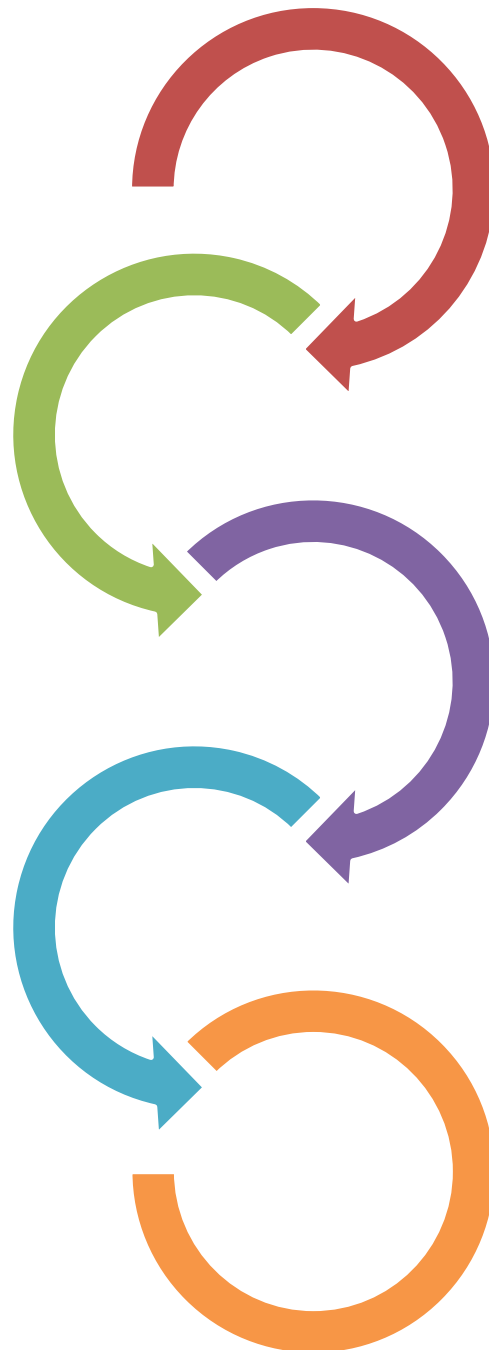


Cyprus' Fourth Biennial Report to the UNFCCC



Republic of Cyprus

Ministry of Agriculture, Rural Development and Environment
Department of Environment

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1.Introduction

This report constitutes the Fourth Biennial Report of Cyprus, as required under Article 18(1) of Regulation (EU) No 525/2013 and Decision 2/CP.17 of the Conference of the Parties under the United Nations Framework Convention on Climate Change (UNFCCC). Cyprus' Fourth Biennial Report includes information on greenhouse gas emissions and trends, on the progress made in achieving its quantified economy wide emission reduction target under the UNFCCC, and on policies and measures in place to meet mitigation targets and promote climate change adaptation.

The greenhouse gas emissions of Cyprus have an increasing trend since 1990 with an average rate of 3%, following the improvement of the economy. The greenhouse gas emissions' inventory system has not changed since the last biennial submission.

2. Greenhouse gas emissions and trends

This Section summarises information on Cyprus' historical greenhouse gas (GHG) emissions since 1990. The GHG emission data presented in this Biennial Report is consistent with the GHG emissions reported by the EU to the UNFCCC Secretariat in 2019¹, and correspond to the totals in the CRF tables under the UNFCCC.

Geographical coverage

Cyprus submits an inventory for the areas of the Republic of Cyprus that are under the effective control of the Republic of Cyprus. There have been no changes in geographical coverage compared to Cyprus' Fourth Biennial Report (4BR). The time series considered is 1990 to 2017.

Sectoral scope

The sectoral scope of the emissions in this Report is aligned with the reporting requirements under the Convention², unless stated. Indirect emissions of CO₂ are included in all the emission data quoted in this Report. International aviation emissions are not included in the totals, unless otherwise indicated.

2.1. Summary information on GHG emission trends

At the time the BR4 was prepared and submitted, NIR2020 was not yet ready. Therefore, the inventory that was used for the preparation of the BR4 was the 2019 re-submission to the UNFCCC after the ERT review, which was approved and submitted to the UNFCCC on 25th of October 2019³. The emission data presented here is based on Cyprus' national greenhouse gas inventory covering the period 1990 to 2017. The inventory is in line with the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention (Decision 24/CP.19) and with Regulation (EU) No 525/2013.

¹ <https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2019>

² UNFCCC, 2013 <http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=2>

³ <https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2019>

2.1.1. Trends in total GHG emissions

Cyprus' emissions during the period 1990-2017 increased by 58% excluding land use, land-use change and forestry (LULUCF) (Table 1 and Figure 1). Emissions per capita increased by 7% for the same period, from 9.6 t/capita, to 10.2 t/capita, while it is important to note that there was peak in 2007 of 12.7 t/capita (Figure 1). The significant drop noticed after 2008 is mainly due to the economic crisis and increase of production of energy from renewable sources. This decrease however is counterbalanced by the CO₂ emissions from road transport and hydrofluorocarbons (HFC) emissions from consumption of halocarbons which increased considerably between 1990 and 2017.

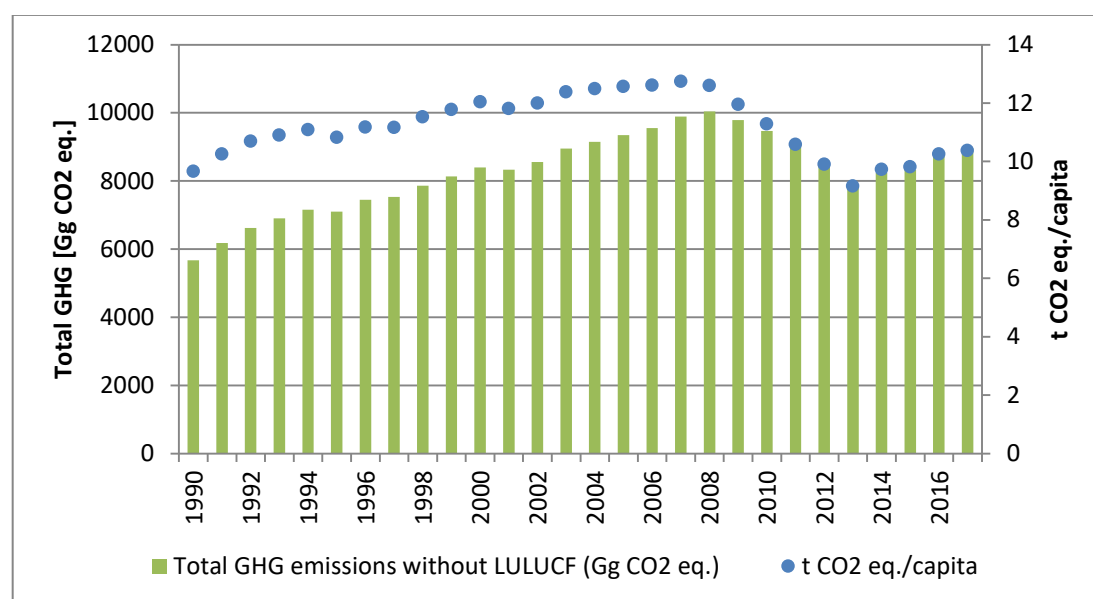


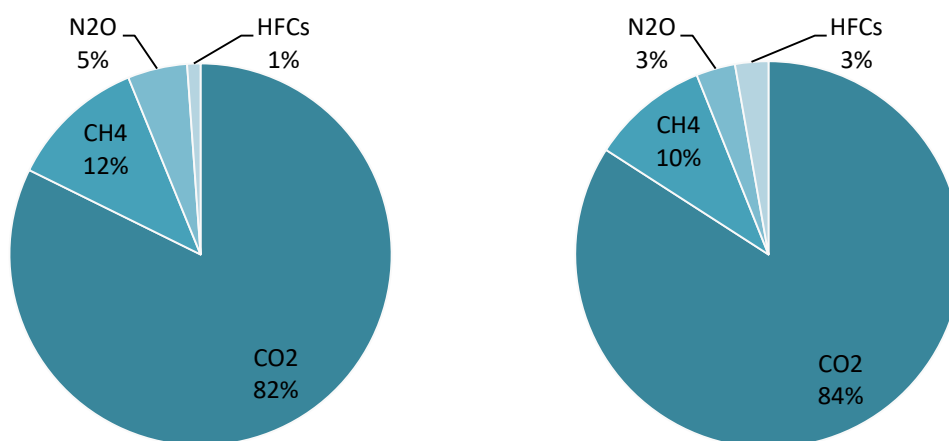
Figure 1. Trend of total GHG emissions without LULUCF and emissions per capita

Table 1. Cyprus' total GHG emissions during the period 1990-2017

Gg CO ₂ eq.	1990	1991	1992	1993	1994	1995	1996	1997
Without LULUCF	5669	6184	6618	6901	7155	7099	7446	7537
With LULUCF	5418	5936	6363	6629	6899	6822	7162	7282
	1998	1999	2000	2001	2002	2003	2004	2005
Without LULUCF	7866	8135	8394	8334	8560	8950	9152	9344
With LULUCF	7685	7776	8463	8148	8223	8598	8804	8967
	2006	2007	2008	2009	2010	2011	2012	2013
Without LULUCF	9554	9893	10041	9789	9473	9117	8577	7860
With LULUCF	9102	9685	9529	9247	8985	8552	8032	7280
	2014	2015	2016	2017				
Without LULUCF	8234	8321	8759	8963				
With LULUCF	7657	7748	8835	8429				

2.1.2. Trends in emissions by gas

Table 2 gives an overview of the main trends in GHG emissions and removals for 1990 to 2017 in Cyprus. The most important GHG by far is CO₂, accounting for 84.1% of total emissions in 2017, excluding LULUCF (see Figure 2). In 2017, CO₂ emissions without LULUCF were 8,429.2 thousand tonnes, which was 58.1% above 1990 levels.



1990: 5669 Gg CO2 eq.

2017: 8963 Gg CO2 eq.

Figure 2. Percentage of total 1990 and 2017 emissions by gas (as CO2 equivalent), excluding LULUCF

Table 2. Trends in emissions by gas 1990-2017

Gg CO2 eq.	1990	1995	2000	2005	2010	2015	2016	2017	1990-2017 (%)
CO ₂ without LULUCF	4665.61	5889.45	7140.26	8021.49	8082.33	6956.59	7362.10	7538.49	61.61
CO ₂ with LULUCF	4413.35	5611.89	7199.52	7644.20	7592.29	6383.92	7421.65	7003.97	58.70
CH ₄ without LULUCF	654.58	744.37	787.63	815.04	826.97	833.03	863.76	881.96	34.74
CH ₄ with LULUCF	654.63	744.78	794.83	815.25	828.10	833.18	875.77	882.35	34.78
N ₂ O without LULUCF	285.75	373.29	345.44	313.36	318.08	280.48	287.82	293.05	2.56
N ₂ O with LULUCF	285.77	373.44	347.96	313.43	318.47	280.53	292.03	293.19	2.60
HFCs	63.88	91.92	120.21	194.12	245.65	250.45	245.28	249.56	290.65
PFCs	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	0.00
SF ₆	0.03	0.06	0.08	0.12	0.15	0.16	0.17	0.17	541.56
NF ₃	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Total (without LULUCF)	5668.85	7099.09	8393.62	9344.12	9473.17	8320.73	8759.13	8963.24	58.11
Total (with LULUCF)	5417.66	6822.09	8462.60	8967.11	8984.65	7748.25	8834.89	8429.23	55.59

2.1.3. Trends in GHG emissions from main source and sink categories

Table 3 gives an overview of GHG emissions in the main source categories for 1990 to 2017. The most important sector by far is energy (which includes emissions from combustion and fugitive sources), accounting for 73.8% of total emissions in 2017, excluding LULUCF. During the same year, in the energy sector, 50% of the emissions come from the Energy industries

and 32% come from transport. Industrial activities and other product use (IPPU), agriculture and waste contribute 14.2%, 5.5% and 6.5% respectively.

Table 3. Trends in GHG emissions from main source and sink categories

Gg CO2 eq.	1990	1995	2000	2005	2010	2015	2016	2017	1990-2017 (%)
1. Energy	3969.76	5132.14	6376.29	7136.00	7495.37	6080.77	6480.13	6619.35	66.74
2. IPPU	841.14	956.68	997.87	1178.66	933.62	1221.35	1225.40	1269.52	50.93
3. Agriculture	471.23	580.14	552.35	532.98	531.62	457.27	481.54	494.73	4.99
4. LULUCF	-251.19	-277.01	68.99	-377.01	-488.52	-572.48	75.76	-534.01	112.59
5. Waste	386.73	430.14	467.10	496.47	512.56	561.33	572.06	579.64	49.88
6. Other	0	0	0	0	0	0	0	0	0
Total (without LULUCF)	5668.85	7099.09	8393.62	9344.12	9473.17	8320.73	8759.13	8963.24	58.11
Total (with LULUCF)	5417.66	6822.09	8462.60	8967.11	8984.65	7748.25	8834.89	8429.23	55.59

2.2. Summary information on national inventory arrangements

Details on the national inventory arrangements are available in section 1.2 (page 28) of the National GHG Inventory Report 2019⁴.

2.2.1. Institutional, legal and procedural arrangements

The Department of Environment of the Ministry of Agriculture, Rural Development and Environment (DoE), is the governmental body responsible for the development and implementation of environmental and climate policy in Cyprus, as well as for the provision of information concerning the state of the environment in Cyprus in compliance with relevant requirements defined in international conventions, protocols and agreements. Moreover, the DoE is responsible for the co-ordination of all involved ministries, as well as any relevant public or private organisation, in relation to the implementation of the provisions of the Kyoto Protocol, according to the Law 29(III)/2009 with which Cyprus ratified the Kyoto Protocol.

In this context, the DoE has the overall responsibility for the national GHG inventory, and the official consideration and approval of the inventory prior to its submission (Contact person: Dr. Nicoletta Kythreotou⁵). Figure 3 provides an overview of the organisational structure of the National Inventory System. The entities participating in the National Inventory System are: (a) the DoE designated as the national entity responsible for the national inventory, which keeps the overall responsibility, and an active role in the inventory planning, preparation and management, including technical and scientific responsibility for the compilation of the annual inventory⁶; (b) governmental ministries and agencies through their

⁴ Available at <https://unfccc.int/sites/default/files/resource/cyp-2019-nir-15%20May19.zip>

⁵ Dr. Nicoletta Kythreotou, Environment Officer A', Department of Environment, Ministry of Agriculture, Rural Development and Environment, Offices' address: 20-22 28th Oktovriou Ave., Engomi, 2414, Nicosia, Cyprus, Postal address: Department of Environment, 1498 Nicosia, Cyprus, Tel. +357 22 408 947, Fax. +357 22 774 945, www.moa.gov.cy/environment

⁶ For 2017, there is a contract with an external expert for scientific and technical support to the inventory team of the DoE and the QA of the GHG inventory. As of 2018, according to the Council of

appointed focal persons, ensure the data provision. International or national associations, along with individual public or private industrial companies contribute to data providing and development of methodological issues as appropriate.

The legal framework defining the roles-responsibilities and the co-operation between the DoE Inventory team and the designated contact points of the competent Ministries was formalized by Council of Ministers' Decision adopted 15/11/2017 entitled "Structure and operation of the National Greenhouse Gases Inventory System - Roles and Responsibilities". The above-mentioned Decision includes a description of each entity's responsibilities, concerning the inventory preparation, data providing or other relative information. This formal framework has improved the collaboration between the entities involved, assuring the timely collection and quality of the activity data required and solving data access restriction problems raised due to confidentiality issues.

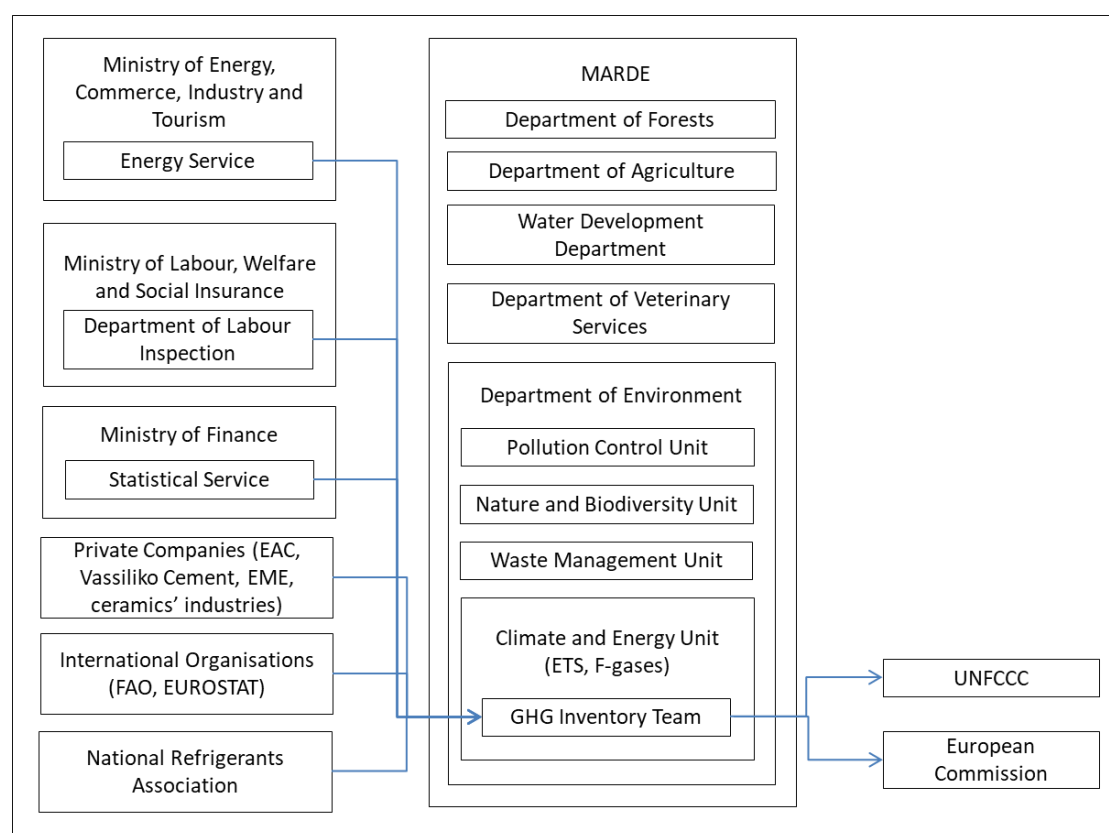


Figure 3. Overview of the organisational structure of the National Inventory System

2.2.2. Overview of inventory planning, preparation and management

The preparation of Cyprus' GHG emissions inventory is primarily based on the application of the 2006 IPCC Guidelines.

Ministers' Decision of 15/11/2017, the technical and scientific responsibility for the compilation of the annual inventory for all sectors will be assigned, on a contract basis, to an independent consultant by DoE.

The preparation of the Cyprus' GHG emissions inventory is the responsibility of the Climate Action Unit of the Department of Environment of the Ministry of Agriculture, Rural Development and Environment.

The preparation of the Cyprus' GHG emissions inventory is based on the application of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The compilation of the inventory is completed in three main stages (Figure 4).

- Stage 1: The first stage consists of data collection and checks for all source / sink categories. The main data sources used are the National Statistical Service, the national energy balance, the government ministries / agencies involved, along with the verified reports from installations under the EU ETS. Quality control of activity data include the comparison of the same or similar data from alternative data sources (e.g. National Statistical Service, EU ETS reports and energy balance) as well as time-series assessment in order to identify changes that cannot be explained. In cases where problems and / or inconsistencies are identified, the agency's representative, responsible for data providing, is called to explain the inconsistency and / or help solving the problem.
- Stage 2: Once the reliability of input data is checked and certified, emissions / removals per source / sink category are estimated. Emissions estimates are then transformed to the format required by the CRF Reporter. This stage also includes the evaluation of the emission factors used and the assessment of the consistency of the methodologies applied in relation to the provisions of the IPCC Guidelines, the IPCC Good Practice Guidance and the LULUCF Good Practice Guidance. Quality control checks, when at this stage, are related to time-series assessment as well as to the identification and correction of any errors / gaps while estimating emissions / removals and entering the data in the CRF Reporter.
- Stage 3: The last stage involves the compilation of the NIR and its internal check. During this period, the Inventory Team has to revise the report according to the observations and recommendations of the QA. On the basis of this interaction process, the final version of the report is compiled. The Director of the Department of Environment approves the inventory and then the contact points submit the NIR to the European Commission for compliance with Regulation (EU) No 525/2013 and thereafter to the UNFCCC secretariat.

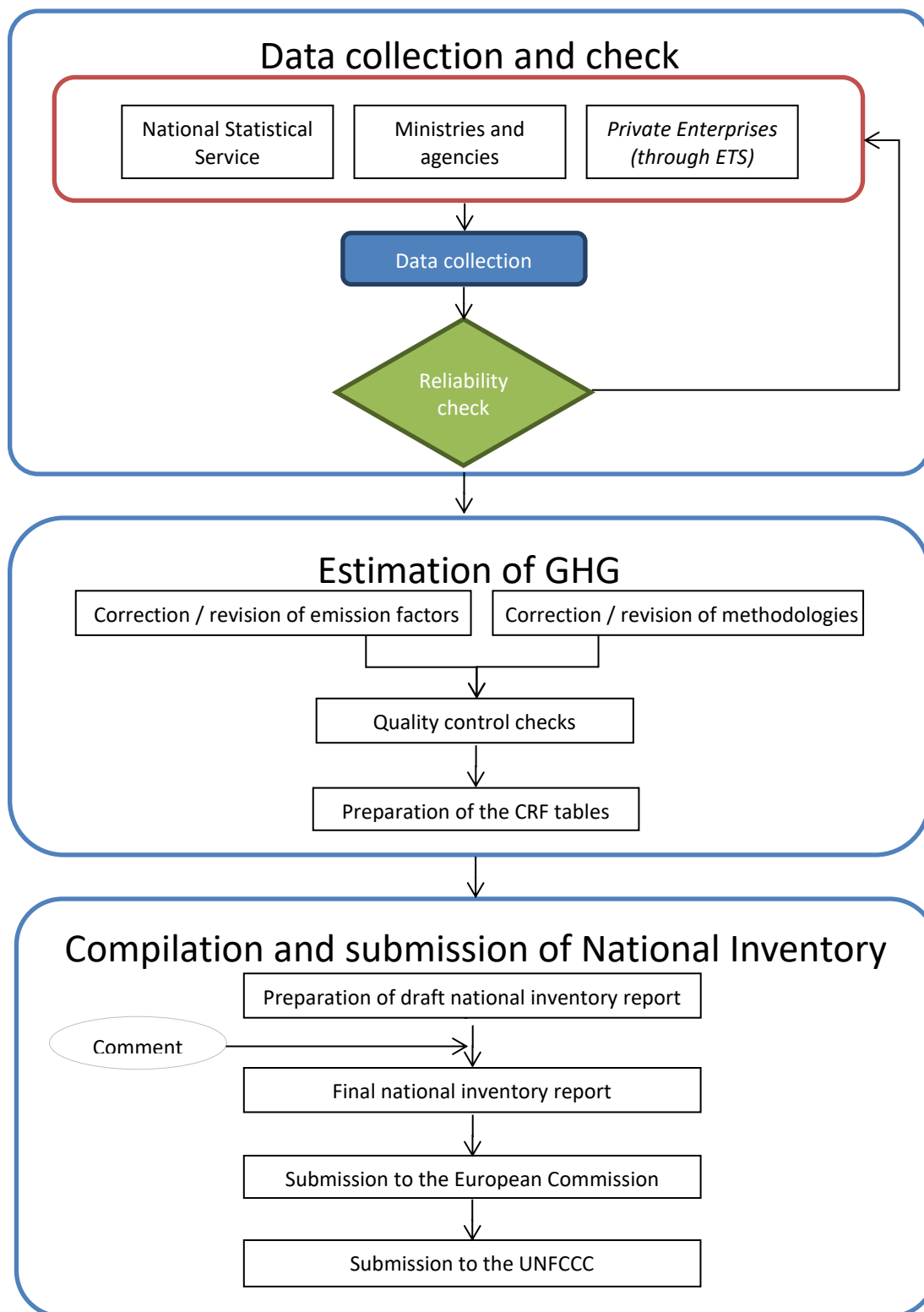


Figure 4. GHG emissions inventory preparation process in Cyprus

As shown in the timetable (Figure 5), the government ministries and agencies and the individual private or public industrial companies referred previously should have collected and delivered to the Inventory Team⁷ the respective activity data needed for the inventory (for year X-2) and any changes in activity data for the period 1990 to year X-2, within the time period of May to November of year X-1 (X is the submission year of CRF tables and NIR referred to X-2 GHG emissions inventory).

The information that is related to the annual GHG emissions inventory (activity data, emission factors, analytic results, compilation in the required analysis level of the CRF tables) is stored in MS Excel spreadsheets. Moreover, the final results (NIR and CRF tables) are available in the DoE website⁸.

DELIVERABLES														
	Year X-1										Year X			
	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	
ACTIVITIES	Data collection & check													
	Estimation of emissions & check													
	CRF tables compilation													
	National Inventory Report compilation & check													
	Official approval													
	Preparation of Centralised Inventory File													

Figure 5. Timetable for inventory preparation

2.2.3. Quality assurance, quality control and verification plan

A QA/QC plan is an internal document to organise and implement all activities across all of the emissions inventory activities including:

- stakeholder engagement (stakeholders = e.g. suppliers of data, reviewers, recipients, other inventory compiling institutes (e.g. NFR))
- data collection
- data management
- inventory compilation
- consolidating the inventory estimates (e.g. into a single national database)
- reporting.

The QA/QC plan is a fundamental element of an inventory management system. The plan needs to clearly identify all important activities used by the inventory compiler and ensure that the minimum data quality objectives required under any relevant reporting obligations are met.

The development and the implementation of an inventory QA/QC plan represents a key tool for meeting the objectives of National Systems under Article 5 Paragraph 1 of the Protocol as

⁷ and the technical consultants (in the future)

⁸ <http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/21395032E3B9BB6CC2257FF0003813DD?OpenDocument>

described in Decision 20/CP.7.

Quality management is essential in order to comply with the requirements of (a) producing transparent, consistent, comparable, complete and accurate emissions estimates, (b) establishing a reliable central archiving system concerning all necessary information for GHG emissions inventories development and (c) compiling national reports according to the provisions of the CMP adopted decisions.

In this framework, a QA/QC system was first prepared in 2012, and is revised after 2016 and 2017 ERT recommendations.

Table 4 presents the list of procedures within each process and Figure 6 the relationship between the processes and the activities of the inventory team.

