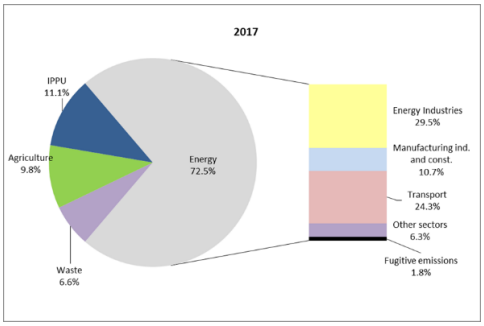
NA- Not applicable; NE - Not estimated; NO - Not occurring

2.3 GHG emissions by sector

According to the UNFCCC Reporting Guidelines, emissions estimates are grouped into five large IPCC categories: Energy; Industrial Processes and Product Uses (IPPU); Agriculture; Land Use, Land-Use Change and Forestry (LULUCF); and Waste.

Figure III.10

GHG's emissions in Portugal by sector (LULUCF excluded).



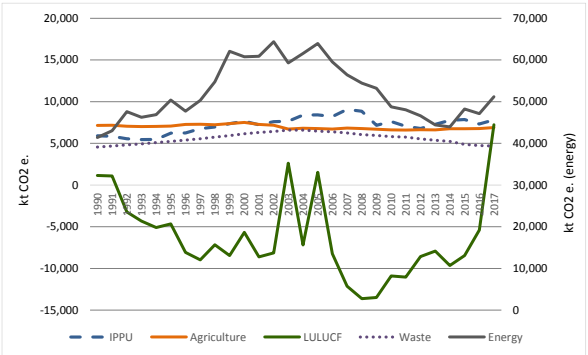
Energy is by far the most important sector, accounting for 73% of total emissions in 2017, and presenting an increase of 24% over the 1990-2017 period. Energy industries and transport are the two most important sources representing, respectively, around 30% and 24% of total emissions in 2017. Within the energy industries, public electricity and heat production represented alone 26% of the total emissions. This reflects the country's important dependence on fossil fuels for electricity generation and transportation, which have grown steadily until the mid-2000's due to the continued increase of electricity demand driven in particular by the residential/commercial sector, and the growth of mobility.

Mobile sources, which are largely dominated by road traffic, are one of the sectors that have risen faster. In the period 1990-2017 the emissions of transportation sources increased 62%, due to the steady growth of vehicle fleets (in particular with more powerful engines) and road travel from 1990 to the early 2000's, reflecting the increase in family income and the strong investment in the road infrastructure of the country in the 1990's and 2000-10's decades. Indirectly the increase in road traffic activity also augments the emissions from fossil fuel storage, handling and distribution. As previously said, this seems to have stabilized in the early 2000's and started to decline in 2005. An inversion of this tendency is registered the most recent years, with an increase in transport emissions of 8.4% from 2013 to 2017.

Still within the energy sector, the "other sectors" category, which include the residential and commercial activities, also registered a significant increase of emissions in 1990-2005 (almost 55% rise), but this tendency has decelerated (6% decrease in 1990-2017), due to the implementation energy efficiency measures and, in the most recent years, to the stagnation of the economic growth and recession.

Figure III.11

GHG emissions and removals by sector



Industrial processes and product use represented 11% of the Portuguese emissions in 2017, and have grown 32% since 1990. These emissions which are generated as by-product of many non-energy-related activities, are mostly related to the increase of cement production, road paving, limestone and dolomite use, lime production, and glass.

Agriculture was, in the period analysed, a significant source of GHG's emissions, responsible for 10% of the Portuguese emissions in 2017, corresponding to a decrease of 4% since 1990. This fact is related to the reduction of the livestock production of certain categories of animals (sheep and swine), the extensification of cattle production and the decrease of fertilizer consumption, in a certain extent related to a significant conversion of arable crops to pastures.

Waste represented near 7% of Portuguese emissions in 2017, recording an increase of approximately 3% since 1990. This increase in emissions is primarily related to the rise of waste generation (associated with development of the family income and the urbanization growth registered during the 1990 decade) and the deposition of waste in landfills.

Estimates of emissions and sinks from LULUCF category show that this category has changed from being a net emitter in 1990 (1.2 Mt CO_2eq.) to a carbon sink in 1992 onwards. This situation was again reverted in the years 2003 and 2005 due to the severe forest wildfires events registered in these years. In 2017 this sector became again a net emitter, with a total of 7.2 Mt CO_2e., representing 9% of the country´s total emissions including the sector. This situation is related to the exceptional and tragic year in terms of forest wildfires, associated to an exceptional dry year, heat waves, occurring namely outside the normal summer period (biggest wildfires took place in June and October), and unusual strong winds, as the Ophelia hurricane that swept the coast of the Iberian Peninsula in October 2017.

Figure III.12
GHGs emissions percentage change (1990-2017) by IPCC category (LULUCF excluded).

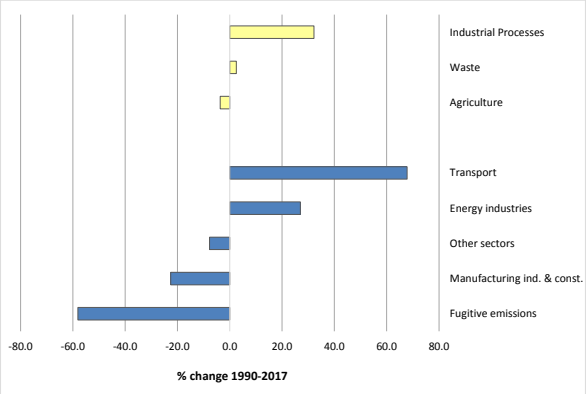


Table III.4
GHG emissions and removals by sector.

GHGs SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)													
1. Energy	41,474	43,094	47,655	46,281	46,935	50,402	47,750	50,335	54,751	62,097	60,768	60,897	64,403	59,309
2. Industrial processes and product use	5,906	5,852	5,557	5,447	5,479	6,225	6,251	6,761	6,953	7,362	7,655	7,212	7,591	7,664
3. Agriculture	7,157	7,177	7,063	7,006	7,033	7,073	7,268	7,292	7,239	7,378	7,519	7,282	7,173	6,708
4. Land use, land-use change and forestry(5)	1,155	1,091	-3,232	-4,331	-5,092	-4,654	-8,073	-8,978	-7,160	-8,449	-5,678	-8,620	-8,135	2,616
5. Waste	4,554	4,673	4,811	4,936	5,090	5,228	5,383	5,555	5,739	5,920	6,140	6,298	6,434	6,585
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

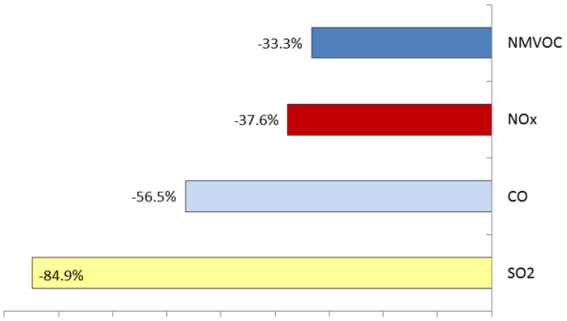
GHGs SOURCE AND SINK	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	% change
	CO_2 equivalent (Gg)														1990-2017
1. Energy	61,560	63,958	59,555	56,441	54,471	53,228	48,752	48,055	46,598	44,447	43,960	48,236	47,116	51,202	**23.5**
2. Industrial processes and product use	8,396	8,419	8,210	9,063	8,858	7,165	7,618	7,034	6,786	7,281	7,760	7,850	7,307	7,781	**31.7**
3. Agriculture	6,819	6,770	6,707	6,833	6,782	6,694	6,622	6,586	6,633	6,620	6,762	6,765	6,784	6,897	**-3.6**
4. Land use, land-use change and forestry(5)	-7,176	1,520	-8,247	-12,134	-13,628	-13,495	-10,910	-11,047	-8,571	-7,928	-9,659	-8,465	-5,394	7,230	**526.0**
5. Waste	6,574	6,463	6,383	6,238	6,046	5,946	5,808	5,741	5,539	5,362	5,227	4,884	4,728	4,667	**2.5**
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	**NO**

NA- Not applicable; NE - Not estimated; NO - Not occurring

2.4 Indirect GHG and SOx emissions

Several gases do not have a direct influence in CC but affect the formation or destruction of other GHG. CO, NOx, and NMVOC are precursor substances for ozone which is a GHG. SOx produce aerosols, which are extremely small particles or liquid droplets that can also affect the absorptive characteristics of the atmosphere.

Figure III. 13
Indirect GHG and SOx emissions: 1990-2017 variation.



In 2017, all these gases emissions have decreased from 1990's levels: SOx 85%, CO 57%, NOx -38% and NMVOC -33%.

Energy is the major responsible sector for emissions of NOx, SOx and CO. Its contribution for NMVOC emissions is also significant, together with Industrial processes and Product use sector.

Within energy, transportation is responsible for the major share of NOx, emissions, approximately 46% of 2017's totals. Despite the fast growing trends of the transport sector (mainly road) since the 90's, the introduction of new petrol-engine passenger cars with catalysts converters and stricter regulations on diesel vehicles emissions, limited the growth of these emissions or even its decrease. In fact, the situation started to change in the last years, as transport emissions growth has first stabilized and started to decline since 2005. In the most recent years, this outlook has been inversed with an increase in transport emissions after 2013. In the time period under analyse (1990-2017), NOx emissions from transport decreased -24%; and CO and NMVOC emissions registered reductions of more than -80%.

Other sectors (commercial/ institutional, residential and agriculture/ forestry) is a primary source of CO emissions and represents 39% of the 2017's total.

SOx emissions are mainly generated in the energy industry sector (approximately 30% of total emissions in 2017) and combustion in manufacturing industries (approximately 36% of total emissions in 2017), which are major consumers of fossil fuels. Oil and coal represent the biggest share of the fuel mix used in thermal electrical production in the country, and they are in majority imported. This status quo is however improving with a significant development of renewable sources (mainly wind) and energy efficiency measures, among other factors as reflect the introduction of new stricter laws regulating the residual fuel oil[23].

The introduction of natural gas and its increasing use, since 1997, is also another positive factor that has contributed to control of SOx emissions. The emissions variation in the time period of 1990-2017 shows a substantial decrease in SOx emissions in both sub-categories: energy industries (93%) and manufacturing industries (79%). Since 2007, SOx emissions from the energy industries registered a significant reduction (approximately -87%), which is explained by the implementation of two new abatement systems (desulfurization in two Large Point Source Energy Plants in Mainland Portugal).

[23] Decree-Law 281/2000 from November the 10th.

Table III.5 Indirect GHG and SOx emissions: 1990-2017

Gas emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg)													
CO	809	821	858	831	839	850	823	800	766	736	704	641	618	595
NOx	267	282	304	294	294	305	287	286	296	309	302	299	306	281
NMVOC	250	253	259	249	249	245	247	250	253	244	246	241	236	225
SO2	325	313	373	316	294	328	269	283	330	339	303	282	278	188

Gas emissions	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	% change
	(Gg)														1990-2017
CO	566	533	500	475	437	414	412	384	371	353	337	345	334	352	**-56.5**
NOx	283	291	265	254	234	222	203	186	172	169	166	169	163	166	**-37.8**
NMVOC	219	208	202	198	187	174	176	167	164	164	169	169	166	167	**-33.3**
SO2	191	192	167	159	110	77	67	61	55	50	46	48	47	49	**-84.9**

IV. QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET

In 2010, the EU submitted a pledge to reduce its GHG emissions by 2020 by 20 % compared to 1990 levels. Portugal as an EU Member State is a part of the EU 2020 emission reduction target.

The definition of the Convention target for 2020 is documented in the revised note provided by the UNFCCC Secretariat on the 'Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention' (FCCC/SB/2011/INF.1/Rev.1 of 7 June 2011). EU provided additional information relating to its quantified economy wide emission reduction target in a submission as part of the process of clarifying the developed country Parties' targets in 2012 (FCCC/AWGLCA/2012/MISC.1).

The following assumptions and conditions apply to the EU's -20% commitment under the UNFCCC:

- The EU Convention pledge does not include emissions/removals from Land Use, Land Use Change and Forestry (LULUCF); however, this sector is estimated to be a net sink over the relevant period. EU GHG inventories include information on emissions and removals from LULUCF in
- accordance with relevant reporting commitments under the UNFCCC. Accounting for LULUCF activities only takes place under the Kyoto Protocol;
- The target covers the gases CO2, CH4, N2O, HFCs, PFCs and SF6;
- The target refers to 1990 as a single base year for all covered gases and all Member States. Emissions from outgoing flights are included in the target;
- A limited number of CERs, ERUs and units from new market-based mechanisms may be used to achieve the target under certain conditions established under the Effort Sharing Decision and the EU-ETS Directive;

The Global Warming Potentials (GWPs) used to aggregate GHG emissions up to 2020 under EU legislation were those based on the Second Assessment Report of the IPCC when the target was submitted. For the implementation until 2020, GWPs from the IPCC AR4 will be used consistently with the UNFCCC reporting guidelines for GHG inventories.

Tabela IV.1: Assumptions and conditions apply to the EU's commitment under the Convention

Parameters	Target
Base Year	1990
Target Year	2020
Emission Reduction target	-20 % in 2020 compared to 1990
Gases covered	CO2, CH4, N2O, HFCs, PFCs, SF6
Global Warming Potential	AR4
Sectors Covered	All IPCC sources and sectors with the exception of LULUCF, as measured by the full annual inventory including international aviation (outgoing flights).
Land Use, Land-Use Change, and Forestry (LULUCF)	Accounted under KP, reported in EU inventories under the Convention. Assumed to produce no debits
Use of international credits (JI and CDM)	Possible subject to quantitative and qualitative limits
Possible scale of contributions of market-based mechanisms under the convention	The 2020 Climate and Energy Package allows Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) to be used for compliance purposes, subject to a number of restrictions in terms of origin and type of project and up to an established limit. In addition, the legislation foresees the possible recognition of units from new market mechanisms. Under the EU ETS the limit does not exceed 50 % of the required reduction below 2005 levels. In the sectors not covered by the ETS, annual use shall not

	exceed to 3 % of each Member States' non-ETS greenhouse gas emissions in 2005. A limited number of Member States may use an additional 1 %, from projects in LDCs or SIDS subject to conditions.
CERs	The use of these units under the ETS Directive and the Effort Sharing Decision is subject to the limits specified above which do not separate between CERs and ERUs, but include additional criteria for the use of CERs.
ERUs	The use of these units under the ETS Directive and the Effort Sharing Decision is subject to the limits specified above which do not separate between CERs and ERUs, but include additional criteria for the use of CERs.
AAUs	AAUs for the period 2013-2020 have not yet been determined. The EU and its Members States expect to achieve its 20 % target for the period 2013-2020 with the implementation of the ETS Directive and the ESD Decision in the non-ETS sectors which do not allow the use of AAUs from non-EU Parties.
Carry-over units	The time-period of the Convention target is from 1990-2020, no carry-over units will be used to achieve the 2020 target.
Other mechanism units under the Convention (specify)	There are general provisions in place in the EU legislation that allow for the use of such units provided that the necessary legal arrangements for the creation of such units have been put in place in the EU which is not the case at the point in time of the provision of this report.
Any other information:	In December 2009, the European Council reiterated the conditional offer of the EU to move to a 30 % reduction by 2020 compared to 1990 levels as part of a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities.
Possible scale of contributions of other market-based mechanisms	None

Source: EU Decision No 406/2009/EC, Annex 2 and EU BR4

Implementation of this target is ensured by EU legislation adopted under the "2020 climate and energy package" (2013-2020). The package introduced a clear approach to achieving the EU's 20 % reduction of total GHG emissions from 1990 levels, which is equivalent to a 14 % reduction compared to 2005 levels. This 14 % reduction objective is divided between the ETS and ESD sectors. These two sub-targets are:

- a 21 % reduction target compared to 2005 for emissions covered by the ETS (including outgoing flights);
- a 10 % reduction target compared to 2005 for ESD sectors, shared between the 28 Member States (MS) through individual national GHG targets.

