Department of Environment
Ministry of Agriculture,
Rural Development and Environment

Cyprus' update on the national system for policies and measures and projections, the low-carbon development strategy, climate policies and measures and greenhouse gas projections

in accordance to

Articles 13 and 14 on reporting by Member States of "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"

and

Articles 20, 21, 22 and 23 of "Commission Implementing Regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council"

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1. Background

Pursuant to Articles 13 and 14 in "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" (MMR)[1], EU Member States must report to the Commission updated information on the national system for policies and measures and projections, the low-carbon development strategy, climate policies and measures and greenhouse gas projections no later than 15 March 2015, and every second year thereafter. Moreover, Member States should communicate to the Commission any substantial changes to the information reported pursuant to this Article during the first year of the reporting period, by 15 March of the year following the previous report.

The previous ordinary update of policies and projections was submitted to the Commission in March 2017.

This update is submitted to the Commission based on the revisions made during the preparation of the 7ths National Communication and 3rd Biennial Report under the UNFCCC.

The content of this update meets the requirements in Articles 13 and 14 of regulation no 525/2013, and the requirements in the implementing acts referred to in Article 12(3) of the regulation. This includes information in accordance with Articles 20 – 23 in "Commission Implementing Regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council"(MMR IR)[2].

NOTES

- This report is accompanied by the electronic submission of tables included in Annex XII and Annex XII of IR, through the EIONET CDR.
- This report uses the NIR2017 submitted to the UNFCCC in October 2017 as the latest NIR.

[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:165:0013:0040: N PDF
[2] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0749&from EN

2. Reporting on policies and measures (MMR Art. 13)

2.1. Description of the national system for reporting on policies and measures and projections (MMR Art. 13(1)(a))

In accordance with Article 13(1)(a) of the MMR and Article 20 of the IR this chapter contains information on Cyprus' national system pursuant to Article 12(1) for reporting on policies and measures and projections of anthropogenic greenhouse gas emissions by sources and removals by sinks.

2.1.1. Information concerning the relevant institutional, legal and procedural arrangements, including the designation of the appropriate national entity or entities entrusted with overall responsibility for the policy evaluation of the Member State concerned and for the projections of anthropogenic greenhouse gas emissions

In Cyprus, the Department of Environment under the Ministry of Agriculture, Rural Development and Environment is the national entity entrusted with the overall responsibility for policy evaluation and for providing projections of anthropogenic greenhouse gas emissions.

The procedural arrangement for compiling information for policy evaluation and for making projections of anthropogenic greenhouse gas emissions in accordance with reporting requirements in EU legislation and under the UNFCCC and the Kyoto Protocol includes the involvement of and contributions from the following relevant ministries and institutions:

- Energy Service under the Ministry of the Energy, Commerce, Industry and Tourism
- Ministry of Transport, Communications and Works
- Department of Forests under the Ministry of Agriculture, Rural Development and Environment
- Department of Agriculture under the Ministry of Agriculture, Rural Development and Environment
- Ministry of Finance
- Directorate General for European Programmes, Coordination and Development
- Private companies for cement, ceramics and lime production

There are no legal arrangements for the collaboration that exists.

2.1.2. Description of relevant institutional, legal and procedural arrangements established within a Member State for evaluating policy and for making projections of anthropogenic greenhouse gas emissions by sources and removals by sinks

The institutional and legal arrangements for evaluating policy and for making projections of anthropogenic greenhouse gas emissions by sources and removals by sinks are described in Section 2.1.1.

There are no legal arrangements for the collaboration that exists for the preparation of the projections and the policies for GHG mitigation. When climate relevant policies are being evaluated and projections of anthropogenic greenhouse gas emissions by sources and removals by sinks are being elaborated, the procedural arrangement includes writing letters or emails to relevant ministries asking for their contributions to the evaluations and projections - either as information on the relevant policies and measures and their effects and, if available, specific projections, or as comments to draft text, draft findings and/or draft projections relevant to a particular policy or measure under the responsibility of the relevant ministry. The procedural arrangement usually also includes setting up the steering group with representatives from the relevant ministries and institutions.

2.1.3. Description of the relevant procedural arrangements and timescales to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the information reported on policies and measures and the information reported on projections

A description of the relevant procedural arrangements is included in section 2.1.2.

The relevant timescales to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the information reported on policies and measures and the information reported on projections are defined by the Department of Environment for the purpose of complying with reporting requirements in EU legislation, under the UNFCCC and under the Kyoto Protocol in a timely manner.