Table 4. QA/QC procedures for the GHG emissions inventory

Process	Procedure code	Procedure
Quality management	QM01	System review
	QM02	System improvement
	QM03	Training
	QM04	Record keeping
	QM05	Internal reviews
	QM06	Non-compliance-corrective and preventing actions
	QM07	Quality management system
	QM08	Documents control
	QM09	Internal communication
Quality control	QC01	Data collection
	QC02	Estimation of emissions/removals
	QC03	Data quality control check
	QC04	Input data record keeping
Archiving of inventory information	AI01	Centralised archiving of inventory information
	AI02	Compilation of reports
Quality assurance	QA01	Expert review of input data and parameters
	QA02	Expert review of GHG emissions/removals inventory
	QA03	Review from public
Uncertainty estimation	UE01	Uncertainty analysis
Inventory improvement	II01	Recalculations management

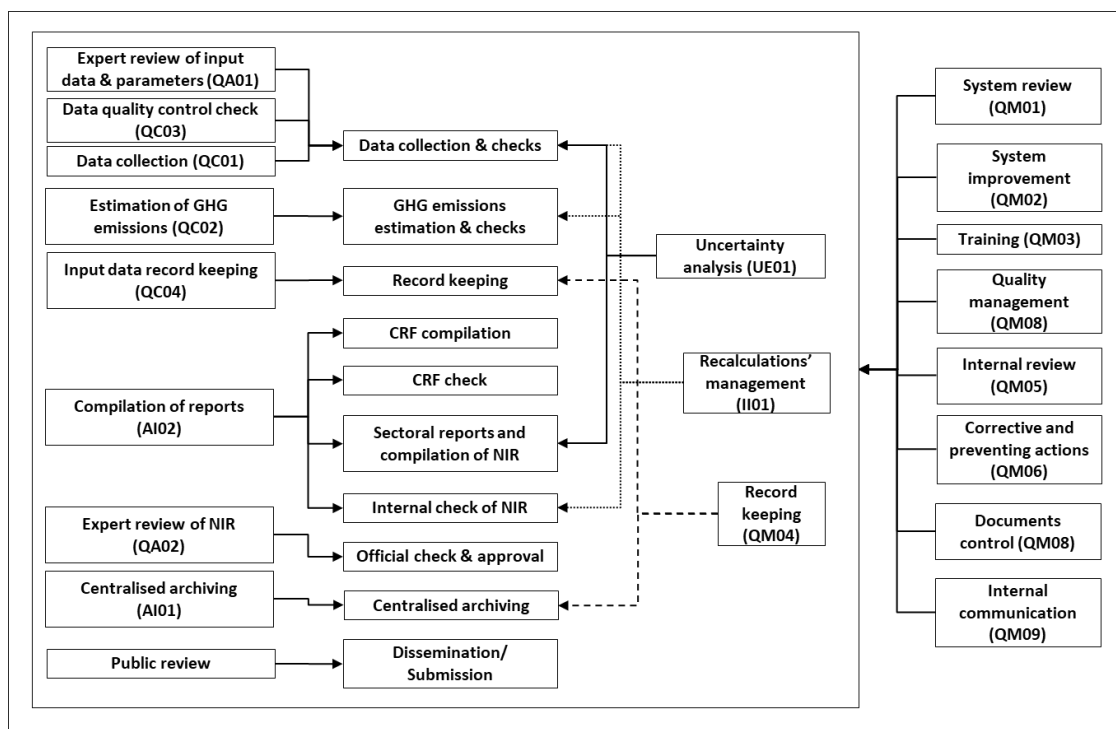


Figure 6. QA/QC process and procedures and inventory related activities

All the procedures described in the QA/QC manual are followed by any consultants (where applicable) and the Department of Environment. Audits by independent local experts are planned and implemented at least once every five years.

Each year the EU performs QA/QC checks (called initial checks) to its Member States as a part of EU QA/QC system. These tests are performed annually between 15/1 and 28/2. These checks have been designed to verify the transparency, accuracy, consistency, comparability and completeness of the information submitted. Moreover, EU carries out comprehensive reviews (similar to centralised UNFCCC reviews) of the national inventory data submitted by Member States. Two comprehensive reviews of Cyprus' inventory, for all sectors except LULUCF, have been performed by the EU, in 2012 and 2016.

Inventory activities in relation to QA/QC activities have been allocated to the members of the inventory team and other experts involved in the QA/QC process of Cyprus.

2.2.4. Changes in the national inventory arrangements since previous annual GHG inventory submission

In 2018, for the preparation of the 2019 GHG inventory submission, the estimation of the emissions from the sources included in Product uses as substitutes for ODS (2F) has been outsourced to a local expert. This is the only change compared to the National Communication 7 submitted in 2018.

3. Quantified economy-wide emission reduction target

This section explains the EU 2020 emission reduction target under the UNFCCC and the target compliance architecture set up within the EU in order to meet that target. It also gives an overview of other EU emission reduction targets that are helping achieving the quantified economy-wide emission reduction target under the UNFCCC.

3.1. The EU target under the Convention

Cyprus, as a Member State of EU, is under the joint quantified economy-wide emission reduction target of EU and its Member States. This section explains this target and the target compliance architecture set up within the EU in order to meet that target.

In 2010, the EU submitted a pledge to reduce its GHG emissions by 2020 by 20 % compared to 1990 levels, in order to contribute to achieving the ultimate objective of the UNFCCC: 'to stabilise GHG concentrations at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system'⁹, or, in other words, to limit the global temperature increase to less than 2°C compared to temperature levels before industrialization (FCCC/CP/2010/7/Add.1).

The definition of the EU target for 2020 under the Convention 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)¹⁰. The 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)¹¹.

The EU's accounting rules for the target under the UNFCCC are more ambitious than the rules under the Kyoto Protocol, for example, including outgoing flights and adding an annual compliance cycle for emissions under the Effort Sharing Decision (ESD; see Section 4.2.2) or higher Clean Development Mechanism (CDM) quality standards under the EU Emissions

⁹ First steps to a safer future: Introducing the United Nations Framework Convention on Climate Change: <https://unfccc.int/process-and-meetings/the-convention/whatis-the-united-nations-framework-convention-on-climate-change>

¹⁰ <http://unfccc.int/resource/docs/2011/sb/eng/inf01r01.pdf>

¹¹ <http://unfccc.int/resource/docs/2012/awglca15/eng/misc01.pdf>

Trading System (EU ETS) (FCCC/TP/2013/7). Accordingly, 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; 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 Protocol¹².
- The target covers the following gases: CO₂, CH₄, N₂O, HFCs, PFCs and SF₆;
- The target refers to 1990 as a single base year for CO₂, CH₄ and N₂O for all Member States, whereas for HFCs, PFCs, SF₆ and NF₃ the base year is country specific¹³. 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 (see Section 3.2.2): in the EU ETS, the use of international credits was allowed up to specific levels set in the EU ETS Directive, amounting to over 1500 million CER and ERU entitlements in the period up to 2020. Quality standards also apply to the use of international credits in the EU ETS, including not allowing the use of credits from LULUCF projects and certain industrial gas projects. International credits will no longer be used for EU ETS compliance in the system's fourth trading period (2021-2030). In the ESD sectors, the annual use of international credits is currently limited to up to 3 % of each Member State's ESD emissions in 2005, with a limited number of Member States being permitted to use an additional 1% from projects in least developed countries (LDCs) or small island developing states (SIDS), subject to conditions. From 2021 onwards, as with the EU ETS, international credits will no longer be used for compliance under the ESD.
- 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.

The following assumptions and conditions apply to the EU's 20 % target under the UNFCCC (QEERT):

- The EU Convention pledge does not include emissions/removals from Land Use, Land Use Change and Forestry, but it is estimated to be a net sink over the relevant period. EU inventories also 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.

¹² The LULUCF Decision (Decision 529/2013) requires preparing and maintaining annual LULUCF accounts according to the rules set out in the Kyoto Protocol; however, these accounts do not contribute to the achievement of the EU Convention pledge.

¹³ The base year for Cyprus, for HFCs, PFCs, SF₆ and NF₃ is 1995.

- Emissions from international aviation to the extent it is included in the EU ETS 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: in the ETS, the use of international credits is capped (up to 50 % of the reduction required from EU ETS sectors by 2020). Quality standards also apply to the use of international credits in the EU ETS, including a ban on credits from LULUCF projects and certain industrial gas projects. In the ESD sectors, the annual use of international credits is limited to up to 3 % of each Member State's ESD emissions in 2005, with a limited number of Member States being permitted to use an additional 1 % from projects in Least Developed Countries (LDCs) or Small Island Developing States (SIDS), subject to conditions.
- 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. In accordance with the CMP Decision to revise the GWPs to those from the IPCC Fourth Assessment Report (AR4) revised GWPs from AR4 were adopted for the EU ETS. The revised GWPs were taken into account for the revision of the ESD target. For the implementation until 2020, GWPs from AR4 will be used consistently with the UNFCCC reporting guidelines for GHG inventories.

The QEERT target is also described in CTF Tables 2(a-f).

3.2. The EU target compliance architecture

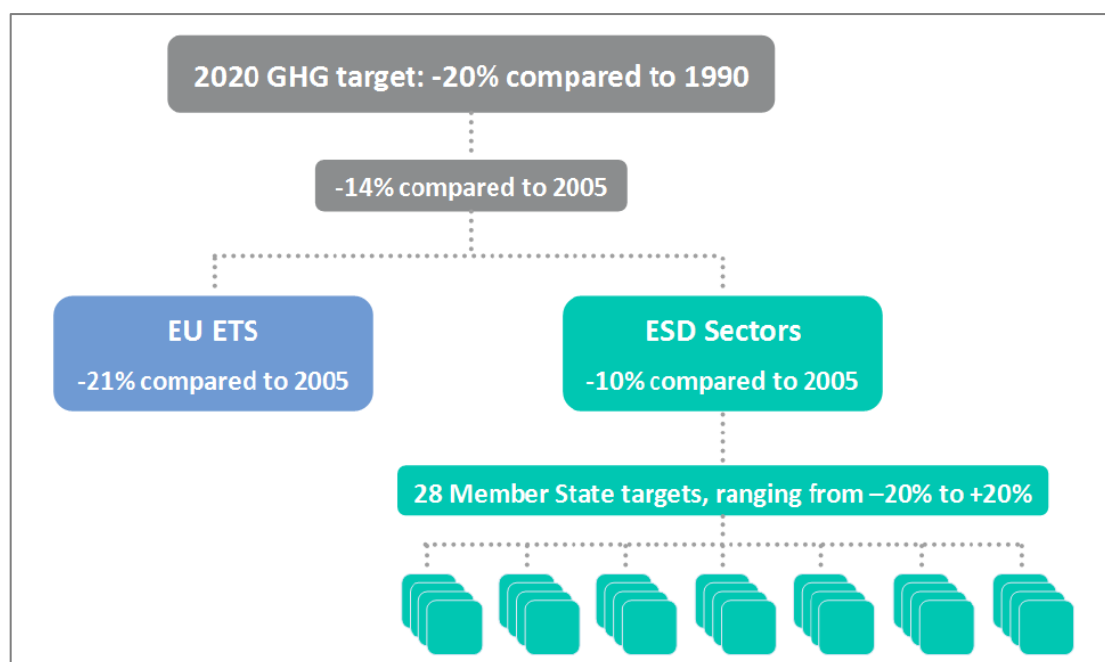
3.2.1. The 2020 Climate and Energy Package

In 2009 the EU established internal rules under its “2020 climate and energy package”¹⁴ – these underpin the EU implementation of the target under the Convention. The package introduced a clear approach to achieving the 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 domestic and international aviation);
- a 10 % reduction target compared to 2005 for ESD sectors, shared between the 28 Member States (MS) through individual national GHG targets.

The distribution of the total target across the ETS and ESD is shown in Figure 7.

¹⁴ http://ec.europa.eu/clima/policies/package/index_en.htm



Source: European Commission

Figure 7. EU GHG targets under the 2020 climate and energy package

Under the EU ETS Directive as revised for the system's current trading period from 2013 to 2020 (Directive 2009/29/EC), a single ETS cap covers EU Member States and three participating non-EU countries (Norway, Iceland and Liechtenstein), and there are no further by 1.74 % annually, starting from the average level of allowances issued by Member States for the second trading period (2008–2012).

The three non-EU countries participating in the EU ETS are also subject to a similarly defined cap and the same annual decrease in allowance allocation. For further additional information on recent changes in the EU ETS, see Section 4.2.1.

The vast majority of emissions within the EU, which fall outside the scope of the EU ETS, are addressed under the Effort Sharing Decision (ESD) (Decision 406/2009/EC). The ESD covers emissions from all sources outside the EU ETS, except for de minimis aviation emissions, international maritime emissions, and emissions and removals from land use, land use change and forestry (LULUCF). It thus includes a diverse range of small-scale emitters in a wide range of sectors: transport (cars, lorries), buildings (in particular heating), services, small industrial installations, fugitive emissions from the energy sector, emissions of fluorinated gases from appliances and other sources, agriculture and waste. Such sources accounted for 58% of total GHG emissions in the EU in 2017¹⁵.

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 (see Figure 8). Under the Effort Sharing Decision, national emission targets for 2020 are set, expressed as

¹⁵ European Environment Agency (2019); Trends and projections in Europe 2019. Tracking progress towards Europe's climate and energy targets; https://www.eea.europa.eu/publications/trends-and-projections-in-europe-1/at_download/file

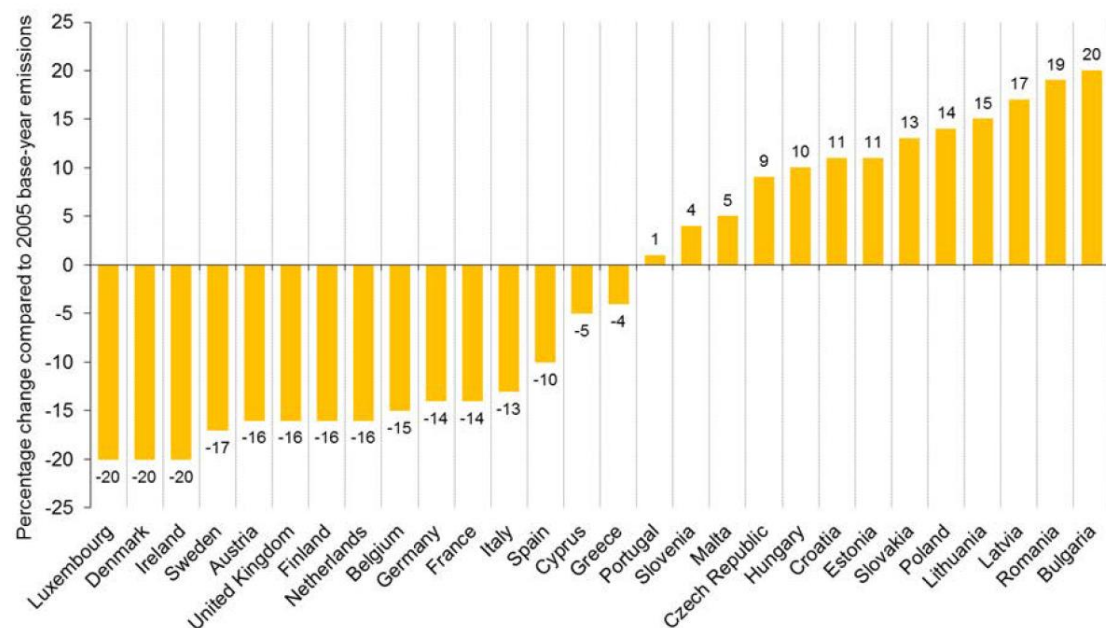
percentage changes from 2005 levels. These changes have been transferred into binding quantified annual emission limits for the period from 2013 to 2020 (Commission Decisions 2013/162/EU and 2013/634/EU), denominated in annual emission allocations (AEAs). At country level, 2020 targets under the ESD range from -20% to +20%, compared to 2005 levels. ESD targets for 2020 for each EU Member State are shown in Figure 8.

The target levels have been set on the basis of Member States' relative Gross Domestic Product (GDP) per capita. Up to certain limitations, the ESD allows Member States to make use of flexibility provisions for meeting their annual targets: carry-over of over-achievements to subsequent years within each Member State, transfers of AEAs between Member States and use of international credits (credits from Joint Implementation and Clean Development Mechanism).

ESD targets are designed in a strict manner: Every year, once MS emissions are reviewed according to strict criteria (described in Chapter III of the Commission Implementing Regulation 749/2014), the European Commission issues an implementing decision on MS ESD emissions in the given year. MS exceeding their annual AEA, even after taking into account the flexibility provisions and the use of JI/CDM credits, will face inter alia a penalty – a deduction from their emission allocation of the following year (excess emissions, multiplied by 1.08).

For more details about the Effort Sharing Decision, see Section 4.2.2.

The 2020 ESD target of Cyprus is to reduce emissions by 5% compared to 2005 levels. The binding quantified annual reduction targets for the period from 2013 to 2020, or the Annual Emission Allocations (AEAs) of Cyprus are presented in Table 5.



Source: Decision No 406/2009/EC, Annex 2

Figure 8. National 2020 GHG emission limits under the ESD, relative to 2005 emissions levels

Table 5. Annual Emission Allocations (AEAs) of Cyprus for the year 2013 to 2020 calculated applying global warming potential values from the fourth IPCC assessment report¹⁶

Year	AEAs (t CO ₂ eq.)
2013	5 919 071
2014	5 922 555
2015	5 926 039
2016	5 929 524
2017	4 196 633
2018	4 122 837
2019	4 049 042
2020	3 975 247

3.2.2. Accounting for Market-based Mechanisms under the 2020 QEERT target

In general, in the EU the use of flexible mechanisms can take place on the one hand by operators in the EU ETS, on the other hand by governments for the achievement of ESD targets.

The amended EU ETS Directive 2009/29/EC (Article 11a(8)) sets the upper limit for credit use for the period from 2008 to 2020 at a maximum of 50% of the reduction effort below 2005 levels. This is further specified into installation-level limits in the Commission Regulation on international credit entitlements (RICE) (EU No 1123/2013)¹⁷. Since some entitlements are expressed as a percentage of verified emissions over the entire period, the exact overall maximum amount will only be known at the end of the third trading period (2013-2020).

Since 2013, it is no longer possible to track the use of flexible mechanisms in the EU ETS directly via information on EUTL public website because CERs and ERUs are no longer surrendered directly but are exchanged into EUAs. These exchanges will become public on an installation level after three years¹⁸; however aggregated data at EU-level are available at the BR CTF Table 4 of EU.

As mentioned above, the ESD allows Member States to make use of international credits for meeting their annual targets, but with certain limitations. In the ESD sectors, the annual use of carbon credits is limited to up to 3 % of each Member State's ESD emissions in 2005. Member States that do not use their 3 % limit for the use of international credits in any specific year can transfer the unused part of their limit to another Member State or bank it for their own use until 2020. Cyprus is among the EU Member States that fulfil additional criteria and may use credits from projects in least developed countries (LDCs) and small island developing states (SIDS) up to an additional 1 % of their verified emissions in 2005. These credits are neither bankable nor transferable.

¹⁶ According to COMMISSION DECISION (EU) 2017/1471 of 10 August 2017 amending Decision 2013/162/EU to revise Member States' annual emission allocations for the period from 2017 to 2020

¹⁷ The amount of entitlements per installation / aircraft operator can be found at https://ec.europa.eu/clima/ets/ice.do;EUROPA_JSESSIONID=XEfRdZUbkbUf_jmZaZsGFIz0AvkaqZ42N7l7kSansqwTX-lpOW2Zl-869459281

¹⁸ Annex XIV of European Commission. Commission Regulation (EU) No 389/2013. 2013. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32013R0389>

So far, Cyprus has not used and does not plan of using any international credits for complying with their obligations under the ESD.

3.2.3. 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 to the Convention through the EU's Nationally Determined Contribution submitted under the Paris Agreement, and has been adopted by the EU under the 2030 Climate and Energy Framework¹⁹. 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 commitment under the Paris Agreement. In order to achieve this target:

- The EU emissions trading system (ETS) sectors will have to cut emissions by 43% (compared to 2005) by 2030. This has been agreed under the revised EU ETS Directive (2018/410)²⁰;
- 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, as agreed under the Effort Sharing Regulation (2018/842)²¹. While the Effort Sharing Regulation does not cover the LULUCF sector as such, it does allow Member States to use up to 280 million credits from the land-use sector over the entire period 2021-2030 to comply with their national targets;
- 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)²². Each Member State will have to ensure that the LULUCF sector does not create debits, once specific accounting rules are applied. This is known as the “no debit” rule.

¹⁹ Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions. A policy framework for climate and energy in the period from 2020 to 2030. /*COM/2014/015 final*/. 2014. <https://eur-lex.europa.eu/legalcontent/EN/TXT/?uri=CELEX:52014DC0015>

²⁰ DIRECTIVE (EU) 2018/410 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814 <https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:32018L0410&from=EN>

²¹ REGULATION (EU) 2018/842 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0842&from=EN>

²² REGULATION (EU) 2018/841 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0841&from=EN>

The 2030 pledge has been allocated to MS with the same method as was allocated for the 2020 pledge. A binding target to cut emissions in the EU by at least 40% below 1990 levels by 2030, has already been agreed and regulated with the necessary EU legislation. To achieve the target:

- EU emissions trading system (ETS) sectors will have to cut emissions by 43% (compared to 2005) – to this end, the ETS has been revised for the period after 2020
- non-ETS sectors will need to cut emissions by 30% (compared to 2005) – this has been translated into individual binding targets for Member States.

The national target for Cyprus according to Regulation (EU) 2018/842²³ for 2030 is -24% compared to 2005.

The revised Renewable Energy Directive (2018/2001)²⁴ and the amended Energy Efficiency Directive (2018/2002)²⁵ set separate EU level targets on renewable energy and energy efficiency in 2030. For renewable energy, a binding target of at least 32 % of final energy consumption by 2030 was set. Concerning energy efficiency, it is a headline target of at least 32.5 %. Both the renewable energy target and the energy efficiency target include a review clause by 2023 for an upward revision.

Beyond these periods and targets, on 28 November 2018, the European Commission presented and adopted its strategic vision for 2050. Under the Long Term Strategic Vision on GHG Emissions Reduction, the European Commission showed long-term pathways and called for a climate-neutral Europe by 2050. It is expected that the long-term strategy is adopted and submitted to the United Nations Framework Convention on Climate Change (UNFCCC) as required under the Paris Agreement.

In Table 6, all GHG relevant targets for the EU and their key facts are displayed in an overview. On the left, the table includes the international commitments under the Kyoto Protocol, the UNFCCC and the Paris Agreement. On the right, the EU commitments under the 2020 Climate and Energy Package and the 2030 Climate and Energy Framework are listed.

²³ Regulation (EU) 2018/842²³ OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013

²⁴ DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L2001&from=EN>

²⁵ DIRECTIVE (EU) 2018/2002 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 amending Directive 2012/27/EU on energy efficiency, <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32018L2002&from=EN>

Table 6. Overview of EU targets

	International commitments				EU domestic legislation				
	Kyoto Protocol		UNFCCC	Paris Agreement	Climate and Energy Package		Climate and Energy Framework		
					EU ETS	ESD	EU ETS	ESR	LULUCF
Target year of period	First commitment period (2008-2012)	Second commitment period (2013-2020)	2020	2030	2013-2020		2021 – 2030		
Emission reduction target	-8 %	-20 %	-20 %	At least -40%	-21 % compared to 2005 for ETS emissions	Annual targets by MS. In 2020 -10 % compared to 2005 for non-ETS emissions	-43% for EU ETS sectors	-30% for ESR sectors (translated into individual binding targets for MSs)	No-debit target based on accounting rules
Further targets	-	-	Conditional target of -30 % if other Parties take on adequate commitments	-	Renewable Energy Directive: 20 % share of renewable energy of gross final energy consumption; Energy Efficiency Directive : Increase energy efficiency by 20 %		A binding renewable energy target for the EU for 2030 of at least 32% of final energy consumption, including a review clause by 2023 for an upward revision of the EU level target. A headline target of at least 32.5% for energy efficiency to be achieved collectively by the EU in 2030, with an upward revision clause by 2023.		
Base year	1990 KP Flexibility rules (Art 3(5)) regarding F-Gases and Economies in Transition	1990, but subject to flexibility rules. 1995 or 2000 may be used as the base year for NF ₃	1990	1990	1990 for overall emission reduction target; 2005 for renewable energy and energy efficiency target; as well as for targets broken down into ETS and non-ETS emissions		2005		Subject to accounting rules
Aviation	Domestic aviation included. International aviation excluded	Domestic aviation included. International aviation excluded	Aviation in the scope of the EU ETS included. In practice total outgoing flight emissions considered	Aviation in the scope of the EU ETS included. In practice total outgoing flight emissions considered	Outgoing flights included	Excluded	Outgoing flights included	Excluded	Not applicable
Use of international credits	Use of KP flexible mechanisms subject to KP rules	Use of KP flexible mechanisms subject to KP rules	Subject to quantitative and qualitative limits	No contribution from international credits	Subject to quantitative and qualitative limits, see section 3.2.2.1	Subject to quantitative and qualitative limits, see section 3.2.2.1	No contribution from international credits		
Carry-over of units from preceding periods	Not applicable	Subject to KP rules including those agreed in the Doha Amendment	Not applicable	Not applicable	EU ETS allowances can be banked into subsequent ETS trading periods since the second trading period	No carry-over from previous period			
Gases covered	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ , NF ₃	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ , NF ₃	CO ₂ , N ₂ O, CF ₄ and C ₂ F ₆	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	CO ₂ , N ₂ O, CF ₄ and C ₂ F ₆	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	CO ₂ , CH ₄ , N ₂ O (emissions of HFCs, PFCs, SF ₆ do not occur in the sector)
Sectors included	Annex A of KP (Energy, IPPU, agriculture, waste), LULUCF according to KP accounting rules for CP1	Annex A of KP (Energy, IPPU, agriculture, waste), LULUCF according to KP accounting rules for CP2	Energy, IPPU, agriculture, waste, aviation in the scope of the EU ETS	Energy, IPPU, Agriculture, Waste, LULUCF	Power & heat generation, energy-intensive industry sectors, aviation (Annex 1 of ETS directive)	Transport (except aviation), buildings, non-ETS industry, agriculture (except forestry) and waste	As under Climate and Energy Package	As under Climate and Energy Package ²⁶	Land-use, land-use change and forestry
GWPs used	IPCC SAR	IPCC AR4	IPCC AR4	IPCC AR4	IPCC AR4				

²⁶ The ESR allows the use of land-use credits under certain conditions and up to a total limit over the period 2021-2030 as a flexibility option

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

4.1. Introduction

Policies and measures for the Member States of the European Union (EU) are developed at both the Union and national levels. At the EU level, they stem from legislative proposals from the European Commission, which are subsequently approved or amended by the European Parliament and the Council of the EU. These EU laws are applicable to all Member States, but some of them, referred to as Directives, only set objectives and minimum standards that may then be implemented in different ways by Member States. National policies translate the relevant pieces of legislation into practice. Additionally, EU Member States can adopt national climate policies and measures on top of those required under EU legislation.

4.2. EU policies and measures

This section focuses on the key cross-cutting policies and measures implemented to achieve the EU level targets, namely the EU Emissions Trading System (EU ETS) and Effort Sharing legislation (ESD, ESR). It then describes some key cross-cutting initiatives, such as EU funding instruments. Details on the EU ETS and ESD are provide in the EU 4BR.

4.2.1. The EU Emissions Trading System (EU ETS)

The EU ETS is based on the 'cap and trade' principle, and has been operational since 2005. It limits emissions from nearly 11,000 energy intensive installations (power stations and industrial plants) and over 500 aircraft operators operating between European Economic Area (EEA) countries, and it covers around 40% of the EU greenhouse gas emissions. In Cyprus the ETS contributes approximately 50% to the total national emissions.

Putting a price on greenhouse gas emissions is important to harness market forces and achieve cost-effective emission reductions. In parallel to providing a carbon price, which incentivises emissions reductions, the EU ETS, in its third trading period, is supporting the reduction of greenhouse gas emissions by providing €2.1 billion for the deployment of innovative renewables and carbon capture and storage, via the sale of 300 million emission allowances from the New Entrants' Reserve (the so-called NER 300 programme).

The 3BR described the legislative proposal for the revision of the EU ETS for phase four in line with the 2030 Climate and Energy Framework. Since the 3BR, the revised EU ETS Directive establishing the framework of the EU ETS for the period 2021-2030 (Directive (EU) 2018/410) entered into force on 8 April 2018²⁷. The preparation of implementing legislation based on the revised EU ETS Directive is ongoing, with the aim of having all necessary implementing provisions adopted by January 2021.

In Cyprus, the trading system for the period 2008-2012 comprises of 13 installations (3 power plants, 2 cement plants and 8 ceramics plants). The installations have currently reduced to 9 (3 power plants, 1 cement plant and 5 ceramics plants).