While the EU ETS target is to be achieved by the EU as a whole, the ESD target was divided into national targets to be achieved individually by each Member State. Under the Effort Sharing Decision, national emission targets for 2020 are set, expressed as percentage changes from 2005 levels. For Portugal this means a +1% target compared to 2005 levels. These changes have been transferred into binding quantified annual emission limits for the period from 2013 to 2020, denominated in Annual Emission Allocations (AEAs).

Within the scope of the climate and Energy Package for 2020, this emission reduction target was coupled with the establishment Of EU targets of 20% share of renewable energy in final energy consumption (Portugal's contribution to this amounts to a 31% share of renewables in its final energy consumption) and an increase in energy efficiency by 20% (the same objective applies to Portugal and to all other Member States).

Other EU emission reduction targets

In addition to the EU target under the Convention, the EU also committed to a legally binding quantified emission limitation reduction commitment for the second commitment period of the Kyoto Protocol (2013 - 2020).

A further target has been pledged under the Paris Agreement through the EU's Nationally Determined Contribution, and has been adopted by the EU under the 2030 Climate and Energy Framework (2021-2030). The emission reduction target is a pledge to reduce emissions by at least 40% (compared to 1990 levels) by 2030, enabling the EU to move towards a low-carbon economy and implement its commitments under the Paris Agreement. In order to achieve this target:

- EU emissions trading system (ETS) sectors will have to cut emissions by 43% (compared to 2005) by 2030.
- Effort Sharing sectors will need to cut emissions by 30% (compared to 2005) by 2030 – this has been translated into individual binding targets for Member States (for Portugal the target is a reduction of 17% compared to 2005 levels);
- Emissions and removals from the LULUCF sector are included for the first time in the EU climate target through the so-called LULUCF Regulation (2018/841). Each Member State will have to ensure that the LULUCF sector does not create debits ("no debit" rule).

Separate targets on renewable energy and energy efficiency had been set under the 2030 Climate and Energy Framework and updated. For renewable energy a binding target of at least 32% of final energy consumption by 2030 has been set (Portugal committed to a 47% share of renewables in its final energy consumption). With regards to energy efficiency it is a headline target of at least 32,5% of final energy consumption (Portugal committed to a 35% increase in energy efficiency). A target of 15% of interconnection capacity for energy interconnections, so as to ensure the full participation of all Member States in the internal energy market.

In December 2019 a new agenda for growth was presented by the European Commission: "The European Green Deal." The European Council has adopted in December 2019 the objective of carbon neutrality by 2050 for the EU.

V. PROGRESS IN ACHIEVEMENT OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGETS AND RELEVANT INFORMATION

1. Mitigation actions and their effects

Since the 3rd Biennial Report (2017), Portugal has maintained the main national climate policy instruments in terms of mitigation and adaptation, including the National Program for Climate Change (PNAC 2020/2030), approved in 2015, through the Resolution of the Council of Ministers n.º 56/2015, of July 30th, the National Plan of Action for Renewable Energy 2013-2020 (PNAER) and the National Plan of Action for Energy Efficiency 2013 -2016 (PNAEE), approved in 2013 through the Resolution of the Council of Ministers 20/2013, of April 10th, the National Strategy for Adaptation to Climate Change (ENAAC 2020), approved by the Resolution of the Council of Ministers n.º 56/2015, of July 30th, as well as the National System of Policies and Measures (SPeM), regulated by the Resolution of the Council of Ministers n.º 45/2016, of August 26th, which assumes the challenge of identifying policy options to meet the objectives and targets already established under the Green Growth Commitment (CCV).

PNAC 2020/2030 established a set of sectoral targets and listed a set of policy options and measures to deliver an emission reduction of -18% to -23% by 2020 and of -30% to -40%, by 2030 compared to 2005.
Through the Resolution of the Council of Ministers above mentioned it was also created the Interministerial Commission on Air, Climate Change and the Circular Economy (CA2). CA2 provides guidance of a political nature and promotes the articulation and integration of climate change policies into sectoral policies and monitoring of the implementation of the relevant sectoral measures, programs and actions that are adopted.

In addition to monitoring compliance with Portugal's commitments at national, Community and United Nations levels, this Commission should also ensure the promotion, supervision and monitoring of the implementation of policies and measures for effective implementation of the guidelines and compliance with the emission reduction targets.

In response to the commitment assumed by the Portuguese state in 2016, to ensure the neutrality of its emissions by the end of 2050, was approved by the Council of Ministers the Roadmap for Carbon Neutrality 2050 (RNC 2050) through the Resolution n.º 107/2019 of July 1st, which identifies the main decarbonisation vectors in all sectors of the economy (energy and industry, mobility and transport, waste and wastewater and agriculture and forests), policies and measures options and the path to reduce emissions in order to achieve it, under different scenarios of socio-economic development.

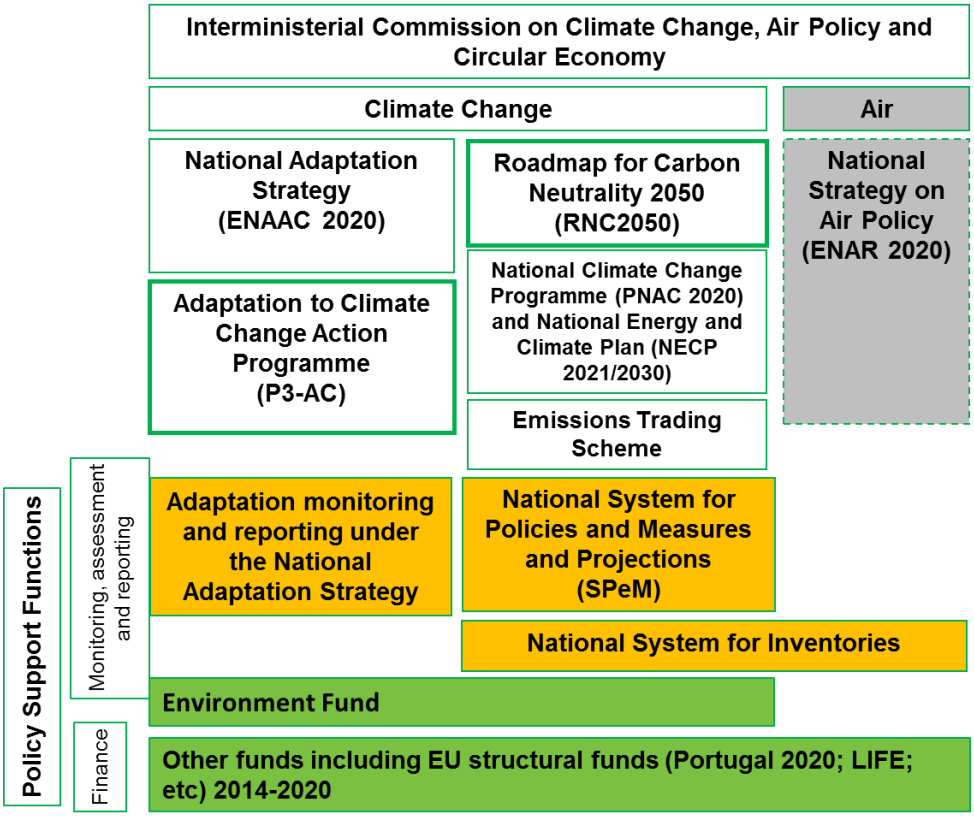
RNC 2050 is the national strategy for long-term low-GHG development and has already been submitted on the 20th of September 2019, to the United Nations Framework Convention on Climate Change (UNFCCC) in accordance with the Paris Agreement and the European Commission, which is in line with the EU Energy Union and Climate Action Governance Regulation. It is a forward-looking document of where to go, contributing to the definition of trajectories, not a policy and measures planning document.

The main sectoral policy instruments at national level that are currently in force or being finalized and contribute to the achievement of energy and climate targets and objectives, while contributing to the Energy Union dimensions - decarbonisation, energy efficiency, security of supply, internal energy market and research, innovation and competitiveness - are identified below.

These instruments include the National Program for Spatial Planning Policy (PNPOT), the Action Plan for Circular Economy (PAEC) and the Roadmap for Carbon Neutrality (RNC2050), which make up the three major Environment and Climate Action policy, representing, respectively, the policies for the valorisation of the territory, the circular economy and the decarbonisation of society.

Aligned with the Roadmap vision of "*Promoting the decarbonisation of the economy and the energy transition towards carbon neutrality in 2050, as an opportunity for the country, based on a democratic and fair model of territorial cohesion that enhances wealth generation and the efficient use of resources*" and developed in conjunction with RNC2050, Portugal's integrated National Energy Climate Plan (NECP 2030) will be the main instrument of energy and climate policy for the 2021-2030 decade while maintaining the targets established under PNAC for 2020. The NECP identifies the main priority areas for action in the coming decade. Its final version is under preparation and will be submitted to the European Commission by the end of 2019.

Figure V.1
Portuguese Climate Change Policy Architecture



The following table illustrates the national targets and contributions set for the 2030 horizon within the NECP 2030.

Under the RNC 2050 Portugal has revised its previous 2030 target (-30 to -40%) to -45% to -55% by 2030. Additionally, it has established a trajectory up to 2050 comprising emission reductions of - 65% to -75% by 2040, and from -85% to -90% by 2050 compared to 2005.

Table V.1 - Portugal's targets for 2020

Targets 2020	National Contributions for the Union Targets	Other National Targets
Reduction of CO2e emissions (without LULUCF) (Mt CO2e), compared to 2005	+1 %	-18 % a -23 %
Strengthen the share of Renewable Energy (% of gross final energy consumption)	+31 %	
Increase Energy Efficiency (% reduction in primary energy consumption)	+20 %	

Table V.2 - Portugal's targets for 2030

Targets 2030	National Contributions for the Union Targets	Other National Targets
Reduction of CO2e emissions (without LULUCF) (Mt CO2e), compared to 2005	-17%	-45% a -55%
Strengthen the share of Renewable Energy (% of gross final energy consumption)	47% (20% target on transport)	
Increase Energy Efficiency (% reduction in primary energy consumption)	35%	
Electrical Interconnections	15%	

The subsequent table presents the sectorial targets established under PNAC (for 2020) and NECP (for 2030).

Table V.3 – National sectoral targets (non-EU ETS)

Sectoral GHG Reduction Targets	2020	2030
Services	-65%	-70%
Residential	-14%	-35%
Transports	-14%	-40%
Agriculture	-8%	-11%
Waste and Wastewater	-14%	-30%

The road to a carbon neutral economy requires joint action from the various strategic areas, with a focus on energy efficiency, enhanced diversification of energy sources, increased electrification, infrastructure upgrading, interconnection development, market stability and investment, reconfiguring and digitising the market, encouraging research and innovation, promoting low carbon processes, products and services and better energy services and informed consumer choice.

Monitoring the implementation of policies and measures, as well as actions developed by Portugal is one of the key elements in the management of NECP, as it not only monitors progress but also ensures compliance with the obligations assumed, at both Community level under the Energy and Climate Action Union Governance Regulation and the Effort Sharing Regulation, and internationally under the UNFCCC.

The BR – CTF table 3 presents the policies and measures which are already implemented and planned to be implemented in a near future to accomplish an economy-wide emissions reduction target.

In this context, it is therefore important to take advantage of existing monitoring structures at national level, adapting them to this new reality which is more integrating between energy and climate policies.

To this end, the SPeM will be used, and It is being adapted to include the monitoring of policies and measures and projections that impact on the energy transition and will enable progress in the implementation of sectoral policies and mitigation measures to be assessed, enhancing sector involvement and enhancing sectoral accountability in integrating the climate dimension into sectoral policies, ensuring:

- Managing the process of identifying and designing policies and measures, or groups of policies and measures, to limit or reduce greenhouse gas emissions and other air pollutants by sources, or to intensify their removals by sinks, compliance with national obligations;

- Monitoring and reporting the implementation of policies and measures and their effects, as well as the reporting of projections in accordance with the requirements and the European and international guidelines, and ensure its agreement with the national inventory of anthropogenic emissions by sources and removal by sinks of atmospheric pollutants (INERPA);
- The preparation of national projections of greenhouse gas emissions and other air pollutants by sources and their removals by sinks, as well as the expected effects of the policies and measures being implemented and to be implemented, in accordance with the requirements and guidelines European and international, in conjunction with INERPA;
- Assessment of compliance of national obligations, including sectoral targets under the climate and energy package of the European Union and the air in the horizons policies in 2020, 2025 and 2030, as set out in the national strategic documents of climate change policies and air.

In addition, given the synergies between climate and energy policy and air policies and measures, SPeM will continue to support monitoring, as well as projections in this area, while ensuring proper articulation with the National Emissions by Sources Inventory System, the Removal by Atmospheric Pollutant Sinks (SNIERPA) and the monitoring and reporting system provided for under the National Climate Change Adaptation Strategy (ENAAC 2020).

In this context a platform for monitoring and reporting the impacts of cross-sectoral policies and measures on climate change and energy transition will be developed in conjunction with the sectors through the development of indicators and the identification of the respective regulatory, financing, tax and other.

Achieving carbon neutrality in 2050 means progressively moving from a linear economic model based on fossil fuels to an economy sustained by renewable resources and that uses resources efficiently, continuing with circular economy models that value the territory and promotes territorial cohesion, but leaving no one behind.

It is important to stress that NECP 2030 has economic and social concerns, through the integration of the security of supply and fair transition measures that do not translate directly into reducing GHG emissions.

Cross-Cutting Policies and Measures

The new energy model towards carbon neutrality represents a unique opportunity for Portugal. Within the framework of the economic recovery that the country has been achieving in recent years, the challenge of the energy transition is seen as an opportunity to leverage the national economy in a sustainable development logic based on a democratic and fair model that promotes civilizational progress, technological advancement, job creation and prosperity, wealth creation, territorial cohesion alongside the preservation of natural resources. Hence, the path to decarbonisation of the economy is at the same time an opportunity for economic growth.

Aligning tax policy should with the carbon neutrality objective, giving the right signals to the economy, internalising externalities, influencing behaviour change and at the same time allowing the generation of public revenues that can be applied in decarbonisation measures and to ensure a fair transition is among the objectives of green taxation aiming at a triple dividend, economic, social and environmental.

Setting a carbon price is one of the most cost-effective measures and a real incentive to reducing GHG emissions. A carbon price can be applied through a carbon tax or through an emissions trading systems, such as EU ETS. Portugal has been participating in EU ETS since 2005 and adopted a carbon tax for non EU ETS sectors in 2015, in the form of an addition to the Petroleum and Energy Products Tax.