Therefore the timescales take into account: the due date for the reporting of the information and the time needed for making the information sufficiently transparent (e.g. descriptions of methods and assumptions in the context of projections), accurate (e.g. sensitivity analyses in the context of projections), consistent (in the context of projections e.g. that the results of the GHG projections are presented in such a way that they are consistent with the historic GHG inventories), comparable (in the context of projections e.g. that the results of the GHG projections are presented in such a way that they can be compared with the historic GHG inventories and with projections of other countries, if they present the results of their projections in a similar way) and complete (in the context of projections e.g. that all sources, sinks and greenhouse gases included in the historic GHG inventories are also included in the greenhouse gas projections).

These requirements are taken into account when information on policies and measures and projections are to be reported to the European Commission or the secretariat for the UNFCCC and the Kyoto Protocol.

Furthermore, when information on policies and measures and projections are to be reported to the European Commission or the secretariat for the UNFCCC and the Kyoto Protocol, the most updated information is reported – including information on the most recently published comprehensive and well-documented GHG projection.

2.1.4. Description of the overall process for the collection and use of data, together with an assessment of whether consistent processes for collection and use of data are underpinning the evaluation of policies and measures and the making of projections as well as the different projected sectors in the making of projections

The overall process for the collection and use of data is coordinated by the Department of Environment under the Ministry of Agriculture, Rural Development and Environment and involves collection and use of information and data from:

- Energy Service under the Ministry of the Energy, Commerce, Industry and Tourism
- Ministry of Transport, Communications and Works
- Department of Forests under the Ministry of Agriculture, Rural Development and Environment
- Department of Agriculture under the Ministry of Agriculture, Rural Development and Environment
- Ministry of Finance
- Directorate General for European Programmes, Coordination and Development
- Private companies for cement, ceramics and lime production

The processes for collection and use of information and data necessary for the evaluation of policies and measures and the making of projections are consistent as all relevant contributors are addressed in such a way that the information and data provided, e.g. activity data projections, are consistent with the statistical activity data used for the elaboration of historic greenhouse gas inventories.

To the extent that the projection methodologies across different projected sectors are based on the same parameters and assumptions, consistency across the sector projections is ensured. When the main drivers behind the projections of activity data differ across different projected sectors, consistency in the presentation of results is ensured. For all sectors it is ensured that the projection results in terms of greenhouse gas emissions are presented in a way that is consistent with the historic greenhouse gas inventories.

2.1.5. Description of the process for selecting assumptions, methodologies and models for policy evaluation, and for making projections of anthropogenic greenhouse gas emissions

Information on policy evaluation in relation to evaluation of effects and costs is included in Section 2.3.

Information on projections of anthropogenic greenhouse gas emissions, including information on assumptions, methodologies and models is included in Chapter 3.

2.1.6. Description of the quality assurance and quality control activities and of the sensitivity analysis for projections carried out

Information on projections of anthropogenic greenhouse gas emissions, including information on the quality assurance and quality control activities and of the sensitivity analysis for projections carried out is included in Chapter 3.

2.2. Update relevant to Cyprus' low-carbon development strategy (LCDS) and its implementation

Information on Cyprus' low-carbon development strategy and its implementation was submitted to the Commission on 16 March 2015. In accordance with Article 13(1)(a) of the MMR it should be noted that since then there have been no changes to the strategy, and no new information on its implementation. Information required under Article 21(a-e) of the IR can be obtained from the 16 March 2015 submission.

2.3. Information on applicable and relevant national policies and measures, or groups of measures, and on implementation of applicable and relevant Union policies and measures, or groups of measures, that limit or reduce greenhouse gas emissions by sources or enhance removals by sinks, presented on a sectoral basis and organised by gas or group of gases

The national policies are prepared, updated, and monitored by the Ministry of Agriculture, Rural Development and Environment (MARDE), in collaboration with the responsible Ministry for each measure or policy. Energy is the sector which has to contribute the most in the reduction of greenhouse gases of Cyprus. The emissions of the energy sector except transport increased from 2,727 Gg CO_2 eq. in 1990 to 4,178 Gg CO_2 eq. in 2015, corresponding to 53% increase. In 2015, emissions increased by 1% compared to 2014. The policies and measures currently in implementation are presented in Table 1.

Table 1. List of Policies and measures

Energy	
E1	Natural Gas
E2	RES[3] in electricity
E3	EE[4] in industry (existing companies)
E4	Residential new buildings
E5	Residential buildings energy upgrade
E6	Residential solar panels replacement
E7	Tertiary new buildings
E8	Tertiary buildings energy upgrade
E9	Public buildings
E10	Promotion of biomass and alternative fuels in industry
E11	RES in residential (heating & cooling)
E12	RES in commercial (heating & cooling)
Transport	
T1	Biofuels
IPPU	
I1	F-gases Recovery of F-gases from old equipment
Agriculture	
A1	Promotion of anaerobic digestion for treatment of animal waste
Waste	
W1	Sorting
W2	Landfilling
W3	Composting
W4	Anaerobic digestion
W5	Biogas recovery

The contents of the sections that follow (2.3.1 - 2.3.6) contain information regarding:

- The objective of the policy or measure and a short description of the policy or measure (MMR Art. 13(1)(c)(i))
- Type of policy instrument (MMR Art. 13(1)(c)(ii))
- Status of implementation of the policy or measure or group of measures (MMR Art. 13(1)(c)(iii))

Indicators to monitor and evaluate progress over time (MMR Art. 13(1)(c)(iv)) are not used and therefore not included in this report. Quantitative estimates of the effects on emissions by sources and removals by sinks of greenhouse gases (MMR Art. 13(1)(c)(v)) are presented in Chapter 3.