Between 2013 and 2018, emissions in the sectors covered by the EU ETS have decreased by 11.8%. In Cyprus, during the same period emissions in the ETS increased by 13%. To increase the pace of emissions cuts in phase four, the overall number of emission allowances will decline at an annual rate of 2.2% from 2021 onwards, compared to 1.74% during the period 2013-2020. This increase implies a steady reduction of some million allowances annually, compared to 38 million currently, and is consistent with a 43% reduction in GHG emissions from ETS covered sectors by 2030, compared to 2005 levels.

The Market Stability Reserve (MSR), a mechanism set in place for reducing the imbalance on the carbon market, has been substantially reinforced by the revision. Between 2019 and 2023, the rate at which allowances will be placed in the MSR will be doubled to 24% in order to restore the balance of emission allowances in the carbon market more swiftly. Moreover, from 2023 onwards, the number of emission allowances held in the MSR will be limited to the auction volume of the previous year.

The MSR became operational in January 2019. In preparation for this, the Commission has published as from mid-May 2017 the surplus of allowances for the preceding year. In May 2019, the surplus was published for the third time, corresponding to 1.65 billion allowances. On the basis of the 2018 surplus and the revised legislation, the auction volumes from September to December 2019, and from January to August 2020, will be reduced by close to 397 million allowances, corresponding to 24% of the surplus.

Member States may voluntarily cancel allowances from the total auction volume available to them in case of closure of electricity generation capacity resulting from additional national measures. If power plants are closed without the Member State concerned opting to cancel allowances, the MSR rules will capture the effect, by increasing the reserve feeds or by later releases of allowances from the reserve.

The existing free allocation framework has been broadly maintained for phase four to ensure predictability and transparency for European industry, addressing the competitiveness concerns in a more focused and targeted way than before. Free allocation will continue to be based on benchmark values derived with reference to the performance of the 10% most

²⁷ DIRECTIVE (EU) 2018/410 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814

efficient installations in the EU, updated to reflect the technological progress since the previous exercise, and including procedures to take account for changes in production levels.

Several low-carbon funding mechanisms will help industrial sectors and the power sector meet the innovation and investment challenges of the transition to a low-carbon economy in phase four. In particular, an Innovation Fund will support the demonstration of innovative renewable energy and low-carbon innovation in industry, as well as carbon capture, utilisation and storage, with resources corresponding to the market value of at least 450 million allowances at the time of auctioning, as well as any unspent funds from the NER300 programme. A Modernisation Fund will provide at least 310 million allowances to support modernisation of energy systems and just transition in ten lower income EU Member States.

4.2.1.1. Aviation under the EU ETS

The aviation sector has been part of the EU ETS since 2012. The original legislation covers all flights in and out of the European Economic Area (EEA). However, for 2012-2016, in order to support the development of a global measure by the International Civil Aviation Organisation (ICAO) for reducing aviation CO₂ emissions, the EU provided a derogation limiting obligations solely to flights within the EEA and to flights within the EEA outermost regions.

In light of the adoption of a Resolution by the 2016 ICAO Assembly on the global measure “Carbon Offsetting and Reduction Scheme for International Aviation” (CORSIA), pending the ICAO's adoption of the relevant CORSIA instruments and subsequent decisions by the EU on the possible implementation of CORSIA in the EU, and to provide continued momentum to the international process, the EU decided in 2017 to extend the current derogation from EU ETS obligations for flights to and from third countries until 31 December 2023, subject to review⁵³. The review should consider how to implement the ICAO global measure in Union law through a revision of the EU ETS legislation. The review would take due account of the necessary consistency with EU climate objectives and commitments under the Paris Agreement.

In October 2018, the ICAO Council adopted the Standards and Recommended Practices (SARPs) for CORSIA. As of 1 January 2019, aircraft operators will be required to monitor and report their emissions for CORSIA. To this end, the EU has put in place a legally binding monitoring, reporting and verification (MRV) framework based on the CORSIA SARP and the existing MRV framework under the EU ETS.

The inclusion of intra-EEA flights in the EU ETS has delivered around 100 Mt of CO₂ reductions between 2012 and 2018. While some reductions are likely to be within the aviation sector, encouraged by the EU ETS's economic incentive for limiting emissions or use of aviation biofuels, the majority of reductions are expected to have occurred in other sectors.

Cyprus for 2019 was allocated with 7 active aircraft operators with approximate emissions 30 Gg CO₂.

The Innovation Fund, established by and funded through the EU ETS, will also support the aviation sector through funding of innovation projects in low-carbon technologies and processes; the production of e-fuels and synthetic kerosene to replace carbon intensive refinery products; and in the production of e-fuels, hydrogen and synthetic kerosene where these are forms of energy storage.

4.2.2. The Effort Sharing Decision (2013-2020), the Effort Sharing Regulation and the LULUCF Regulation (2021-2030)

The EU Effort Sharing Decision (2013-2020)²⁸ covers direct emissions from the non-ETS sectors such as buildings, transport (excluding aviation) and agriculture (excluding land use, land use change and forestry) for the period 2013-2020. It sets binding national emission targets for 2020, expressed as percentage changes from 2005 levels, and a trajectory of annual limits between 2013 and 2020 for each Member State. By 2020, these national targets will collectively deliver a reduction of around 10% in total EU emissions from the sectors covered compared with 2005 levels. Under the decision, EU Member States report annually their greenhouse gas emissions for the period 2013-2020. The European Commission reviews the emissions and checks that Member States comply with their annual limits (so-called annual emission allocations, AEAs). The next annual compliance check for the year 2018 will be carried out in 2020.

Cyprus' binding national emission target for 2020 is -5% compared to 2005. The annual emission allocations are presented in Table 5 (section 3.2.1).

The decision provides for a number of flexibilities to help Member States to manage annual variations in emissions within the period, including banking and borrowing. For example, if a Member State's emissions are below its annual emissions allocation (AEA) in a given year, the surplus can be carried over and used to contribute towards its allocation in subsequent years. However, if emissions from a Member State exceed its annual emissions allocation for a given year, even when its use of flexibilities has been accounted for, it will be subject to a penalty and will have to take corrective action in order to comply with the ESD. In such a case, the Member State in question will have to achieve the missing emission reductions in the next year, multiplied by a factor of 1.08 as a penalty. It will also have to submit a corrective action plan to the Commission detailing how it intends to get back on track towards meeting its 2020 target. In addition, it will temporarily lose the right to transfer any allocations to other Member States.

The progress of Member States in meeting the emissions reduction targets set in the Effort Sharing Decision (ESD) is assessed under the Monitoring Mechanism Regulation (Regulation

²⁸ DECISION No 406/2009/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020

No 525/2013)²⁹, and as part of the European Semester. National Effort Sharing emissions in 2017 were 2% above 2005 levels³⁰.

The EU 3BR described the legislative proposals for the revision of EU legislation covering the non-ETS emissions in line with the 2030 Climate and Energy Framework. The two main developments since the 3BR are the adoptions of the Effort Sharing Regulation on binding annual emission reductions by Member States from 2021 to 2030 and the LULUCF Regulation in 2018. The Effort Sharing Regulation sets national emissions reduction targets for 2030 (and trajectories with annual limits in 2021-2030) for all Member States, ranging from 0% to - 40% from 2005 levels³¹. The Effort Sharing Regulation keeps many of the flexibilities and the need for annual compliance in 2021-2030 as currently under the Effort Sharing Decision. There is a new option for some Member States to use a limited amount of allowances from the EU ETS. There are also some flexibilities with the new LULUCF Regulation, which defines for the first time an EU target for the land use, land use change and forestry sector, and includes the so-called “no-debit rule”. In total, Member States can use up to 280 million tons of LULUCF credits for effort sharing compliance and can use effort sharing AEAs to cover LULUCF debits. The allocation for Cyprus is 0.6 million tons of LULUCF credits³².

4.2.3. Other cross-cutting policies and measures

To respond to challenges and investment needs related to climate change, the EU has agreed that at least 20% of its budget for 2014-2020 – as much as €180 billion – should be spent on climate change related action. To achieve this increase, mitigation and adaptation actions are integrated into all major EU spending programmes. Current estimates show that the EU budget annual allocation to climate action has exceeded the 20% target in 2016 and will remain close to it over 2017-2020. It is set to deliver slightly above €200 billion. Negotiations on EU budget 2021-2027 are ongoing.

The available financial tools are European Structural and Investment Funds (ESIF), European Fund for Strategic Investments, InvestEU Programme, LIFE programme, Horizon 2020, Updated Bioeconomy Strategy and European Covenant of Mayors for Climate and Energy. Further details on these are available in the EU 4BR (section 4.2.3).

²⁹ REGULATION (EU) No 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 climate change and repealing Decision No 280/2004/EC

³⁰ as agreed for AEA allocation (Commission Decision (EU) 2017/1471 of 10 August 2017 amending Decision 2013/162/EU to revise Member States' annual emission allocations for the period from 2017 to 2020)

³¹ More information can be found on the European Commission's website https://ec.europa.eu/clima/policies/effort/regulation_en

³² Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013

4.3. EU Sectoral policies and measures

4.3.1. Energy

The Energy Union Strategy was published in February 2015, and the Commission publishes regular reports on the progress achieved in its five dimensions, the most recent of which was in April 2019. As outlined in the 3BR, the Commission's 'Clean Energy for All Europeans' package was published in November 2016. One of its proposed instruments was the Regulation on the Governance of the Energy Union and Climate Action, which entered into force on 24 December 2018. Its goals are:

- To implement strategies and measures which ensure that the objectives of the Energy Union, including in particular the EU's 2030 energy and climate targets, and the long-term EU greenhouse gas emissions commitments are consistent with the Paris Agreement;
- To stimulate cooperation between Member States in order to achieve the objectives and targets of the Energy Union;
- To promote long-term certainty and predictability for investors across the EU and foster jobs, growth and social cohesion;
- To reduce administrative burden, in line with the principle of better regulation. This was done by integrating and streamlining most of the current energy and climate planning and reporting requirements of EU countries as well as the Commission's monitoring obligations;
- To ensure consistent planning, reporting and monitoring by the EU and its Member States under the UN Framework Convention on Climate Change and the Paris Agreement, replacing the existing climate monitoring and reporting system from 2021 onwards.

As part of this process, Member States are required to prepare and adopt integrated national energy and climate plans (NECPs), covering ten-year periods starting from 2021 to 2030, EU and national long-term strategies, as well as integrated implementation reports. Draft NECPs for all Member States, as well as the Commission's assessment and recommendations, can be found on the European Commission website³³.

Further details on EU energy policies are available in the EU 4BR.

Cyprus' final NECP has been prepared and submitted to the European Union in late January 2020. Further details are available in section 4.4.

4.3.2. Transport

EU-level transport policies contribute to the fulfilment of EU's 2020, 2030 and 2050 ambition. With the global shift towards a low-carbon, circular economy already underway, the Commission's low-emission mobility strategy, adopted in July 2016, aims to ensure Europe stays competitive and able to respond to the increasing mobility needs of people and

³³ <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate-plans>

goods. Europe's answer to the emission reduction challenge in the transport sector is an irreversible shift to low-emission mobility. By mid-century, greenhouse gas emissions from transport will need to be at least 60% lower than in 1990 and be firmly on the path towards zero emissions of air pollutants from transport that harm our health need to be drastically reduced without delay. The strategy integrates a broader set of measures to support Europe's transition to a low-carbon economy and supports jobs, growth, investment and innovation. The strategy will benefit European citizens and consumers by delivering improvements in air quality, reductions in noise levels, lower congestion levels and improved safety. Consumers will benefit from less-energy consuming cars, from better infrastructure for alternative fuels, better links between modes of transport and better safety and fewer delays thanks to the roll-out of digital technologies.

Main elements of the strategy

The Communication identifies three priority areas for action:

- Increasing the efficiency of the transport system by making the most of digital technologies, smart pricing and further encouraging the shift to lower emission transport modes,
- Speeding up the deployment of low-emission alternative energy for transport, such as advanced biofuels, electricity, hydrogen and renewable synthetic fuels and removing obstacles to the electrification of transport
- Moving towards zero-emission vehicles. While further improvements to the internal combustion engine will be needed, Europe needs to accelerate the transition towards low- and zero-emission vehicles.

Cities and local authorities will play a crucial role in delivering this strategy. They are already implementing incentives for low-emission alternative energies and vehicles, encouraging active travel (cycling and walking), public transport and bicycle and car-sharing /pooling schemes to reduce congestion and pollution.

Further details on the relevant policies and available funding are available on the Commission website³⁴ and the EU 4BR. Details on the actions implemented at national level are presented in section 4.4.

4.3.3. Industry / industrial processes

Greenhouse gas emissions arising from industrial processes in the mineral, chemical and metal industry are covered under the EU Emissions Trading System. Further controls on emissions are applied through other sectoral policies and measures.

To control emissions from fluorinated greenhouse gases (F-gases), including hydrofluorocarbons (HFCs), the EU has adopted two legislative acts: the 'MAC Directive' (2006/40/EC)³⁵ on air conditioning systems used in small motor vehicles, and the 'F-gas

³⁴ https://ec.europa.eu/clima/policies/transport_en

³⁵ DIRECTIVE 2006/40/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 relating to emissions from air-conditioning systems in motor vehicles and amending Council Directive

Regulation' ((EC) 842/2006 replaced by (EU) 517/2014)³⁶ which covers all other key applications in which F-gases are used. These policies are estimated to lead to cumulative emission savings of 1.5 Gt CO₂eq. by 2030 and 5 Gt CO₂eq. by 2050. Following 13 years of increasing emissions of F-gases, emissions have declined in 2015, 2016 and 2017 compared to the previous year. This sends a signal that the policy measures are effective.

The action taken by the EU and its Member States under the F-gas Regulation will enable the EU to comply with the Kigali amendment to the Montreal Protocol on a global phase-down of hydrofluorocarbons (HFCs). The EU has ratified the Kigali amendment, which entered into force on 1 January 2019. The consumption of HFCs in the EU is already well below the limit set by the Kigali amendment.

In terms of progress, a comprehensive report on the effects of the F-gas Regulation will be published by the end of 2022. The European Environment Agency publishes every year a report on fluorinated greenhouse gases, the latest is available on the EEA website³⁷. Thanks to the phase-down foreseen in Regulation 517/2014, no more than 63% of the amount of HFCs was placed on the market during 2018 in comparison to the 2009-2012 baseline (in tonnes of CO₂ equivalent). While the baseline includes only bulk gases, in 2017, HFCs imported in pre-charged equipment were also included under the phase-down limit. Thus, the reduction related to placing on the market of bulk gases only has been almost halved since the phase-down started in 2015.

Details on the actions implemented at national level are presented in section 4.4.

4.3.4. Agriculture

Agricultural activities can result in methane emissions from livestock digestion processes and storage of animal manure; and the use of organic and mineral nitrogen fertilisers can lead to nitrous oxide emissions. The Effort Sharing Decision and Regulation cover these emissions. On the other hand, agricultural lands can sequester and store carbon, thus contributing to climate change mitigation (this contribution is recognised in the LULUCF sector). Finally, agricultural activities supply biomass, which can be used as a renewable energy source and replace fossil-based materials and fuels. Thus, biomass can contribute to CO₂ savings that are allocated to the energy and industrial sectors as well as in construction and other sectors of bio-economy. While there is no emission reduction target specifically for the agricultural sector, the Common Agricultural Policy has integrated climate objectives and provides funding to support practices that are beneficial for the climate. Details on the Common Agricultural Policy are available in the EU 4BR (section 4.3.4.1). Details on the actions implemented at national level are presented in section 4.4.

70/156/EEC <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:161:0012:0018:EN:PDF>

³⁶ REGULATION (EU) No 517/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0517&from=FR>

³⁷ <https://www.eea.europa.eu/publications/fluorinated-greenhouse-gases-2018/>

4.3.5. LULUCF

Through the EU LULUCF Regulation, adopted in May 2018, greenhouse gas emissions and removals from LULUCF sector are included in the 2030 Climate and Energy Framework. The Regulation promotes the implementation of the Paris Agreement, which points to the critical role of the land use sector. Sustainable forest management is key in this context. The Regulation sets a binding commitment for each Member State to balance the sector's accounted emissions with an equivalent amount of removals of CO₂ from the atmosphere, through action in the sector (the so-called no-debit rule). The new rules provide a framework to incentivise a more climate-friendly land use, without imposing new restrictions or red tape on individual actors. This framework should encourage Member States to develop practices on agricultural land and forests that support climate action, to provide clear and transparent rules to ensure that emissions from harvests are correctly accounted, and to highlight the climate benefits of wood products, which can store carbon sequestered from the atmosphere and substitute for emission-intensive materials and fuels.

The LULUCF Regulation:

- Brings a LULUCF commitment into the EU climate policy for the first time;
- Establishes rules to measure the changes in carbon emissions and removals from this sector;
- Requires an improvement in the accuracy of the LULUCF inventories;
- Ensures that the CO₂ impact of bioenergy and biomaterials produced from domestic sources is fully accounted.

The Regulation also allows some flexibility for Member States. For instance, if a Member State has net emissions from land use and forestry, they can use allocations from the Effort Sharing Regulation to satisfy the "no debit" commitment. Moreover, Member States can buy and sell net removals from and to other Member States. This can encourage Member States to increase CO₂ removals beyond their own commitment. On the other hand, a Member State may choose to enhance removals or reduce emissions in the LULUCF sector, thereby helping compliance in the Effort Sharing Regulation.

4.3.6. Waste management / waste

Policies and measures related to solid waste disposal, biological treatment of waste, waste incineration and open burning of waste, as well as wastewater treatment and discharge, are climate-relevant. Important GHGs in this sector are methane (CH₄), which mainly arises from the treatment and disposal of solid waste, and nitrous oxide (N₂O) which originates from wastewater. In addition, a substitution of primary raw materials by secondary raw materials coming from recycling allows for significant GHG savings due to lower demand for energy needed to extract raw materials and turn them into products.

The revised Waste Package (consisting of five waste directives, including the Waste Framework Directive³⁸ (WFD) was adopted in May 2018. For municipal waste, the recycling

³⁸ https://ec.europa.eu/environment/waste/framework/framework_directive.htm

targets are set at 55% in 2025, 60% in 2030 and 65% in 2035 and the cap on landfilling of municipal waste is set at 10% by 2035.

The assessment of the impacts found that, depending on the options implemented, between 13 and 62 million tons of GHG emissions could be avoided in 2030 at EU level³⁹.

Details on the EU policies are available in the EU 4BR (section 4.3.6), while actions implemented at national level are presented in section 4.4.

4.4. National mitigation actions and their effects

4.4.1. National Integrated Energy and Climate Plan

The National Energy and Climate Plan (NECP), which was recently adopted by Cyprus (Council of Ministers Decision 15.1.2020), constitutes a strategic plan for Cyprus on Climate and Energy issues and comprises a detailed roadmap for achieving concrete Energy and Climate Goals by 2030. The NECP presents and analyses Policy Priorities and Measures in a wide range of economic and development activities for the next decade.

The implementation of the energy policy while attaining the climate and environmental targets requires a radical transformation of the energy system over the next decade and, therefore, the implementation of significant investments in energy infrastructure as well as in energy efficiency. Major investments have been planned and scheduled in renewable energy, in the transformation of the network and the introduction of smart meters in power distribution, in power transmission networks, in importing and using natural gas for increasing energy efficiency in power generation, in the energy efficiency in households, businesses, public sector and water sector, in transport infrastructures and sustainable mobility as well as in technological research.

The national targets for the next decade are looked into in detail in this national climate and energy plan (NECP) on a mid-term basis, up to 2030, and should serve as a basis for an ambitious long-term strategy aiming towards the minimisation of greenhouse gas emissions by 2050. Therefore, the decarbonisation dimension is the first and foremost component of the NECP structure.

Figure 9 shows the quantitative targets in the context of attaining the national energy and climate objectives for 2030. The key policy priorities of the national climate and energy plan, which are deemed necessary for attaining these objectives, are presented in Table 7.

The policies and measures presented here and in the relevant CTF tables, have predominately introduced for achieving the national emissions' reduction target for 2030 and not 2020. Some of these measures (e.g. promotion of RES and energy efficiency, further promotion of anaerobic digestion for animal waste) have been introduced earlier and could contribute towards the achievement of the 2020 national emissions' reduction target.

³⁹ https://eur-lex.europa.eu/resource.html?uri=cellar:0c4bbc1d-02ba-11e4-831f-01aa75ed71a1.0001.02/DOC_6&format=PDF, see table 2 in part 2/6

Based on the GHG projections for 2020 and 2030 presented Chapter 5, Cyprus faces challenges to make progress toward the GHG emission reduction targets. With regards to 2020, the national target will be met through the use of the flexibility mechanisms provided in the EU Effort Sharing Decision; i.e. Cyprus plans to use its own surplus AEAs for compliance. Regarding 2030, Cyprus plans to introduce additional policies and measures in a later stage in time (expected in 2023-2024), when the best available technologies will be more financially viable and the effects of the fiscally neutral green tax reform planned for 2021 will be assessed.

Table 7. Policies to reduce greenhouse gas emissions

Name of policy	Sector Category
Promotion of natural gas as an intermediate fuel for the decarbonisation of the energy system	Electricity
Promotion of renewable energy sources	Energy – all
Improvement in energy efficiency in all sectors	Energy – all
Reduction of emissions in the transport sector	Transport
Reduction of fluorinated gas emissions	Industry
Reduction of emissions in the agricultural sector	Agriculture
Reduction of emissions in the waste sector	Waste
Reduction of emissions from the businesses	All non-ETS
Increase of absorptions by LULUCF	LULUCF

Reducing greenhouse gas emissions and environmental objectives

- Emissions in the non-ETS sectors to be reduced by 20.9% compared to 2005. The non-ETS national target is going to be achieved by the use of flexible mechanisms provided by the ESR.
- Emissions from land use, land use change or forestry are offset by at least an equivalent removal of CO₂ from the atmosphere
- Emissions in ETS sectors to be reduced by 24.9% compared to 2005
- Attaining quantitative targets for reducing national emissions of specific air pollutants

Increasing the share of RES in energy consumption

- Share of RES in gross final energy consumption to reach 23%
- Share of RES in gross final electricity consumption can reach at least 26%
- Share of RES in heating and cooling to reach 39%
- Share of RES in the transport sector to reach 14%

Improving Energy Efficiency

- Final Energy Consumption of 2.0 Mtoe in 2030, representing 13% reduction in final energy consumption*
- Primary Energy Consumption of 2.4 Mtoe in 2030, representing 17% reduction in primary energy consumption*
- Achieving cumulative energy saving of 243.04 ktoe during 2021-2030

* compared to the respective projection for Cyprus in the 2007 in the EU PRIMES 2007 Reference Scenario

Figure 9. National energy and environmental objectives for the period 2021-2030 in the context of EU policies

All these policy priorities and the specific measures resulting from their implementation are part of an integrated plan for the optimal attainment of the national energy, environmental, socio-economic and development objectives, which requires consistency, horizontal combination and coordination in monitoring the priorities and implementing the measures. A key requirement for attaining the objectives set out in the context of NECP is to understand that the progress made in each individual sector automatically affects that made in the other sectors, and consequently the impact of the measures that are finally planned and implemented does not relate to or affects just one topic and section of the NECP, but has an impact on the overall development of the energy system.

Businesses

A new financial support scheme is currently in development that is planned for implementation for 2020 to 2022, to encourage business to take measures towards their reduction of greenhouse gas emissions. The scheme started as an initiative, “Business4Climate”⁴⁰ through which the Cyprus Employers and Industrialists Federation, the Cyprus University of Technology and the Department of Environment of the Ministry of Agriculture, Rural Development and Environment, aimed to commit businesses to more actively involved in climate action by reducing their greenhouse gas (GHG) emissions by 8% until 2030 through a voluntary commitment. Currently there are 64 signatories.

Energy

Policies to reduce emissions from conventional power plants contribute to reducing greenhouse gas emissions in the coming period. The most important policy measure relevant to electricity production concerns import and utilisation of natural gas for electricity production.

Promoting RES is a top policy priority to move towards the decarbonisation of the economy. All measures for the penetration of RES in electricity generation, in heating and in transport contribute to this objective.

The implementation of energy efficiency improvement measures, which have been included in the policies for improving energy efficiency in all sectors, also contribute to reducing greenhouse gas emissions.

Transport

The Amendment of the Motor Vehicles and Road Traffic Law (Law 100(I)/2013) for revision of the vehicle taxes and annual circulation taxes, a measure that relates to the tax imposed on vehicles with a view to reducing CO₂ emissions, which has been in force since 2014. The latest amendment was decided on 29 March 2019 and has revised the method of calculating the motor vehicle registration fees beyond the CO₂ parameter. More specifically, higher fees are now charged for vehicles emitting more than 120 g/km. Furthermore, an additional fee is included based on the ‘Euro’ technical specifications of vehicles. This action further promotes the use and purchase of low emission vehicles, including zero emissions vehicles.

⁴⁰ <http://www.oeb.org.cy/en/drasis/business4climate/>

At the same time, incentives for the purchase and use of low/zero emission vehicles including the old vehicle scrapping scheme and financial incentives for the purchase of electric vehicles have been announced in late 2019. This scheme will have a total cost of €3 million and will come into force in 2020.

Moreover, the Integrated Fleet Management System (Central Government vehicles) includes the installation of an Integrated Fleet Management System by the Department of Electrical and Mechanical Services, on approximately 1800 government owned vehicles. The system was installed in 2017 and its total cost was €1.7 million. This measure aims amongst other benefits, to utilise the vehicle refuelling data to compare and high fuel consumption vehicles and replace them where necessary.

For the promotion of the use of electric cars, the Electricity Authority of Cyprus has deployed a total of 19 recharging stations accessible to the public in Cyprus. Furthermore, the Department of Electromechanical Services is proceeding with the installation of 10 double fast-charging stations in highways and public roads. This action will be completed in 2020 and its total cost is approximately €1 million. 3 additional charging stations will be installed by the Public Works Department in 2020 through the European Programme EnernetMob.

Regarding public transport, new bus concessions are planned to be put in force in 2020 and will further improve the system. The increase of the use of buses that have low or zero GHG emissions will be implemented for the contract period 2020-2030. Furthermore, the new bus contracts include specific requirements for the use of electric buses and provision for conversion of operator's bus fleet to use Compressed Natural Gas (CNG), when such fuel source is available in Cyprus and the prerequisites for doing so exist.

Additionally, towards the improvement of the efficiency of the public transport system, the Ministry of Transport, Communications and Works, has installed a telematic system that manages the bus services and records data. The related website and mobile application contain a detailed map of the routes and the timetable of buses in order to facilitate passengers in real time. This action was completed in 2018 and its cost was approximately €7 million, including maintenance for 5 years.

Concerning biofuels their use was 2.5% at the end of September 2019, and is currently at 5% (December 2019). These percentages will be increased in 2020 in order to meet the obligatory targets. A support scheme is currently under development by the Ministry of Agriculture, Rural Development and Environment for the promotion of local production of biofuels. It is expected to be ready for implementation in 2020 for the period 2020-2022.

LPG vehicles were seen as a possible short-term solution, as the construction of 25 LPG fuel stations was planned within the next years and conversions from petrol cars are often cost efficient. Currently, there are only 8 LPG fuel stations moment and the impact of LPG on the RES goals is negligible. A further development of the technology is not foreseen in the long term – as more efficient technologies using RES such as e-mobility take over. Moreover, the import of natural gas and future plans to exploit the reserves of natural gas, located in its economic exclusive zone, could support the promotion of CNG/LNG vehicles instead of LPG vehicles. The cost for this action is covered by private investments.

Fluorinated gases

The New EU F-gas Regulation adopted in 2014 and applies from 1 January 2015, aims among others in preventing emissions of F-gases from existing equipment by requiring leakage

checks, proper serving and recovery of the gases at the end of the equipment's life. For the full implementation of this regulation in Cyprus a proper recovery system needs to be setup and used in Cyprus. Given the high GWP of the F-gases, and their increasing contribution to the national emissions, it is considered crucial for proper recovery to be implemented within the following years.