Carbon pricing policies are key, particularly through effective implementation of the EU ETS, promoting actions that lead to reinforcement of the carbon price, encouraging widespread application of the carbon tax to sectors

not covered by EU ETS and removing perverse incentives for fossil fuels or investments that increase emissions.

The investment dynamics associated with decarbonisation of the economy and energy transition also provide an opportunity for innovation in the financial sector with the creation of new products and services linked to this new green economy, especially green bonds, green loans, sustainable investment funds and impact funds.

Concerning the promotion of energy efficiency measures targeting the Public Administration it is relevant to mention the Action Plan for Energy Efficiency in Public Administration (ECO.AP) in order to proceed with the Energy certification of State buildings and energy efficiency management contracts, it is also being targeted a more efficient public administration transport and efficient public lighting.
Main policy framework includes:

- Roadmap for Carbon Neutrality (RNC2050), approved by the Council of Ministers Resolution n. º 107/2019 of July 1st;
- National Program Climate Change (PNAC 2020/2030), and National Strategy for Adaptation to Climate Change (ENAAC 2020), approved through the Council of Ministers Resolution n.º 56/2015, of July 30th which also created the National Policy and Measures subsequently regulated by the Resolution of the Council of Ministers n.º 45/2016, of August 26th;
- Climate Change Adaptation Action Program (P-3AC), approved through the Council of Ministers Resolution n. º 130/2019, of August 2nd;
- National Strategy for the Air (ENAR 2020), approved through the Resolution of the Council of Ministers n. º 46/2016, of August 26th;
- Circular Economy Action Plan (PAEC), approved through the Council of Ministers Resolution n. º 190-A/2017;
- National Program for Spatial Planning Policy (PNPOT), approved through the Law n. º 99/2019, of September 5th;
- National Program for Territorial Cohesion (PNCT), approved through the Council of Ministers Resolution 72/2016, of November 24th;
- National Action Program to Combat Desertification 2014-2024 (PANCD), approved through the Resolution of the Council of Ministers n. º 78/2014, of December 24th;
- National Strategy for Sustainable Cities 2020, approved through the Council of Ministers Resolution n. º 61/2015, of August 11th;
- National Strategy for Green Public Procurement (ENCPE 2020), approved through the Resolution of the Council of Ministers n. º 38/2016, of July 29th;
- National Strategy for the Conservation of Nature and Biodiversity 2030 (ENCNB 2030), approved through the Council of Ministers Resolution n. º 55/2018, of May 7th;
- National Strategy for Environmental Education (ENEA 2020), for the period 2017-2020, approved through the Council of Ministers Resolution n. º 100/2017, of July 11th;
- European Emissions Trading Scheme (EU ETS), Decree-Law n.º 38/2013, of March 15th, changed by Decree-Law n.ºs 42-A/2016, 12th August and by Decree-Law n.º 10/2019, 18th January and Decree-Law n.º 93/2010, of July 27th, changed by Decree-Law n.º 195/2015, 14th September;
- Phased withdrawal of coal tax exemptions until 2030, State Budget Law 2018;
- National Investment Program (PNI 2030), approved through the Assembly of the Republic Resolution n.º 154/2019, of August 23th.

Energy sector policies and measures

The energy system covers in an integrated manner energy production, transport and distribution and final energy consumption in the various sectors (industry, transport, residential and services and agriculture).

It is possible to identify, with current technologies and knowledge about their future evolution, neutrality trajectories with cost-effective options to achieve emissions reductions of around 60% by 2030 and 90% by 2050 (compared to 2005). These trajectories express a mix of technologies that minimises the cost to the national energy system, through progressive technological substitution, that begins with the sectors/technologies for which the transition is most cost-effective and progressively expands to more expensive sectors/technologies, until the desired emissions reductions are achieved.

In the energy system, transport and the power generation sector have the greatest potential for reducing GHG emissions in the decade of 2020-2030, and decarbonisation of buildings and industry will be more intense, respectively, in the decades of 2030-2040 and 2040-2050.

The path towards carbon neutrality will lead to a much wider use of endogenous renewable energy resources of which over two thirds are sun and wind, accounting for over 80% of primary energy consumption by 2050. The national energy system will need to move from an essentially fossil base to an essentially renewable base by 2050, with positive consequences for the energy bill, the trade balance and the reduction of energy dependency.

The vision of a heavily decentralized, digitalized, decarbonized electrical system that focuses on the consumer/ energy producer as an active participant in the system and ensures adequate levels of service quality and security of supply will not be possible without a new conception and strategic orientation that consider all these new variables.

Smart grids, management support systems, producer and / or consumer aggregators, bidirectional smart meters, storage systems, local energy production, active consumers, supply / demand flexibility, electric vehicle, among others, are the variables to take into account in building the network model of the future. To ensure true integration of all variables, and regardless of the configuration that may be adopted, it is important to form a strategic vision of the national electricity system that will contribute to the achievement of national goals and targets for the 2030 horizon.

In the residential sector, it is intended to reinforce the thermal comfort of the dwelling, both in heating and cooling, favoring insulation solutions and continuing with the electrification trend of the sector. A continued commitment to urban regeneration will provide the opportunity for the incorporation of improvements in energy and water efficiency, the incorporation of low carbon materials and renewable energy sources, contributing to the fight against energy poverty.

In the services sector, some potential that still exists to increase the electrification of consumption should be exploited, and it will be crucial to increase the energy efficiency of installed equipment and the use of renewable energy sources.

At infrastructure level, energy interconnections are essential for the development of the internal energy market, ensuring security of supply, improving the functioning of energy systems, increasing competition and stability in energy markets, promoting market integration, greater fairness and balance in setting energy costs and prices and contributing to meeting EU energy, climate and competitive targets. In addition, the importance of regional cooperation should be strengthened in order to bring Member States closer together, with a special focus on Spain and France, with the aim of monitoring and evaluating interconnection projects that address the interconnection needs of markets and energy systems.

From a transitional point of view the energy sector, current natural gas reception, storage, transport and distribution infrastructures will play an important role in enabling the introduction, distribution and consumption of renewable gases, in particular bio methane and hydrogen, in the various sectors of the energy sector, leading to higher levels of incorporation of renewable energy sources into final energy consumption.

In this perspective, it is worth highlighting the focus, over the next decade, on the production and incorporation of renewable gases such as hydrogen and bio methane, which promotes a more intense fossil fuel substitution and reduces the country's energy dependence. The growing recognition of the importance of renewable gases, in particular hydrogen, is based on the fact that it allows the storage of energy and the

preparation of other renewable fuels, thus contributing to the achievement of national targets for the incorporation of renewable sources into final energy consumption, decarbonisation of consumption, with particular emphasis on industry and mobility (especially freight and rail).

In this context, the Government is promoting an industrial policy on hydrogen and renewable gases, which is based on the definition of a set of public policies that guide, coordinate and mobilize public and private investment in projects in the areas of production, storage, transport and consumption of renewable gases in Portugal. This new approach stems from the fact that Portugal has very favourable conditions for setting up a green hydrogen production industry with export potential, the main advantage being the low costs of producing electricity from renewable sources. The development of a green hydrogen production industry in Portugal has the potential to boost a whole new economy, coupled with the huge potential for decarbonisation of various sectors.

Furthermore, it has recently established the compromise to phase-out the electricity production based on coal by 2023.

Main policy framework:

- National Action Plan for Renewable Energy 2013-2020 (PNAER), approved through the Council of Ministers Resolution n. º 20/2013, of April 10th;
- National Program for High Hydroelectric Potential Dams (PNBEPH);
- National Plan for the Promotion of Bio-refineries, approved through the Council of Ministers Resolution n. º 163/2017, of October 31th;
- National Sea Strategy (ENM 2013-2020), approved through the Council of Ministers Resolution n. º 12/2014, of February 12th;
- Industrial Strategy and Action Plan for Renewable Ocean Energy, approved through the Council of Ministers Resolution n. º 174/2017, of November 24th;
- National Action Plan for Energy Efficiency 2013 -2016 (PNAEE), approved through the Council of Ministers Resolution n. º 20/2013, of April 10th;
- Energy Efficiency Program in Public Administration - ECO.AP, created through the Council of Ministers Resolution n. º 2/2011, of January 12th;
- National Electricity System Supply Security Monitoring Report (under evaluation) and Natural Gas System Supply Security Monitoring Report, under evaluation;
- Development and Investment Plan of the National Electricity Transmission Network for the period 2018-2027, under evaluation;
- Development and Investment Plan of the National Natural Gas Transport Network for the period 2018-2027, under evaluation.

Waste and wastewater sector policies and measures

The nature of the waste and wastewater sector, in particular its importance as a public service, and existing and foreseeable environmental constraints on its future operation and performance, establishes an investment framework that has much more to do with regulation of the sector and existing environmental regulations.

Indeed, in order to meet the targets set out in the EU Landfill Directive, in the year 2035 only a maximum of 10% of the municipal waste produced will be landfilled. Thus there will be a paradigm shift also in the need for greater reuse and recycling of waste, betting on a more circular economy and less waste.

The priority will therefore be to reduce waste generation first, followed by strengthening selective urban waste collection, with priority to the biological treatment of bio-waste and the intensive exploitation of reuse and recycling solutions. Thus, the focus is on strengthening the specific flow management systems, with a view to creating synergies and evaluating the application of Producer Extended Responsibility (RAP) to emerging flows.

The rational use of existing water resources and the needs of all consumers, including the environment, must be ensured. The untapped national hydroelectric potential will be assessed by establishing rigorous site selection criteria for the deployment of new major hydroelectric utilities that contribute to meeting the established energy targets, considering and considering environmental, social and economic components in an integrated manner.On the other hand, with energy costs being one of the major components in operating and operating costs of water supply and wastewater services, with direct implications on tariffs, energy management is today one of the main challenges of the managing bodies of these services.

Main policy framework:

- Strategic Plan for Urban Waste (PERSU 2020+), approved through the Ordinance n. º 241-B/2019 of 31stJuly;
- National Strategy to Combat Food Waste (ENCDA), approved through the Council of Ministers Resolution n. º 46/2018, of 27th April;
- National Waste Management Plan 2014-2020 (PNGR), approved through the Council of Ministers Resolution n. º 11-C/2015, of 16th March;
- Strategic Plan for Water Supply and Wastewater Sanitation (PENSAAR 2020), approved through the Official Order n. º 4385/2015, of 30th April;
- Legal regime for the production and use of water for reuse, obtained from wastewater treatment, approved through the Decree-Law n. º 119/2019, of 21st August.

Agriculture and Forest sector policies and measures

Although at a slower pace than other sectors, it is expected that in the next decade, changes in the agricultural sector will be made to reduce emissions, with a focus on more sustainable agriculture, through the expansion of organic, conservation and precision agriculture, emissions from animal effluents and the use of synthetic fertilizers and enhancing carbon sequestration resulting from increases in soil organic matter content, in particular through the promotion of biodiverse pastures. This type of agriculture will also have consequences for the improvement of water use efficiency, allowing productivity gains and water savings, which is a scarce and essential good to preserve.

It will also be necessary to research new forms of animal diet with a view to achieve improvements in feed digestibility with consequent positive impact on emissions reduction.

It will be equally important to rethink the entire food chain, from choices that make up the diet, reducing food waste, how plants and animals are produced for food, pressure on soils, water, but also on marine resources and fisheries.

In the case of forest and other land uses, proper agroforestry management will be essential to progressively reduce the burned area, increasing productivity and reinforcing the commitment to ecosystem services that enable and contribute to the fight against desertification and the valorisation of the territory, as one of the foundations of territorial cohesion. Sink potential, particularly in the forestry area, will need to be strengthened, assuming its management in articulating land use planning, investing in management practices and models that enhance the role of forest sink and increase their resilience climate change which has the potential to worsen conditions for forest fires and soil degradation.

Therefore it will be put in place the Rural Space Ecosystem Services Remuneration Program, which aims to provide rural territories with greater competitiveness and to ensure a model of greater environmental sustainability, with less exposure to risks, particularly from fires.

It will also be implemented the remuneration of ecosystem services with the aim to promote the biodiversity of territories, reflecting a transformation in the use of territories, moving from a short-term profitability model to a model whose profitability needs a longer time frame, but which ensures greater appreciation and resilience of the territories. This program aims to compensate for non-market inputs, such as contributing to erosion

control, carbon sequestration, water cycle regulation, biodiversity conservation, reduced susceptibility to fire and improved landscape quality (launched in 2019).

Main policy framework:

- Rural Development Program 2014-2020 (RDP 2020), approved through the Commission Implementing Decision C (2014) 9896, of 12th December;
- National Strategy for Agricultural and Agro-Industrial Effluents (ENEAPAI) 2018-2025, under review;
- Code of Good Agricultural Practice (CBPA), approved through the Official Order n. º 1230/2018, of 5th February;
- National Forest Strategy (NFE), update approved through the Council of Ministers Resolution n. º 6-B/2015, of 4th February;
- National Strategy for the Promotion of Cereal Production, approved through the Council of Ministers Resolution n. º 101/2018, of 26th July;
- National Strategy for Organic Farming (ENAB), approved through the Council of Ministers Resolution n. º 110/2017, of 27th July;
- National Irrigation Program, approved through the Council of Ministers Resolution n. º 133/2018, of 12th October;
- Common Agricultural Policy Strategic Plan (PEPAC 2021-2027), under development;
- Bioeconomy Strategy, under development.

Mobility and Transport sector policies and measures

The transport sector is, together with the power generation system, one of the main national emitters (representing about 25% of emissions) and is the sector with the highest growth in emissions in recent decades. This sector includes road, rail and maritime transport and aviation (only its national components) and can be divided into passenger and freight transport.

The road subsector accounts for 96% of transport emissions, with national rail, aviation and shipping accounting for only 4% of emissions. Car use accounts for 60% of emissions in relation to the total for road transport.

This is also the sector with the highest energy intensity and the largest indirect contribution to primary energy imports and associated energy dependence. These transport modes have quite low usage efficiency rates, with values of about 1.2 passengers per private vehicle and average public transport occupancy between 17% and 24% (percentages below the European average), leaving room for significant efficiency gains.

Thus, this is a sector in which it is urgent to reverse the growing trend in emissions. The next decade will be a paradigm shift in this sector. Major changes towards decarbonisation of the sector are foreseen, with traditional fossil fuels being progressively replaced by electricity, advanced biofuels and hydrogen, resulting in significant environmental and efficiency gains. The future of mobility will be sustainable, autonomous and shared. It will be a future where users will have greater power to manage their own mobility as a result of increasing digitization.

However, the paradigm shift does not end with technological innovation. A continued focus on public transport, changing the mobility patterns of the Portuguese and reversing the trends of recent years, is one of the most important decarbonisation and energy efficiency measures to pursue.

Increased demand for passenger mobility should be ensured with more public transport using low-emission vehicles and with the widespread use of shared transport, with a view to increasing the expression of active modes in short-distance mobility. Changing behaviours towards mobility is still an aspect not to be neglected, both with regard to mobility decisions, as well as the adoption of more efficient behaviours by promoting eco-driving and the use of new technologies to induce sustainable mobility behaviours.

The decarbonisation of mobility is also intrinsically linked to the models of territorial organization of cities, economic and leisure activities and their implications in terms of mobility needs, as well as the implications in terms of collective versus individual mobility. Cities have been active agents in the decarbonisation of the economy, and it is essential to take advantage of this dynamic to create low carbon cities.