[3] RES: Renewable energy source (% contribution to total energy)
[4] EE: Energy Efficiency (TJ savings)

Where available, estimates of the projected costs and benefits of policies and measures, as well as estimates, as appropriate, of the realised costs and benefits of policies and measures (MMR Art. 13(1)(c)(vi)) are reported.

Where available, all references to the assessments and the underpinning technical reports (MMR Art. 13(1)(c)(vii)) are reported.

2.3.1. Sectoral policies and measures: Energy

The emissions of the energy sector except transport increased from 2,727 Gg CO_2 eq. in 1990 to 4,178 Gg CO_2 eq. in 2015, corresponding to 53% increase. In 2015, emissions increased by 1% compared to 2014. Energy is the sector which has to contribute the most in the reduction of greenhouse gases of Cyprus. The import of natural gas, and its initial use for electricity production, is expected to contribute considerable reductions of emissions.

Cyprus is the southernmost region of the European Union at the crossroads of three continents, with a dominant position in the Mediterranean and South East. In general Cyprus presents the common energy problems of most islands:

(a) Isolated energy system.
(b) High rates of economic and social development involving high rates of growth in energy demand.
(c) High cost of energy supply.
(d) High dependence on petroleum products - small supply security.
(e) Seasonal variations in energy demand.
(f) Maximum operation of the system of production and distribution of electricity in peak load demand.
(g) Strict limitations of protection and promotion of the island environment that act as a disincentive to develop initiatives in energy investments.

Since its independence in 1960, Cyprus has relied on oil for all of its energy related needs; electricity generation, transport, and heating and cooling. In the absence of any domestic oil production, there has been high vulnerability to fluctuating oil prices. Despite the widespread use of solar water heaters for several decades throughout the island, it was only in recent years that additions of renewable energy technologies have been made for electricity generation. By the end of 2015 renewable energy corresponded to roughly 8.5% of total generation (Ministry of Energy, Commerce, Industry and Tourism based on information released by TSO-Cy, 2016).

The past system of electricity generation has dominated for the past 40 years and has been based on monopolised ownership of a few, large, centralised and inflexible generation plants. Even though it has served well for most of the past, recent years have increasingly exposed its vulnerability, be it from the risk of consequences of generation incidents, be it from the emergence of rather high swing load during the day and year due to the lack of base consumption and the high tertiary activity

during the day in summer months, or be it simply to volatility to global oil price fluctuations.

A key challenge for Cyprus is therefore its high dependency on fossil fuels for energy – the biggest share within the EU in fact, which makes it crucial for the country to develop both its hydrocarbon and renewable energy sources. Cyprus is reliant on fossil fuel imports for its electricity needs, and spends over 8% of its GDP to cover the costs.

The island also saw the biggest increase in energy demand among the EU28, growing 41% since 1990 from 1.6 million tonnes of oil equivalent (Mtoe) to 2.3 Mtoe in 2015. These figures may be low when compared with its larger EU partners, but a more accurate comparison would be Malta where consumption was only 0.8 Mtoe in 2015. However, Cyprus is determined to find a cleaner solution until it can exploit its own reserves.

Several stricter restrictions regarding emissions of greenhouse gases and air pollutants will effectively be introduced in 2020. These will affect electricity generation, transportation, and heating and cooling sectors. Frequently, energy planning decisions are made in a disaggregated manner. The electricity supply may be assessed individually and be seen as disconnected from demands for heating and cooling. At the same time, the transport sector is often treated as a separate entity. However, it is obvious to argue that in case of an increased electric vehicle fleet, for instance, this is no longer the case. Similarly, once domestic gas reserves become operational, demand for natural gas may not be confined to conventional power generation. Compressed natural gas may become a viable alternative in the transport sector. Also, even though outside the scope of this study, use of natural gas in industry, residential heating purposes or gasification of the transport sector are potential alternatives.

Such shifts in the national energy profile can bring about challenges, but can also provide opportunities.

The 13% Renewable Energy Sources (RES) goal for 2020[5] is set to be generated by wind farms, photovoltaic (PV) systems, solar thermal plants and biomass and biogas utilisation plants. Latest data show that RES accounted for 8.4% of electricity production in 2016. RES power production rose 6% in 2016, compared to 2015, mainly on increased output generated by private photovoltaic systems. Wind farms generated almost 55% of electricity from RES in 2016, while the private-owned photovoltaic systems generation rose by approximately 15% from 2015 to 2016.