Under the provisions of Article 9 of Regulation 517/2014/EC, on fluorinated greenhouse gases, without prejudice to existing Union legislation, Member States shall encourage the development of producer responsibility schemes for the recovery of fluorinated greenhouse gases and their recycling, reclamation or destruction. Cyprus has recently adopted and harmonized the above Regulation into Cypriot Law 62(I)/2016 and 46(I)/2017. The next step is to adopt a national Law regarding a producer's responsibility scheme. The main provision of this Law, which is currently discussed at the parliament, follows the "polluter pays" principle and each producer has to participate in an appropriate scheme for management of f-gases that have been recovered for any reason.

At the same time, certified technicians will be encouraged to return to the scheme any fluorinated gases they have recovered, for a pre-decided profit, through the development of a financial support scheme which is currently designed. Its implementation is expected to start in 2021 for the period 2021-2022. The goal is to achieve 5% recovery by 2030.

Agriculture

The Common Agricultural Policy (CAP) promotes sustainable food production, sustainable farm management and environmentally and climate-friendly practices and methods. The measures that implemented aim at preventing desertification, improving water management, reducing the intensity of natural resources, optimising the use of agricultural land, reducing the use of fertilisers and improving animal waste management, where special emphasis is given to the promotion of anaerobic digestion for the treatment of animal waste.

In addition, the Rural Development Programme promotes forestry, which also increases the absorption from the LULUCF sector.

Currently, the contribution of measures other than anaerobic digestion to the country's overall emissions/absorption balance cannot and have not been estimated.

Anaerobic digestion technology may help to address two congressional concerns that have some measure of interdependence: development of clean energy sources and reduction of greenhouse gas emissions. Anaerobic digestion, as a way of converting biomass to energy, has been practiced for hundreds of years. It is a technology that helps to reduce waste, generate energy and cut down on carbon emissions. The general performance of anaerobic digesters and the diversity of wastes which they can treat have been increasing steadily as a result of new reactor design, operating conditions, or the use of specialised microbial consortia, during the last decades. In Cyprus there are currently operating more than 10 anaerobic digesters, of which the majority is at large animal farms. All available studies show

that there is a great potential in Cyprus to further promote anaerobic digestion for the treatment of waste with high organic content.

Even though anaerobic digestion is not clearly stated in the European or national legislation, the technology is preferred by large animal farms to comply with the terms stated on the wastewater and air emissions permits. The technology is strongly promoted by the Department of Environment, especially for the large installations that fall under the Industrial Emissions directive. Relevant national legislation that encourages the promotion of anaerobic digestion is (a) the Control of Water Pollution (Waste Water Disposal) Regulations 2003, Κ.Δ.Π. 772/2003; (b) the Control of Water Pollution (Sensitive Areas for urban waste water discharges) Κ.Δ.Π. 111/2004. It is a voluntary measure which is expected to increase. Therefore it is considered important to further promote the use of anaerobic digestion for the treatment of animal waste (target for 2030: 11.5% for cattle waste, 5% for sheep and goat waste, 22.8% for poultry waste and 66% for pig waste).

Waste

A package of policy measures are contributing towards reducing the quantities of biodegradable waste in solid waste treatment facilities. Measures are promoted for the separate collection of bio-waste, recycling and energy recovery through anaerobic digestion. These measures are primarily aimed at the reduction of the quantities of biodegradable waste in solid waste treatment facilities, not only for electricity and thermal energy generation (e.g. biogas production), but also for recycling. The above measures, which have already been launched in the framework of the National Municipal Waste Management Strategy, will be intensified in the period 2021-2030, as National Planning is currently being revised under the EU circular economy package and the new waste Directives.

With the EU Waste Framework Directive being the main guiding force, in conjunction with the need to improve the waste management infrastructure of the country to ensure the appropriate management of waste in line with EU obligations and targets, Cyprus has developed and is implementing, as part of its Strategy, the National Municipal Waste Management Plan of 2015-2021 which is currently undergoing a major revision. The implementation of the Plan is the responsibility of the Department of Environment.

The National Municipal Waste Management Plan of 2015-2021 (MWMP) contains quantitative and qualitative targets and enumerates specific measures and actions to be taken in order for the EU targets to be reached. One of the quantitative target is that no more than 95,000 tonnes of biodegradable waste to be disposed in landfills (represents the 35% target of the 1999/31/EC directive). Also the Legal Measures will be focused on the:

- Development of local waste prevention and management schemes
- Mandatory obligation for the establishment of separate collection systems by local authorities,
- Establishment of extended producer responsibility (EPR) for streams other than packaging waste,
- Establishment of a landfill tax/levy,
- Banning the disposal of certain waste streams from entering into landfills (e.g. green waste, high calorific value waste, etc.)

The following measures have so far been implemented:

- a) One Sanitary Landfill and one Residual Sanitary Landfill (supplementing MBT unit at Koshi) were constructed and operated (both meet the requirements of directive 99/31/EC). The MBT unit has been in operation since 2010 serving the Larnaca - Ammochostos districts. The Plant was designed in a way that a high separation of recycled and biodegradable material is achieved. Another I.W.M.P (Integrated Waste Management Plant) serving the Limassol district came into operation in 2017.
- b) The construction of the Green Points Network (22 collection points for various household waste streams– bulky waste, green, textile, furniture, WEEE, etc.) has been completed and all Green Points are now in operation.
- c) Currently, there is a system for the separate collection of packaging waste from households, operated by the collective system which has been established under the Packaging Directive. The system carries out door-to-door collection in most urban centres, with a number of smaller communities serviced by central collection points. Draft Regulations have been prepared, as set out in the National Strategy for the Management of Municipal Waste, with a view to their adoption in 2020, which define the obligations of local authorities for the management of municipal waste. The Regulations will provide for the preparation of local waste management plans and waste prevention programmes by the local authorities, the obligatory establishment of separate collection systems for a number of waste streams (specifically paper, glass, plastic and metals, including packaging, wood and synthetic packaging and bulky waste), the obligatory establishment of a separate collection systems for organic waste (including food and garden waste), and the adoption of a pay-as-you-throw scheme.
- d) The construction works for the rehabilitation/restoration of the old non approved landfills, which are closed at Paphos and Larnaca - Ammochostos districts, were completed. The preparation of studies/documents regarding the rehabilitation/restoration of the 20 non sanitary landfills of Nicosia district and the 44 sanitary landfills of Limassol district will be completed within 2018 and after that the construction works will begin.

A comprehensive study was undertaken in 2005 for the elaboration of a Strategic Plan, an Environmental study and a Feasibility study for the restoration and management of landfills. The purpose of the study was to record all landfills, assess their status and level of risk, create a restoration priority list based on pollution risk assessments, and undertake the appropriate environmental studies as well as feasibility studies for the restoration of the prioritised landfills. These studies were a necessary step for the restoration of all landfills recorded.

The last two (2) illegal landfills were closed in February 2019 and plans for the restoration are underway. According to recent data, these two landfills were fed with approximately 155,000 ton and 200,000 ton of municipality waste each year respectively (reference year 2012).

Sixty two (62) non sanitary landfills are planned to be restored appropriately within the following years. According to the preliminary study conducted in 2005, these landfills contain

approximately 597,269 m³ of solid waste excluding 2 major landfills that have not been closed yet.

Fifty three (53) landfills have been restored the last five years and are being monitored. During their restoration a total of 4,902,000 m³ of solid waste were reallocated and properly buried using composite liners and leakage collection systems.

The key features of the strategy that have been included in the GHG reduction Policies and Measures are the following:

- Reduction of waste to solid waste disposal sites from sorting at production level (40% from 2021, 55% in 2025, 60% in 2030).
- Reduction of organics to landfills to 15% from 2021.
- Introduction of anaerobic digestion for the treatment of organic wastes treated by (5% from 2021)

An additional measure considered and not included in the solid waste management strategy is biogas recovery from old landfills, during their restoration (20% from 2020).

Education, training and public awareness

Climate change in the context of formal and non - formal education is an issue of interdisciplinary investigation and interconnected with all the issues of environment and sustainable development as a matter of national, regional and international interest. The consideration of climate change in this context relies on the fact that climate change is not a mono-dimensional problem, cut off from the rest of the issues, but could be the apparent cause and consequence of a chain of direct and indirect human effects on all environmental issues.

Access of environmental information to the public is provided through the websites of the relevant Ministries and other governmental agencies. With the ratification of the Aarhus Convention, Cyprus has posed legal obligations for the access of information regarding the state of the Environment. In addition, law no. 119(I)/2004 by which Cyprus incorporated the Directive 2003/4/EC on “public access to environmental information” into national legislation, seeks to increase public access and dissemination of information, contributing to a greater public awareness in decision making and environmental protection. According to this law, “environmental information” includes information related to climate change such as: state of elements (among others air, atmosphere, water, coastal areas, biological diversity, and the interactions among them), factors (e.g. emissions, energy), policies and measures, reports, cost-benefit analyses.

The Cypriot Government gives high priority to public consultation and awareness. Draft legislation related to climate change, energy and environmental issues are open to public consultation before their adoption.

The work on education, training and public awareness is continuous and its contribution has not been assessed with respect to reduction of greenhouse gas emissions. Further details on the issue are available in the 7th National Communication of Cyprus (Chapter 9)⁴¹.

Further details on the policies and measures are available in the Cyprus' NECP⁴² and the CTF table 3. Summary of the policies and measures are presented in Table 8 (existing) and Table 9 (additional).

Table 8. List of existing policies and measures

Sector	Policies and measures
Non-Energy and Transport	○ Recovery of fluorinated gases (at least 5% by 2030).
	○ Increase of anaerobic digestion for treatment of livestock waste (target for 2030: 23% poultry waste, 5% sheep and goat waste, 66% poultry waste).
	○ Business greenhouse gas emission reduction support program (target for 2030: reduction of at least 8%).
	○ Sorting at the source of solid waste (40% by 2021, 55% by 2025, 60% by 2030).
	○ Decrease in organic waste to landfill to 15% by 2021.
	○ Recovery of biogas from old disposal sites by at least 20% by 2020.
	○ Use of anaerobic digestion for municipal waste treatment since 2021 (at least 5%).
	○ Information / Awareness.
Energy	○ Promotion of natural gas for electricity production
	○ Energy interconnection with neighbouring countries (electricity and natural gas)
	○ Renewable Energy Sources
	- Support for projects below 1MW → Energy Communities (No Electricity Market).
	- Continuation of Net-Metering & Net (+ Virtual) Billing.
	- Promotion of electricity from RES; production of local biofuels and biogas.
	- Promotion of efficient Heat-Pumps utilisation.
	- Solar in business.
	- Information / Awareness.
	○ Improvement in energy efficiency
	- Excise duty on motor fuels beyond the EU minimum
	- Imposing energy efficiency obligations on energy distributors.
	- Financial incentives.
	- Information / Awareness.
Transport	○ Install 10 extra dual electric vehicle recharge points.
	○ Old Car Withdrawal Plan / Incentives to buy electric cars.
	○ Fleet management system for public service vehicles.
	○ New bus contracts / Telematics system installation at bus services.
	○ Review of vehicle taxes and annual traffic taxes.
	○ Use of biofuels in the transport sector
	○ Use of LPG in vehicles.
	○ Information / Awareness.

⁴¹ <https://unfccc.int/documents/64731>

⁴² [http://www.moa.gov.cy/moa/environment/environmentnew.nsf/all/EE3E8BE9D5282E5CC22584F700273BD9/\\$file/submission.zip?openelement](http://www.moa.gov.cy/moa/environment/environmentnew.nsf/all/EE3E8BE9D5282E5CC22584F700273BD9/$file/submission.zip?openelement)

Table 9. List of additional policies and measures

Sector	Policies and measures
Non-Energy and Transport	○ Further recovery of fluorinated gases (at least 10% by 2030).
	○ Further increase of anaerobic digestion for treatment of livestock waste (target for 2030: 25.7% poultry, 10% sheep and goats, 69% pig farming).
	○ Further recovery of biogas from old disposal sites by at least 30% by 2020.
	○ Special tree planting program
	○ Information / Awareness.
Energy	○ Further promotion of natural gas for energy production
	○ Renewable Energy Sources
	- Speed up digitization of applications for new projects → One Stop Shop
	- In case of Non-Electrical Interconnection
	▪ Promoting Energy Storage by 2023-2024
	▪ Promoting Geothermal and Solar in Business → Increasing Commitments
	- Information / Awareness.
	○ Improvement in energy efficiency
	- Additional investment in savings measures in the residential and tertiary sectors (total €65 mil. per year) and industry (€67 mil. for the decade)
	- Information / Awareness.
Transport	○ Promote sustainable modes of transport
	○ Further use of low or zero emission buses
	○ Further use of vehicles with low or zero emissions
	○ Extensive tree planting on urban and interurban roads
	○ Information / Awareness
Horizontal	○ Fiscally neutral green tax reform

LULUCF

The Department of Forests is implementing a plan to increase forest tree production from its nurseries for planting in now non-forested lands. The campaign is titled “I plant for Climate” and is directed towards public or private organizations such as municipalities, churches, schools, NGOs and firms who wish to forest public or privately owned lands and who will agree to be responsible to provide the funds and care (i.e. water) of these areas for a minimum of three years. The Department of Forests, after evaluating the applications, will be providing the trees for free, taking into account the area of the plot and the specificities of the location, i.e. elevation. The plants supplied will be selected from a specific list of mostly indigenous, non-invasive species that are suited to the climatic conditions of Cyprus such as: *Pinus brutia*, *Cupressus semperivines*, *Quercus spp.*, *Juniperus spp.*, *Tamarix spp.*, *Laurus nobilis*, *Ceratonia siliqua*, *Myrtus nobilis*, *Nerium oleander* and *Rosmarinus officinalis*. The scheme starts from around 70,000 trees in 2020 and is planned to reach 300,000 trees planted per year in 2030.

Additionally, extensive tree planting of up to 650,000 trees along the urban road network and up to 350,000 trees along the interurban road network is an ambitious measure currently studied by the Ministry of transport. The cost of this action is estimated at €85 million and includes the planting cost and infrastructure changes required along the urban network, but it does not include the maintenance and watering costs. The positive impacts for this measure include CO₂ absorption, aesthetic upgrading, shading, lowering

temperatures and better conditions for cycling and walking that could have a significant impact in the use of sustainable modes of transport. It is noted that the effects of this measure has not been examined in terms of GHG reductions.

4.4.2. Information on changes its domestic institutional arrangements

The institution responsible for energy issues in Cyprus is the Ministry of Energy, Commerce and Industry, while climate change is the responsibility of the Ministry of Agriculture, Rural Development and Environment and in particular the Department of Environment. The Department of Environment has a team of seven officers allocated to climate issues, working both on adaptation and mitigation issues. The Ministry of Energy, Commerce and Industry is also responsible authority for the preparation of the National Energy and Climate Plan, with almost all the personnel within the Department of Energy contributing to the above effort.

For the purposes of implementing the Regulation on the Governance of the Energy Union and Climate Action [(EU) 2018/1999]⁴³ and in particular to set out the necessary foundation for a reliable, inclusive, cost-efficient, transparent and predictable Governance that ensures the achievement of the 2030 and long-term objectives and targets of the Energy Union in line with the 2015 Paris Agreement on climate change following the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (the “Paris Agreement”), through complementary, coherent, and ambitious efforts by the Union and its Member States, while limiting administrative complexity, a new structure for climate and energy governance has been approved by the Council of Ministers (15/11/2017 decision no. 83.709).

The core of this new structure (see Figure 10), the “National Governance System for Climate and Energy” is a Ministerial Committee, consisting of the Minister of Agriculture, Rural Development and Environment, the Minister of Energy, Commerce and Industry, the Minister of Finance and the Minister of Transport, Communications and Works. The Ministerial Committee is co-chaired by the Minister of Agriculture, Rural Development and Environment and the Minister of Energy, Commerce and Industry. This committee has to propose the National Energy and Climate Plan (NECP) to the Council of Ministers which takes the final decision. The proposal of the NECP is prepared by the Technical Committee, which consists of the Permanent Secretaries of the same Ministries. The Technical Committee also monitors the implementation of the NECP and makes proposals for its revisions when necessary. The Technical Committee is co-chaired by the Permanent Secretary of the Ministry of Agriculture, Rural Development and Environment and the Permanent Secretary of the Ministry of Energy, Commerce and Industry. The Technical Committee is consulted by the following seven Expert Working Groups: Decarbonisation, Energy Efficiency, Energy Security, Internal Energy Market, Research, Innovation and Competitiveness, Renewable Energy and Transport. Transport is an additional working group created due to the

⁴³ Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council

significant contribution of the sector to the national emissions. Each Working Group has a coordinator. All working groups with the exception of decarbonisation are the responsibility of the Ministry of Energy, Commerce and Industry; decarbonisation is the responsibility of the Department of Environment (Ministry of Agriculture, Rural Development and Environment). The secretariat of the National Governance System for Climate and Energy is held by the Department of Environment.

4.4.3. Economic and social consequences

The Impact Assessment of the National Energy and Climate Plan of Cyprus has been based on detailed modelling of the energy system of the country, which was mainly conducted with the OSeMOSYS optimisation model. Final energy demand projections for sectors other than road transport have been derived from a separate demand forecast model that has been used for the assessment of national energy efficiency action plans of Cyprus in the recent past, which were then input to OSeMOSYS. The optimisation results, as shown in Chapter 5.1 of the NECP, along with the associated costs and calculated emissions of GHGs and air pollutants, have been fed into other models in order to assess the macroeconomic and employment impacts of the two scenarios that were explored. Apart from the above energy-related data and results, information about emissions abatement and costs for non-energy-related GHG emissions were obtained from the relevant calculations of national authorities that are included in the NECP of Cyprus.

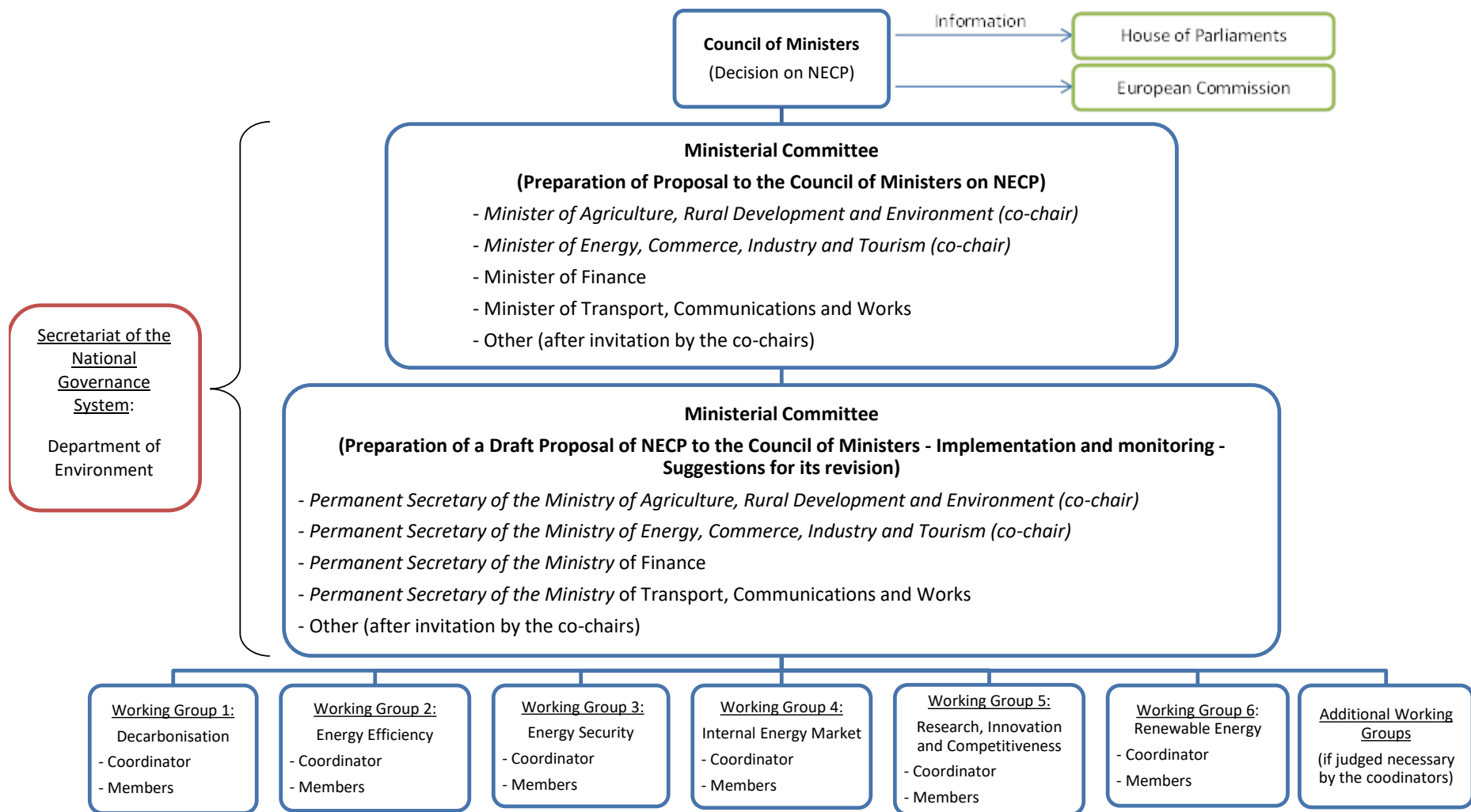


Figure 10. Structure of the national governance system for Climate and Energy

Taking into account that national authorities have decided to proceed in their energy and climate policy in three stages time steps base on the 3 reporting periods (Stage 1 implement all Planned Policies and Measures till 2022, Stage 2 additional Planned Policies and Measures based on the progress of stage 1 and Stage 3 being an intention to proceed with more ambitious measures in the near future in order to fill the gap towards the -24% CO₂ target), the main findings of the Impact Assessment can be summarised as follows:

1. Existing policies and measures (Stage 1 of the national climate policy) are clearly insufficient to lead Cyprus to compliance with its obligations stemming from the Energy Union Governance Regulation. They cannot lead to compliance with the national renewable energy and energy efficiency targets, and they can only lead to 3% reduction in non-ETS emissions in 2030 compared to 2005; this will require purchasing a significant amount of emission allowances to fill the 2030 emissions gap, which, under optimistic assumptions, will cost the Republic of Cyprus at least 131 million Euros⁴⁴ in the period up to 2030. Moreover, non-compliance with the 2030 target of 14% renewable energy in transport will lead to additional costs in the WEM scenario, because the gap in renewable share will have to be covered through the Statistical Transfer procedure.
2. The Planned Policies and Measures scenario that will be implemented in stages, is able to make Cyprus meet its goals. If fully implemented, these measures will lead to net economic benefits to the society of more than 500 million Euros'2016 by 2030, accompanied by small positive effects on economic indicators – a 0.3% increase in national GDP and a 0.3% rise in economy-wide employment in 2030. The changes in energy costs to end consumers will be very small and overall will have essentially no adverse impact on the welfare of households and social equity.
3. Road transport holds the key to emissions abatement both for 2030 and for the longer term. Investments in sustainable mobility may exceed 1.3 billion Euros throughout the period 2020-2030 and can therefore be considered as costly. However, these investments are expected to fully pay off because of multiple benefits from the reduction of the use of passenger cars, which can yield aggregate economic benefits to society of the order of 2 billion Euros'2016. Coupled with a fast electrification of the passenger car sector, they can enable achieving the 2030 non-ETS emission reduction target and shifting the whole Cypriot economy to a low-carbon path towards 2050.
4. There are essentially no higher investment requirements to realise the WAM scenario in comparison to the existing measures, but a re-allocation towards public investments for sustainable transport; these are expected to pay off because fuel import costs throughout the lifetime of these measures may decline considerably due to these investments.

⁴⁴ This calculation is based on assumptions provided by MARDE about the evolution of ETS allowance prices up to 2030. They are considered to be optimistic because Cyprus will not have the right to 'borrow' emission allowances from ETS installations, and since most EU Member states expect to be in deficit of allowances for meeting their 2030 ESR targets, it is likely that the cost for purchasing allowances to cover the non-ETS emissions gap will be considerably higher.

5. However, successful implementation of the package of Planned Policies and Measures is not guaranteed because it requires significant investments for energy renovations in buildings and industry and – most importantly – a substantial commitment to promote public transport and non-motorised transport modes (walking and cycling) as well as a shift to electric cars.
6. Among the list of Planned Policies and Measures, some measures are more cost-effective than others (e.g. roof insulation or installation of heat pumps in buildings and further deployment of rooftop PVs and solar panels for hot water use). However, with very few exceptions, all other measures pass the cost-effectiveness test and can be deployed without delay.
7. Non-energy-related measures can also contribute to emission reductions. Recovery of fluorinated gases seems to be cost-effective, while extensive planting of trees may be a measure with relatively limited potential and high cost up to 2030, but is an important ingredient of decarbonisation policy in the longer term.
8. In the event that the project of electricity interconnection of Cyprus with Greece and Israel is realised, penetration of renewable energy will be considerably higher. This will enable substantial additional investments for decarbonising the electricity system, and will be able to put Cyprus on track to meet its long-term decarbonisation targets. On the other hand, if the project is not materialized substantial investments are needed in Energy Storage to support at least the minimum level of RES penetration that is required for the Cyprus to meet the RES targets for 2030. On the other hand, if the project is not materialized substantial investments are needed in Energy Storage to support at least the minimum level of RES penetration that is required for the Cyprus to meet the RES targets for 2030.
9. On the way to decarbonisation of the energy system, research and innovation can play an important role. Although great technological breakthroughs are unlikely to come from research in Cyprus alone, the existence of a critical mass of researchers in topics such as energy efficiency, renewable energy sources and fuels, and emission abatement measures can accelerate a) the demonstration and deployment of novel technologies in Cyprus, b) the implementation of innovative measures under the particular conditions of the Cypriot market, and c) the development of expertise for innovative services related to low-carbon technologies.
10. Even if implemented fast and effectively, Planned Policies and Measures are not sufficient for reaching the non-ETS GHG emission reduction target of 24% by 2030, as required from Cyprus in the Effort Sharing Regulation; the reduction can only reach 14.7% in the WAM scenario. In order to achieve full compliance, the government of Cyprus has to choose between three options:
 - a. Not proceed with further GHG emission abatement measures and use instead flexibility mechanisms to purchase emission allowances, with the associated costs; these are estimated to reach at least 55 million Euros up to 2030 but as indicated in point 1 above, may reach much higher levels if several EU Member States are in need to purchase emission allowances to fill their own emission abatement gap.

- b. Implement stronger emission abatement policies and measures (e.g. double the number of energy renovations of buildings, increase cogeneration plants or biogas production plants from waste, encourage accelerated replacement of conventional cars with electric ones); however, all these measures are extremely difficult to implement at such a scale within the short time frame available; therefore they cannot be considered as a realistic alternative.
 - c. Induce energy conservation measures through the adoption of a fiscally neutral green tax reform, by imposing a gradually increasing carbon tax on all non-ETS sectors. The revenues of such a tax can be recycled in the economy by reducing labour taxes and providing financial support to energy conservation and green transport policies. Such a reform can have substantial economic benefits without harming low-income households or the competitiveness of firms⁴⁵.
11. In view of the declared political commitment of the European Union to carbon neutrality by 2050, the measures foreseen in the NECP of Cyprus and the options mentioned above for filling the non-ETS emissions abatement gap have to be assessed in light of the need for deep decarbonisation. It has been shown that it is impossible to attain the 2050 target if there is low ambition about decarbonisation in 2030.^{46,47,48} Therefore, purchasing allowances to fill the 2030 emissions gap is both costly and does not lead to a strong decarbonisation path towards 2050; hence it is not the preferred option for the government of Cyprus.
12. In September 2019 the Finance Minister of Cyprus announced that a green tax reform will be put in consultation in 2020 with the aim to adopt the relevant legal framework and implement such a reform in 2021. As this measure is still provisional and no specific details have been agreed, it has not been included by authorities in the Planned Policies and Measures scenario of the NECP. Based on the previous considerations outlined in this section, the gradual implementation of a green tax reform from 2021 onwards (Stage 3) seems to be a necessary additional policy, both for leading Cyprus to achievement of the non-ETS emission reduction target of 2030 and for enabling the transition to a net-zero-carbon economy by 2050.