In freight transport the focus on logistics management, including reverse logistics and fleet management and optimization, will be of major importance, with a major focus, by 2030 on light electric goods vehicles, and biofuels and hydrogen for heavy vehicles. Rail will play an important role in the decarbonisation of freight transport in the medium and long haul, and investment in this infrastructure will be intensified, decarbonised through electrification and other energy vectors such as hydrogen and in its modernization and expansion. At the same time, the aim is to decarbonize maritime transport, investing in new forms of energy, promoting short-distance transport and streamlining the connection and interoperability of rail freight with commercial ports.

It is important to stress that some main policies and measures are already in place, such as the deployment of charging infrastructure, electric mobility management structure and expansion of the charging network. Together with the promotion of the acquisition of vehicles of high environmental performance, namely of low carbon by individuals and companies, in particular hybrids and electric.

There is also a positive discrimination on motor vehicles taxes: 1) CO2 component on registration tax; 2) CO2 component on the annual circulation tax; 3) exemption of registration and annual circulation taxes for electric vehicles.

It has started in 2019 the Public Transport Tariff Reduction Support Program. This program aims to attract passengers to public transport, supporting the Transport Authorities with an annual budget, allowing them to operate at lower tariffs to the passengers.

It is also foreseen to expand public transport networks and equipment throughout the territory (metro and train).

Due to the great importance of the public transport Portugal is keen to continue to promote fleet renewal by co-financing 'clean buses', in particular as regards electricity and hydrogen.

On active mobility it will be implement the National Active Mobility Strategy 2020-2030, which for example provides for a significant extension of the bicycle network.

Main policy framework:

- Transport and Infrastructure Strategic Plan (PETi3 +) for 2014-2020, approved through the Council of Ministers Resolution n. º 61-A/2015, of 20th August;
- Sustainable Mobility Program for Public Administration - ECO.mob 2015-2020, approved through the Council of Ministers Resolution n.º 54/2015, of 28th July;
- National Strategy for Cyclic Active Mobility (EMNAC) 2020-2030, approved through the Council of Ministers Resolution n. º 131/2019, of 2nd August.

F-gases sector policies and measures

Since 2005, emissions of fluorinated gases have significantly increased.

The emissions of these gases result mainly from their use in refrigeration or air conditioning equipment, fire protection systems, truck and trailer refrigeration units, and electrical change-over switches and are therefore found throughout various sectors of the economy.

The reduction in emissions of fluorinated gases is marked by the withdrawal of such gases imposed by the reduction targets set at international and European Union level, through restrictions on the marketing of

equipment with fluorinated gases with a high global warming potential, thus making room for use of other refrigerant gases, such as natural refrigerants and hydrofluorolefins.

The main focus is to continue the implementation of the provisions laid down in Regulation (EU) N.º 517/2014 of the European Parliament and the Council, of 16th April 2014, on fluorinated greenhouse gases and repealing Regulation (EC) Nº 842/2006, in order to promote their substitution by other substances with lower or no GWP. This regulation took into consideration the Kigali Agreement percentage targets for average HFC emissions for the period 2011-2013.

Additionally, Portugal has also implemented the 2006 Directive on Mobile Air Conditioning (MAC) restrictions (Directive 2006/40/CE), which prohibits the use of fluorinated gases with a GWP value greater than 150 on new types of cars and vans introduced from 2011 and on all new cars and vans from 2017.

Main policy framework:

- Regulation (EU) N. º 517/2014 of the European Parliament and the Council, of 16th April 2014;
- Directive 2006/40/EC of the European Parliament and the Council, of 17th May 2006.

Industry sector policies and measures

Strengthening the prospects of the circular economy and "industry 4.0" are crucial in the way to identify and create innovative, efficient, green and zero-emission solutions.

Although it is a sector where decarbonisation is expected at a slower pace with current technologies available, it is nonetheless a highly motivated sector for resource efficiency issues, and several sector roadmaps are underway for a future of the more decarbonised industry, where a bet on the circular economy through industrial symbioses and the reuse of resources can be an asset in the 2030 horizon.

This sector will still be strongly influenced by robotisation and digitisation, with increasing electrification, with greater use of biomass together with other forms of renewable energy, such as solar thermal.

Most of the Portuguese industry is in the scope of the EU ETS. Hence the main policies and measures are related to this scheme, so the key is the EU ETS implementation - Industrial installations.

In parallel there is in place the System for the management of energy intensive (SGCIE), with the aim to promote energy efficiency and monitor the energy consumption of energy-intensive consumer installations.

Main policy framework:

- Directive (EU) N. º 2003/87/EC of the European Parliament and the Council, of 13th October 2003;
- Directive 2012/27/EU of the European Parliament and the Council, of 25th October 2012.

Research and Innovation Sector Policies and Measures

The path to carbon neutrality is also the path of innovation and knowledge, qualification and training. New technology-driven research and innovation will play a key and cross-cutting role in meeting the challenges of decarbonisation and energy transition.

Developing new technologies and refining existing low-carbon technologies requires a significant research and innovation effort that will be achieved through the adoption of an ambitious and broad agenda that covers all stages of the technology development cycle until their completion commercialization. This will be supported by national support frameworks that will be oriented towards research and technological development in accordance with the country's priorities, such as hydrogen, storage, smart grids, advanced biofuels, deep geothermal, solar thermal concentration, ocean energy, energy integration, energy conversion and storage, low carbon processes, circular economy, precision agriculture, among others.

Portugal has been developing Research and Innovation Thematic Agendas 2030 with the objective to establish the main lines to be studied in each area.

- Research and Innovation Strategy for Smart Specialization EI&I, 2014-2020, approved in December 23th of 2014;
- Research and Innovation Thematic Agendas 2030, under development by FCT following the Council of Ministers Resolution n. º 32/2016, of June 3th.

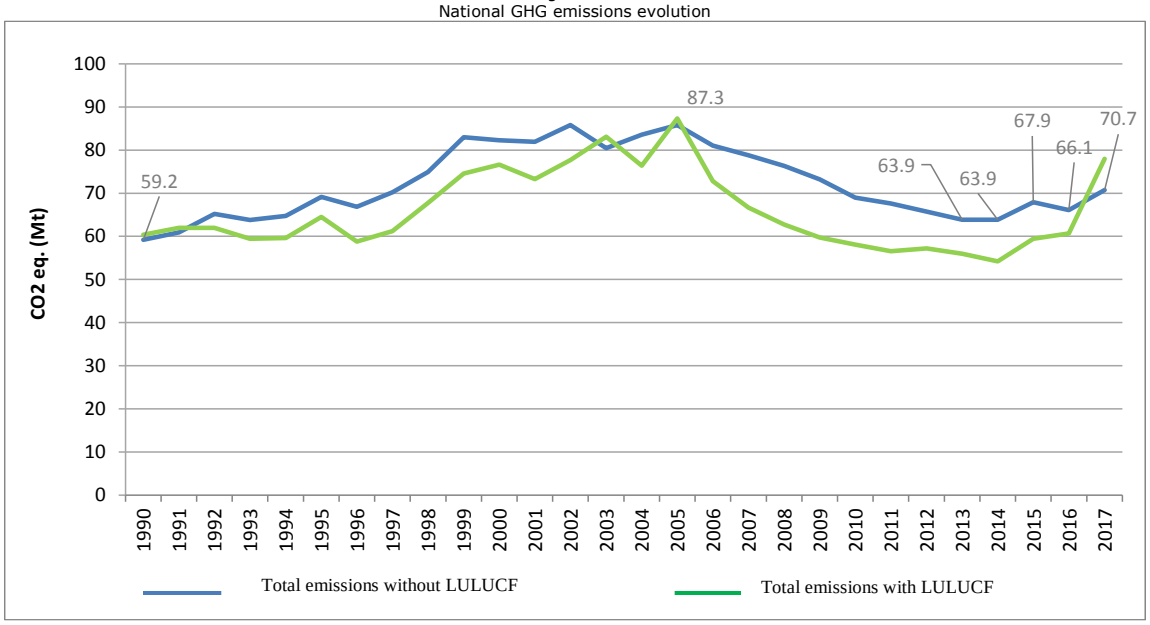
The outermost regions of the Portuguese Republic are the Autonomous Region of the Azores (RAA) and Autonomous Region of Madeira (RAM), two archipelagos located in the Atlantic Ocean. They have administrative and political autonomy, with a set of political, legislative and administrative powers. In matters such as energy, climate or mobility, the autonomous regions develop their own strategies and plans taking into account the reality of each region, but aligned with the national defined targets and objectives, such as the renewable energy and the emissions reductions targets. Hence their policies and measures are specific for their reality, but with the aim to contribute to the Energy Union dimensions - decarbonisation, energy efficiency, security of supply, internal energy market and research, innovation and competitiveness.

2. Estimates of emission reductions and removals and the use of units from the market-based mechanisms and land use, land-use change and forestry activities

Quantified progress to 2020 targets

The evolution of GHG emissions largely reflects the evolution of the Portuguese economy, which was characterized by strong growth associated with increased demand for energy and mobility in the 1990s. Since 2005 emissions have been on a decreasing trend as a result of technological improvements in pollution control and energy efficiency systems in industry (including the EU-ETS), transport and buildings; the introduction of lower GHG emitting fuels, especially natural gas for electricity production and for use in buildings from the late 1990s onwards; the significant growth in energy from renewable energy sources (particularly wind energy since 2005); the implementation of waste management measures aimed at increasing selective disposal, reuse and recycling.

Figure V.2
National GHG emissions evolution



Source: APA

GHG emissions, without accounting for LULUCF emissions, are estimated at around 70,7 Mt CO2e for 2017, representing an increase of 19,5% over 1990 and a growth of 7,0% over 2016.

Considering the LULUCF sector, total emissions in 2017 are estimated at 78,0 MtCO2e, corresponding to an increase of 29,2% over 1990 and an increase of + 28,5% over 2016. This increase in emissions in 2017 is strongly related to extreme drought and wildfires that occurred in 2017.

Still, emissions recorded in 2017 confirm a path towards meeting national and European emission reduction targets for 2020 and well on track for 2030 targets. Total emissions, representing a reduction of about 18% over 2005 levels, are in the range of the 2020 GHG emissions reduction PNAC target.

Table V.4
Non-ETS Emissions from Annual Allocations under Community Commitments

	Unit	2013	2014	2015	2016	2017
AEA	Mton	49,3	49,6	49,9	50,1	47,9
Non-ETS sectoral emissions	Mton	38,6	38,8	40,6	41,6	40,2
Difference between emissions level and AEA	**%**	- 21,7	- 21,7	- 18,5	- 17,1	- 16,2

Source: APA

Portugal is in compliance with its Effort Sharing target which is also its contribution for the EU's 20% reduction target by 2020. National emissions in non-ETS sectors are consistently below the annual targets (AEA) set for 2013, 2014, 2015, 2016 and 2017.

No international credits (certified emission reductions (CERs) and emission reduction units (ERUs)) are included or used up to this point in time for achieving the targets nor is it expected to be used by the end of 2020.

Assessment of the economic and social consequences of response measures

Portugal's contribution to the minimization of the adverse effects of climate change in other Parties, particularly developing countries, is carried out first of all through a strong commitment to implementing the Convention and the Kyoto Protocol.

By working on the implementation of the Protocol, Portugal is struggling to minimize not only the adverse effects of climate change in specific sectors, industries or other Parties, but also any adverse effects due to the reduction of greenhouse gases. This is due to the development of different actions and implementation of different instruments conceived to promote sustainable development and the commitment to support developing countries.

The policies and measures implemented, adopted or foreseen in the National Plan for Climate Change (PNAC), targeting the six GHG of the Kyoto Protocol through its broad portfolio of instruments and wide-ranging coverage of all sectors of the economy, make up a significant effort by the Portuguese Government to address climate change, including the minimization of adverse effects of such policies.

The transition to a carbon neutral economy by 2050 relies on the contribution of all sectors. Particularly, in the context of the 2050 Carbon Neutrality Roadmap and the NECP 2030, there is a strong push for the diversification of energy sources and to the increase of endogenous renewable resources. In some cases, measures already implemented pertaining to the diversification of primary energy sources (namely the

introduction of natural gas in the economy in the late 1990s), can simultaneously have positive effects on Portugal's emissions reduction and in the economy of some fossil fuel exporting countries.

To ensure that all relevant possible impacts are taken into account, Portugal has established SPeM to assess the economic and social consequences of climate policy measures throughout the different sectors.

For the development of new policy initiatives, the members of SPeM (from all the economy sectors) are called to present their policies and measures with the potential of GHG emissions reduction and respective foreseen costs.

Furthermore, Portugal is keen in assisting third countries on a sectoral level, such as for trade agreements, as well as on an overarching political level in regional cooperation with those countries. The action of the Portuguese cooperation is developed on the basis of geographical priorities which are centred in the countries of Portuguese official language, in particular the Portuguese-speaking African countries/ Países Africanos de Língua Oficial Portuguesa (PALOP) and East Timor. All these countries are within the group of more vulnerable countries to the variations caused by climate changed either, because they are situated in its majority in Africa, or belong to the set of least developed countries and/or are small insular States.

This way, it is ensured that the effects of climate change policies on non-EU countries are taken into account. The cooperation of Portugal with third countries looks to the integration of the adaptation dimension of climatic change in the several sectoral policies and instruments of planning, vulnerabilities and risks associates to climate change.

Portugal’s Official Development Assistance (ODA) also supports third countries to effectively implement the Paris Agreement in a manner that unlocks socio-economic opportunities and supports climate objectives, by providing capacity building and technology transfer for partner countries.

At a multilateral level, Portugal supports the implementation of adaptation measures in the most vulnerable countries, in particular within the Community of Portuguese Speaking Countries/ Comunidade dos Países de Língua Portuguesa (CPLP) and contributes to the green climate fund.

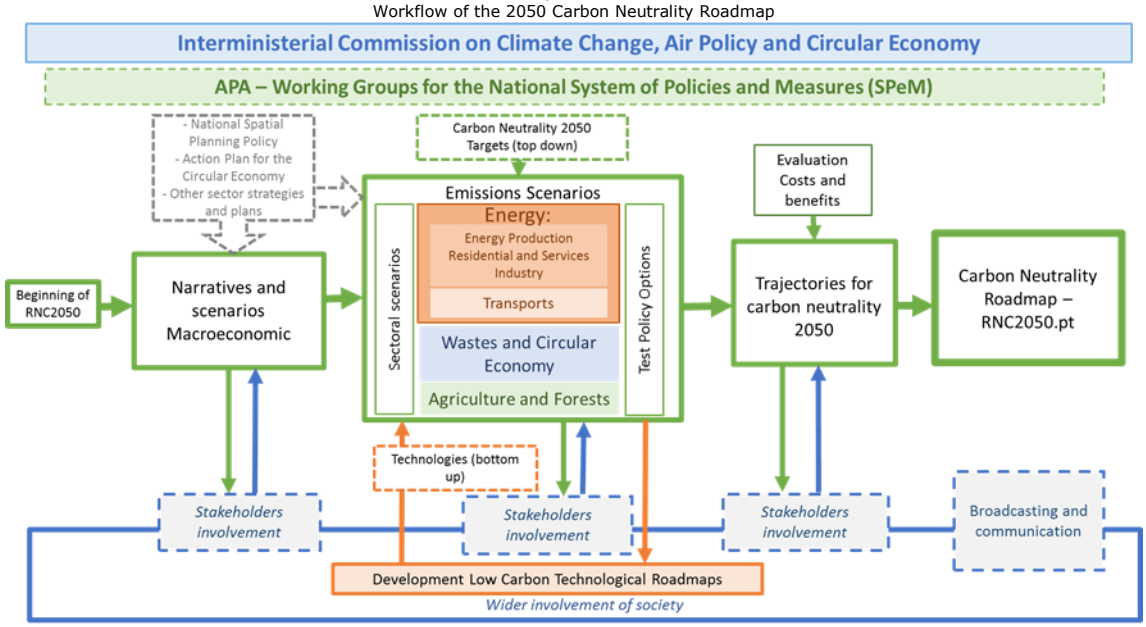
At a bilateral level, Portugal supports projects in Angola, Cabo Verde, Guiné-Bissau, Mozambique and São Tomé e Príncipe; and promotes the sectoral integration of the adaptation component in the Cooperation Programs, in particular in the scope of Superior education and of Research in the field of Environmental Engineering, Agriculture and Rural Development, and Health.