[5] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (Text with EEA relevance), OJ L 140, 5.6.2009, p. 16–62

In Cyprus, electricity from renewable sources is no more promoted through subsidy since 2013 where a net metering scheme and self-consumption has been put in place. In addition a new scheme was recently announced for RES that will participate in the competitive market.

Access of electricity from renewable energy sources to the grid shall be granted according to the principle of non-discrimination. With regard to the use of the grid renewable energy shall be given priority. Grid development is a matter of central planning (Transmission Grid Development Plan 2007-2016 by the Cypriot TSO). In addition, renewable heating and cooling (RES H&C) is promoted by support schemes offering subsidies to households.

However, the country's national grid system has certain intrinsic and technical limitations affecting RES penetration and reliability of the energy system – such as the lack of interconnections to the trans-European electricity networks, a limitation to the amount of intermittent renewable energy that can be connected to the electricity system, and a lack of centralised storage capability.

To tackle these problems the country is exploring ways to introduce smart grids in the national network and is on the look-out for projects that could facilitate energy storage, and ventures that have production on a 24-hour basis. Also the EuroAsia Interconnector could bring more solutions in its wake.

The island is already one of the highest users per capita in the world of solar water heaters in households, with over 90% of households equipped with solar water heaters and over 50% of hotels using large systems of this kind. With almost year-round sunshine, Cyprus certainly has plenty of energy to harness, but competitive energy storing capabilities are crucial in order to fully tap into its solar potential and facilitate better RES penetration.

There continues to be much ground to cover in terms of renewable energy production, but international interest in developing the sector in Cyprus has been on the rise. In this respect, the production of renewable energy is expected to experience considerable growth in coming years, and significant investment is required in order for Cyprus to achieve its targets – opening the field for companies with expertise in renewables.

The Cyprus Energy Regulatory Authority (CERA) has worked towards the full opening up of the energy market and granting consumers the right to choose their own supplier – with expectations of a full liberalisation by May 2019. CERA's proposition is a 'net pool' model, where the operations of the state power company, EAC, are unbundled and the production and supply operations separated. EAC production would then enter into bilateral agreements with suppliers for the sale of energy at regulated prices. However, these plans have experienced some resistance from unions, as they are seen as moves which could put pressure to privatise the state power company.

In respect to the supply of natural gas to Cyprus, the Council of Ministers, at its meeting in June 2016, decided to approve the import of Liquefied Natural Gas (LNG) to Cyprus in a manner leading to the commencement of natural gas supply preferably by the year 2020. For the purpose of implementing the Decision, the Cyprus Natural Gas Company (DEFA) was mandated to carry out a study which concluded that the preferred LNG supply option project is through the use of a floating infrastructure with the development of the necessary mooring facilities and pipeline connection to the natural gas receiving point at Vassilikos. On the basis of the results of the study the Council of Ministers, at its meeting on May 18th 2017, decided to mandate DEFA to issue, as soon as possible, an invitation for tenders regarding the long-term supply of LNG to Cyprus to satisfy electricity requirements and an invitation for tenders for the construction and operation of the necessary infrastructure. In parallel with the above DEFA was mandated to proceed with the FEED study for the internal pipeline network. The anticipated time plan for the implementation of the tenders is expected to take place in the first half of 2018.

The electrical interconnection with Israel and Greece will be the next major challenge in the country energy sector. Cyprus is promoting the «EuroAsia Interconnector» project as aiming at commissioning in 2019-2022. The project will effectively contribute to the security of energy supply and reduction in CO2 emissions by allowing the countries in the region renewable energy sources for electricity generation.

The competent authority in relation to energy policies is the Energy Service of the Ministry of Energy, Commerce, Industry and Tourism. The main energy consumers in Cyprus (2016) are presented in Figure 1.