⁴⁵ Zachariadis T., A Proposed Green Tax Reform for Cyprus and its Co-Benefits for Urban Sustainability In: *Critical Issues in Environmental Taxation*, Ezcurra M.V., Milne J., Ashiabor H. and Andersen M.S. (Eds.), Edward Elgar, 2019.

⁴⁶ Zachariadis T., Michopoulos A., Vougiouklakis Y., Piripitsi K., Ellinopoulos C. and Struss B., Determination of Cost-Effective Energy Efficiency Measures in Buildings with the Aid of Multiple Indices. *Energies* 11 (2018), 191; doi:10.3390/en11010191

⁴⁷ Sotiriou C. and Zachariadis T., Optimal Timing of Greenhouse Gas Emissions Abatement in Europe. *Energies* 12 (2019), 1872; doi:10.3390/en12101872.

⁴⁸ Vogt-Schilb A. and Hallegatte S., Climate policies and nationally determined contributions: Reconciling the needed ambition with the political economy. *WIREs Energy Environ.* 2017, 6, e256.

4.5. Estimates of emission reductions and removals and the use of units from the market-based mechanisms and LULUCF activities

Establishing and implementing the policies and measures described in the section outlining existing measures, it is assessed that the greenhouse gas emissions outside the EU ETS will reduce to 3829 Gg CO₂ eq. in 2030, which corresponds to a reduction of 10.2% compared to 2005. Implementing the additional policies and measures is expected to reduce the GHG to 3374 Gg CO₂ eq., which corresponds to a reduction of 20.9% compared to 2005.

With regards to ETS sectors, the emissions are expected to reduce to 4195 Gg CO₂ eq. in 2030 with existing measures corresponding to a decrease of 17% compared to the 2005 emissions. With the implementation of the additional measures, the emissions are expected to reduce to 3815 Gg CO₂ eq. in 2030, corresponding to a decrease of 25% compared to the 2005. A sharp decrease in the ETS emissions is expected in 2021, with the introduction of natural gas for electricity production.

Overall, the emissions are expected to reduce by 14% with the implementation of the existing measures and by 23% with the implementation of additional measures; i.e. to 8024 Gg CO₂ eq. and 7190 Gg CO₂ eq. respectively.

With regards to 2020 emissions, non-ETS emissions, s these have been published in the EU review reports for the period 2013-2017 are as follows:

- 2013: 3,938,120 t CO₂ eq.
- 2014: 3,924,856 t CO₂ eq.
- 2015: 4,060,621 t CO₂ eq.
- 2016: 4,111,441 t CO₂ eq.
- 2017: 4,270,890 t CO₂ eq.

Regarding 2018, the EU review of the 2020 inventory has not yet finalised. The ESD emissions as these were estimated by Cyprus are 3,751,278 t CO₂ eq.

At national level, Cyprus has not used and does not plan to use any international credits for complying with its obligations; it is however possible to be used by the ETS installations. At national level, there is possibility to buy or sell AEAs to another member state of the EU and there is also a possibility to use the LULUCF flexibility provided by the LULUCF Decision, of a maximum of 0.6 million tonnes CO₂ eq. for the period 2021-2030.

5. Projections

5.1. Introduction

This Chapter describes a “with measures” (WM) or “with existing measures” (WEM) scenario concerning the national projections of greenhouse gas emissions by sources and their removal by sinks for the years 2020 and 2030. The “with measures” scenario assumes that no additional emission reduction policies and measures are adopted than the existing ones (implemented and adopted) as specified in the National Energy and Climate Plan (NECP) (section 4.4.1).

A “with additional measures” (WAM) scenario is also reported, which reflects the effect of all implemented / adopted and planned policies and measures. This scenario includes the additional policies and measures as specified in the National Energy and Climate Plan (NECP).

The GHG emission projections presented in this chapter are predominately based on the latest official energy projection scenarios that are developed by the Ministry of Energy, Commerce and Industry that are presented in detail in the NECP.

The projections of GHG emissions of the WEM and WAM scenarios disaggregated by sector and by gas are presented in CTF Table 6(a) to 6(c) and presented in sections that follow.

5.2. Updated projections for 2020 and 2030

The latest projections of GHG were completed in December 2019 for the preparation of the final NECP. The starting point for all projection scenarios is 2017 which is the latest inventory year available. Emissions projections related to international bunker have not been prepared.

The “with measures” scenario assumes that no additional emission reduction policies and measures are adopted than the existing ones. The “with additional measures” scenario assumes the implementation of additional policies (planned). The two scenarios are presented in the following sections. The resulting impact from the implementation of the two scenarios is presented in summary in Table 10 and Figure 11.

Some important issues that should be noted for these projections are the following:

- a) The change noticed during the recent years in the types and replacement of HFCs used is not taken into consideration due to the high uncertainty associated to any prediction of such changes.

- b) The emissions from the possible exploitation of natural gas in the Exclusive Economic Zone are not taken into account due to the high uncertainty associated to any prediction of such changes.
- c) The organic fraction of solid waste not going to the landfill is treated by composting, anaerobic digestion and incinerated for energy. The additional organics for incineration at the cement installation have not been accounted for.
- d) The municipal solid waste management strategy is currently undergoing a major revision, which is expected to be completed by the end of 2020. This revision in addition to the municipal solid waste management policies and measures to be implemented will also provide a revision of waste production projections.

Table 10. Projections of national GHG emissions disaggregated by sector (excluding LULUCF)

	Sector	1990	2005	2020	2025	2030
WEM	Energy	3970	7136	6787	5450	5549
	IPPU	841	1179	1420	1432	1442
	Agriculture	471	533	492	518	515
	Waste	387	496	493	446	362
	TOTAL	5669	9344	9192	7845	7868
	<i>Compared to 1990</i>			62%	38%	39%
	<i>Compared to 2005</i>			-1.6%	-16%	-16%
WAM	Energy	3970	7136	6784	5192	4931
	IPPU	841	1179	1420	1425	1442
	Agriculture	471	533	492	516	512
	Waste	387	496	450	395	303
	TOTAL	5669	9344	9146	7528	7188
	<i>Compared to 1990</i>			61%	33%	27%
	<i>Compared to 2005</i>			-2.1%	-19%	-23%

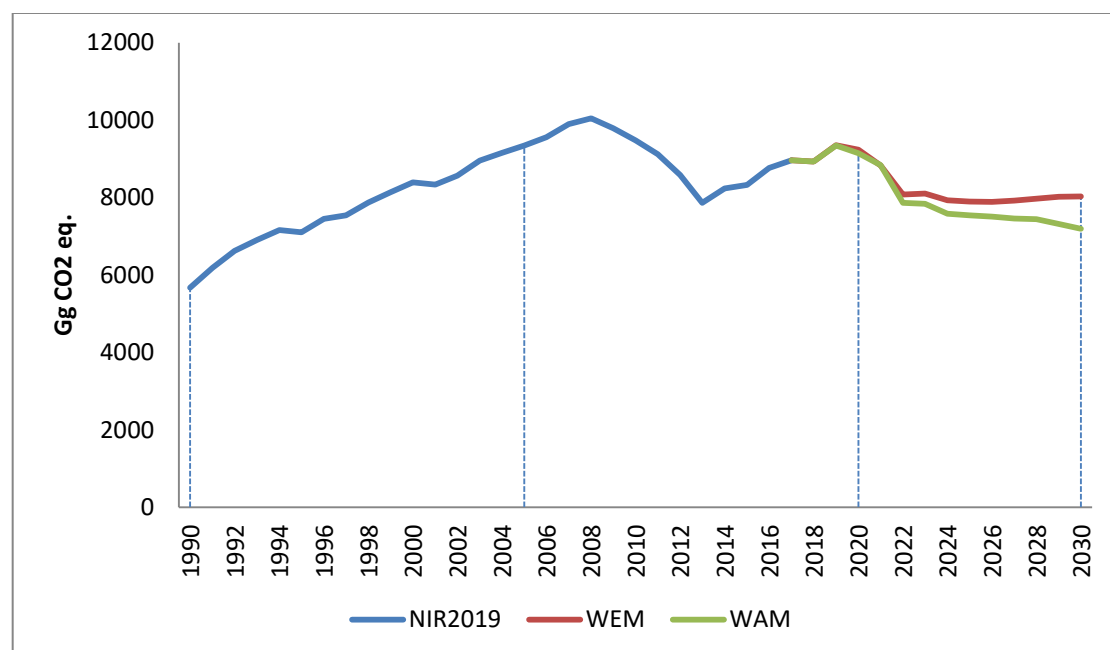


Figure 11 WEM and WAM Projections of total national GHG emissions (excluding LULUCF)

5.2.1. Assessment of aggregate effect of policies and measures

The effect of currently implemented and adopted policies and measures (that are incorporated in the WEM projections scenario) in terms of GHG avoided is estimated at 801 Gg CO₂ eq. in 2030, while the effect of planned policies and measures is 1,635 Gg CO₂ eq. in 2030.

5.2.2. With existing measures (WEM)

The measures included in the WEM scenario are presented in [Annex I](#). The activity data used for the calculations is presented in [Annex II](#). The methodologies applied are the same as those used for the preparation of the 2019 submission of National Greenhouse Gas emissions inventory of Cyprus to the UNFCCC⁴⁹. The impact of the implementation of the Policies and Measures on the emissions is presented in Table 11. Emissions based on the WEM scenario are projected to increase by 39% in 2030 compared to 1990 and reduce by 16% compared to 2005.

Table 11. Total WEM GHG emissions aggregated by source category for 2020 and 2030 (Gg CO₂ eq.)

	2020	2030
ENERGY	6787	5549
1A1 Energy Industries	3273	2083
1A2 Manufacturing Industries and Construction	931	927
1A3a ii Domestic Aviation	1	1
1A3b Road Transport	2048	2007
1A3d ii Domestic water-borne navigation	2	2
1A4a Commercial / Institutional	92	80
1A4b Residential	335	341
1A4c Agriculture / Forestry / Fishing / Fish farms	85	84
1A5 Non-Specified	19	24
IPPU	1420	1442
2A1 Cement production	1065	1065
2A2 Lime Production	4	6
2A4a Ceramics	13	13
2A4b Other Uses of Soda Ash	0.3	1
2D1: Lubricant Use	5	5
2D2: Paraffin Wax Use	0.1	0.1
2D3 Other	20	20
2F. Product uses as ODS substitutes	253	267
2G1b: Use of Electrical Equipment	0.2	0.2
2G3a: Medical Applications	6	6
2G3b: Propellant for Pressure & Aerosol Products	56	59
2G4: Other	0.01	0.01
AGRICULTURE	492	515
3A Enteric Fermentation	253	274
3B Manure Management	90	86
3B2.5 Indirect N ₂ O emissions	28	30
3D1.1 Inorganic N fertilisers	37	37

⁴⁹ <https://unfccc.int/documents/65701>

3D1.2 Organic N fertilisers	65	69
3D1.4 Crop residues	1	1
3D2 Indirect N ₂ O Emissions from managed soils	17	17
3F. Field burning of agricultural residues	0.1	0.1
3H Urea application	0.4	0.4
WASTE	493	362
4A Solid Waste Disposal	398	254
4B Biological Treatment of Solid Waste	9	10
4D1 Domestic Wastewater Treatment & Discharge	51	54
5D2 Industrial Wastewater Treatment & Discharge	35	44
WEM TOTAL (excl. LULUCF)	9192	7867
LULUCF	-526	-635

5.2.2.1. Directive 2003/87/EC and Decision No 406/2009/EC

The total ETS / ESD emissions for the WEM projections are presented in Table 12.

Table 12. ETS and ESD emissions according to the WEM scenario for 2020 and 2030 (Gg CO₂ eq.)

Gg CO ₂ eq.		2020	2030
ENERGY	ETS	4018	2821
	ESD	2769	2728
	TOTAL	6787	5549
IPPU	ETS	1077	1087
	ESD	343	355
	TOTAL	1420	1442
AGRICULTURE	ETS	0	0
	ESD	492	515
	TOTAL	492	515
WASTE	ETS	0	0
	ESD	493	362
	TOTAL	493	362
TOTAL	ETS	5095	3908
	ESD	4097	3959
	TOTAL	9192	7867

5.2.3. With additional measures (WAM)

The additional measures included in the WAM scenario are presented in [Annex I](#). The activity data used for the calculations is presented in [Annex II](#). The methodologies applied are the same as those used for the preparation of the 2019 submission of National Greenhouse Gas emissions inventory of Cyprus to the UNFCCC⁵⁰. The impact of the implementation of the Policies and Measures on the emissions is presented in Table 13. Emissions based on the WAM scenario are projected to increase by 27% in 2030 compared to 1990 and reduce by 23% compared to 2005.

⁵⁰ <https://unfccc.int/documents/65701>

Table 13. Total WAM GHG emissions aggregated by source category for 2020 and 2030 (Gg CO₂ eq.)

	2020	2030
ENERGY	6784	4931
1A1 Energy Industries	3273	1827
1A2 Manufacturing Industries and Construction	931	927
1A3a ii Domestic Aviation	1	1
1A3b Road Transport	2048	1665
1A3d ii Domestic water-borne navigation	2	2
1A4a Commercial / Institutional	91	75
1A4b Residential	333	325
1A4c Agriculture / Forestry / Fishing / Fish farms	85	85
1A5 Non-Specified	19	24
IPPU	1420	1442
2A1 Cement production	1065	1065
2A2 Lime Production	4	6
2A4a Ceramics	13	13
2A4b Other Uses of Soda Ash	0.3	1
2D1: Lubricant Use	5	5
2D2: Paraffin Wax Use	0.1	0.1
2D3 Other	20	21
2F. Product uses as ODS substitutes	253	267
2G1b: Use of Electrical Equipment	0.2	0.2
2G3a: Medical Applications	6	6
2G3b: Propellant for Pressure & Aerosol Products	56	59
2G4: Other	0.01	0.01
AGRICULTURE	492	512
3A Enteric Fermentation	253	274
3B Manure Management	90	83
3B2.5 Indirect N ₂ O emissions	28	31
3D1.1 Inorganic N fertilisers	37	37
3D1.2 Organic N fertilisers	65	69
3D1.4 Crop residues	1	1
3D2 Indirect N ₂ O Emissions from managed soils	17	17
3F Field burning of agricultural residues	0.1	0.1
3H Urea application	0.4	0.4
WASTE	450	303
4A Solid Waste Disposal	355	196
4B Biological Treatment of Solid Waste	9	10
4D1 Domestic Wastewater Treatment & Discharge	51	54
5D2 Industrial Wastewater Treatment & Discharge	35	43
WAM TOTAL (excl. LULUCF)	9146	7188
LULUCF	-526	-635

5.2.3.1. Directive 2003/87/EC and Decision No 406/2009/EC

The total ETS / ESD emissions for the WEM projections are presented in Table 14.

Table 14. ETS and ESD emissions according to the WAM scenario for 2020 and 2030 (Gg CO₂ eq.)

Gg CO ₂ eq.		2020	2030
ENERGY	ETS	4017	2565
	ESD	2766	2366
	TOTAL	6783	4931
IPPU	ETS	1077	1077
	ESD	343	364
	TOTAL	1420	1441
AGRICULTURE	ETS	0	0
	ESD	492	512
	TOTAL	492	512
WASTE	ETS	0	0
	ESD	450	303
	TOTAL	450	303
TOTAL	ETS	5094	3642
	ESD	4052	3546
	TOTAL	9146	7188

5.2.4. Projections of indirect GHG

Projections of indirect GHG until 2030 are presented in Table 15, as these are reported in the Cyprus Initial National Air Pollution Control Programme prepared by the Department of Labour Inspection of the Ministry of Labour, Welfare and Social Insurance in May 2019⁵¹.

Table 15. Projected emissions of indirect GHG with existing measures

	2005	2017	2020	2025	2030
NO _x	21.4	14.5	11.8	8.5	7.8
NMVOCs	22.1	13.3	11.9	11.5	11.0
SO _x	37.9	16.4	3.5	1.3	1.3
NH ₃	7.5	6.5	4.8	4.9	4.6
PM _{2.5}	2.2	1.3	0.9	0.8	0.7

5.3. Changes since its most recent national communication in the model or methodologies used

Two main procedures have been used for the preparation of the projections:

- The projections of energy sector are based on the official energy planning (national energy and climate plan) provided by the Ministry of Energy, Commerce and Industry (MECI). These data were “translated” to GHG emissions based on the spreadsheet models used for the estimation of annual GHG inventory.

⁵¹ Available at https://ec.europa.eu/environment/air/pdf/reduction_napcp/CY%20final%20NAPCP%2024May19%20annexed%20report%20EN.pdf

- Spreadsheet models for the non-energy sectors, in which future changes in activity data are mainly derived from assessments of sectoral experts, while emission factors are based on the 2006 IPCC guidelines and country specific information.
- Actual inventory data till year 2017 have been used in the preparation of the emission projections.

Emissions for all sectors were projected using the same models that were used for the NC7 / BR3, updated to:

- include improvements in inventory reporting;
- include emissions for 2017, as reported in the 2019 NIR submission; and
- update of key assumptions, in order to reflect in the projections the current economic situation, and the most recent forecasts of macroeconomic parameters (e.g. GDP, fuel and carbon prices).

5.3.1. Energy modelling

The updated outlook of primary energy demand in Cyprus combines the final energy demand projections with projections for the power generation sector which were conducted in the frame of Technical Assistance⁵² studies that were performed for MECL in 2019. Most of these forecasts have been performed with the OSeMOSYS optimisation energy systems model⁵³. OSeMOSYS is an open source modelling system for long-run integrated assessment and energy planning.

To calculate the demand for primary energy in power generation, the efficiency parameters of the power generation system presented in Table 16 that are based on the technical specifications of the existing and future power plants in Cyprus, were used.

Table 16. Key parameters of power generation according to forecasts with the OSeMOSYS optimization model.

	Average efficiency of all power generation	Thermal efficiency of power plants		
	Scenario with Planned Policies and Measures (natural gas end of 2021)	Steam turbine plants using fuel oil (average)	CCGT plant using diesel oil	CCGT plant using Natural Gas
2018	38.8%	39.0%	48.2%	--
2019	39.5%	38.3%	48.2%	--
2020	41.2%	38.1%	48.2%	--
2021	47.4%	38.1%	48.2%	51.5%
2022	53.3%	--	--	51.5%
2023	53.3%	--	--	51.5%
2024	55.3%	--	--	51.5%
2025	55.4%	--	--	51.5%

⁵² Technical Support on Long-Term Energy Modelling (available at [http://www.mcit.gov.cy/mcit/energyse.nsf/C1028A7B5996CA7DC22580E2002621E3/\\$file/JRC_LTEM_Final_Workshop_-_Cyl_results.pdf](http://www.mcit.gov.cy/mcit/energyse.nsf/C1028A7B5996CA7DC22580E2002621E3/$file/JRC_LTEM_Final_Workshop_-_Cyl_results.pdf))

⁵³ M. Howells, H. Rogner, N. Strachan, C. Heaps, H. Huntington, S. Kypreos, A. Hughes, S. Silveira, J. DeCarolis, M. Bazillian, A. Roehrl, OSeMOSYS: The Open Source Energy Modeling System, Energy Policy 39 (2011) 5850–5870. <https://doi.org/10.1016/j.enpol.2011.06.033>

2026	55.3%	--	--	51.5%
2027	55.3%	--	--	51.5%
2028	55.3%	--	--	51.5%
2029	55.9%	--	--	51.5%
2030	56.6%	--	--	51.5%
2031	57.3%	---	---	51.5%

In the WAM scenario the projections for primary energy consumption of Cyprus for 2020 and 2030 are both lower than the respective projections for Cyprus in the 2007 EU Reference Scenario⁵⁴ (the projection for Cyprus in PRIMES 2007 EU Reference Scenario was 2.8 Mtoe for 2020 and 2.9 Mtoe for 2030). It can be concluded that the forecast for national primary energy consumption of no more than 2.4 Mtoe in 2030 is lower by about 17%, than the respective projection for primary energy consumption in 2030 that was projected in the PRIMES 2007 Reference Scenario.

The same applies for the final energy consumption, where in PRIMES 2007 EU Reference Scenario the projection was 2.3 Mtoe in 2030, whilst the respective projection in the WAM Scenario, is 2 Mtoe for 2030. It can be concluded that the forecast for national final energy consumption no more than 2 Mtoe in 2030 is lower of about 13% than respective projection for Cyprus final energy consumption in 2030 that was projected in the EU PRIMES 2007 Reference Scenario.

The aforementioned assessment is in line with the methodology in the framework of the amendment of the Energy Efficiency Directive, in order to calculate the EU Energy Efficiency target of 32.5% for 2030. Therefore, using the same approach, Cyprus sets its indicative contribution to the EU 2030 energy efficiency target as:

- 17% reduction in primary energy consumption, compared to the respective projection for Cyprus in the 2007 in the EU PRIMES 2007 Reference Scenario and
- 13% reduction in final energy consumption, compared to the respective projection for Cyprus in the 2007 in the EU PRIMES 2007 Reference Scenario.

Compared to the EU-wide target of 1,273 Mtoe of primary energy consumption in year 2030, Cyprus (under WAM Scenario) is expected to account for 0.21% to the EU wide target for primary energy consumption in 2030, which is higher than its current annual contribution of the EU primary energy consumption.

⁵⁴ https://ec.europa.eu/energy/sites/ener/files/documents/trends_to_2030_update_2007.pdf

Table 17 Trajectory of primary energy consumption and final energy consumption (Mtoe) with WAM Scenario, 2021-2030

	Primary energy consumption (Mtoe)
2021	2.5
2022	2.4
2023	2.4
2024	2.3
2025	2.3
2026	2.3
2027	2.3
2028	2.4
2029	2.4
2030	2.4

Moreover, Cyprus has carried out complete projections and scenarios to allow assessing the expected impacts of the new planned policies, measures and programmes on primary and final energy consumption for each sector, at least until 2040, including an indicative trajectory from 2021 onwards. The results are shown in Table 18.

Under the Planned Policies and Measures, Cyprus strengthened the focus on energy efficiency in the transport sector by increasing the span of measures related to this specific sector, considering that it would represent half of the energy consumed in the country in 2030.

Table 18. Sectoral energy demand forecasts in years 2021-2030 - with planned Policies and Measures

Sectoral projections (Mtoe)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Primary Energy Consumption	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Total final energy consumption	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2	2	2
Final energy consumption – industry	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Final energy consumption - households	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Final energy consumption - agriculture	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Final energy consumption – transport	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Final energy consumption - services	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3

National indicative contributions for primary energy and final energy consumption in 2020

Based on the National Energy Efficiency Action Plan of 2017 (4th NEEAP 2017), Cyprus' national indicative target for energy efficiency was expressed in primary energy consumption of 2.2 Mtoe in 2020.

However, based on the latest modelling results, the anticipated level of national primary energy consumption in 2020 is estimated to be about 2.5 Mtoe.

More specifically, compared to the previous projections used in 4th NEEAP 2017, the latest projections of energy consumption have taken into account the following:

- The updated macroeconomic forecasts of the Ministry of Finance, which were published in September 2018. According to these, a stronger economic growth is foreseen up to 2030. For example, GDP in year 2020 is expected to reach € 21.7 bn (at 2010 prices) whereas the macroeconomic forecast that was used in 2017 reported a GDP of € 20,2bn (at 2010 prices) in 2020.
- The latest developments regarding the use of natural gas for power generation plants. According to the 4th NEEAP 2017, this was expected to happen by the end of 2018, whereas current government plans, supported by relevant contract preparations, show natural gas penetration happening in the last quarter of year 2021.

As stated in the 4th NEEAP 2017, a major reduction in primary energy consumption will be achieved through the switch from oil to natural gas in the power generation sector, which was planned to enter into the national energy mix by the end of 2018, and thus contribute to achieving the projected indicative level of 2.2 Mtoe. However, given that the aforementioned changes and latest developments show that natural gas penetration would happen in the last quarter of year 2021, the primary energy consumption for power generation in 2020 is now projected to reach 0.94 Mtoe, compared with 0.7 Mtoe in the 4th NEEAP 2017.

This explains why the anticipated level of primary energy consumption in 2020 will increase to about 2.5 Mtoe instead of 2.2 Mtoe. It should be noted that, taking into account the measures implemented in order to reduce end-use energy consumption by 2020 and based on the latest modelling results, the national projection included in the 4th NEEAP 2017 for indicative absolute level of final energy consumption of 1.9 Mtoe in 2020, can be achieved.

Methodology and conversion factors used

The methodology to forecast final energy demand is based on a simplified energy model that was developed at the National Technical University of Athens and used by Cyprus University of Technology (CUT). The model calculates future annual energy consumption in each major economic sector of Cyprus (agriculture, cement industry, other industry, households, services, road passenger transport, road freight transport and air transport) as a function of future macroeconomic variables and energy prices. It also calculates fuel shares in each sector, depending on technology costs (investment, operation, maintenance and fuel costs), the penetration potential of various technologies and technical constraints for the uptake of new technologies, and allows for computing of future final energy consumption by sector and fuel. Chapter IV of the study for Energy Efficiency Potential in Cyprus⁵⁵ describes the mathematical formulation for calculating aggregate energy demand by sector. Final energy demand was then converted to primary energy demand taking into account the conversion table of Annex IV of 2012/27/EE apart for electricity demand where the efficiency coefficients of Table 2.7 were used.

⁵⁵ [http://www.mcit.gov.cy/mcit/EnergySe.nsf/All/B5969066F97FB710C22581D80035DB7F/\\$file/Study%20results-%20Developing%20a%20national%20Energy%20Efficiency%20Strategy%20up%20to%202050.pdf](http://www.mcit.gov.cy/mcit/EnergySe.nsf/All/B5969066F97FB710C22581D80035DB7F/$file/Study%20results-%20Developing%20a%20national%20Energy%20Efficiency%20Strategy%20up%20to%202050.pdf)

Energy Efficiency First Principle

The “Energy Efficiency First Principle” has been considered in the preparation of the final NECP by giving priority to policies and measures that improve the efficiency of the energy system and by taking into account that other decarbonisation measures can be considered only after energy efficiency actions are deemed unfeasible or very costly.

The WAM scenario is in line with the Energy Efficiency First Principle, for the following reasons:

- The measures of the WAM scenario are sufficient to comply with the energy efficiency obligations of the country as required in Article 7 of the Energy Efficiency Directive; this means that the appropriate measures have been taken into account.
- As a result of energy efficiency measures, the energy supply of Cyprus will be lower in comparison to that of the WEM scenario. This means that energy efficiency has indeed been given priority in comparison, for example, to stronger deployment of renewable energy.
- All cost-effective policies and measures that are related to energy efficiency have been included in the WAM scenario. As is being shown in the impact assessment, all these measures have a negative or near-zero total lifetime cost and are therefore cost-effective. Further, energy efficiency measures are not recommended to be deployed because they have a very high cost per tonne of carbon abated (e.g. the renovation of very old buildings to become nearly-zero energy buildings), or are considered to be unrealistic (e.g. an increase in the number of energy renovations of buildings up to 2030, which would reach unprecedented levels of refurbishments that would require very high financial and human resources to realize).
- It is particularly important to note that the WAM scenario foresees energy efficiency measures in transport (modal shift towards public and non-motorized transport and electrification of cars) which involve very significant investments, at substantial levels for the size of the Cypriot economy. This underlines how strongly the Energy Efficiency First principle has been taken into account.
- Apart from the cost-effectiveness argument mentioned above, further prioritizing demand-side measures such as energy efficiency improvements, and would put Cyprus at risk of not meeting two main Energy Union objectives which are related to energy supply: the renewable energy target and the reduction in emissions of ETS sectors – which in the case of Cyprus is predominantly power generation. Therefore, measures in the electricity supply that have been foreseen in the WAM scenario are indeed those which are absolutely necessary for Cyprus to meet the above-mentioned commitments.
- As a result of the above considerations, energy efficiency measures in all end uses of the Cypriot economy, as foreseen in the WAM scenario and to the extent that they will be fully deployed, can greatly improve the security of energy supply of the country.
- The only further policy that is worth examining is the implementation of a green tax reform that would involve carbon pricing in non-ETS sectors of the Cypriot economy. Such a reform can indeed stimulate further improvements in energy efficiency and substitution of liquid fossil fuels by low- or zero-carbon energy forms. In September 2019 the Finance Minister announced that a green tax reform will be put in consultation in 2020 with the aim to adopting the relevant legal framework and implementing such a

reform in 2021. However, considerations for the adoption of such a reform were still at an early stage by the time of finalising this report, so that it could not be considered as part of the government's Planned Policies and Measures. Decisions on green tax reform will be presented in the next NECP update.