VI. PROJECTIONS

The projections described in this chapter were prepared during the elaboration of the National Energy and Climate Plan (PNEC 2030) and of the 2050 Carbon Neutrality Roadmap (RNC 2050), which constitutes the Portuguese Long-Term low GHG emissions development Strategy already submitted to the UNFCCC on the 20th of September 2019. Hence, they were updated comparative to the projections reported in the 3rd Biennial Report.

This new modelling exercise, with the 2050 horizon, aimed to identify cost-effective trajectories and the main decarbonisation drivers consistent with the carbon neutrality objective.

Figure VI.1
Workflow of the 2050 Carbon Neutrality Roadmap



The Roadmap work had as its starting point for the development of greenhouse gas emission trajectories, the development of coherent socioeconomic scenarios, based on common narratives of possible evolutions of the Portuguese society until 2050, based on the evolution of macroeconomic parameters and demographic trends (which are shown in BR-CTF table 5).

The proposed scenarios were subject to an external consultation and validation process, in particular with entities with responsibilities in the field of economic forecasting in Portugal (such as Portugal Central Bank, GPEARI – Finance Ministry Office of Planning, Strategy, Evaluation and International Relations; INE – Portuguese National Statistics Institute; GEE – Economy Ministry Office for Strategy and Studies; Foresight and Planning Department of the Environment Ministry, among others).

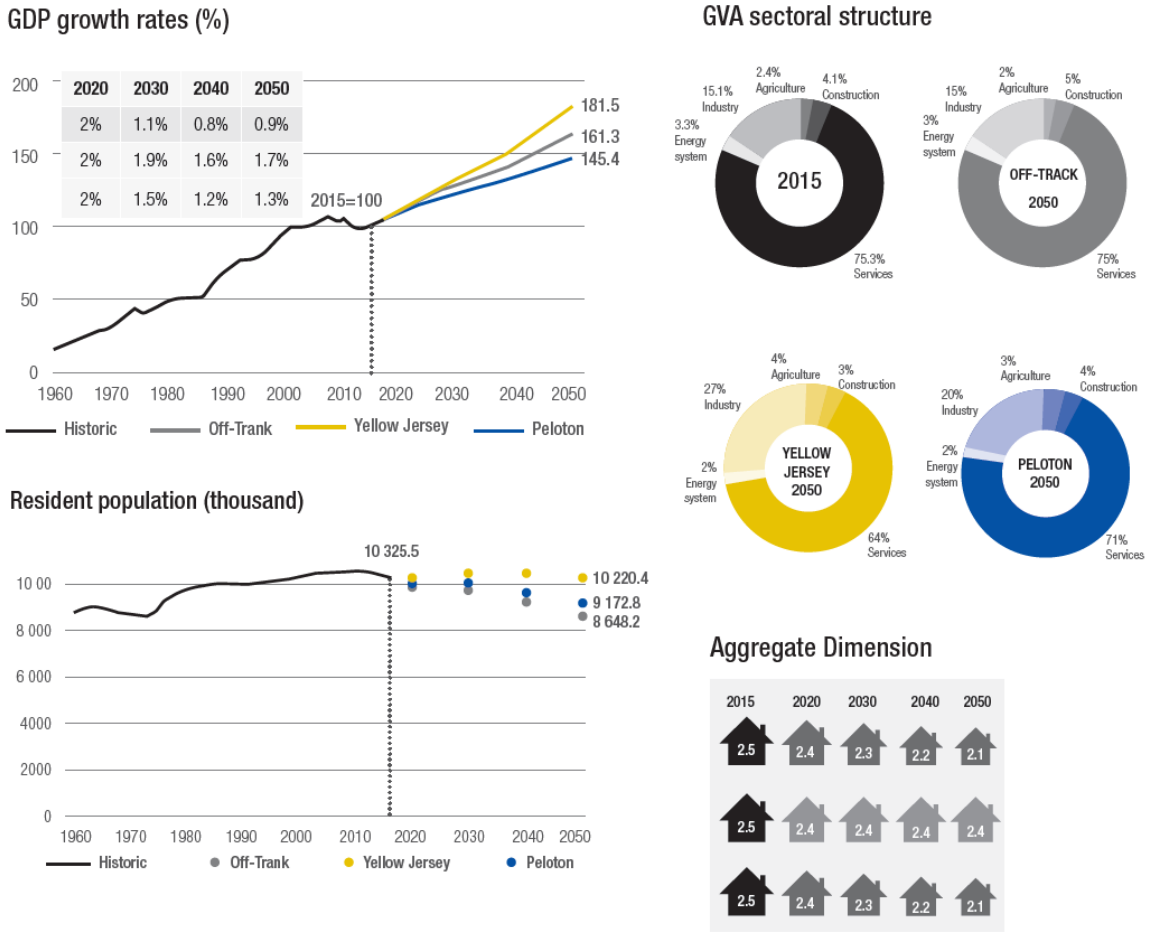
The narratives and their macroeconomic and demographic variables developed allowed, in the later modelling phase, to establish and characterize evolution scenarios for the different activity sectors - energy and industry, transport and mobility, agriculture, forests, and waste and wastewater, namely by the estimation and characterization of demand for energy and services.

In this context three scenarios were developed:

- a scenario that retains the essentials of the economic structure and current trends as well as decarbonisation policies already adopted or in force, but does not include the adoption of additional policies, called the Off-track Scenario (FP);
- two scenarios of socioeconomic evolution compatible with carbon neutrality, however achieved in different contexts, called Platoon Scenario (PL) and Yellow Jersey Scenario (CA). The Platoon scenario is

characterized by the development and application of new technologies that, however, do not significantly change either the production structures or the population's lifestyles. It foresees a modest incorporation of circular economy models and the maintenance of population concentration in the Metropolitan Areas, while the Yellow Jersey Scenario is characterised by a structural and transverse change in production chains, made possible by the combination of a series of technologies of the 4th Industrial Revolution. It foresees a more effective incorporation of circular economy models and greater growth of the importance of medium-sized cities. In the Platoon and Yellow Jersey scenarios, two variants were also considered, one in which the economy evolves without imposing a GHG emission reduction target (called "without neutrality") and a variant in which the economy evolves with the imposition of a GHG emissions reduction target (called "with neutrality"). Thus, for the purposes of this projection report, the macroeconomic scenario associated with the Platoon (PL) scenario was considered (scenario "without neutrality" – corresponding to a WEM scenario and scenario "with neutrality" – corresponding to a WAM scenario), which translates into a more conservative evolution of GDP, the structure of the economy and the population over the period 2020-2050 (compared to the CA scenario).

Figure VI.2
Macroeconomic assumptions considered in the different scenarios of the 2050 Carbon Neutrality Roadmap



More details about the different scenarios, assumptions, sectorial drivers and results can be found in the 2050 Carbon Neutrality Roadmap, available at https://unfccc.int/process/the-paris-agreement/long-term-strategies.

Methodology

As there is no single model for projecting emissions for all sectors and gases in an integrated manner, a methodologically separate approach has been adopted for each of the four major sectors:

1) Energy system: GHG emissions were estimated based on the TIMES_PT optimisation model which includes, in an integrated manner, the entire Portuguese energy system starting from energy generation, transport and distribution through to consumption in the end-use sectors such as industry, transport, residential, services and agriculture in their multiple uses (heating, cooling, lighting, electrical equipment, passenger and freight mobility, among others).

2) Agriculture, forests and other land uses: GHG emissions were estimated based on different assumptions aligned with the narratives of the socioeconomic scenarios, from which the respective evolutionary trends of the crop and animal sector, and their emissions, were established. This sector includes animal emissions and manure management systems, fertiliser use, rural fires, and the emissions or sequestration of different land uses.

3) Waste and wastewater: GHG emissions were estimated based on projections of the volume of municipal waste and domestic wastewater generated each year, considering the resident population, and the impact of the policies already adopted. This sector includes emissions from the disposal and treatment of urban and industrial solid waste and wastewater.

4) Fluorinated gases: GHG emissions were estimated based on the implications of implementation of the Kigali Agreement and the European Regulations that foresee the phasing out of some of these gases over coming decades. This sector includes emissions from the use of fluorinated gases in refrigeration and air conditioning equipment, fire protection systems and electrical switches.

Estimated GHG emissions for each sector were subsequently aggregated to calculate national total emissions. The base year for the modelling in TIMES_PT is 2015.

In all sectors, GHG emissions estimation follows the methodologies presented in the national emissions inventories, which comply with the emissions calculation guidelines of the 2006 Intergovernmental Panel on Climate Change and relevant UNFCCC decisions for calculation of emissions and reporting emissions projections.

The strategic objectives of PNEC 2030 and RNC 2050 ensure a national GHG emission reduction trajectory that will achieve the carbon neutral target by 2050, promoting the mainstreaming of mitigation objectives and a strong focus on renewable energy and energy efficiency.

The scenarios analysed and the modelling performed, confirm the existence of cost-effective trajectories and infer a set of guidelines and action lines for sectoral policies that contribute to the established GHG emission reduction, renewable energy and energy efficiency objectives in the present plan.

It should be noted that due to the share of emissions modelled throughout TIMES it is vital to detail how this model was used. Thus, TIMES_PT is a technological model of linear optimization which results from the implementation of a generation of economy – energy – environment optimized models, with a TIMES technology base, in Portugal.

The generic structure of TIMES can be adapted by each user to simulate a specific energy system, at local system national or multi-regional.

TIMES_PT was initially developed under the European Project NEEDS, integrating a Pan European TIMES model used to estimate total European costs (including externalities) of energy production and consumption. The ultimate goal of any TIMES is to satisfy the demand for energy services at the minor cost. In order to do that, investment options and the operation of some technologies, as well as the primary energy sources and energy exportations and importations, according to the following equation:

$$NPV = \sum_{r=1}^{R} \sum_{y \in YEARS} (1 + d_{r,y})^{REFYR-y} \bullet ANNCOST(r, y)$$

NPV: actualizes net value of total costs; ANNCOST: annual total cost; d: actualization rate; r: region; y: years; REFYR: reference year for the actualization; YEARS: years in which costs exist (all costs for the modelling period + past years when costs where defined for past investments + the number of years after technology life time, in case there are decommissioning costs).

For each year, the TIMES models calculate the current sum of the total costs, expect the income. In the case of TIMES_PT model, the costs taken into account are the investment, operation and maintenance costs (fixed and variable) of the various production technologies and energy consumption. The Income usually considered in TIMES models include subsidies and materials recovery, which are not considered in the TIMES_PT model.

TIMES_PT model represents the Portuguese energy system from 2000 to 2050, including the following sectors:

1. Primary energy supply (refining and synthetic fuels production, import and local resources);
2. Electricity production;
3. Industry (cement, glass, ceramics, steel, chemical, paper and pulp, lime and other industrials);
4. Residential;
5. Commercial and Services;
6. Agriculture, forestry and fisheries (only the energy consumption);
7. Transport.

In each sector the monetary, energy and materials fluxes are modelled according to the various production technologies and energy consumption, including mass balances for some industry sectors.
The simplified structure of the TIMES_PT model is shown in the figure below, as well as its main inputs and outputs.

The implementation of TIMES_PT requires a set of exogenous inputs, namely:

1. Demand for energy services;
2. Technologies' technical and economic characteristics for the base year and the future (e.g. efficiency, input/output ratio, availability, investment, operation and maintenance costs and actualization rate);
3. Availability of primary energy sources in the present and in the future, especially the potential for the use of endogenous energy resources;
4. Policy restrictions (e.g. energy production targets or reduction of emissions).

Based on these elements, it is possible to obtain from the TIMES_PT model a series of outputs, such as:

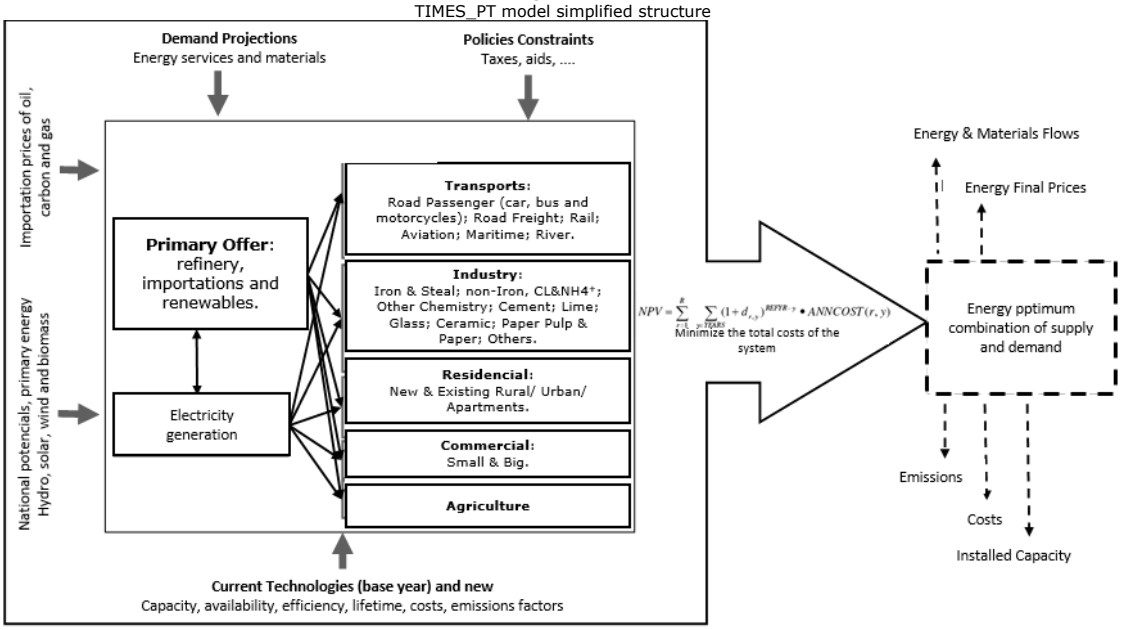
1. Inherent costs to the energy system;
2. Energy flows inherent to each sector;
3. Technological options, including the installed capacity in the electricity production sector;
4. Energy imports and exports;
5. Use of indigenous resources;
6. Emissions by sector.