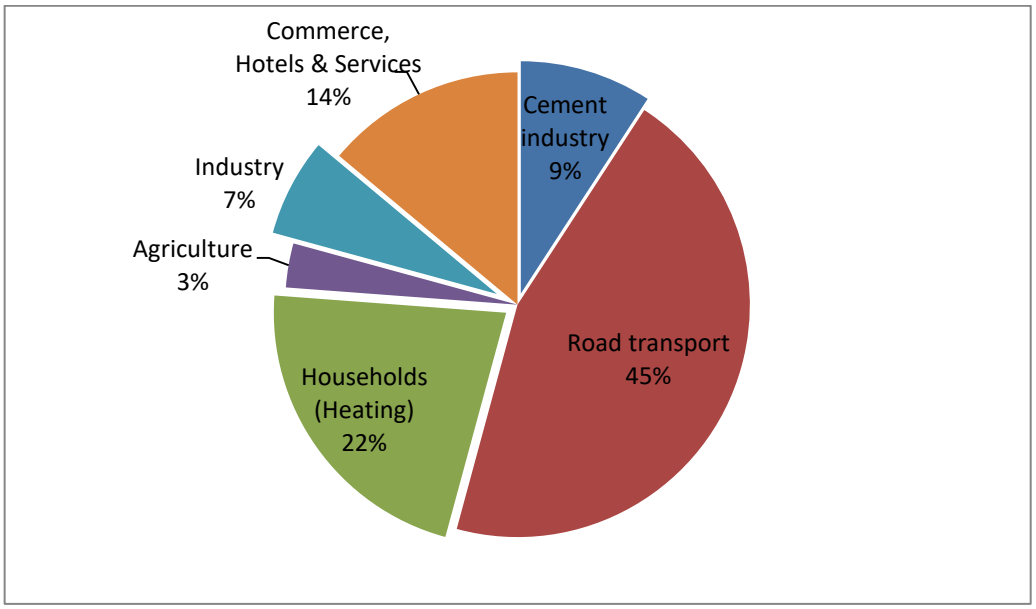

Figure 1. Main energy consumers in Cyprus (2016)[6]

[6] Energy Service; Energy balance 2016 (in toe)

2.3.1.1. Introduction and use of Natural gas in the internal market for electricity production (E1)

The Government of Cyprus, recognizing the positive contribution that the introduction and use of natural gas will have on the economy and the environment of Cyprus, is considering the introduction of natural gas initially for use for electricity generation. It is however expected that after its arrival, natural gas will also be used in other sectors of the economy (commercial, industrial and transport).

In the view of the fact that the interim solution tender process was terminated by DEFA without conclusion with a gas supply agreement, the Ministry of Energy, Commerce, Industry and Tourism, in collaboration with the Cyprus Energy Regulatory Authority (CERA), are examining all available options for the introduction of LNG in Cyprus as soon as possible and complementary to the supply of natural gas from indigenous reserves.

By importing natural gas, apart from the reduction of emissions from the actual use of the natural gas, there would also be a positive contribution to emission reductions through the increased efficiency of the newer technologies used.

The development of natural gas market in Cyprus will be based on the provisions of the relevant EU Directives including the making use of relevant derogations provided in the Directive 2009/73/EC concerning isolated and emergent markets.

Box 1. Key information

Competent authority
Energy Service, Ministry of Energy, Commerce, Industry and Tourism

Other involved authorities
- Cyprus Energy Regulatory Authority
- Public Natural Gas Company (DEFA)
- Electricity Authority of Cyprus
- Department of Environment

Type
Political, legislative

National legislation
- Κ.Δ.Π. 115/2006
- N. 183(I)/2004 as amended

Measures towards attainment
- Introduction and use of natural gas for electricity production
- Installation of combined cycle electricity production units using natural gas as fuel
- Decommissioning or conversion of existing electricity production units

2.3.1.2. Promotion of Renewable energy sources

[7]The energy policy of Cyprus is harmonized with the European Union goal of promoting the use of energy from renewable sources, as a major step towards the reduction of global warming and climate change phenomena.

The EU RES Directive[8] sets out specific national targets to be achieved by each individual Member State, regarding the share of RES generated in each Member State by the year 2020. For Cyprus, the national target states that the share of energy produced from RES must be at least 13% out of the gross national final consumption of energy in 2020.

The main types of RES technologies promoted under these measures for integration in the Cyprus power system are solar energy, wind energy and biomass. Cyprus ranks first in the world in solar energy use for water heating in households, and has achieved significant progress in the production of energy from Renewable Energy Sources (RES).

Cyprus has already exceeded its intermediate 2020 targets, with RES comprising of about 8.7% of its total electricity generation, compared to the 7.45% threshold for 2015- 2016. In addition, Cyprus holds the EU-28 record according to the "European Solar Thermal Industry Federation" for use of solar water heating systems per capita. Currently, more than 93% of households and 52% of hotels in Cyprus heat water through solar power heating systems.

Cyprus is on track in achieving its Renewable Energy Sources (RES) target, i.e. to supply 13% of the island's energy by 2020 (Table 2). Details on how Cyprus will achieve the targets are available in the National Renewable Energy Action Plans that has been prepared according to Article 4 of the renewable energy Directive (2009/28/EC) and submitted in July 2010[9]. Currently there is no policy related to RES for the period after 2020.