Projects and Developments that could potentially increase energy consumption by 2030

The government is working towards the realization of its exploration program in the Exclusive Economic Zone of the Republic of Cyprus. The below projects, in case one or both are implemented, could potentially increase the primary and/or final energy consumption during the period 2020 – 2030:

- Production from the Aphrodite Field (Information presented is according to the approved Development Plan): Cyprus expects initial natural gas production from the Aphrodite field to begin in 2025. The field is estimated to produce 10 MMscfd (million standard cubic feet per day) for 18 years. There is no information on energy needs for the construction phase (2022 – 2025).
- Vasilikos Liquefied Natural Gas (LNG) Plant (Information regarding the energy needs are according to a 2013 pre-FEED study): At present, there are no sufficient quantities of natural gas to support the supply of an LNG Plant. However, exploration activities are ongoing and in case more gas discoveries are discovered, the LNG Plant may go forward. If the LNG Plant is decided to be materialised, it is not expected to commence operations before 2025. It is further expected that the LNG terminal would require a dedicated generation unit of approximately 200 MW.

As a result, it is estimated that if an LNG plant operates in Cyprus, an increase of at least 10-15% will occur in the projected national primary and final energy consumption by 2030. This will have a negative effect on achieving the national indicative targets for energy efficiency in 2030. Given the aforementioned uncertainties on its implementation and the quantities produced, currently an LNG plant cannot be incorporated in the national scenario with planned policies and measures.

5.4. Supplimentarity relating to mechanisms under Article 6, 12 and 17, of the Kyoto Protocol

Within EU, supplimentarity obligations under the Kyoto Protocol require that any international credit purchases by Member States must be in addition to emission abatement action taken domestically. The use of flexible mechanisms within the EU takes place by operators in the EU ETS and by governments in their achievement of Kyoto targets.

Cyprus did not have a Kyoto Protocol target for the 1st commitment period.

In general, in the EU the use of flexible mechanisms can take place on the one hand by operators in the EU ETS, on the other hand by governments for the achievement of ESD targets.

The amended EU ETS Directive 2009/29/EC (Article 11a(8)) sets the upper limit for credit use for the period from 2008 to 2020 at a maximum of 50 % of the reduction effort below 2005

levels. This is further specified into installation-level limits in the Commission Regulation on international credit entitlements (RICE) (EU No 1123/2013). Since some entitlements are expressed as a percentage of verified emissions over the entire period, the overall maximum amount will only be known at the end of the third trading period.

Since 2013 it is no longer possible to track the use of flexible mechanisms in the EU ETS directly via information on the EUTL public website because CERs and ERUs are no longer surrendered directly but are exchanged into EUAs. These exchanges will become public on an installation level after three years⁵⁶; however aggregated data at EU-level is available earlier.

The ESD allows Member States to make use of flexibility provisions for meeting their annual targets, with certain limitations. In the ESD sectors, the annual use of carbon credits is limited to up to 3 % of each Member State's ESD emissions in 2005. Member States that do not use their 3 % limit for the use of international credits in any specific year can transfer the unused part of their limit to another Member State or bank it for their own use until 2020. Member States fulfilling additional criteria (Austria, Belgium, Cyprus, Denmark, Finland, Ireland, Italy, Luxembourg, Portugal, Slovenia, Spain and Sweden) may use credits from projects in Least Developed Countries (LDCs) and Small Island Developing States (SIDS) up to an additional 1 % of their verified emissions in 2005. These credits are not bankable and transferable. Approximately 750 Mt of international credits can be used during the period from 2013 to 2020 in the ESD.

Cyprus will not use credits from flexible mechanisms for its ESD target. EU-ETS operators could use international credits subject to quantitative and qualitative limits.

According to the latest official GHG emission projections of Cyprus, Cyprus is expected to meet its annual ESD target without the use of international carbon credits, on the basis of the domestic policies and measures and the use of flexibility mechanisms provided by the Effort Sharing Decision and Effort Sharing Regulation.

⁵⁶ Annex XIV of European Commission. Commission Regulation (EU) No 389/2013. 2013. <http://eurlex.europa.eu/legal-content/EN/TXT/?uri=celex:32013R0389>

6.Provision of financial, technological and capacity-building support to developing country Parties

6.1. Finance

In 2015 the Republic of Cyprus the Republic of Cyprus, taking up its global responsibility, despite its size and its difficult financial situation at the time, decided to contribute to the Green Climate Fund the sum of €350.000⁵⁷. The transfer of the contribution was completed in 2018. These resources were new and additional.

6.2. Technology development and transfer, capacity-building

Cyprus is located in the Eastern Mediterranean and Middle East region (EMME)⁵⁸ that is characterised as a global “climate hot-spot” with particularly high vulnerability to climate change impacts.

The Cyprus Government Initiative⁵⁹ builds upon the work that led to the International Conference held in Cyprus, in May 2018, which focused on “Climate Change in the Mediterranean and the Middle East”. The Conference which was organized by the Cyprus Institute and placed under the aegis of the President of the Republic of Cyprus, drew international attention, attended by eminent scientists and policy makers (e.g. L. Fabius, P. Taalas, J. Sachs et. al.) from thirty countries as well as leaders of global stature. The principal conclusion of the Conference was that regional concerted action is urgently needed. It is noteworthy that all EMME countries have underlined their serious concerns about regional and national climate change impacts and expressed their willingness to comply with the Paris Agreement. The Cyprus Climate Change Initiative aims at the development of a Regional Action Plan to address the specific needs and challenges countries are facing in the EMME region, to address and ameliorate the impact of climate change and advance mitigation actions in accordance with the Paris Agreement.

⁵⁷ equivalent to \$ 468,202.37 based on the reference exchange rates established for the Pledging Conference in 2014 (GCF/BM-2015/Inf.01/Rev.01).

⁵⁸ The EMME region is comprised of: Bahrain, Cyprus, Egypt, Greece, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, Turkey and UAE.

⁵⁹ [https://www.pio.gov.cy/assets/pdf/newsroom/2019/09/%CE%A0%CF%81%CF%8C%CE%B3%CF%81%CE%B1%CE%BC%CE%BC%CE%B1%20%CE%94%CF%81%CE%AC%CF%83%CE%B5%CF%89%CE%BD%20\(1\).pdf](https://www.pio.gov.cy/assets/pdf/newsroom/2019/09/%CE%A0%CF%81%CF%8C%CE%B3%CF%81%CE%B1%CE%BC%CE%BC%CE%B1%20%CE%94%CF%81%CE%AC%CF%83%CE%B5%CF%89%CE%BD%20(1).pdf)

The Initiative was presented by the President Nicos Anastasiades to several of his counterparts in the context of bilateral and trilateral meetings, as well as to all EMME Ambassadors in Nicosia by the Environment Minister Dr. Costas Kadis and the Foreign Minister Nikos Christodoulides earlier this year, and during bilateral meetings of Minister Kadis with several of his counterparts of the EMME region in the margins of the Abu Dhabi meeting. The Cyprus Government Initiative has also been communicated to stakeholders such as the EU and the Food and Agriculture Organization, and is receiving positive reaction from Capitals, both as regards content and value added of the specific focus.

To achieve the objective of developing a Regional Action Plan on Climate Action Coordination, a detailed work programme has been developed, consisting of two distinct components: a scientific and an intergovernmental component.

It is an on-going project of which results are expected in the summer of 2021, with the Adoption of a Regional Action Plan on Coordinating Climate Action.

7. Other reporting matters

No other matters to be reported.

Annex I

Summary table of policies and measures included in the projections.

The policies and measures included in the projections are presented in section 1.2 (existing) and chapter 3 (planned) of the NECP⁶⁰.

⁶⁰ Available at [http://www.moa.gov.cy/moa/environment/environmentnew.nsf/all/EE3E8BE9D5282E5CC22584F700273BD9/\\$file/submission.zip?openelement](http://www.moa.gov.cy/moa/environment/environmentnew.nsf/all/EE3E8BE9D5282E5CC22584F700273BD9/$file/submission.zip?openelement)

WITH EXISTING MEASURES (where RES: Renewable Energy Sources; EE: Energy Efficiency; WST: Waste management; AGR: Agriculture; IEM: Internal energy market; SEC: Energy Security; TRA: Transport; R&I: research, innovation and competitiveness)			
ADOPTED		IMPLEMENTED	
RES	Support scheme for the production of electricity from renewable energy sources for own use Category A:Net-metering	RES	Support scheme for the production of electricity from RES-Feed-in Tariffs for RES installations
RES	Support scheme for the production of electricity from renewable energy sources for own use Category A:Net-billing	RES	Support scheme for the promotion of renewable energy sources and energy saving
RES	Self-consumption of electricity from renewable energy sources	RES	Thermal Conductivity MAP and Ground Temperatures up to 100m depths using neural networks
RES	Stand-alone RES systems	RES	Map for Water Depth around the island for offshore wind parks. Preliminary study contacted for wind speeds around the island
RES	Installation of net-metering PV systems in houses of vulnerable consumers	EE	Support Scheme for promoting energy audits in SMEs
RES	Support scheme for the installation or replacement of solar water heaters in households	EE	Grant Scheme for promoting roof thermal insulation and encouraging the use of RES (end use) in the residential sector
RES	Rural development programme 2014-2020 of the Ministry of Agriculture, Rural Development and Environment.	EE	Minimum energy performance requirements for new and existing buildings, requirements for technical building systems installed in existing buildings, inspections for heating systems and a/c systems
RES	Support scheme for the installation of RES systems that will operate in the competitive electricity market	EE	Support scheme encouraging the use of RES (end use) in the residential, tertiary, industry and agriculture sector (primary consumption energy savings)
RES	Incentives for encouraging the use of RES in different types of developments.	EE	Energy efficiency obligations in public purchases and national green public procurement action plan.
RES	Certification of small-scale RES system installers	EE	Implementation of measures aimed at attaining energy savings in existing public buildings (annual obligation)
RES	Research and innovation programs in the sector of RES	EE	RES& EE fee applied on electricity consumption.
RES	Renewable Energy Communities	EE	Motor vehicle taxes based on CO2 emissions.
RES	25% RES in new Buildings	EE	Integrated Fleet Management System (Central Government vehicles)
RES	Create localised tools for selecting the appropriate PV size and scheme	EE	Technical guidance promotion of NZEB and electronic tool kit for consumers
EE	Energy efficiency Obligation scheme	EE	Energy taxes in road transport fuels
EE	Financing tool providing soft loans for energy efficiency investments	EE	Financing measures for energy efficiency in existing hotels and agricultural sector
EE	Solar water heater replacement scheme	EE	Energy efficiency network with voluntary agreements of businesses to reduce their energy consumption

WITH EXISTING MEASURES (where RES: Renewable Energy Sources; EE: Energy Efficiency; WST: Waste management; AGR: Agriculture; IEM: Internal energy market; SEC: Energy Security; TRA: Transport; R&I: research, innovation and competitiveness)			
ADOPTED		IMPLEMENTED	
EE	Increase of energy efficiency in electricity generation due to the increase of efficiency and the switching of the fuel to natural gas (primary consumption energy savings)	EE	Applying a lower VAT rate for the renovation and repair of private dwellings.
EE	Financing tools for energy efficiency investment using European Structural and Investment Funds in the new Programming Period 2021 – 2027	EE	Net billing Scheme for high efficiency cogeneration (HECHP)
EE	Individual energy efficiency interventions and energy efficiency retrofits in selected governmental and municipal buildings	EE	Pilot projects for installing high efficiency cogeneration in public buildings
EE	Energy efficient street lighting	EE	Energy efficiency in electricity infrastructure by upgrading the medium nominal voltage of 11kV to 22kV in selected areas.
EE	Sustainable Urban Mobility Plans (Increasing the share of cycle, pedestrian and PT trips, increase use of busses)	EE	"Park and drive stations" for the use of public busses instead of private cars
EE	Targeted awareness raising actions for energy efficiency	EE	Grant schemes for promoting deep renovation in residential and commercial buildings
EE	Smart meters roll out	EE	Obligatory energy audits in non-SMEs
EE	Use of buses that have low or no GHG emissions	EE	Effective market surveillance for energy labeling of energy related products, tires and eco design.
EE	Installation of public electric car charging stations	EE	Capacity building, targeted trainings, information workshops and events, promotion of energy managers in public buildings and enterprises
EE	Minimum energy performance requirements for new and existing buildings, requirements for technical building systems installed in existing buildings, inspections for heating systems and a/c systems-revised	EE	Use of telematic system for public busses
SEC	Ministerial Decision 77.286 on 16/11/2014 for the establishment of the New Energy and Industrial Area of Vasilikos	EE	Additional floor space “allowance” for new and renovated buildings with higher energy efficiency than minimum energy performance requirements
SEC	Ministerial Decision 77.286 on 16/11/2014 for concession to the KODAP suitable land in the Vasilikos area for the construction of privately owned oil terminal storage	EE	
IEM	Electricity Interconnectivity of Cyprus	EE	

WITH EXISTING MEASURES (where RES: Renewable Energy Sources; EE: Energy Efficiency; WST: Waste management; AGR: Agriculture; IEM: Internal energy market; SEC: Energy Security; TRA: Transport; R&I: research, innovation and competitiveness)			
ADOPTED		IMPLEMENTED	
IEM	Cyprus TSO Ten Year Network Development Plan 2019-2028 according to Article 63 of the Laws for the Regulation of the Electricity Market from 2003 to 2017.	SEC	Tender announcement for the LNG Import Terminal.
IEM	Regulatory Decision 05/2017 on the Implementation of a Binding Schedule for the Full Implementation and Operation by the DSO of the Meter Data Management System (MDMS).	SEC	Ministerial Decision ΚΔΠ 212/2014 for holding of emergency oil stocks equivalent to 90 days of net imports of petroleum products.
IEM	Regulatory Decision 02/2018 on the Implementation of a Binding Schedule for the Mass Installation and Operation by the DSO of Advanced Metering Infrastructure (AMI).	SEC	Ministerial Decision 84.952 on 14/5/2018 for the Signing of a Memorandum of Understanding and Agreement between the Government of the Republic of Cyprus and the Companies Marketing Petroleum Products, namely BP Eastern Mediterranean Ltd, ExxonMobil Cyprus Ltd, Hellenic Petroleum Cyprus Ltd, Intergaz Ltd, Petrolina (Holdings) Public Ltd and Synergaz Ltd for the relocation of petroleum and liquefied petroleum gas installations from the Larnaca coastline to the Vasilikos area
IEM	Ministerial decision that dedicates MECl as National Competent Authority (NCA). NCA is responsible to implement all the necessary actions in order to achieve real priority status for PCIs in public sector.	SEC	1. Single Action Plan for the restoration of the electrical system after power blackout, 2. Setting certain Quality of Electricity Supply Indicators
IEM	Ministerial decision that dedicates MECl as NCA. NCA is responsible to ensure the transparency and public participation before and during permit granting process and publish a manual of procedures applicable to projects of common interest.	IEM	MoU between the countries of Cyprus, Greece, Israel and Italy (05/12/2017, Nicosia).
IEM	Ministerial decision that dedicates MECl as NCA. NCA is responsible to develop the NCAs' website "OneStopShopPCIs".	IEM	Ministerial Order (no. K.D.P. 289/2015) regarding the energy poverty, the categories of vulnerable customers of electricity and the measures to be taken to protect such customers.
IEM	Financial assistance for the Preparation of the Natural Gas Market in Cyprus- Cynergy programme	TRA	Increasing the share of cycle, pedestrian and PT trips
IEM	Financial assistance of PCIs	TRA	Motor vehicle taxes based on CO2 emissions.
IEM	Regulatory Decision 01/2017 on the Implementation of a Binding Schedule for the Full Commercial Operation of the New Electricity Market Model.	TRA	Revised motor vehicle taxes based on CO2 emissions.

WITH EXISTING MEASURES (where RES: Renewable Energy Sources; EE: Energy Efficiency; WST: Waste management; AGR: Agriculture; IEM: Internal energy market; SEC: Energy Security; TRA: Transport; R&I: research, innovation and competitiveness)			
ADOPTED		IMPLEMENTED	
TRA	Installation of public charging stations	TRA	Integrated Fleet Management System (Central Government vehicles)
R&I	Energy efficiency network with voluntary agreements of businesses to reduce their energy consumption	TRA	Replacement of the conventional transport fuels with biofuels
		R&I	RESTART 2016 - 2020
		R&I	Grant Scheme to Enhance Business Innovation
		R&I	European Territorial Cooperation Programs - INTERREG
		R&I	Climate-KIC
		R&I	Horizon 2020
		R&I	LIFE
		AGR	Promotion of anaerobic digestion for the treatment of animal waste
		IEM	NCA has accepted the EuroAsia Interconnector application file for the starting of the statutory permit granting procedure
		IEM	Ministerial Decision for the establishment of the trilateral cooperation secretariat, on 21/11/2018 (Cross Border collaboration between Cyprus, other Member States and third countries involved in the PCIs)

WITH ADDITIONAL MEASURES (where RES: Renewable Energy Sources; EE: Energy Efficiency; WST: Waste management; AGR: Agriculture; IEM: Internal energy market; SEC: Energy Security; TRA: Transport; R&I: research, innovation and competitiveness)			
PLANNED		PROVISIONAL	
RES	Support scheme for the installation of net-metering photovoltaic systems with capacity up to 20KW, in public schools buildings.	RES	Framework for Repowering of existing RES systems
RES	Support scheme for storage units	RES	Support Scheme for RES in order to promote innovation and reduce CO2
RES	District heating and cooling based on RDF fired cogeneration technologies in tourist areas and rural areas	RES	Statistical Transfer Study and taking advantage of Union Development Platform (Article 8.2)
RES	Subject to Electricity Interconnection open support schemes for other MS	RES	Energy Storage, Further analysis for both behind the meter and central storage for further Penetration of RES (Vehicle to Grid option and smart charging)
RES	Develop a political and technical framework for one stop shop procedure for RES projects	RES	Contact Surveys to measure the existing heat pumps Performance and provide incentives for reporting the replacement of old heat-pumps
RES	Create a financing mechanism in the sense of soft green loans to support further the RES developments in household section	RES	70% RES on all new buildings from on net annual consumption
RES	Renewable Energy Communities, develop framework and incentive mechanisms	RES	Incentive Scheme for process heat RES Systems (CSP) to heavy industrial process
RES	Improve forecasting modelling tool for Weather to Energy production using Real Time Satellite measurements and Real time output measurements from the RES plants. Correlation between PV and Wind on forecasting errors	RES	Conduct studies by Wind Association for offshore floating Wind Parks in Cyprus Exclusive economic zone
RES	Virtual net metering for multi-apartment buildings and for Buildings that they do not have enough space for installing on premises the required PV System	RES	Hybrid GAS turbine with CSP and natural GAS or diesel with storage option
RES	Renewable Cooling Measures - Vapour compression cooling systems, Single Split Devices, Multi Split Devices, Reversible heat Pumps, Photovoltaic Cooling, etc. based on minimum requirements on efficiency of the cooling system (By 31 December 2021, the Commission shall adopt delegated acts in accordance	EE	Efficient district heating and cooling based upon RDF fired cogeneration technologies in tourist areas (primary energy savings)

WITH ADDITIONAL MEASURES			
(where RES: Renewable Energy Sources; EE: Energy Efficiency; WST: Waste management; AGR: Agriculture; IEM: Internal energy market; SEC: Energy Security; TRA: Transport; R&I: research, innovation and competitiveness)			
PLANNED		PROVISIONAL	
	with Article 35 to supplement this Directive by establishing a methodology for calculating the quantity of renewable energy used for cooling and district cooling and to amend Annex VII.)		
RES	Create a framework for water to air and ground to air open loop geothermal systems based on technical potential available	EE	Introduction of environmental fees for the use of the road network
EE	Uptake of energy performance procurement in public sector by removing procurement hurdles	R&I	European Structural and Investment Funds in the new Programming Period 2021 – 2027
EE	Removing barriers that impede the uptake of energy performance contracting and the implementation of energy efficiency investments in general	R&I	Increase of the annual spending in research and innovation related to energy and climate in order to reach an average of 15m Euros per year
EE	Energy efficiency in defense and water sector	R&I	Contact surveys and methodology (or simple online software tools) for tracking down the various white appliances that are directly related with the RES technologies
EE	Fiscally neutral green tax reform by increasing environmental taxes while reducing labor taxation	TR A	Increase the use of cars that have low or no GHG emissions
EE	Scheme to subsidize realised CO2 emission reductions for companies that participate to the Energy efficiency network	IEM	Development of natural gas network pipeline infrastructure in Cyprus
EE	Preparation of the corridor and future development of a tram infrastructure		
EE	Additional floor space “allowance” for new and renovated buildings with higher energy efficiency than minimum energy performance requirements -Revision		
IND	Preparation of the proper recovery system for F-gases in equipment		
WST	Reduction of waste to solid waste disposal sites from sorting at production level		
WST	Reduction of organics to landfills		
WST	Promotion of anaerobic digestion for the treatment of the organic fraction of the municipal solid waste		

WITH ADDITIONAL MEASURES			
(where RES: Renewable Energy Sources; EE: Energy Efficiency; WST: Waste management; AGR: Agriculture; IEM: Internal energy market; SEC: Energy Security; TRA: Transport; R&I: research, innovation and competitiveness)			
PLANNED		PROVISIONAL	
WST	Biogas recovery from old sold waste disposal sites (deep unmanaged)		
IEM	Regulatory Decision on Storage Systems that are installed before the metering point.		
IEM	Amend the national law to enable operation of the electricity market and make the Market Operator/TSO independent from the vertically integrated electricity company		
IEM	Amend Trade and Settlement Rules and Transmission and Distribution Rules to allow for Demand Response in the market according to Art. 15(8) Directive 2012/27/EU		
TRA	Increase the use of buses that have low or no GHG emissions		
TRA	Increasing the share of cycle, pedestrian and PT trips		
TRA	Enhance planting of trees		
R&I	Financing tool for energy efficiency investment		
R&I	Support schemes to promote energy efficiency investments in agricultural sector		
R&I	Fiscally neutral green tax reform by increasing environmental taxes while reducing labor taxation		
AGR	Further promotion of anaerobic digestion for the treatment of animal waste		
RES/IEM	Citizen Energy Communities		
RES	one-stop Shop for the permitting procedure of RES systems Digital Application		
IEM/RES	Introduction of Smart Systems/Meters in the Electricity network for grid management and empowering Consumers		
IEM/RES/EE	Dynamic Electricity Tariffs (hourly/half hourly		
IEM/RES	Investigation/Study on Capacity Mechanisms/Regulation		

Annex II

Activity data used for the “with existing measures” and “with additional measures” projections.

WEM projected activity data

	GDP real	3.87598	3.64963	3.21137	3.01976	2.97373	2.7	2.5	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1A1 Energy Industries																								
1A1a Main Activity Electricity and Heat Production																								
1A1a i Electricity Generation																								
FUEL CONSUMPTION (TJ)		ETS	CT WEM 211119 1300.xlsx																					
Natural Gas	0	0	0	0	6437	32754	33210	33233	33440	32234	33086	34491	35967	36909	34408	30660	23943	24672	25072	22721	22193	21468	20859	18381
HFO	35876.95	32621	24028	19203	24345	2569	2626	105	245	279.93	43.1246	67.5684	111.877	125.456	218.483	208.9	26.9145	51.3026	69.2999	301.8	0	0	0	0
Diesel	10889.74	10498	20294	23730	8894	0	0	0	0	0	0	0	0	0	0	0	0	0	56.7967	97.1	124	142	483	468
	46767	43119	44322	42933	39676	35323	35836	33338	33685	32514	33129	34559	36079	37035	34627	30869	23970	24723	25199	23120	22317	21611	21341	18849
1A2 Manufacturing Industries and Construction																								
1A2f Non-Metallic Minerals (glass, ceramic, cement, etc.; ISIC Division 26)																								
FUEL CONSUMPTION (TJ)		ETS																						
LPG	26	10	13	13	11	9	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Diesel	34	5	6	6	5	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
RFO	403	32	40	40	35	29	24	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Pet-coke consumption	3533	2333	2966	2949	2547	2145	1743	1340	1340	1340	1340	1340	1340	1340	1340	1340	1340	1340	1340	1340	1340	1340	1340	1340
other bituminous coal	125	570	725	721	622	524	426	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328
Waste (non-renewable)	902	2240	2250	2847	3152	3457	3762	4067	4067	4067	4067	4067	4067	4067	4067	4067	4067	4067	4067	4067	4067	4067	4067	4067
solid biomass	838	1446	1500	1898	2102	2305	2508	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712
TOTAL	5861	6636	7499	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474	8474
total without alt. fuel	2949	2949	3749	3728	3220	2712	2203	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695	1695
All other industry																								
FUEL CONSUMPTION (TJ)		Demand results for Taliotis 30Jul2019																						
LPG	298.2	279.0	301.5	322.2	330.3	324.6	317.6	318.6	325.3	333.0	341.8	352.2	362.8	374.2	378.4	384.0	391.2	399.5	408.7	418.6	428.9	439.2	449.2	459.0
Diesel	719.6	495.9	659.1	767.7	822.1	825.1	819.8	833.8	855.8	874.2	890.9	907.8	922.4	936.3	930.8	927.4	926.2	926.5	927.9	930.3	932.7	934.7	935.7	935.7
RFO	816.5	862.8	1025.7	1131.4	1169.3	1147.0	1112.2	1092.6	1082.6	1072.4	1062.5	1054.2	1044.4	1034.7	1005.6	980.1	957.9	937.8	919.6	902.7	886.4	870.0	853.1	835.8
Pet-coke consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
other bituminous coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste (non-renewable)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
solid biomass	71.8	52.0	48.7	48.4	47.8	46.2	44.8	44.9	46.2	48.1	50.6	53.6	57.0	60.8	63.6	66.7	70.2	74.1	78.4	83.0	88.0	93.2	98.6	104.3
TOTAL	1906	1690	2035	2270	2369	2343	2294	2290	2310	2328	2346	2368	2387	2406	2378	2358	2346	2338	2334	2335	2336	2337	2337	2335
1A3 Transport																								
1A3a Civil Aviation																								
1A3a i International Aviation																								
FUEL CONSUMPTION (TJ)		Demand results for Taliotis 30Jul2019																						
Jet kerosene	13962.61	13391.9	14307.7	15070.1	15801	16246.5	16593.1	17014.1	17449.8	17875.7	18285.8	18678.6	19020	19316	19521.8	19735.3	19965.1	20204.5	20452.7	20689.9	20906.4	21097.3	21257.4	21387
1A3a ii Domestic Aviation																								
FUEL CONSUMPTION (TJ)		CUT_draft_demand_projections_Oct2018																						
Jet kerosene	11.4763	8.8191	9.4104	9.92904	10.4371	10.7614	11.0022	11.2471	11.4991	11.7597	12.0211	12.2843	12.5277	12.694	12.8019	12.9251	13.0684	13.2278	13.4038	13.5842	13.7631	13.9376	14.1042	14.2629
1A3b Road Transport																								
FUEL CONSUMPTION (TJ)		CT WEM 211119 1300.xlsx																						
Gasoline	15544.78	15869	16282	15889	16464	16790	17099	17398	17689	17970	18001	17487	17013	16583	16372	16229	15854	15485	15123	14769	14424	14087	13757	13433
Diesel	12842.95	12288	12135	11890	11665	11456	11251	11087	10906	10729	10705	10729	10711	10660	10444	10233	10204	10174	10145	10115	10087	10058	10029	10001
Biodiesel	358.789	660	652	1424	1196	1196	1195	1197	1197	1197	1197	1181	1163	1146	1127	1110	1096	1082	1068	1054	1040	1027	1014	1001
LPG		0	3	7	10	13	16	19	23	26	29	32	38	38	35	25	25	25	25	25	25	25	25	22
TOTAL	28747	28817	29073	29209	29334	29454	29561	29701	29815	29922	29932	29429	28925	28425	27978	27598	27179	26765	26360	25964	25576	25196	24825	24457
% biodiesel to diesel	2.8%	5.4%	5.4%	12.0%	10.2%	10.4%	10.6%	10.8%	11.0%	11.2%	11.2%	11.0%	10.9%	10.7%	10.8%	10.9%	10.7%	10.6%	10.5%	10.4%	10.3%	10.2%	10.1%	10.0%