Presently emissions considered by the model include the GHG emissions generated by combustion and industrial processes, and do not include fugitive emissions associated with the production, storage and distribution of fossil fuels and emissions of F-gases.

Note that TIMES, being a partial equilibrium model, does not consider the economic interactions outside the energy sector, as for instance the implications in the activity of other economy sectors (e.g. impact of wind energy in the metal sector) or the implications in the activity of national sectors dictated by changes in international demand for their goods or services.

Furthermore, TIMES model does not take into account irrational aspects that influence investment in new and more efficient technologies, e.g. motivated by aesthetic preferences or social status which mainly occurs in the acquisition of end-use technologies. Thus, the model assumes that agents have perfect knowledge of the market, present and future. Finally, it should be emphasized that the based technology models such as the TIMES_PT do not accommodate market decisions based on price, instead they make choices based whether technologies or energy resources costs. For this reason, the solutions found show the best options in terms of cost - effectiveness and hence competitiveness, *lato sensu*.

Figure VI.3
TIMES_PT model simplified structure



Economic policy instruments, such as VAT and the ISP (tax on petroleum products and energy products), have not been considered, since the aim is to identify cost-effective technological solutions, and therefore the whole exercise is based on technology costs. The electricity exchange with Spain is also not included in the modelling exercise, since it is mainly based on market decisions, and TIMES_PT model is not an appropriate tool to account for it. According to the expectations of REN (concession holder of the national transport network), a zero balance with Spain is assumed as from 2025.

New in relation to similar exercises in the past is the fact that some of the expected impacts of climate change on the horizon of 2050 have been internalized within the framework of the modelling exercise, in particular by considering changes in technology efficiency and in service demand and resource availability (such as reduced water availability or increased cooling needs).

It should be noted that the TIMES_PT model, provided an important contribution to the setting of national goals and targets by the 2030 horizon and pointing clear guidelines for the horizon 2050.

Main Results

The results of this exercise allowed a review of the potential for national emission reductions, confirming the technical and economic feasibility of pursuing a low carbon pathway to achieve carbon neutrality by 2050.

The sectorial analysis of emissions trajectories confirms that all sectors have significant GHG emission reduction potential in the different analysed scenarios.

It is also noted that, for the purposes of the projections presented in the existing policies scenario, account was taken of the policy instruments and measures approved and published by 31st December 2017, as well as some commitments made by Portugal, such as the end of the production of electricity from coal.

The following table is a summary of the results obtained in terms of sectoral GHG emissions over the 2030, 2040 and 2050 horizon, under existing and additional policy scenarios. The difference between WAM and WEM scenarios for a given year can be taken as an estimate of the emission reductions from additional measures necessary. For 2030 the most significant policies and measures are already identified in the NECP 2030. More detailed information can be found in BR-CTF tables 6a and 6c.

Table VI.1
GHG emission projections by sector and gas (kt CO2eq)

			GHG emission projections						
	Historical GHG emissions and removals		Both scenarios	Scenario With Existing Measures			Scenario With Additional Measures		
(kt CO2 eq)	1990	2005	2020	2030	2040	2050	2030	2040	2050
Sector									
Energy	31 256,75	44 137,24	28 778,15	15 563,91	13 257,77	12 484,68	13 460,72	7 135,18	3 844,20
Transport	10 217,35	19 820,65	16 272,14	11 699,11	7 882,60	5 512,48	10 611,10	3 190,94	473,35
Industry/industrial processes	5 906,05	8 419,21	7 042,81	5 157,46	4 416,09	4 169,95	5 157,46	4 416,09	3 307,17
Agriculture	7 157,17	6 769,77	6 791,07	6 566,02	6 647,62	6 728,19	6 394,81	6 313,05	6 177,13
Forestry/LULUCF	1 155,02	1 519,85	-3 778,43	-8 082,46	-9 310,19	-10 617,39	-9 248,86	-10 541,39	-11 913,39
Waste management/waste	4 554,28	6 463,48	4 404,75	3 316,65	2 358,34	1 746,15	3 316,65	2 358,34	1 746,15
Gases									
CO_2 emissions including net CO_2 from LULUCF	45 908,58	69 669,26	41 836,56	20 144,35	12 873,29	8 622,42	15 834,05	1 017,25	-6 915,36
CO_2 emissions excluding net CO_2 from LULUCF	45 630,69	69 554,15	48 497,06	30 442,78	24 282,07	21 135,43	27 298,87	13 657,23	6 893,65
CH_4 emissions including CH_4 from LULUCF	9 906,12	12 039,95	9 337,43	8 104,82	7 069,26	6 429,78	7 961,55	6 777,97	5 945,15
CH_4 emissions excluding CH_4 from LULUCF	9 605,78	11 198,76	9 171,94	7 977,59	6 948,77	6 320,93	7 834,32	6 657,48	5 836,31
N_2O emissions including N_2O from LULUCF	4 431,92	4 314,46	6 110,30	5 103,14	4 793,71	4 459,63	5 027,90	4 561,01	4 092,58
N_2O emissions excluding N_2O from LULUCF	3 855,13	3 750,91	3 393,72	3 014,42	2 815,61	2 672,86	2 939,18	2 582,92	2 305,81
HFCs (1)	NO,NE,NA	1 076,60	2 131,54	703,11	353,60	352,76	703,11	353,60	352,76
PFCs (2.)	NO,NE,NA	3,30	15,29	15,29	15,29	15,29	15,29	15,29	15,29
SF_6 (3)	NO,NE,NA	26,63	79,36	149,97	147,07	144,18	149,97	147,07	144,18
NF_3 (4)	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
Total with LULUCF	60 246,61	87 130,20	59 510,48	34 220,69	25 252,22	20 024,05	29 691,88	12 872,20	3 634,60
Total without LULUCF	59 091,60	85 610,35	63 288,91	42 303,15	34 562,42	30 641,44	38 940,74	23 413,60	15 548,00
Total ETS sectors	NA	36 426,00	25 749,00	12 795,20	10 301,10	9 363,33	11 135,10	7 160,70	3 962,25
Total non-ETS sectors	59 091,60	49 184,00	37 241,50	29 309,20	24 089,30	21 127,54	27 606,80	16 193,10	11 529,32

(1) For base year and 1990: should read NO, NE, NA.
(2) For base year, 1990 and 1995: should read NO, NE, NA.
(3) For base year and 1990: should read NO, NE, NA.
(4) For all time series:should read NO and NA.

With Existing Measures scenario (WEM)

As can be perceived even in an existing policy scenario, there is already a sharp reduction in GHG emissions in the coming decades and there is a cost-effective potential for Portugal to achieve total emission reductions of around 51% in 2005 compared to 2005, up to 60% by 2040 (without LULUCF).

In the transport and mobility sector, profound changes are foreseen, with large penetration of the electric vehicle, which leads to an emission reduction of about 41% in 2030 compared to 2005, and about 60% in 2040.

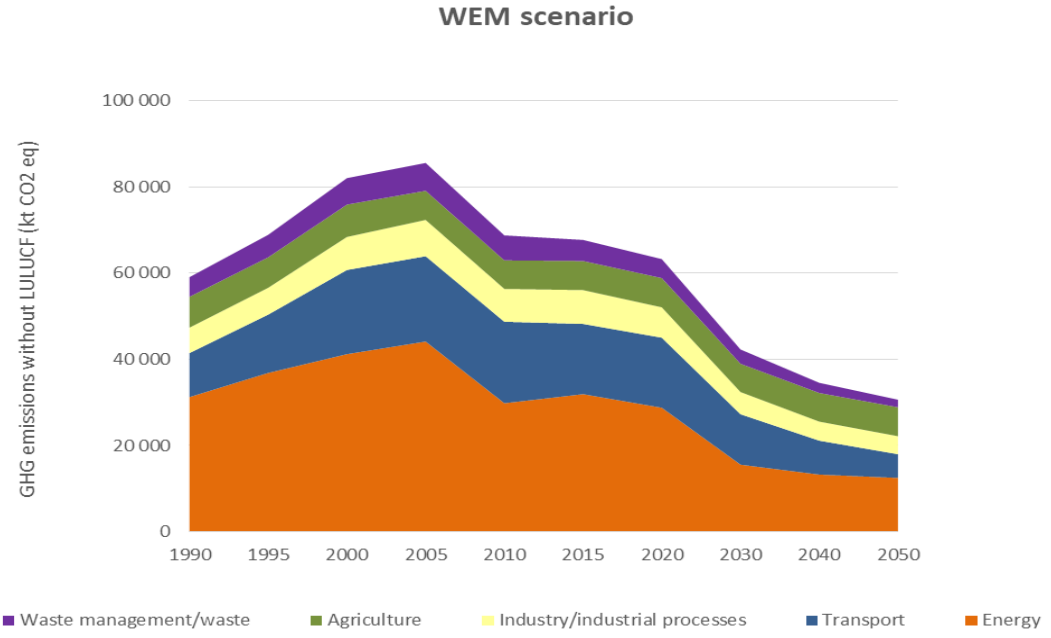
The services and waste sectors also have a strong potential to reduce GHG emissions, contributing with reductions of 62% and 49% respectively in 2030 (and around 73% and 64% respectively in 2040), as a result of the increase energy efficiency and the necessary compliance with the Landfill Directive which restricts disposal to only 10% by 2035. Thus, as far as the waste sector is concerned, the existing policy scenario already presupposes the achievement of the target set in the Landfill Directive. The projections of this sector are identical in both the existing policy scenario and the additional policy scenario.

The residential, industrial and agricultural sectors have a lower decarbonisation potential over this time horizon. Still, the residential sector could contribute with a 23% reduction by 2030 (about 27% by 2040) and the industrial sector by 42% (about 47% by 2040). For the agriculture sector the figures are around 3% reduction in 2030 and considering the effect of agricultural soils and pastures reductions are expected that can reach 22% in that period.

In terms of F-gases, whose relevance in terms of emissions has been increasing in recent years, emission reductions of around 20% by 2030 and 52% by 2040 are expected. As with the waste sector, in the F-gases sector, it is assumed that the targets set in the Kigali Amendment are met, and the projections of this sector are identical both in the existing policy scenario and in the additional policy scenario.

However, for most sectors there is a need to consider a set of additional policy measures in order to pursue a more ambitious low carbon path and achieve carbon neutrality by 2050.

Figure VI.4
Sectorial projections with existing measures scenario (kt CO_{2eq})



With Additional Measures scenario (WAM)

With regards to the additional policy scenario (or neutrality scenario), unlike the previous one, emission restrictions consistent with carbon neutrality were imposed in 2050. This scenario thus allows to assess the additional effort required for each sector so that overall achieve neutrality, not accurately translating a typical scenario of policy impact assessment and planned measures.

There is still a cost-effective potential to reduce GHG emissions more sharply compared to the existing policy scenario, around 55% compared to 2005, rising to 73% by 2040 (without LULUCF), decarbonizing almost entirely electricity production, and strongly reducing emissions from mobility and transport and buildings, over the next two decades (2020-2040).

Thus, the electricity generation sector in an additional policy scenario has in 2030 a GHG emission reduction potential of around 95% compared to 2005, the transport sector by 46% and the building sector by 48% , rising to 98%, 84% and 82% respectively by 2040.

As for the industrial sector, reductions of around 47% in 2030 to 59% in 2040 are expected, due to the expected improvements in process efficiency and the use of less polluting fuels, with the incorporation of more CDR, biomass and electrification of some subsectors. .

The agricultural sector, in this scenario of additional policies could contribute to emission reductions of about 6% in 2030, and considering the effect of agricultural soils and pastures, reductions of up to 36% in this period are expected.

Within the waste and F-gas sectors, and given the assumption, respectively, of meeting the targets set in the Landfill Directive and the Kigali Amendment, the evolution is similar to the scenario with existing policies.
In this context, it is still necessary to reinforce the role of forest sink and other land uses, and effective agroforestry management is a determining factor in achieving the goal of neutrality in 2050.

Figure VI.5
Sectorial projections with additional measures scenario (kt CO_{2eq})

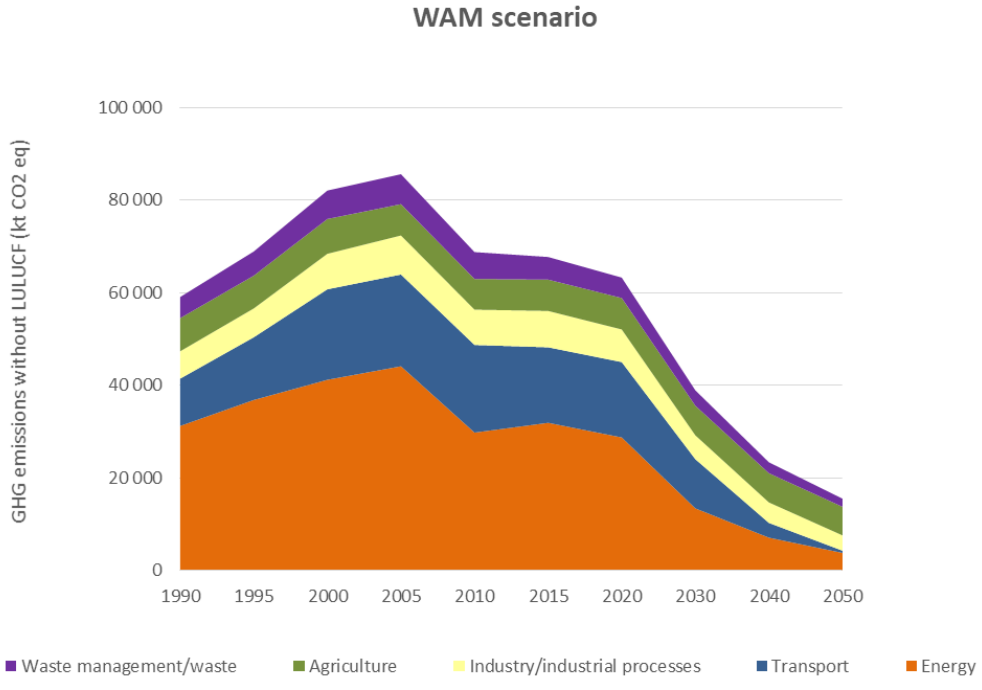
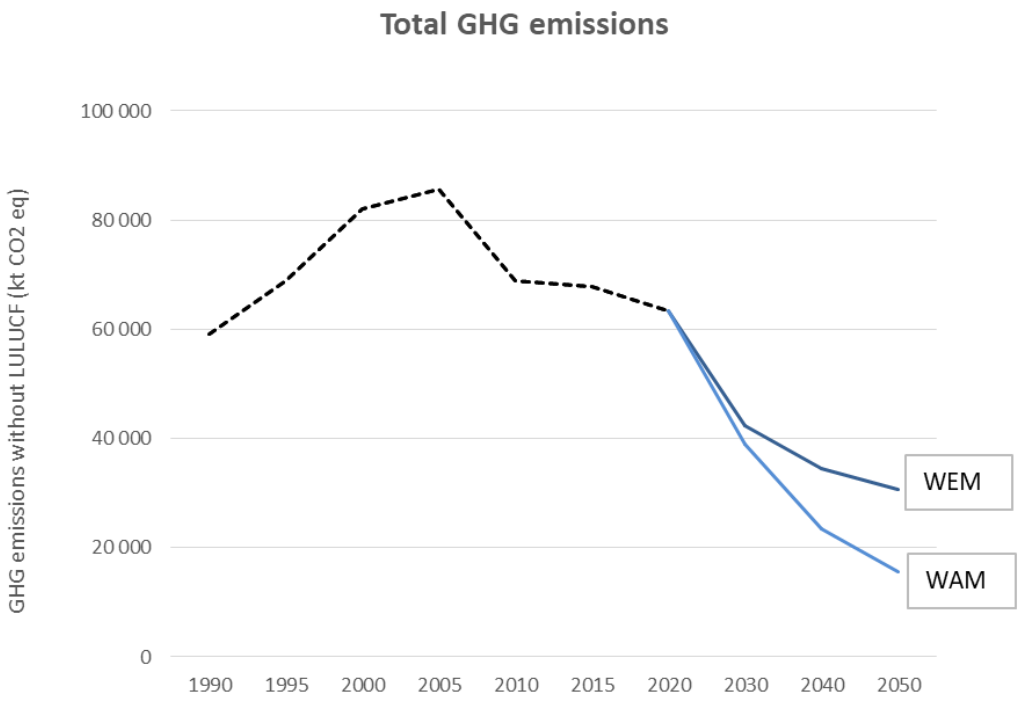


Table VI.2
Potential for GHG emission reductions compared to 2005 (%)

	Potential for GHG emission reductions compared to 2005 (%)					
	Scenario With Existing Measures			Scenario With Additional Measures		
Sector	2030	2040	2050	2030	2040	2050
Energy	-65%	-70%	-72%	-70%	-84%	-91%
Transport	-41%	-60%	-72%	-46%	-84%	-98%
Industry/industrial processes	-39%	-48%	-50%	-39%	-48%	-61%
Agriculture	-3%	-2%	-1%	-6%	-7%	-9%
Waste management/waste	-49%	-64%	-73%	-49%	-64%	-73%
Total without LULUCF	-51%	-60%	-64%	-55%	-73%	-82%

Figure VI.6
Total GHG emissions trajectories (kt CO_{2eq})



This scenario of neutrality also served to inform the new greenhouse gas emission reduction targets set for the 2030, 2040 and 2050 horizon, from -45% to -55% by 2030, -65 % to -75% by 2040, and from -85% to -90% by 2050 compared to 2005, as mentioned above.