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[7] http://www.investcyprus.org.cy/en/growth-sectors/cyprus-investmentsectors/energy - sector

[8] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (Text with EEA relevance), OJ L 140, 5.6.2009, p. 16–62

[9] https://ec.europa.eu/energy/sites/ener/files/documents/dir_2009_0028_action_plan_cyprus.zip

Table 2. Summary of the targets trajectory for Renewable energy sources in Cyprus (according to the National Renewable Energy Action Plan) excluding transport

	2010	2015	2020
Renewable energy sources to reach 13% in 2020 in the gross final energy consumption			
Heating and cooling	16.2%	20%	23.5%
Electricity production	4.3%	8.4%	16%
Transport	2.2%	3.1%	4.9%
Total share of RES	6.5%	9.0%	13%

The most important projects relating to power generation from RES concern wind parks and photovoltaic (PV) parks, concentrated solar thermal plants and biomass and biogas utilisation plants. 6 wind parks are currently in operation, while as regards solar energy, 4 PV parks have been connected to the national grid so far, generating 1,000 MWh. Table 3 shows the distribution of the renewable energy sources according to the type of renewable technology and consumer.

Table 3. Renewable energy sources in the energy balance of Cyprus in toe, 2016[10]

	Solar Thermal	Geothermal	Biomass	Electricity from Biomass	Heating from CHP (Biomass)	Electricity from wind	Electricity from PV Systems	Biofuels
Cement industry			11529					
Road transport								8889
Households (Heating)	58621	1551	8027				1828	
Agriculture				1325	4441			
Industry			1718					
Commerce, Hotels & Services	10345		5748			36.8	5.5	
Electricity from RES fed to the Grid				3148		19459	10864	

Measures are separated into two key categories: Renewable energy sources in electricity production and renewable energy sources for heating and cooling.

2.3.1.2.1. Renewable energy sources in electricity production

Electricity production contributed 50% to the emissions of the energy sector in 2015, which corresponds to 36% to the total emissions of the country (excluding LULUCF)

[10] Energy Service; Energy balance 2016 (in toe)

(Department of Environment, 2017). This corresponds to 3,033 Gg CO_2 eq., whereas the total emissions of the country without LULUCF were 8,467 Gg CO_2 eq. All units producing electricity in Cyprus for public use running on conventional fuels are operated by the Electricity Authority of Cyprus. The main fuel used for the production of electricity is HFO while there also some consumption of gas oil (approximately 10% in 2015). Electricity production is regulated by the Emissions Trading System.

Box 2. Key information

Competent authority

Energy Service, Ministry of Energy, Commerce, Industry and Tourism

Other involved authorities

- Cyprus Energy Regulatory Authority
- Transmission System Operator
- Ministry of Finance
- Department of Town Planning and Housing, Ministry of Interior
- Department of Environment, Ministry of Agriculture, Natural Resources and Environment

Type

Legislative, voluntary

National legislation

- Law No. 112(I)/2013 on the promotion and encouragement of the use of renewable energy sources which has repealed the old one (N.33(I)/2013)
- Law 110(I)/2011 establishing a European emissions trading system and other relevant issues

Relevant EU legislation

- Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity from renewable energy sources in the internal electricity market (Directive 2001/77/EC is repealed by Directive 2009/28/EC from 1 January 2012. Moreover, from 1 April 2010, Article 2, paragraph 2 of Article 3 and Articles 4 to 8 will be deleted)
- Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
- Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community

Measures towards attainment

- RES support schemes
- Informational campaigns
- Implementation of relevant legislation

2.3.1.2.2. Renewable energy sources for heating and cooling

Heating and cooling for industrial, housing and tertiary sectors, contributed 18% to the emissions of the energy sector in 2015, and 13% to the total emissions of the country (excluding LULUCF) (Department of Environment, 2017).

The main technologies being traditionally used in Cyprus for heating and cooling are Oil-burning central heating and air-conditioning split units. The low operating cost based on cheap oil prices in the past, and clean and effective heating, provided practical advantages, far outweighing the implementation cost in the long-run. While there are not major changes during the recent years in cooling, for heating, gas-burning central heaters, fireplaces and wood-burning stoves have been gaining popularity in recent years.

The measures promoted are predominately associated with the promotion of solar thermal, biomass and geothermal energy.

Box 3. Key information

Competent authority

Energy Service, Ministry of Energy, Commerce, Industry and Tourism

Other involved authorities

- Department of Town Planning and Housing, Ministry of Interior
- Department of Environment, Ministry of Agriculture, Natural Resources and Environment
- Department of Labour Inspection, Ministry of Labour and Social Insurance

Type

Legislative, voluntary

National legislation

- Law No. 112(I)/2013 on the promotion and encouragement of the use of renewable energy sources, which has repealed the old one (N.33(I)/2013)
- Law No. 142(I)/2006 regulating energy efficiency in buildings
- Law No. 30(I)/2009 amending Law No. 142(I)/2006 regulating energy efficiency in buildings
- Law No. 56(I)/2003 on Integrated Pollution Prevention Control (with amending laws no. 15(I)/2006, 12(I)/2008)