1A3d Water-borne navigation																								
1A3d i International water-borne navigation																								
FUEL CONSUMPTION (TJ)		gdp																						
Diesel	4355.685	4525	4690	4840	4986	5135	5273	5405	5529	5657	5787	5920	6056	6195	6338	6484	6633	6785	6941	7101	7264	7431	7602	7777
RFO	6226	6468	6704	6919	7128	7340	7538	7726	7904	8086	8272	8462	8657	8856	9060	9268	9481	9699	9922	10150	10384	10623	10867	11117
TOTAL	10582	10992	11393	11759	12114	12474	12811	13132	13434	13743	14059	14382	14713	15051	15397	15751	16114	16484	16864	17251	17648	18054	18469	18894
1A3d ii Domestic water-borne navigation																								
FUEL CONSUMPTION (TJ)		gdp																						
Diesel	22.16783	23	24	25	25	26	27	28	28	29	29	30	31	32	32	33	34	35	35	36	37	38	39	40
TOTAL	22.16783	23.0271	23.8675	24.6339	25.3778	26.1325	26.8381	27.509	28.1417	28.789	29.4511	30.1285	30.8215	31.5303	32.2555	32.9974	33.7564	34.5328	35.327	36.1395	36.9707	37.8211	38.691	39.5808
1A4 Other Sectors																								
1A4a Commercial / Institutional																								
FUEL CONSUMPTION (TJ)		Demand results for Taliotis 30Jul2019																						
diesel	616	503	526	547	539	528	514	514	516	516	515	515	512	509	507	504	500	495	490	483	476	468	459	449
RFO	127	259	242	241	240	235	229	220	209	199	191	183	175	168	161	156	150	144	139	134	129	124	119	114
LPG	573	471	479	491	484	475	461	457	452	446	441	436	430	425	420	414	409	403	396	390	382	374	366	356
solid biomass	17	18	20	22	21	21	20	21	22	23	24	25	25	26	26	27	27	28	28	28	28	28	28	28
gas biomass	12	13	14	15	15	15	14	15	16	16	17	17	18	18	19	19	19	19	20	20	20	20	20	20
charcoal	209	221	248	265	262	257	250	259	272	283	292	302	309	316	323	329	334	339	342	345	346	347	346	344
TOTAL	1554	1484	1529	1581	1562	1531	1488	1486	1486	1484	1480	1477	1470	1462	1456	1449	1439	1428	1414	1399	1381	1361	1337	1311
	biomass	252	282	302	299	293	284	295	310	322	333	343	352	360	368	375	381	386	390	393	394	395	394	391
		biomass distribution based on 2017 statistics																						
1A4b Residential																								
FUEL CONSUMPTION (TJ)		Demand results for Taliotis 30Jul2019																						
Other kerosene	630	514	547	539	535	536	530	528	529	529	528	525	521	515	502	488	474	459	443	423	405	386	367	349
Diesel/gas oil	2886	2356	2506	2470	2452	2454	2427	2417	2423	2424	2418	2406	2387	2361	2298	2236	2171	2101	2028	1940	1853	1768	1683	1599
LPG	1605	1635	1749	1726	1714	1716	1699	1716	1761	1802	1843	1883	1920	1955	1951	1950	1949	1946	1944	1917	1893	1869	1845	1819
Solid Biomass	163	168	182	179	176	174	171	175	184	192	201	209	217	224	226	228	230	232	234	233	231	230	228	227
Charcoal	255	262	285	279	275	273	267	274	288	301	314	326	339	350	353	357	360	363	366	364	362	359	357	354
TOTAL	5539	4935	5269	5193	5151	5153	5094	5111	5185	5249	5304	5349	5384	5406	5331	5259	5184	5101	5016	4877	4744	4612	4481	4348
	Diesel/gas oil	2871	3053	3009	2987	2990	2957	2945	2952	2953	2946	2931	2908	2876	2800	2724	2645	2559	2471	2363	2258	2153	2051	1948
	Solid Biomass	429	467	458	450	447	439	449	472	493	514	535	555	574	580	585	590	595	601	596	593	589	585	581
		biomass distribution based on 2017 statistics																						
		Diesel/gas oil distribution to diesel and kerosene based on 2017 stats																						

1A4c Agriculture / Forestry / Fishing / Fish farms																								
1A4c i Stationary																								
<u>FUEL CONSUMPTION (TJ)</u>		Demand results for Taliotis 30Jul2019																						
Diesel/gas oil	951	945	980	983	998	982	957	946	943	943	943	946	947	949	945	940	936	930	925	918	909	897	884	868
LPG	115	74	75	74	75	74	72	70	69	67	66	66	65	64	63	62	61	60	59	58	57	56	55	54
solid biomass																								
gas biomass	487	592.23	592.23	831.033	2373.7	2373.7	2373.7	2373.7	2373.7	2373.7	2373.7	2373.7	2373.7	2373.7	2373.7	2373.7	2373.7	2373.7	2380.23	2397.45	2470.71	2521.7	2521.7	
TOTAL	1553	1611.86	1646.93	1888.76	3446.49	3429.54	3402.83	3389.93	3385.61	3383.74	3383.37	3385.03	3385.81	3386.93	3381.35	3375.76	3370.62	3364.3	3357.66	3356.22	3363.45	3424.41	3460.51	3443.83
		gas biomass from "Primary Energy - Electricity" sheet																						
1A4c ii Off-road Vehicles and Other Machinery																								
IE in 1A3b road transport																								
1A4c iii Fishing (mobile combustion)																								
<u>FUEL CONSUMPTION (TJ)</u>		gdp																						
Diesel	86	89	93	96	98	101	104	107	109	112	114	117	120	122	125	128	131	134	137	140	143	147	150	154
1A5 Non-Specified																								
1A5a Stationary																								
<u>FUEL CONSUMPTION (TJ)</u>		gdp																						
Diesel/gas oil	238	247	256	264	272	280	288	295	302	309	316	323	331	338	346	354	362	371	379	388	397	406	415	425
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solid Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	237.919	247.141	256.16	264.387	272.371	280.47	288.043	295.244	302.034	308.981	316.088	323.358	330.795	338.403	346.187	354.149	362.294	370.627	379.152	387.872	396.793	405.919	415.255	424.806
1A5b Mobile																								
<u>FUEL CONSUMPTION (TJ)</u>		gdp																						
Jet kerosene	74.6	78	80	83	85	88	90	93	95	97	99	101	104	106	109	111	114	116	119	122	124	127	130	133
1AD Feedstocks, reductants and other non-energy use of fuels																								
Lubricants	LC transport	0.00246	0.00887	0.0047	0.00428	0.0041	0.00363	0.00473	0.00383	0.0036	0.00034	-0.0168	-0.0171	-0.0173	-0.0157	-0.0136	-0.0152	-0.0152	-0.0151	-0.0151	-0.0149	-0.0148	-0.0147	-0.0148
LC-Fuel Consumption (TJ)	314.6	315.4	318.2	319.7	321.0	322.4	323.5	325.0	326.3	327.5	327.6	322.1	316.6	311.1	306.2	302.0	297.4	292.9	288.5	284.1	279.9	275.8	271.7	267.7
Bitumen		gdp																						
LC-Fuel Consumption (TJ)	1565.79	1626	1686	1740	1793	1846	1896	1943	1988	2033	2080	2128	2177	2227	2278	2331	2384	2439	2495	2553	2611	2671	2733	2796

2. INDUSTRIAL PROCESSES		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
2A Mineral Industry																										
2A1 Cement production																										
Moni	0	ETS																								
Vasiliko	1716889		full capacity																							
Total Clinker (tn)	1716889	1593425	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	
Total Clinker (kt)	1716.89	1593.425	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	
2A2 Lime Production																										
slaked lime production (t)	4369	4648	4928	5207		5486	5766	6045	6324	6603	6883	7162	7441	7721	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	
2A4 Other Process Uses of Carbonates																										
2A4a Ceramics			full capacity 2025																							
total production (t)	152570	159636	166703	173769	180835	187901	194968	202034	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	
total production (kt)	152.570	159.636	166.703	173.769	180.835	187.901	194.968	202.034	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	
non-ETS production (t)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2A4b Other Uses of Soda Ash																										
adopted for soda ash		continuing 2015-2017 trend																								
imports - Mc (t)	449	533	597	660	724	787	851	915	978	1042	1105	1169	1233	1296	1360	1423	1487	1551	1614	1678	1741	1805	1868	1932		
imports - Mc (kt)	0.449	0.533	0.597	0.660	0.724	0.787	0.851	0.915	0.978	1.042	1.105	1.169	1.233	1.296	1.360	1.423	1.487	1.551	1.614	1.678	1.741	1.805	1.868	1.932		
2D Non-Energy Products from Fuels and Solvent Use																										
2D1: Lubricant Use																										
		assume constant 2017																								
LC-Fuel Consumption (kt)	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	
LC-Fuel Consumption (TJ)	314.605	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	314.6052	
2D2: Paraffin Wax Use																										
		assume constant 2017																								
imports (kt)	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	
2D3 Other																										
2019 TOTAL	17.875	17.985	18.097	18.214	18.330	18.444	18.557	18.667	18.774	18.876	18.975	19.069	19.158	19.244	19.325	19.402	19.476	19.547	19.616	19.682	19.747	19.811	19.873	19.935		
population	864.2	869.5	874.9	880.6	886.2	891.7	897.2	902.5	907.6	912.6	917.4	921.9	926.2	930.4	934.3	938.0	941.6	945.0	948.3	951.5	954.7	957.8	960.8	963.8		
per capita (t/cap)	0.02068																									
Urea-based catalysts																										
diesel consumption road tran	298.67	285.76	282.22	276.51	271.27	266.42	261.65	257.83	253.62	258.27	261.58	263.55	264.55	263.19	261.99	260.55	263.25	265.87	268.43	270.92	269.89	268.86	267.83	266.81		
activity	5.97	5.72	5.64	5.53	5.43	5.33	5.23	5.16	5.07	5.17	5.23	5.27	5.29	5.26	5.24	5.21	5.26	5.32	5.37	5.42	5.40	5.38	5.36	5.34		
2F Gg CO2 eq.																										
population (1000s)	864.2	865.2554	870.6544	876.2578	881.8411	887.3533	892.7814	898.0682	903.1987	908.1378	912.8796	917.398	921.705	925.8166	929.7218	933.4467	936.9943	940.4086	943.7077	946.9007	950.0174	953.0881	956.0917	959.0632		
2F. Product uses as ODS subs	249.565	249.8693	251.4284	253.0466	254.6589	256.2508	257.8183	259.345	260.8266	262.2529	263.6223	264.9271	266.1709	267.3582	268.486	269.5617	270.5861	271.5721	272.5248	273.4469	274.347	275.2337	276.1011	276.9592		
2F per capita (t/cap)	0.28878	using 2017 per cap emissions																								
2G1b: Use of Electrical Equipment																										
per capita emissions (kg/cap)																										
AVERAGE	0.00019	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193		
population	864200	865255.4	870654.4	876257.8	881841.1	887353.3	892781.4	898068.2	903198.7	908137.8	912879.6	917398	921705	925816.6	929721.8	933446.7	936994.3	940408.6	943707.7	946900.7	950017.4	953088.1	956091.7	959063.2		
Sf6 emissions (Gg CO2 eq.)	0.16713	0.16733	0.168374	0.169458	0.170538	0.171604	0.172653	0.173676	0.174668	0.175623	0.17654	0.177414	0.178247	0.179042	0.179797	0.180517	0.181203	0.181864	0.182502	0.183119	0.183722	0.184316	0.184897	0.185471		
2G3: N2O from Product Uses																										
2G3a: Medical Applications																										
Total Population (1000 persons)	864.2	865.2554	870.6544	876.2578	881.8411	887.3533	892.7814	898.0682	903.1987	908.1378	912.8796	917.398	921.705	925.8166	929.7218	933.4467	936.9943	940.4086	943.7077	946.9007	950.0174	953.0881	956.0917	959.0632		
2G3b: Propellant for Pressure and Aerosol Products																										
Total Population (1000 persons)	864.2	865.2554	870.6544	876.2578	881.8411	887.3533	892.7814	898.0682	903.1987	908.1378	912.8796	917.398	921.705	925.8166	929.7218	933.4467	936.9943	940.4086	943.7077	946.9007	950.0174	953.0881	956.0917	959.0632		
2G3c: Other																										
2G4: Other																										
	assume constant as 2016																									

3. AGRICULTURE	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
3A Livestock																								
3A Enteric Fermentation																								
3A1 Cattle																								
3A1a Dairy cattle																								
Pregnancy (NEp)		assume constant 2017																						
% pregnant	72.24	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400	72.2400
Cpregnancy																								
NEp=C*NEm *%pregnant	3.17	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692	3.16692
GE (gross energy intake)																								
Digestibility of feed, DE (%)																								
GE MJ/head/day	290.829	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286	290.8286
3A1b Other cattle																								
population	36600	35748.9	35748.9	35748.9	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994
3A2 Sheep																								
population	321488	316354	319396	319396	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606	334606
3A3 Swine																								
population	350163	359222.6	359222.6	362744.4	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7	373309.7
3A4 Horses																								
population	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342
3A4 Mules and Asses																								
population	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316
3A4 Goats																								
population	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637
3B Manure Management																								
3B1 CH4 emissions																								
3B1.1 Cattle																								
T2 - equation 10.23, pg. 10.41, vol.4, IPCC2006																								
3B1.1a Dairy cattle																								
population	30137	29785	29785	29785	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202	34202
waste management																								
solid storage	95%	94.5%	94.0%	93.5%	93.0%	92.5%	92.0%	91.5%	91.0%	90.5%	90.0%	89.5%	89.0%	88.5%	88.0%	87.5%	87.0%	86.5%	86.0%	85.5%	85.0%	84.5%	84.0%	83.5%
anaerobic digester	5%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%	8.5%	9.0%	9.5%	10.0%	10.5%	11.0%	11.5%	12.0%	12.5%	13.0%	13.5%	14.0%	14.5%	15.0%	15.5%	16.0%	16.5%
3B1.1b Other cattle																								
population	36600	35749	35749	35749	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994	37994
waste management																								
solid storage	95%	94.5%	94.0%	93.5%	93.0%	92.5%	92.0%	91.5%	91.0%	90.5%	90.0%	89.5%	89.0%	88.5%	88.0%	87.5%	87.0%	86.5%	86.0%	85.5%	85.0%	84.5%	84.0%	83.5%
anaerobic digester	5%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%	8.5%	9.0%	9.5%	10.0%	10.5%	11.0%	11.5%	12.0%	12.5%	13.0%	13.5%	14.0%	14.5%	15.0%	15.5%	16.0%	16.5%
3B1.2 Sheep																								
population	321488	316354.5	319396.4	319396.4	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7	334605.7
3B1.3 Swine																								
T2 - equation 10.23, pg. 10.41, vol.4, IPCC2006																								
breeding swine (sows)	33157	33260	33260	33586	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564	34564
waste management																								
anaerobic digester	55%	55.9%	56.7%	57.6%	58.5%	59.3%	60.2%	61.1%	62.0%	62.8%	63.7%	64.6%	65.4%	66.3%	67.2%	68.0%	68.9%	69.8%	70.7%	71.5%	72.4%	73.3%	74.1%	75%
aerobic treatment (liquid systems)	45%	44.1%	43.3%	42.4%	41.5%	40.7%	39.8%	38.9%	38.0%	37.2%	36.3%	35.4%	34.6%	33.7%	32.8%	32.0%	31.1%	30.2%	29.3%	28.5%	27.6%	26.7%	25.9%	25%
market swine (all except sows)	317006	325962	325962	329158	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745	338745
Volatile substance excretion (VS)																								
waste management																								
anaerobic digester	55%	55.9%	56.7%	57.6%	58.5%	59.3%	60.2%	61.1%	62.0%	62.8%	63.7%	64.6%	65.4%	66.3%	67.2%	68.0%	68.9%	69.8%	70.7%	71.5%	72.4%	73.3%	74.1%	75%
aerobic treatment (liquid systems)	45%	44.1%	43.3%	42.4%	41.5%	40.7%	39.8%	38.9%	38.0%	37.2%	36.3%	35.4%	34.6%	33.7%	32.8%	32.0%	31.1%	30.2%	29.3%	28.5%	27.6%	26.7%	25.9%	25%

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3D1.2 Organic N fertilisers																								
3D1.2b Sewage Sludge applied to soils assuming constant as 2017																								
dry sludge applied on land (t DM)	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	
3D1.2c Other organic fertilisers applied to soils																								
Constantinos Ioannides 16/11/2017: personal comm extrapolating using 2013-2017 trend																								
TOTAL composting (1000t wet mass)	36.52	48.927	53.698	58.469	63.24	68.011	72.782	77.553	82.324	87.095	91.866	96.637	101.408	106.179	110.95	115.721	120.492	125.263	130.034	134.805	139.576	144.347	149.118	153.889
3D1.4 Crop residues																								
Crop production (t/yr)																								
Wheat	16592	7316.12	7454.16	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2
Barley	18754	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907
Oats	248	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352
Beans & pulses (legumes)	4145	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
Potatoes (tubers)	111410	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803
cultivated area (ha)																								
Wheat	8678	8889	9057	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225
Barley	10953	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536
Oats	490	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
Beans & pulses (legumes)	493	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498
Potatoes (tubers)	4440	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041
Crop yield (YieldFresh), kg/ha																								
Wheat	1912	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823
Barley	1712	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Oats	506	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959
Beans & pulses (legumes)	8408	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032
Potatoes (tubers)	25092	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361
3F. Field burning of agricultural residues																								
Area Burnt (ha/yr)																								
FracBURN (kg N/kg crop-N)	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Wheat	868	889	906	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922
Barley	1095	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454
Oats	49	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
Beans & pulses (legumes)	49	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Potatoes (tubers)	444	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504
3H Urea application																								
CO2-C=M*EF																								
M - t Urea applied to soils (assumed = to se	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570

5. WASTE	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
4A Solid Waste Disposal																								
	864200	865255.4	870654.4	876257.8	881841.1	887353.3	892781.4	898068.2	903198.7	908137.8	912879.6	917398	921705	925816.6	929721.8	933446.7	936994.3	940408.6	943707.7	946900.7	950017.4	953088.1	956091.7	959063.2
POPULATION	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Regional Population (1000 persons)																								
Lefkosia	335.9	336.3	338.4	340.5	342.7	344.9	347.0	349.0	351.0	352.9	354.8	356.5	358.2	359.8	361.3	362.8	364.1	365.5	366.8	368.0	369.2	370.4	371.6	372.7
Ammochostos	47.5	47.6	47.9	48.2	48.5	48.8	49.1	49.4	49.7	49.9	50.2	50.4	50.7	50.9	51.1	51.3	51.5	51.7	51.9	52.1	52.2	52.4	52.6	52.7
Larnaca	146.5	146.7	147.6	148.5	149.5	150.4	151.3	152.2	153.1	153.9	154.7	155.5	156.2	156.9	157.6	158.2	158.8	159.4	160.0	160.5	161.0	161.6	162.1	162.6
Lemesos	242.0	242.3	243.8	245.4	247.0	248.5	250.0	251.5	253.0	254.3	255.7	256.9	258.1	259.3	260.4	261.4	262.4	263.4	264.3	265.2	266.1	266.9	267.8	268.6
Pafos	92.3	92.4	93.0	93.6	94.2	94.8	95.4	95.9	96.5	97.0	97.5	98.0	98.4	98.9	99.3	99.7	100.1	100.4	100.8	101.1	101.5	101.8	102.1	102.4
TOTAL	864.2	865.3	870.7	876.3	881.8	887.4	892.8	898.1	903.2	908.1	912.9	917.4	921.7	925.8	929.7	933.4	937.0	940.4	943.7	946.9	950.0	953.1	956.1	959.1
Urban Population (1000 persons)																								
Lefkosia	246.9	247.2	248.7	250.3	251.9	253.5	255.1	256.6	258.0	259.4	260.8	262.1	263.3	264.5	265.6	266.7	267.7	268.7	269.6	270.5	271.4	272.3	273.1	274.0
Ammochostos		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Larnaca	86.6	86.7	87.3	87.9	88.4	89.0	89.5	90.0	90.6	91.0	91.5	92.0	92.4	92.8	93.2	93.6	93.9	94.3	94.6	94.9	95.2	95.6	95.9	96.2
Lemesos	184.6	184.8	186.0	187.2	188.4	189.6	190.7	191.8	192.9	194.0	195.0	196.0	196.9	197.8	198.6	199.4	200.2	200.9	201.6	202.3	202.9	203.6	204.2	204.9
Pafos	65.1	65.2	65.6	66.0	66.4	66.9	67.3	67.7	68.0	68.4	68.8	69.1	69.4	69.8	70.0	70.3	70.6	70.8	71.1	71.3	71.6	71.8	72.0	72.3
TOTAL	583.2	584.0	587.6	591.4	595.1	598.9	602.5	606.1	609.6	612.9	616.1	619.1	622.1	624.8	627.5	630.0	632.4	634.7	636.9	639.1	641.2	643.2	645.3	647.3
Rural Population (1000 persons)																								
Lefkosia	89.0	89.1	89.6	90.2	90.8	91.4	91.9	92.5	93.0	93.5	94.0	94.4	94.9	95.3	95.7	96.1	96.5	96.8	97.2	97.5	97.8	98.1	98.4	98.7
Ammochostos	47.5	47.6	47.9	48.2	48.5	48.8	49.1	49.4	49.7	49.9	50.2	50.4	50.7	50.9	51.1	51.3	51.5	51.7	51.9	52.1	52.2	52.4	52.6	52.7
Larnaca	59.9	59.9	60.3	60.7	61.1	61.5	61.8	62.2	62.6	62.9	63.2	63.5	63.8	64.1	64.4	64.6	64.9	65.1	65.4	65.6	65.8	66.0	66.2	66.4
Lemesos	57.4	57.5	57.9	58.2	58.6	59.0	59.3	59.7	60.0	60.3	60.7	61.0	61.2	61.5	61.8	62.0	62.3	62.5	62.7	62.9	63.1	63.3	63.5	63.7
Pafos	27.2	27.2	27.4	27.6	27.8	27.9	28.1	28.3	28.4	28.6	28.7	28.9	29.0	29.1	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2
TOTAL	281.0	281.3	283.1	284.9	286.7	288.5	290.2	292.0	293.6	295.2	296.8	298.3	299.7	301.0	302.3	303.5	304.6	305.7	306.8	307.8	308.9	309.9	310.8	311.8
per capita production to disposal sites (kg/cap)	481	498	502	506	510	514	519	524	528	534	539	545	552	559	561	566	572	577	583	588	594	599	605	610
Annual per capita production (kg/cap) to model	655.58	662.31	667.81	672.77	678.55	684.28	690.33	696.52	702.96	709.90	717.26	725.38	734.16	743.71	746.17	753.31	760.54	767.83	775.15	782.52	789.89	797.26	804.64	811.99
Population to model (mln)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Un-managed, deep	0.578	0.579	0.338	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Un-managed, shallow	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Managed, anaerobic	0.286	0.287	0.532	0.876	0.882	0.887	0.893	0.898	0.903	0.908	0.913	0.917	0.922	0.926	0.930	0.933	0.937	0.940	0.944	0.947	0.950	0.953	0.956	0.959
40% sorting at source from 2021; 55% 2025; 60% 2030; 65% 2035																								
MSW to disposal sites (% of total)	75%	75%	75%	75%	60%	56%	53%	49%	45%	44%	43%	42%	41%	40%	39%	38%	37%	36%	35%	35%	35%	35%	35%	35%
composition of waste to disposal sites																								
Food	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%
Garden	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Paper	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%
Wood	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Textile	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Nappies	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
15% of organics to landfill from 2021; 10% in 2035																								
MSW to disposal sites (% of total)	75%	75%	75%	75%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%
composition of waste to disposal sites																								
Food	48%	48%	48%	48%	14%	14%	14%	13%	13%	13%	12%	12%	12%	12%	11%	11%	11%	10%	10%	10%	10%	10%	10%	10%
Garden	8%	8%	8%	8%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Paper	27%	27%	27%	27%	52%	52%	53%	53%	53%	53%	54%	54%	54%	54%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%
Wood	3%	3%	3%	3%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Textile	11%	11%	11%	11%	21%	21%	21%	21%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%
Nappies	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
4B Biological Treatment of Solid Waste																								
Increase composting to 10% in 2021 and keep constant																								
BaU M composted, 1000 t wet waste	33.120	45.696	46.362	47.007	47.713	48.417	49.143	49.878	50.627	51.406	52.210	53.063	53.957	54.903	55.317	56.070	56.823	57.577	58.330	59.083	59.836	60.590	61.343	62.096
NIR2019 composting (%)	6.7%	7.5%	8.3%	9.2%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Increase AD to 5% in 2021 and keep constant																								
W4 AD (1000t) from Feb2018 PROJ					67.9	68.4	69.0	69.7	70.3	71.0	71.7	72.5	73.4	74.4	74.6	75.3	76.1	76.8	77.5	78.3	79.0	79.7	80.5	81.2