The results also indicate that a trajectory that achieves emission reductions of -85% to 90% in 2050 compared to 2005 levels, will induce significant effects on renewables and energy efficiency, very significant final consumption of final energy consumption reaching 85-90% by 2050, in particular in electricity generation and transport which could reach full electrification by 2050 (road and rail) and a significant increase in economy efficiency.

VII. PROVISION OF FINANCIAL, TECHNOLOGICAL AND CAPACITY BUILDING SUPPORT TO DEVELOPING COUNTRY PARTIES

1. General Information

Portugal as an Organisation for Economic Cooperation and Development (OECD) country and OECD/DAC Member, tracks development financing according to the Creditor Reporting System (CRS) directives and provides information on climate financial flows based on the OCDE 'Rio markers' methodology for climate change mitigation and adaptation. Camões – Instituto da Cooperação e da Língua I.P. (Institute for Cooperation and Language), is the coordinating entity for development cooperation, and works with diferent institutions from sectorial ministries to academia, including public and private sectors. In this role Camões, I.P. has the responsibility to coordinate the Portuguese CRS data.

In addition to the Portugal's Official Development Assistance (ODA) data provided by OECD/DAC, and regarding transparency principles and best practices a more detailed and in-depth analysis of the Portuguese ODA (ptODA), could be found in the following webaddress: http://coop.instituto-camoes.pt/bdcoopfrontend.

From a geographical point of view, the ptODA focus mainly in the lusophone developing countries, in particular the Portuguese Speaking African Countries (PALOP) and Timor-Leste, according with the Portuguese Strategic Concept for Development Cooperation 2014-2020. However, and despite the geographical focus mentioned above, new beneficiary countries have been added in the last years, such as in North Africa and Latin America regions.

In Portugal, ODA for environment has had limited expression regarding total values by virtue of the sectorial strategic priorities that essentially lie in areas such as Education, Health, Security and Justice, however considerable efforts have been made in order to curve this trend by strengthening mainstreaming guidelines.

Following the publication of Decree-Law 42-A/2016 of 12th of August which established the Portuguese Environmental Fund (FA), and according to the Order No 538-B/2017 of 5th of January of the Minister of the Environment, the national public entity in charge of managing the Environmental Fund is the Secretariat-General of the currently designated Ministry of the Environment and Climate Action (MAAC).

The majority of Portuguese Cooperation climate related to Programmes, Projects and Actions (PPA) includes capacity building components. Neverthless the CRS does not allow data tracking by component.

1.1. Rio Markers implementation methodology

Portugal, as refered in the introduction, tracks development cooperation financing according to the Creditor Reporting System (CRS) directives.

The OECD/DAC plays a central role on the production of statistics on aid to developing countries from bilateral and multilateral donor agencies on an annual basis. The data is published in the OECD website in both formats: aggregated by partner/donor country and disaggregated by activity. Therefore, all information regarding Portuguese provision of financial support to non-Annex I Parties can be found in the OECD website. The data are publicly available in the CRS database (and also on Camões, I.P. website/statistic ODA).

Climate financial flows are tracked based on Rio markers mitigation and adaptation methodology established by the DAC in close collaboration with the Secretariat of the UNFCCC. The above mentioned aid flows support the implementation of the Convention objectives.

These climate markers (definitions and criteria) allow for an assessment of donor's policy objectives in relation to all range of PPA. A Principal Objective (Mitigation or Adaptation) is identified when promoting the objectives of the UNFCCC as the main reason for undertaking the PPA. When the Program, Project or Activity is marked as "significant" it means other objectives then climate, but contribute also to meet the UNFCCC objectives.

1.2. Cooperation – policies, priorities and programmes in Portugal

As in previous Biennial Reports, Portugal continued to prioritize cooperation activities towards its partner countries, namely the PALOP. However, as mentioned before, new beneficiary countries and regions have been added in the last years.

Portugal has a descentralized model of cooperation, which means a permanent intergovernmental and institutionally collaboration between Camões – Institute for Cooperation and Language, I.P. (under the scope of the Ministry of Foreign Affairs) in the capacity of cooperation for development coordinator entity and the MAAC is responsible for the thematic areas of environment and energy.

The strategic framework and guidelines for development cooperation Programmes, Projects and Actions (PPA) are aligned with the needs and priorities of partner countries. At an institutional level Camões have established a Memorandum of Understanding (MoU) discussed and agreed with partner countries. It should be stressed that it is the partner country that promotes the PPA and presents it to Portuguese Cooperation (PtC) for financing and has to demonstrate how the PPA contribute to meet its specific policies, priorities and strategies. The partner country is responsible for the selection process of the entity that will execute the PPA. In some areas the private sector is better placed to execute them. Therefore, the PtC has kept an open door to the private sector (from beneficiary and/or donor country) engagement working hand in hand with public institutions and/or local communities of the beneficiary/ partner country.

When initiatives or activities include several lusophone countries, the Portuguese Speaking Countries Community (CPLP[24]) Climate Change Network is usually consulted about its interest and relevance. Most of these countries are Least Developed Countries (LDC) and/or Small Island Developing States (SIDS).

2. Finance

2.1. General Information

The ptODA features a regular and strong geographical concentration in the PALOP countries (Portuguese-speaking African Countries) and in Timor-Leste, in line with the geographical priorities set out in the Strategic Concept of Portuguese Cooperation for 2014-2020, which can be found at http://www.instituto-camoes.pt/images/cooperacao/rcm_17_2014.pdf.

In 2017 and 2018, the main beneficiaries of bilateral Climate ODA were, Moçambique, Cabo Verde, Cuba, Guiné-Bissau and Angola (table VII.1). All belonging to the group of the most vulnerable countries (LDC, SIDS and/or in Africa).

Portugal, as a member country of the OECD/DAC, reports ODA finance flows in compliance with the directives of the CRS.

[24] Comunidade de Países de Língua Oficial Portuguesa.

Applying the Rio markers, which include mitigation and adaptation to CC, means the use of a scoring system of three values, according to which the ODA amount reported within the DAC/CRS is screened and marked as:

i. Targeting the Convention as a 'principal' objective (score "2"): when the objective (mitigation or adaptation to CC) is explicitly stated as fundamental in the design of, or the motivation for, the activity, and promoting the objectives of the Convention is thus stated in the activity documentation as one of the principal reasons for undertaking it. In other words, the activity would not have been undertaken that particular way, had it not been for that specific objective.
ii. As a 'significant' objective (score "1"): when the objective (mitigation or adaptation to CC) is explicitly stated but it is not the fundamental driver or motivation for designing or undertaking the activity. The activity has other prime objectives but it has been formulated or adjusted to help meet the relevant climate concerns, particularly in the field of mitigation and adaptation to CC.
iii. Not targeting the objectives of the Convention (score "0"): it means that the activity was examined but found not to target the objective (mitigation or adaptation to CC) in any significant way.

It is therefore on the basis of the methodologies described above that the amounts provided in the tables below are calculated and reported, i.e. the finance flows of ODA which contribute to the objectives of the UNFCCC, in particular for the period reported in the context of this Biennial Report (from 2017 to 2018).

The focus of PtODA are education, health, security and justice, with a view to sustainable development and fight against poverty. However, following the OECD/DAC recommendations, Portugal has sought to develop wherever possible the integration of environmental and CC issues in the activities targeted at other sectors.

In its efforts to strengthen its work on fighting climate change and reinforcing resilience, Portugal is involved, together with other EU Member States, in the implementation of projects in the form of delegated cooperation (on behalf of the EU). In this respect, Portugal has been implementing in Timor-Leste since 2013, together with GIZ and the Ministry of Agriculture the EU support programme for Climate Change, which aims at contributing to the sustainable well-being of rural communities in Timor-Leste and strengthening the capacity of people living in selected sub-districts and vulnerable to climate change to address the effects of climate change through the sustainable management of natural resources and the improvement of their life choices by using local development mechanisms. The beneficiaries are MAF–Timor-Leste and small primary producers (including agricultural livestock husbandry). It should be underlined that the total amount support is 4,0 million Euros and the project finished in 2018. For more information, please consult the web page http://www.gccatl.eu/. Additional financial support information is available in the last EU National Communication.

2.2. Provision of financial resources

In 2017 and 2018, the PALOP'S focus remains and can also be underlined the support given to Cuba in this period. The table VII.1 refers to Bilateral Climate support given per country in 2017 and 2018, which totalized 4 382 724,89 USD. This amount concerns only to the Bilateral PPA which main objective are Climate Change combat, that means score "2". Portugal does not apply yet a coefficient approach complementary to Rio Marker methodology.

Table VII.1

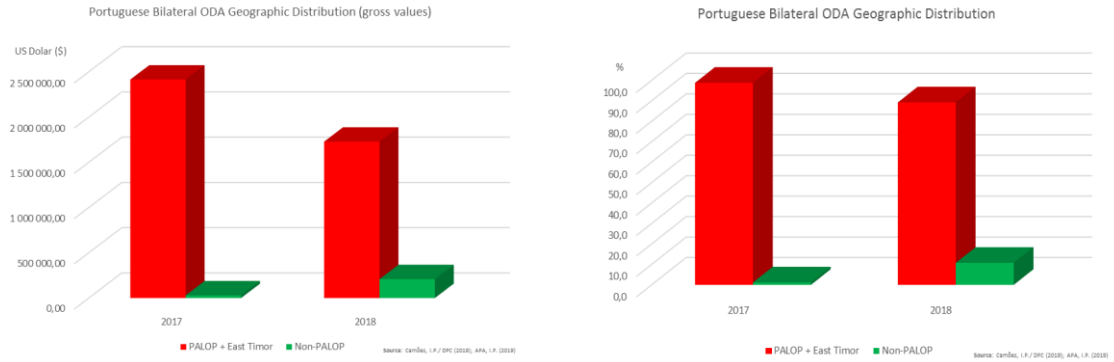
Bilateral cooperation, committed amount per year and per country (principal objective only) in USD[25]

Country	2017	2018
Cabo Verde	496 725,28	781 711,32
Cuba	29 666,33	185 013,57
Angola	0,00	94 095,36
Guiné-Bissau	189 056,48	0,00
Moçambique	1 729 305,60	853 033,16
LDC (not specified)	0,00	24 117,79
Total	**2 444 753,69**	**1 937 971,20**

Source: Camões, I.P./DPC (2019)

It should be noted that in 2017, 98,8% of the total of Portuguese Bilateral ODA falls on PALOP's countries, share decreasing to 89,2% in 2018 (figure VII.1) which is justified by the opening to new geographical areas to support (Cuba).

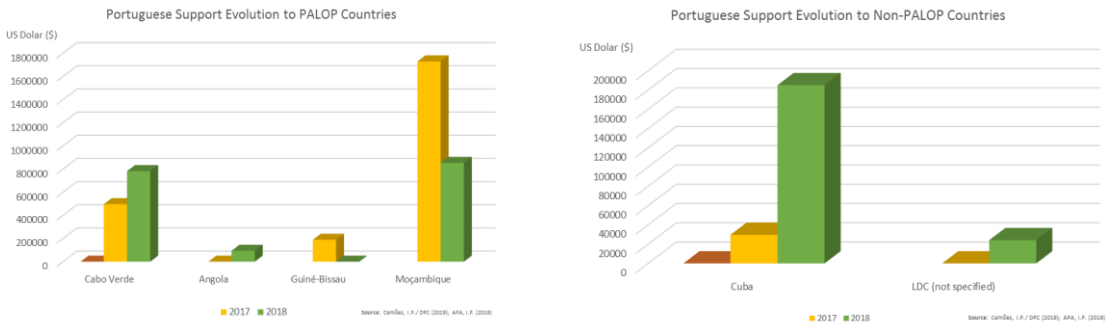
Figure VII.1



In 2017 and 2018, Moçambique and Cabo Verde kept on receiving a significative financial support from ptODA, which flow was reinforced in Cabo Verde.

In 2018, Cuba was the first LDC outside the CPLP's geographic boundaries to be granted with a financial support in matters related to Mitigation and Adaptation to CC (figure VII.2).

Figure Vii.2



[25] Amounts in USD (OECD/DAC exchange rate for 2017 is 0,8871 and for 2018 is 0,8473).

Regarding the Multilateral Cooperation (table 4), the total amount disbursed reached in 2017 the amount of USD 60 742 591,59 largely due to three major transfers to World Bank, African Development Bank and Inter-American Development Bank.

In 2018, the total amount disbursed was USD 40 048 551,87 and this value was distributed by several international organizations, such as: World Bank; African Development Bank; Asian Development Bank; Inter-American Development Bank and Asian Infrastructure Investment Bank.

Table VII.2
Multilateral cooperation, disbursed amount per year

Year	Multilateral financial institutions, including regional development banks	Specialised United Nations bodies	Total
	USD ($)Erro! Marcador não definido.		
2017	60 644 572,20	98 019,39	**60 742 591,59**
2018	39 919 336,72	129 215,15	**40 048 551,87**

Source: Camões, I.P./DPC (2019); APA (2019).

As agreed in the context of the OECD/DAC, it is up to the multilateral financial institutions themselves to apply the system of Rio markers to the amounts of multilateral ODA and to inform OECD/DAC by reporting the activities undertaken (CRS). On the basis of that report and the core multilateral contributions, the OECD/DAC allocates annually to each donor country the part corresponding to activities related to climate.