Relevant EU legislation

- Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity from renewable energy sources in the internal electricity market (Directive 2001/77/EC is repealed by Directive 2009/28/EC from 1 January 2012. Moreover, from 1 April 2010, Article 2, paragraph 2 of Article 3 and Articles 4 to 8 will be deleted)
- Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

- Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community
- Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control and related amendments

Measures towards attainment

- RES support schemes
- Informational campaigns
- Implementation of relevant legislation

2.3.1.3. Promotion of energy efficiency (E3-E9)

Because of its national peculiarities, which make it a small and isolated system (an island country) without any interconnections to European or other energy networks (electricity, petroleum, natural gas) at present, Cyprus attaches great importance to energy efficiency aiming, inter alia, to improve energy supply security, increase competitiveness and ensure sustainable development/environmental protection.

There is significant potential for end use energy efficiency, especially in buildings and in the transport sector. Cyprus has met the interim end use energy savings EU target for 2010. The measures taken so far, combined with the measures expected to be taken in implementation of the Energy Efficiency Directive (Directive 2012/27/EU) and the Energy Performance of Buildings Directive (Directive 2010/31/EU), will allow Cyprus to largely exceed the end use target set for 2016, while laying the ground for achieving the 2020 primary Energy Saving target. Raising consumer awareness in combination with the measures promoted by Cyprus under the EU Directives for improving energy efficiency have contributed decisively to the reduction in the growth rate of energy consumed and have brought positive results for the economy and employment sector.

In application of the provisions of the Directive 2012/27/EU on energy efficiency, as an alternative to the adoption of an energy efficiency obligation scheme, Cyprus has prepared a National Energy Efficiency Programme (NEEP) for the purpose of achieving the cumulative end use energy savings target. Some of the measures selected for inclusion in the NEEP relate to proposals submitted for project co-financing by EU Structural and Investment Funds. Grant Schemes have been put in place for the implementation of these measures. In particular, these measures are:

- An annual renovation of 3% of the surface of air conditioned and heated public buildings owned by the State and used by the central government.
- Conducting energy inspections in industries and implementing investments in energy savings.
- Energy upgrading of existing residences so that they may comply with the minimum energy efficiency requirements.
- Installation of roof thermal insulation on dwellings.

- Energy upgrading of existing buildings so that they may comply with the minimum energy efficiency requirements for buildings.
- Infrastructure for supporting and promoting electric vehicles in Cyprus.
- Installing an integrated AMI system with 500 000 smart metres.

Further details on the energy efficiency policy and measures are available in the 3rd National Energy Efficiency Action Plan (NEEAP) of Cyprus[11].

2.3.1.3.1. Energy efficiency in industry (existing companies) – E3

A Grant Scheme for encouraging the use of Renewable Energy Sources and Energy Saving for Natural and Legal Persons as well as for Public Sector Bodies engaged in an economic activity, was in place up until the end of 2013. The investments covered by the Grant Scheme fall into two subcategories. NA - Energy Saving (SA) and NB - Renewable Energy Sources (RES).

According to the provisions of the 2013 NEEAP, energy-savings investment means an investment in systems, equipment and materials whose installation achieves at least 10% energy savings in a specific application. Eligible expenses also included the design costs, where necessary, under the restrictions set out in the relevant application documents for the different categories and subcategories of the Scheme.

Category NA1 of the grant scheme applied only to existing undertakings operating in Cyprus for at least four (4) years. Financial aid was granted to energy investments in existing holdings of the undertakings in question, under the condition that the building licence was issued by 28 December 2008. There were five (5) subcategories of investments as follows:

1. Purchase/installation of new equipment for the recovery of waste energy, either directly or indirectly by recovery/recycling of discarded materials, product or employed medium.
2. Purchase/integration of new materials and equipment to reduce idle energy consumption and energy losses.
3. Purchase of new equipment for the production, transmission, distribution and use of energy.
4. Purchase/installation of a new energy management IT system and/or integration of automated direct energy regulation/switch-off devices.
5. Replacement of existing materials and/or equipment connected with the subcategories 1 to 4.

Training seminars on energy management are held on an annual basis, in cooperation with the Human Resources Development Authority of Cyprus (HRDA), the Productivity Centre and the Energy Institute. Four (4) seminars were held in 2013 in Nicosia, Limassol, Larnaca and Paphos, with a duration of 60 hours each. The seminars were addressed to unemployed engineers of all specialties and focused,

[11] https://ec.europa.eu/energy/sites/ener/files/documents/CuprusArt42014.pdf

inter alia, on issues related to energy saving and energy efficiency improvement technologies/systems, ways of operation, selection of an appropriate system and applications in Cyprus (industry, hotels, services, etc.). In addition, examples for drawing up a technical-financial study for the installation of energy-saving systems and other examples of studies under ES Grant Schemes were presented.