WAM projected activity data

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1A3d ii Domestic water-borne navigation																								
FUEL CONSUMPTION (TJ)		gdp																						
Diesel	22.167831	23	24	25	25	26	27	28	28	29	29	30	31	32	32	33	34	35	35	36	37	38	39	40
TOTAL	22.167831	23.027053	23.867455	24.633928	25.377813	26.132481	26.838058	27.509009	28.141716	28.788976	29.451122	30.128498	30.821454	31.530347	32.255545	32.997422	33.756363	34.53276	35.327013	36.139534	36.970744	37.821071	38.690955	39.580847
1A4 Other Sectors																								
1A4a Commercial / Institutional																								
FUEL CONSUMPTION (TJ)		Demand results for Taliotis_30Jul2019.xlsx																						
diesel	616	502.51752	524.34529	540.71297	528.79684	518.02436	501.41134	498.62243	497.40728	494.82554	491.34229	488.11621	483.64268	478.66011	463.67191	448.51282	433.41517	418.21203	402.92179	387.55278	369.36481	351.18471	333.03065	315.00865
RFO	127	258.70991	242.07969	240.14296	234.85074	230.06643	222.68821	214.18826	202.32941	192.32811	183.52278	175.28036	167.57221	160.23124	151.80943	143.87144	136.24633	128.87279	121.8414	115.08666	108.17349	101.55717	95.206579	89.11374
LPG	573	471.29246	477.3801	486.59822	475.87467	466.1803	451.22992	444.17302	436.77245	429.42033	422.11181	415.35965	408.07684	400.71301	386.04977	371.58238	357.38758	343.31298	329.39537	315.60467	299.8381	284.24942	268.83287	253.65425
solid biomass	17	18	20	21	21	20	20	20	21	22	22	23	24	24	24	23	23	23	22	22	21	20	19	19
gas biomass	12	13	14	15	15	14	14	14	15	15	16	16	17	17	17	17	16	16	16	15	15	14	14	13
charcoal	209	221	247	262	256	251	243	249	260	269	276	283	289	294	291	287	283	278	272	267	258	249	239	229
TOTAL	1554	1484.0987	1524.7661	1565.4657	1530.9663	1499.778	1451.6801	1440.8486	1432.8857	1422.8403	1411.4323	1401.3729	1388.6099	1374.8954	1333.0195	1290.7875	1248.8382	1206.6793	1164.3385	1121.8265	1071.0742	1020.2981	969.51946	919.02111
biomass		251.5788	280.96106	298.01159	291.44407	285.50686	276.35067	283.86485	296.37654	306.26635	314.45541	322.61672	329.3182	335.29109	331.48839	326.82082	321.7891	316.28146	310.17996	303.58234	293.6978	283.30685	272.44936	261.24447
biomass distribution based on 2017 statistics																								
1A4b Residential																								
FUEL CONSUMPTION (TJ)		Demand results for Taliotis_30Jul2019.xlsx																						
Other kerosene	630	514	545	536	531	531	524	522	519	516	511	505	499	493	479	464	448	430	411	390	370	350	331	313
Diesel/gas oil	2886	2356	2499	2457	2435	2430	2400	2389	2377	2362	2341	2315	2285	2258	2193	2125	2051	1968	1881	1786	1693	1604	1517	1432
LPG	1605	1635	1743	1716	1701	1699	1679	1695	1723	1749	1774	1799	1822	1856	1847	1835	1818	1794	1764	1720	1678	1638	1599	1560
Solid Biomass	163	168	182	177	174	172	169	173	179	186	192	198	204	211	212	213	213	212	210	205	201	198	194	190
Charcoal	255	262	284	277	272	269	264	270	281	290	300	309	318	330	332	333	332	331	327	321	315	309	303	298
TOTAL	5539	4935	5253	5164	5113	5101	5035	5048	5079	5102	5118	5127	5127	5148	5064	4970	4862	4734	4593	4421	4257	4099	3945	3793
Diesel/gas oil		2871	3044	2993	2966	2961	2924	2911	2896	2877	2852	2821	2783	2751	2672	2589	2498	2398	2292	2175	2063	1954	1848	1745
Solid Biomass		429	465	455	446	441	432	442	460	476	491	507	522	541	544	546	545	542	537	526	516	507	497	488
biomass distribution based on 2017 statistics																								
Diesel/gas oil distribution to diesel and kerosene based on 2017 stats																								
1A4c Agriculture / Forestry / Fishing / Fish farms																								
1A4ci Stationary																								
FUEL CONSUMPTION (TJ)		Demand results for Taliotis_30Jul2019.xlsx																						
Diesel/gas oil	951	945	980	983	998	982	957	946	943	943	943	946	948	949	945	940	936	931	925	918	910	898	885	870
LPG	115	74	75	74	75	74	72	70	69	67	66	66	65	64	63	62	61	60	59	59	58	56	55	54
solid biomass		0	0	0	1	1	1	1	2	4	6	8	11	15	19	24	30	37	45	55	67	80	94	111
gas biomass	487	592	592	831	2374	2374	2374	2374	2374	2374	2374	2374	2830	2830	2830	2830	2830	2830	2830	2830	2830	2830	2830	2830
TOTAL	1553	1611.8616	1647.2321	1889.1225	3447.0283	3430.0872	3403.3858	3391.0843	3387.9674	3387.5884	3389.139	3393.3587	3853.5766	3858.5343	3857.1818	3856.5413	3857.4274	3858.3033	3860.2026	3862.2914	3863.865	3864.6832	3864.5018	3864.576
gas biomass from "Primary Energy - Electricity" sheet																								
1A4cii Off-road Vehicles and Other Machinery																								
IE in 1A3b road transport																								
1A4ciii Fishing (mobile combustion)																								
FUEL CONSUMPTION (TJ)		gdp																						
Diesel	86	89	93	96	98	101	104	107	109	112	114	117	120	122	125	128	131	134	137	140	143	147	150	154
TOTAL	86	89.333347	92.593684	95.567211	98.45311	101.38084	104.11812	106.72107	109.17566	111.6867	114.25549	116.88337	119.57169	122.32184	125.13524	128.01335	130.95766	133.96968	137.05098	140.20316	143.42783	146.72667	150.10138	153.55372
1A5 Non-Specified																								
1A5a Stationary																								
FUEL CONSUMPTION (TJ)		gdp																						
Diesel/gas oil	238	247	256	264	272	280	288	295	302	309	316	323	331	338	346	354	362	371	379	388	397	406	415	425
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solid Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	237.919	247.1407	256.16043	264.38669	272.37053	280.47009	288.04278	295.24385	302.03446	308.98125	316.08782	323.35784	330.79507	338.40336	346.18664	354.14893	362.29435	370.62712	379.15155	387.87203	396.79309	405.91933	415.25548	424.80635
1A5b Mobile																								
FUEL CONSUMPTION (TJ)		gdp																						
Jet kerosene	74.6	78	80	83	85	88	90	93	95	97	99	101	104	106	109	111	114	116	119	122	124	127	130	133
TOTAL	74.6	77.5	80.3	82.9	85.4	88.0	90.3	92.6	94.7	96.9	99.1	101.4	103.7	106.1	108.6	111.1	113.6	116.2	118.9	121.6	124.4	127.3	130.2	133.2
1AD Feedstocks, reductants and other non-energy use of fuels																								
Lubricants	transport	0.0024663	0.0088432	0.0046905	-0.009432	-0.009739	-0.010137	-0.00869	-0.011871	-0.014934	-0.031937	-0.03302	-0.033665	-0.034291	-0.019901	-0.017381	-0.019283	-0.018888	-0.020124	-0.019446	-0.01894	-0.018942	-0.018815	-0.015886
LC-Fuel Consumption (TJ)		314.6	315.4	318.2	319.7	316.6	313.6	310.4	307.7	304.0	299.5	289.9	280.4	270.9	261.6	256.4	252.0	247.1	242.4	237.6	232.9	228.5	224.2	220.0
Bitumen		gdp																						
LC-Fuel Consumption (TJ)		1565.79	1626	1686	1740	1793	1846	1896	1943	1988	2033	2080	2128	2177	2227	2278	2331	2384	2439	2495	2553	2611	2671	2733
2796																								

2. INDUSTRIAL PROCESSES		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
2A Mineral Industry																										
2A1 Cement production																										
Moni	0	ETS																								
Vasiliko	1716889		full capacity																							
Total Clinker (tn)	1716889	1593425	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	
Total Clinker (kt)	1716.89	1593.425	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	
2A2 Lime Production																										
slaked lime production (t)	4369	4648	4928	5207	5486	5766	6045	6324	6603	6883	7162	7441	7721	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	
2A4 Other Process Uses of Carbonates																										
2A4a Ceramics			full capacity 2025																							
total production (t)	152570	159636	166703	173769	180835	187901	194968	202034	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	209100	
total production (kt)	152.570	159.636	166.703	173.769	180.835	187.901	194.968	202.034	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	209.100	
non-ETS production (t)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2A4b Other Uses of Soda Ash																										
adopted for soda ash		continuing 2015-2017 trend																								
imports - Mc (t)	449	533	597	660	724	787	851	915	978	1042	1105	1169	1233	1296	1360	1423	1487	1551	1614	1678	1741	1805	1868	1932		
imports - Mc (kt)	0.449	0.533	0.597	0.660	0.724	0.787	0.851	0.915	0.978	1.042	1.105	1.169	1.233	1.296	1.360	1.423	1.487	1.551	1.614	1.678	1.741	1.805	1.868	1.932		
2D Non-Energy Products from Fuels and Solvent Use																										
2D1: Lubricant Use																										
LC-Fuel Consumption (kt)	7.826	assume constant 2017																								
		7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826	7.826		
2D2: Paraffin Wax Use																										
		assume constant 2017																								
imports (kt)	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100		
PW (TJ)	4.01887	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874	4.018874		
2D3 Other																										
Solvent Use																										
population	864.2	869.5	874.9	880.6	886.2	891.7	897.2	902.5	907.6	912.6	917.4	921.9	926.2	930.4	934.3	938.0	941.6	945.0	948.3	951.5	954.7	957.8	960.8	963.8		
per capita (t/cap)	0.02068																									
Urea-based catalysts																										
		A PaMs_080819_1300 LoMS_ECtemplate.xlsx																								
		12288.15	12135.23	11889.69	11723.27	11565.73	11408.45	11295.17	11612.96	11785.26	11900.72	11955.22	11801.72	11445.38	11519.12	11508.25	11612.21	11726.56	11810.22	11906.29	11858.89	11810.46	11763.19	11331.95		
diesel consumption road tran	298.67	285.77	282.21	276.50	272.63	268.97	265.31	262.68	270.07	274.08	276.76	278.03	274.46	266.17	267.89	267.63	270.05	272.71	274.66	276.89	275.79	274.66	273.56	263.53		
activity																										
	5.97	5.72	5.64	5.53	5.45	5.38	5.31	5.25	5.40	5.48	5.54	5.56	5.49	5.32	5.36	5.35	5.40	5.45	5.49	5.54	5.52	5.49	5.47	5.27		
2F Gg CO2 eq.																										
population (1000s)	864.2	865.2554	870.6544	876.2578	881.8411	887.3533	892.7814	898.0682	903.1987	908.1378	912.8796	917.398	921.705	925.8166	929.7218	933.4467	936.9943	940.4086	943.7077	946.9007	950.0174	953.0881	956.0917	959.0632		
2F. Product uses as ODS subs	249.565	249.8693	251.4284	253.0466	254.6589	256.2508	257.8183	259.345	260.8266	262.2529	263.6223	264.9271	266.1709	267.3582	268.486	269.5617	270.5861	271.5721	272.5248	273.4469	274.347	275.2337	276.1011	276.9592		
2F per capita (t/cap)	0.28878	using 2017 per cap emissions																								
2G1b: Use of Electrical Equipment																										
per capita emissions (kg/cap)																										
AVERAGE	0.00019	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193	0.000193		
population	864200	865255.4	870654.4	876257.8	881841.1	887353.3	892781.4	898068.2	903198.7	908137.8	912879.6	917398	921705	925816.6	929721.8	933446.7	936994.3	940408.6	943707.7	946900.7	950017.4	953088.1	956091.7	959063.2		
2G3: N2O from Product Uses																										
	864200	865255	870654	876258	881841	887353	892781	898068	903199	908138	912880	917398	921705	925817	929722	933447	936994	940409	943708	946901	950017	953088	956092	959063		
2G3a: Medical Applications																										
Total Population (1000 persons)	864.2	865.2554	870.6544	876.2578	881.8411	887.3533	892.7814	898.0682	903.1987	908.1378	912.8796	917.398	921.705	925.8166	929.7218	933.4467	936.9943	940.4086	943.7077	946.9007	950.0174	953.0881	956.0917	959.0632		
2G3b: Propellant for Pressure and Aerosol Products																										
Total Population (1000 persons)	864.2	865.2554	870.6544	876.2578	881.8411	887.3533	892.7814	898.0682	903.1987	908.1378	912.8796	917.398	921.705	925.8166	929.7218	933.4467	936.9943	940.4086	943.7077	946.9007	950.0174	953.0881	956.0917	959.0632		
2G4: Other																										
	assume constant as 2016																									
CO2 (kt)	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215	0.01215		

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3B1.4 Other - Horses																								
population	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342
3B1.4 Other - Mules and Asses																								
population	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316
3B1.4 Other - Goats																								
population	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637	257637
3B1.4 Other - Poultry																								
Laying chicken	570330	593125.5	598884	604642.5	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918	621918
Broiler chicken	2777700	2756064	2782822	2809580	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853	2889853
Turkeys	11860	9960.1	10056.8	10153.5	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6	10443.6
Other poultry	0	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Total population (1000s)	3359.890	3359.151	3391.765	3424.380	3522.220	3522.221	3522.222	3522.223	3522.224	3522.225	3522.226	3522.227	3522.228	3522.229	3522.230	3522.231	3522.232	3522.233	3522.234	3522.235	3522.236	3522.237	3522.238	3522.239
3D Agricultural Soils																								
3D1 Direct NsO emissions from managed soils																								
3D1.1 Inorganic N fertilisers																								
FSN (kg N in fertilizer)	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000	7841000
EF1 (kgN2O-N/kg N)	assuming constant as 2017																							
3D1.2b Sewage Sludge applied to soils																								
dry sludge applied on land (t DM)	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1	1613.1
3D1.2c Other organic fertilisers applied to soils																								
TOTAL composting (1000t wet mass)	36.52	48.927	53.698	58.469	63.24	68.011	72.782	77.553	82.324	87.095	91.866	96.637	101.408	106.179	110.95	115.721	120.492	125.263	130.034	134.805	139.576	144.347	149.118	153.889
3D1.4 Crop residues																								
Crop production (t/yr)																								
Wheat	16592	7316.12	7454.16	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2	7592.2
Barley	18754	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907	2907
Oats	248	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352
Beans & pulses (legumes)	4145	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
Potatoes (tubers)	111410	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803	122803
cultivated area (ha)																								
Wheat	8678	8889	9057	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225	9225
Barley	10953	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536	14536
Oats	490	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
Beans & pulses (legumes)	493	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498
Potatoes (tubers)	4440	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041	5041
Crop yield (YieldFresh), kg/ha																								
Wheat	1912	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823	823
Barley	1712	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Oats	506	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959	959
Beans & pulses (legumes)	8408	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032	8032
Potatoes (tubers)	25092	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361	24361
3F. Field burning of agricultural residues																								
Area Burnt (ha/yr)																								
FracBURN (kg N/kg crop-N)	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Wheat	868	889	906	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922	922
Barley	1095	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454
Oats	49	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
Beans & pulses (legumes)	49	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Potatoes (tubers)	444	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504	504

5. WASTE	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
4A Solid Waste Disposal																								
POPULATION	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Regional Population (1000 persons)																								
Lefkosia	335.9	336.3	338.4	340.5	342.7	344.9	347.0	349.0	351.0	352.9	354.8	356.5	358.2	359.8	361.3	362.8	364.1	365.5	366.8	368.0	369.2	370.4	371.6	372.7
Ammochostos	47.5	47.6	47.9	48.2	48.5	48.8	49.1	49.4	49.7	49.9	50.2	50.4	50.7	50.9	51.1	51.3	51.5	51.7	51.9	52.1	52.2	52.4	52.6	52.7
Larnaca	146.5	146.7	147.6	148.5	149.5	150.4	151.3	152.2	153.1	153.9	154.7	155.5	156.2	156.9	157.6	158.2	158.8	159.4	160.0	160.5	161.0	161.6	162.1	162.6
Lemesos	242.0	242.3	243.8	245.4	247.0	248.5	250.0	251.5	253.0	254.3	255.7	256.9	258.1	259.3	260.4	261.4	262.4	263.4	264.3	265.2	266.1	266.9	267.8	268.6
Pafos	92.3	92.4	93.0	93.6	94.2	94.8	95.4	95.9	96.5	97.0	97.5	98.0	98.4	98.9	99.3	99.7	100.1	100.4	100.8	101.1	101.5	101.8	102.1	102.4
TOTAL	864.2	869.5	874.9	880.6	886.2	891.7	897.2	902.5	907.6	912.6	917.4	921.9	926.2	930.4	934.3	938.0	941.6	945.0	948.3	951.5	954.7	957.8	960.8	963.8
Urban Population (1000 persons)																								
Lefkosia	246.9	247.2	248.7	250.3	251.9	253.5	255.1	256.6	258.0	259.4	260.8	262.1	263.3	264.5	265.6	266.7	267.7	268.7	269.6	270.5	271.4	272.3	273.1	274.0
Ammochostos		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Larnaca	86.6	86.7	87.3	87.9	88.4	89.0	89.5	90.0	90.6	91.0	91.5	92.0	92.4	92.8	93.2	93.6	93.9	94.3	94.6	94.9	95.2	95.6	95.9	96.2
Lemesos	184.6	184.8	186.0	187.2	188.4	189.6	190.7	191.8	192.9	194.0	195.0	196.0	196.9	197.8	198.6	199.4	200.2	200.9	201.6	202.3	202.9	203.6	204.2	204.9
Pafos	65.1	65.2	65.6	66.0	66.4	66.9	67.3	67.7	68.0	68.4	68.8	69.1	69.4	69.8	70.0	70.3	70.6	70.8	71.1	71.3	71.6	71.8	72.0	72.3
TOTAL	583.2	584.0	587.6	591.4	595.1	598.9	602.5	606.1	609.6	612.9	616.1	619.1	622.1	624.8	627.5	630.0	632.4	634.7	636.9	639.1	641.2	643.2	645.3	647.3
Rural Population (1000 persons)																								
Lefkosia	89.0	89.1	89.6	90.2	90.8	91.4	91.9	92.5	93.0	93.5	94.0	94.4	94.9	95.3	95.7	96.1	96.5	96.8	97.2	97.5	97.8	98.1	98.4	98.7
Ammochostos	47.5	47.6	47.9	48.2	48.5	48.8	49.1	49.4	49.7	49.9	50.2	50.4	50.7	50.9	51.1	51.3	51.5	51.7	51.9	52.1	52.2	52.4	52.6	52.7
Larnaca	59.9	59.9	60.3	60.7	61.1	61.5	61.8	62.2	62.6	62.9	63.2	63.5	63.8	64.1	64.4	64.6	64.9	65.1	65.4	65.6	65.8	66.0	66.2	66.4
Lemesos	57.4	57.5	57.9	58.2	58.6	59.0	59.3	59.7	60.0	60.3	60.7	61.0	61.2	61.5	61.8	62.0	62.3	62.5	62.7	62.9	63.1	63.3	63.5	63.7
Pafos	27.2	27.2	27.4	27.6	27.8	27.9	28.1	28.3	28.4	28.6	28.7	28.9	29.0	29.1	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2
TOTAL	281.0	281.3	283.1	284.9	286.7	288.5	290.2	292.0	293.6	295.2	296.8	298.3	299.7	301.0	302.3	303.5	304.6	305.7	306.8	307.8	308.9	309.9	310.8	311.8
per capita production to disposal sites (kg/cap)	481	498	502	506	510	514	519	524	528	534	539	545	552	559	561	566	572	577	583	588	594	599	605	610
Annual per capita production (kg/cap) to model	655.58	662.31	667.81	672.77	678.55	684.28	690.33	696.52	702.96	709.90	717.26	725.38	734.16	743.71	746.17	753.31	760.54	767.83	775.15	782.52	789.89	797.26	804.64	811.99
MSW to disposal sites (% of total)	75%	75%	75%	75%	60%	56%	53%	49%	45%	44%	43%	42%	41%	40%	39%	38%	37%	36%	35%	35%	35%	35%	35%	35%
composition of waste to disposal sites																								
Food	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%
Garden	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Paper	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%
Wood	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Textile	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Nappies	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
MSW to disposal sites (% of total)	75%	75%	75%	75%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%
composition of waste to disposal sites																								
Food	48%	48%	48%	48%	14%	14%	14%	13%	13%	13%	12%	12%	12%	12%	11%	11%	11%	10%	10%	10%	10%	10%	10%	10%
Garden	8%	8%	8%	8%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Paper	27%	27%	27%	27%	52%	52%	53%	53%	53%	53%	54%	54%	54%	54%	55%	55%	55%	55%	55%	55%	55%	55%	55%	55%
Wood	3%	3%	3%	3%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Textile	11%	11%	11%	11%	21%	21%	21%	21%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%
Nappies	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%

WEM RESULTS (Gg CH4) from model																								
Un-managed, deep	13.648811	13.82343	13.66599	13.04847	12.46021	11.89977	11.36577	10.85692	10.37197	9.909768	9.469191	9.049186	8.648749	8.26693	7.902825	7.556352	7.226652	6.912909	6.614346	6.330228	6.059856	5.802566	5.557728	5.324742
Un-managed, shallow	2.3566903	2.251598	2.15142	2.055919	1.964865	1.878043	1.795248	1.716285	1.640969	1.569124	1.500582	1.435186	1.372785	1.313236	1.256401	1.202153	1.150367	1.100928	1.053725	1.00865	0.965605	0.924493	0.885224	0.847712
Un-managed, total	16.005501	16.07503	15.81741	15.10439	14.42508	13.77781	13.16102	12.5732	12.01294	11.47889	10.96977	10.48437	10.02153	9.580165	9.159226	8.758505	8.37702	8.013837	7.66807	7.338878	7.025461	6.72706	6.442953	6.172454
Managed, anaerobic	3.0367011	3.336461	3.629603	4.300448	5.492924	6.650475	7.774804	8.868233	9.932542	10.96961	11.98172	12.97082	13.9395	14.89003	15.82483	16.72981	17.61647	18.48571	19.33836	20.17524	20.99712	21.80472	22.59873	23.37981
TOTAL	19.042202	19.41149	19.44702	19.40484	19.918	20.42828	20.93582	21.44143	21.94548	22.4485	22.95149	23.45519	23.96103	24.47019	24.98406	25.48832	25.99349	26.49954	27.00643	27.51412	28.02258	28.53178	29.04169	29.55227
30% RECOVERY of deep unmanaged and managed from 2020				30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
biogas recovered (Gg CH4)	0.0	0.0	0.0	5.2	5.4	5.6	5.7	5.9	6.1	6.3	6.4	6.6	6.8	6.9	7.1	7.3	7.5	7.6	7.8	8.0	8.1	8.3	8.4	8.6
W5 emissions (Gg CH4)	19	19	19	14	15	15	15	16	16	16	17	17	17	18	18	18	19	19	19	20	20	20	21	21
4B Biological Treatment of Solid Waste																								
Increase composting to 10% in 2021 and keep constant																								
BaU M composted, 1000 t wet waste	33.120	45.696	46.362	47.007	47.713	48.417	49.143	49.878	50.627	51.406	52.210	53.063	53.957	54.903	55.317	56.070	56.823	57.577	58.330	59.083	59.836	60.590	61.343	62.096
Increase AD to 5% in 2021 and keep constant																								
W4 AD (1000t) from Feb2018 PROJ					67.9	68.4	69.0	69.7	70.3	71.0	71.7	72.5	73.4	74.4	74.6	75.3	76.1	76.8	77.5	78.3	79.0	79.7	80.5	81.2
4D Wastewater Treatment and Discharge																								
4D1 Domestic Wastewater Treatment and Discharge - T2																								
Population	846200	869498.6	874924.1	880555	886165.7	891704.9	897159.6	902472.3	907628	912591.4	917356.4	921897	926225.1	930356.8	934281.2	938024.4	941589.4	945020.4	948335.7	951544.3	954676.4	957762.1	960780.4	963766.5
SEPTIC SYSTEMS																								
Ui	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%	23.8%
Ti,j	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TREATED: CENTRALISED AEROBIC - WELL MANAGED																								
Ui	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%	76.2%
Ti,j	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
P	846200	869498.6	874924.1	880555	886165.7	891704.9	897159.6	902472.3	907628	912591.4	917356.4	921897	926225.1	930356.8	934281.2	938024.4	941589.4	945020.4	948335.7	951544.3	954676.4	957762.1	960780.4	963766.5
Protein, kg/person/yr	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81	28.81
P	846200	869498.6	874924.1	880555	886165.7	891704.9	897159.6	902472.3	907628	912591.4	917356.4	921897	926225.1	930356.8	934281.2	938024.4	941589.4	945020.4	948335.7	951544.3	954676.4	957762.1	960780.4	963766.5
TPLANT, %	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%
SD2 Industrial Wastewater Treatment and Discharge																								
	4.23	4.043249	3.820768	3.380806	3.0443	2.7	2.5	2.3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Industrial production (t)																								
assuming growth proportional to GDP																								
alcohol	631	656	681	704	726	745	764	781	797	813	829	846	863	880	898	916	934	953	972	991	1,011	1,031	1,052	1,073
beer	39,140	40,723	42,279	43,708	45,039	46,255	47,411	48,502	49,472	50,461	51,470	52,500	53,550	54,621	55,713	56,828	57,964	59,123	60,306	61,512	62,742	63,997	65,277	66,583
soft drinks	15,070	15,679	16,278	16,828	17,341	17,809	18,254	18,674	19,047	19,428	19,817	20,213	20,617	21,030	21,450	21,879	22,317	22,763	23,219	23,683	24,157	24,640	25,132	25,635
dairy products	108,113	112,484	116,782	120,730	124,405	127,764	130,958	133,970	136,650	139,383	142,170	145,014	147,914	150,872	153,890	156,967	160,107	163,309	166,575	169,907	173,305	176,771	180,306	183,912
meat & poultry	88,304	91,874	95,384	98,609	101,611	104,354	106,963	109,424	111,612	113,844	116,121	118,444	120,812	123,229	125,693	128,207	130,771	133,387	136,054	138,775	141,551	144,382	147,270	150,215
refinery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
soaps & detergents	8,543	8,888	9,228	9,540	9,830	10,095	10,348	10,586	10,798	11,014	11,234	11,458	11,688	11,921	12,160	12,403	12,651	12,904	13,162	13,425	13,694	13,968	14,247	14,532
vegetable oils	12,217	12,711	13,196	13,643	14,058	14,437	14,798	15,139	15,442	15,750	16,065	16,387	16,714	17,049	17,390	17,737	18,092	18,454	18,823	19,200	19,584	19,975	20,375	20,782
vegetables, fruits & juices	76,012	79,085	82,107	84,883	87,467	89,828	92,074	94,192	96,076	97,997	99,957	101,956	103,995	106,075	108,197	110,361	112,568	114,819	117,116	119,458	121,847	124,284	126,770	129,305
wine	8,810	9,166	9,516	9,838	10,137	10,411	10,671	10,917	11,135	11,358	11,585	11,816	12,053	12,294	12,540	12,790	13,046	13,307	13,573	13,845	14,122	14,404	14,692	14,986

Annex III

Information about key underlying assumptions and values of variables used in projections

Parameter	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
Population	million	0.910	0.914	0.917	0.920	0.923	0.926	0.929	0.930	0.931	0.933	0.934	0.936	0.930
GDP	EUR million	21754	22406	23011	23587	24129	24612	25104	25606	26118	26640	27173	30002	33124
Number of passenger-kilometers	Billion Veh-km	7.03	6.97	6.91	6.85	6.79	6.73	6.66	6.60	6.54	6.48	6.42	6.92	7.45
Public road transport	Billion Veh-km	0.07	0.08	0.08	0.09	0.10	0.10	0.11	0.12	0.12	0.13	0.14	0.15	0.16
Private cars	Billion Veh-km	6.75	6.69	6.62	6.55	6.49	6.42	6.36	6.29	6.22	6.16	6.09	6.56	7.07
Motorcycles	Billion Veh-km	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.21	0.22
Rail	Billion Veh-km	0	0	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001
Freight transport tonnes-kilometres	Billion Veh-km	0.32	0.32	0.33	0.33	0.34	0.35	0.35	0.36	0.36	0.37	0.37	0.40	0.43
Trucks	Billion Veh-km	0.32	0.32	0.33	0.33	0.34	0.35	0.35	0.36	0.36	0.37	0.37	0.40	0.43
International Fuel prices	EUR/GJ													
Oil	EUR of 2016/GJ	5.13	5.40	5.69	5.99	6.30	6.64	6.71	6.79	6.86	6.93	7.01	8.51	9.61
Gas (NCV)	EUR of 2016/GJ	5.16	5.43	5.73	6.03	6.34	6.69	6.76	6.83	6.91	6.98	7.06	8.57	9.68
Coal	EUR of 2016/GJ	2.29	2.42	2.50	2.56	2.65	2.74	2.84	2.95	3.06	3.16	3.28	3.48	3.63
Carbon price ETS sectors	EUR of 2016/ ton CO2	15.5	17.6	18.6	20.7	21.7	23.3	25.9	27.9	30.0	32.1	34.7	43.5	51.7
Exchange rate to EUR	EUR/ USD	1.16	1.17	1.18	1.18	1.19	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20