As regards contributions to the Global Environment Facility (GEF), Portugal has not formalised any commitment aimed at its potential participation in the replenishment of this facility since 2010.

Regarding the resources effectively addressed to the needs of non-Annex I Parties with regard to climate change adaptation and mitigation, it should be highlighted that all the PPA financed by Portuguese Cooperation are proposed by the partner countries which are also entirely responsible for their design. It should be stressed that it is the partner country that promotes the PPA and presents it to Portuguese Cooperation (PtC) for financing and has to demonstrate that and how the PPA contribute to meet its specific policies, priorities and strategies.

2.3. Mitigation

Regarding the bilateral projects that had Mitigation to CC as a Principal Objective, this represents 64,4% in 2017 and 38,5% in 2018 of the total related ODA (table VII.4), which implies a total decrease of USD 768 606, 38.

Table VII.4
Climate change related ODA - Mitigation

YEAR		SIGNIFICANT OBJECTIVE	PRINCIPAL OBJECTIVE	BILATERAL ODA TOTAL
2017	USDERRO! MARCADOR NÃO DEFINIDO.	767 200,99	1 385 145,98	2 152 346,97
	%	35,6	64,4	100,0
2018	USDERRO! MARCADOR NÃO DEFINIDO.	986 618,67	616 539,60	1 603 158,27
	%	61,5	38,5	100,0

[26]

Source: Camões, I.P./GPPE (2019)

[26] Committed. Only Principal Objective.

2.4. Adaptation

In general, Portugal has been paying particular attention to Adaptation to CC, specially its mainstreaming into Development Cooperation (DC), thus seeking to follow international guidelines.

Regarding the bilateral projects that had Adaptation to CC as a Principal Objective, this represents 27,5% in 2017 and 33,7% in 2018 of the total related ODA (table VII.5), which implies a total increase of USD 261 823,90.

Table VII.5
0Climate change related ODA – Adaptation

Year		Significant objective	Principal objective	Bilateral ODA total
2017	USD Erro! Marcador não definido.	2 798 322,62	1 059 607,71	3 857 930,33
	%	72,5	27,5	100,0
2018	USD Erro! Marcador não definido.	2 718 191,90	1 321 431,61	4 039 623,51
	%	67,3	33,7	100,0

Source: Camões, I.P./GPPE (2019) ; APA (2019).

2.5 Provision of new and additional resources

As a EU Member State, Portugal made the commitment to mobilise 0.15% to 0.20% of its GNI as ODA allocated to LDC by 2030. It also endorsed the commitment derived from the 2014 ministerial-level meeting of the Development Assistance Committee (OECD/DAC) to focus the support from member countries on countries most in need (which includes Fragile States, LDC and SIDS).

In the absence of an international definition accepted by all Parties of 'new and additional' financing, Portugal considers FA as an additional financial resource compared with conventional ODA. Although mainly focused at environmental domestic level, the FA can also support environmental cooperation for development PPA, in particular climate action aiming to support *"the shift towards a low-carbon competitive economy through funding or co-funding of measures which contribute to meeting the commitments of the Portuguese State under the Kyoto Protocol and other international and Community commitments in the field of climate change"*.

Following the publication of Decree-Law 42-A/ 2016 of 12th of August which constitutes the Environmental Fund (FA), this financial instrument main purpose is to support environmental policies for the pursuit of sustainable development objectives, contributing to the achievement of national and international objectives and commitments, in particular those related to CC, water resources, waste and nature conservation, and biodiversity, financing entities, activities or projects that fulfill the following objectives:

- Mitigation of CC through actions that contribute to the reduction of GHG's emissions and achieve of targets, particularly in the field of renewables and energy efficiency in the residential sectors and productive in the case of small and medium-sized enterprises, and in the field of transport;
- Adaptation to CC, specially with actions in the coastal zone and other water resources areas;
- Cooperation in the field of CC, in particular for the fulfillment of international commitments;
- Carbon sequestration;
- Use of the carbon market to meet international goals;
- Promoting the participation of entities in the carbon market;
- Efficient use of water and protection of water resources;

- Sustainability of water services;
- Prevention and redress of environmental damages;
- Compliance with national and community objectives and targets for urban waste management;
- Transition to a circular economy;
- Protection and conservation of nature and biodiversity;
- Environmental awareness and training.

Currently and according to national legislation, all the PPA financed by FA that should account as ODA must have previous favorable appraisal and approval by Camões, I.P. as cooperation for development coordinatour entity.

Bearing in mind that financing ODA projects is not a core objective of the FA, Portugal considers that all financing provided by this fund to activities that aim to promote the economic development and welfare of developing countries is new and additional to the conventional sources of ODA (tables VII.6 and VII.7).

Table VII.6

NEW AND ADDITIONAL FINANCIAL RESOURCES (MITIGATION)*				
Source of Flows	*Amount Commited*			
	2017		2018	
	USD Erro! Marcador não definido.	%	USD Erro! Marcador não definido.	%
Total ODA/CLIMA Disbursed	1 385 145,98	100,0	616 539,60	100,0
Of which, disbursements from the Portuguese Environmental Fund (new and additional)	**1 332 827,19**	96,2	**568 425,59**	92,2

*Only Principal Objective was considered. **Source:** Camões, I.P./ GPPE (2019)

Table VII.7

NEW AND ADDITIONAL FINANCIAL RESOURCES (ADAPTATION)*				
Source of Flows	*Amount Commited*			
	2017		2018	
	USD Erro! Marcador não definido.	%	USD Erro! Marcador não definido.	%
Total ODA/CLIMA Disbursed	1 059 607,71	100,0	1 321 431,61	100,0
Of which, disbursements from the Portuguese Environmental Fund (new and additional)	**771 311,01**	72,8	**970 684,53**	73,5

*Only Principal Objective was considered. **Source:** Camões, I.P./ GPPE (2019)

Regarding information on tables VII.6 and VII.7 the difference between the total climate financing flows disbursed and the ones disbursed by the Environmental Fund is considered conventional ODA.

In addition to the information already mentioned on this report, it should be highlighted that all the PPA financed by Portuguese Cooperation are proposed by the partner countries which are also entirely responsible for their design. As donor, PT appraise the PPA proposals taking into account their relevance, efficiency, problems addressed, viability, sustainability, results, accountability and also the adequacy of the technologies supposed to be developed and/or transferred, as well as capacity building components and also the indicators for monitoring and evaluation.

Table VII.8 shows some examples of financial assistance projects under FA management:

Table VII.8
Examples of Support Through the Environmental Fund

Programme or project title	Recipient country/ region	Targeted area	Description of programme or project
Community Action Plan for Adaptation in Mozambique – PACA (ex-IPPALAM) – Moçambique	Moçambique	Adaptation	Funded to date by the Ministry of the Environment (through the Portuguese Carbon Fund, currently Environmental Fund), this project aims to increase resilience to the impacts of CC in 9 Mozambican locations, through the implementation of adaptation measures.
Roadmap of waste in Cape Verde	Cape Verde	Mitigation	Funded to date by the Ministry of the Environment (through the Portuguese Carbon Fund, currently Environmental Fund), this project aims to map the technologies, locations, methods of collection and to define training actions and the necessary legislative framework in the waste setor for future implementation of projects regarding the reduction of Emissions of Greenhouse Gases (GHGs). The project's promoter is the National Water and Sanitation Agency (ANAS) of Cabo Verde and the executor is the consortium led by the Portuguese company Ecovisão, which also includes the public company Águas de Portugal and the Portuguese NGO TESE.

3. Technology Transfer

Concerning technology transfer (table VII.9) and considering the definition formally accepted in the UNFCCC, particularly item c, paragraphs 1 and 5 of Article 4, in several cases a PPA being implemented by the PtC under the context of ODA involves technology transfer, in terms of practices and appropriate processes to each area of the PPA as well as the necessary knowledge to implement these technologies.

Notwithstanding, it becomes difficult to specify a case due to the policy of statistical report of the OECD/ DAC that currently does not foresee a marker for the transfer of technology that allows the qualification of the PPA in this perspective or to specifically identify the technology or technologies transferred in each case. Currently in order to overcame this constrain, PT is considering ways to address the systematic collection of data regarding technology transfer.

Portuguese cooperative action in the context of tackling CC has increased significantly since the establishment (in 2005) of CPLP countries' Network for Climate Change, which seeks the development and implementation of actions in the areas of capacity building, exchange of experiences and best pratices among these countries. In this context, the MAAC started the promotion of some activities and projects which focused on the transfer of know–how, processes and technology to these countries, in different sectors and aligned with the strategic vision for PtC.

In terms of technology transfer, the following projects are highlighted:

Table VII.9

Description of projects or programmes promoting practical steps to facilitate and/or finance access to technology transfer.

Programme/project title: Installation of photovoltaic System in 50 towns			
Objective: Promote the access to renewable energy.			
Beneficiary	**Sector**	**Total Funding**	**Duration**
Moçambique	Energy	373 272,46 USD[27]	2010-2017
Description: Provide 50 remote villages in all provinces with photovoltaic solar systems in schools and health centers and associated housing that will allow basic access to electric energy that allows not only lighting but also refrigerators for vaccines and water pumping systems, allowing access to health and education of the populations without these resources. Installation of two solar water heating systems in two pilot health centers for future replication. This project is financed by the Portuguese Ministry of the Environment through the Portuguese Carbon Fund and is promoted by the Mozambican Energy Fund (FUNAE) and has the company Selfenergy as the executor.			
Developed technology: photovoltaic panels			
Impact of GHG emissions: The system does not include an emissions monitoring system.			

Programme/project title: Mini Sewage treatment plant of Palmerejo			
Objective: Sensitization, information and education of the population for the reuse of effluents, as a possibility to minimize the problems associated with water scarcity.			
Beneficiary	**Sector**	**Total Funding**	**Duration**
Cabo Verde	Water Resources Conservation	97 195,36 USD	2017-2018
Description: Sensitization, information and education of the population for the reuse of effluents, as a possibility to minimize the problems associated with water scarcity in Cape Verde.			
Developed technology: Menbrane Biological Reactor			
Impact of GHG emissions: The system does not include an emissions monitoring system.			

Programme/project title: Bioenergy – Local energy production from biomass (Cuba)			
Objective: Promote the access to renewable energy.			
Beneficiary	**Sector**	**Total Funding**	**Duration**
Cuba	Energy	160.337,66 USD[28]	2016-2018
Description: Improve the living conditions of the population by providing clean energy to communities; Promote capacity building of the local community (community associations) and access to information; Promotion dissemination of results.			
Developed technology: Anaerobic digestion			
Impact of GHG emissions: The system does not include an emissions monitoring system.			

Regarding the support for the development and enhancement of the endogenous capacities and technologies of non-Annex I Parties, it should be highlighted that all the PPA financed by Portuguese Cooperation are proposed by the partner countries which are also entirely responsible for their design. It should be stressed that it is the partner country that promotes the PPA and presents it to Portuguese Cooperation (PtC) for financing and has to demonstrate that and how the PPA contribute to meet its specific policies, priorities and strategies.

4. Capacity Building

In general, the PPAs supported by the Portuguese cooperation have a strong component of technical assistance targeted at national capacity-building. It is endeavoured to give special attention to the implementation of the aid effectiveness principles enshrined in the Paris Declarations and developed in Accra and Busan, mainly: leadership and control by beneficiaries so that they can strategically allocate their

[27] Financial support disbursed in 2017.

[28] Financial support disbursed in 2017 and 2018.

resources; to enhance existing capacities as a starting point, avoiding the creation of parallel structures and using national systems in a systematic manner to implement aid; technical cooperation driven by partner demand.

The area of climate change is no exception to this, with some projects being even exclusively dedicated to institutional capacity-building, which are shown in BR-CTF table 8. This applies to the PPAs exclusively dedicated to this subject as well as to the inclusion of a capacity-building component in the different PPAs as an effort to adapt them to a demand for change, to the beneficiary institutions and to the potentialities and weaknesses of existing national systems in beneficiary countries, so as to build capacities of independent problem-solving, which is the case of the following projects:

- Training and capacity building project of the Cabo Verde National Water and Sanitation Agency
- National Plan for Support of Urban Sanitation in the perspective of Reducing Emissions and Climate Change Adaption - PLASU-AC (Moçambique)
- Roadmap of waste in Cabo Verde
- Measures to strengthen water availability and increase the resilience of water supply systems under climate change (Moçambique).

In particular with regard to cooperation projects in the field of CC, Portugal intends for partners to lead and control, and often uses national systems for the implementation of aid.

Regarding the approach and methodologies used to track support capacity-building provided to non-Annex I Parties, as donor PT appraises the PPA proposals taking into account their relevance, efficiency, problems addressed, viability, sustainability, results, accountability and also the adequacy of the technologies supposed to be developed and/or transferred, as well as capacity building components and also the indicators for monitoring and evaluation.

Annex A: CTF tables, as submmited to UNFCCC portal

Table 1s1	Emission trends: summary
Table 1s2	Emission trends: summary
Table 1s3	Emission trends: summary
Table 1(a)s1	Emission trends CO2
Table 1(a)s2	Emission trends CO2
Table 1(a)s3	Emission trends CO2
Table 1(b)s1	Emission trends CH4
Table 1(b)s2	Emission trends CH4
Table 1(b)s3	Emission trends CH4
Table 1(c)s1	Emission trends N2O
Table 1(c)s2	Emission trends N2O
Table 1(c)s3	Emission trends N2O
Table 1(d)s1	Emission trends HFCs, PFCs Y SF6
Table 1(d)s2	Emission trends HFCs, PFCs Y SF6
Table 1(d)s3	Emission trends HFCs, PFCs Y SF6
Table 2(a)	Description of quantified economy-wide emission reduction target: base year
Table 2(b)	Description of quantified economy-wide emission reduction target: gases and sectors covered
Table 2(c)	Description of quantified economy-wide emission reduction target: global warming potential values (GWP)
Table 2(d)	Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF sector
Table 2(e)I	Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention
Table 2(e)II	Description of quantified economy-wide emission reduction target: other market-based mechanisms
Table 2(f)	Description of quantified economy-wide emission reduction target: any other information
Table 3	Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects
Table 4	Reporting on progressa, b
Table 4(a)_2017	Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 2017
Table 4(a)_2018	Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 2018
Table 4(a)II	No data was imported from KP-LULUCF CRF table 10 from the latest official GHG inventory submission.
Table 4(b)	Reporting on progress
Table 5	Summary of key variables and assumptions used in the projections analysis
Table 6(a)	Information on updated greenhouse gas projections under a 'with measures' scenario
Table 6(b)	GHG projections: Scenario 'without measures' was not included.
Table 6(c)	Information on updated greenhouse gas projections under a 'with additional measures' scenario
Table 7 2017	Provision of public financial support: summary information in 2017
Table 7 2018	Provision of public financial support: summary information in 2018

Table 7(a) 2017	Provision of public financial support: contribution through multilateral channels in 2017
Table 7(a) 2018	Provision of public financial support: contribution through multilateral channels in 2018
Table 7(b) 2017	Provision of public financial support: contribution through bilateral, regional and other channels in 2017
Table 7(b) 2018	Provision of public financial support: contribution through bilateral, regional and other channels in 2018
Table 8	Provision of technology development and transfer support
Table 9	Provision of capacity-building support