Furthermore, information days were held in Nicosia, Limassol and Paphos addressed mainly to engineers who are members of the Cyprus Scientific and Technical Chamber (ETEK), the Cyprus Employers and Industrialists Federation (OEB), the Cyprus Chamber of Commerce and Industry (KEBE), hotel owners, entrepreneurs, credit institutions, municipalities and communities, contractors and the general public. Information days focused on energy audits, the energy efficiency of buildings, energy labelling, energy-saving and RES technologies used for heating and cooling purposes.

In recent years, the Cyprus Employers and Industrialists Federation (OEB) holds an annual fair on energy saving, in cooperation with the EAC and the Energy Department. Printed information material on the different energy-saving technologies is distributed at the fairs. In addition, information is provided to the general public with regard to the provisions of the grant schemes. The most efficient energy-saving investments made by natural or legal persons under the grant scheme of the Special Fund ES are rewarded at the 'Save Energy' fair.

Within 2013, the Energy Service has approved training institutes to carry out training programmes for candidate Category A and B energy auditors. Category A relates to all buildings regardless of their surface and air conditioning system and includes, inter alia, ports, airports and street lighting. Category B relates to industrial facilities, as well as agricultural activities and installations. The first category B energy auditors have been entered in the relevant registry within 2014. The first energy auditors have been included in the registry of Category A energy auditors in 2013.

In addition, Cyprus' NEEP establishes, as a measure to achieve the target under Article 7, co-financing for conducting energy audits in industries and for the implementation of the energy-saving investments proposed by the energy audit. The measure will concern approximately 10 industries per year.

These measures are expected to be renewed within the following years in view of the new EU obligations for 2030.

Box 4. Important information

Competent authority
Energy Service, Ministry of Energy, Commerce, Industry and Tourism

Other involved authorities
Department of Environment

Type
Legislative, compulsory

National legislation

Law No. 31/2009 on energy end-use efficiency and energy services

Relevant EU legislation

- Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC.
- Decision 406/209/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

Measures towards attainment

Grant scheme for energy conservation

2.3.1.3.2. Residential buildings – E4-E5-E6

According to Article 4 of Directive 2012/27/EU on energy efficiency, Member States shall establish a long-term strategy for mobilising investments in the renovation of their national stock of buildings.

In Cyprus, it is estimated that houses account for 19% of final energy consumption, whereas another 13% corresponds to commerce, hotels and services, i.e., mainly office buildings[12]. The different political, economic and social conditions over the years did not allow for the implementation of energy-saving measures during the construction of buildings. The first organised attempt to implement energy-saving measures in buildings was made in 2004 through the grant schemes of the Special Fund for RES and ES, whereas the implementation of compulsory measures in new buildings and large buildings undergoing major renovation started in 2007 with the adoption of the 2007 Decree on the 'Regulation of the Energy Efficiency of Buildings (Minimum Energy Efficiency Requirements)'. Therefore, there is currently an energy-intensive building stock, which has negative consequences for the economy and the environment. In addition, the lack of sufficient thermal insulation measures and the excessive exposure to sunlight observed in many buildings are harmful to the health of citizens, reduce the productivity of workers and diminish the quality of life. Major building renovations offer an opportunity to resolve many of these issues.

Dwellings are the majority of Cyprus' building stock, as 431 059 dwellings have been recorded (2014). However, 78 088 houses are used as weekend or tourist residences, which means that they are used less and, therefore, they consume less energy. In addition, 54 651 homes are empty.

[12] Energy Service, 2014, Strategy for encouraging investments in the renovation of buildings Under Article 4 of Directive 2012/27/EU on energy efficiency; Annex F of 3rd National Energy Efficiency Action Plan (NEEAP) of Cyprus available at https://ec.europa.eu/energy/sites/ener/files/documents /CuprusArt42014.pdf

Most dwellings of Cyprus' current building stock have been constructed in the period 2001-2008, followed by the 1980's and the 1990's, which reflect the periods of increased construction activity. In the case of 91% of dwellings, there was no obligation to apply thermal insulation or any other energy-saving measures at the time they were built. Therefore, the energy status of most buildings may be characterised from poor to average, given that, as a rule, building owners did not take any measures during the building's construction, whereas some home owners have taken energy-saving measures at a subsequent stage, mainly under grant schemes of the Special Fund for RES and ES. According to the available statistics, 49% of dwellings have not taken any energy efficiency measures, whereas only 12% have applied some sort of thermal insulation at the building's envelope. The situation is better in the case of window frames, where over 38% have double-glazing.

The main energy product used in the residential sector is electricity coming from the grid, as it is responsible for almost half the final energy consumption, followed by fuel oil and LPG, which are the most important energy products after electricity. Solar energy has penetrated the market with a rate exceeding 16%, whereas other renewable energy sources, such as PV systems, geothermal heat pumps and biomass have a smaller contribution. The highest primary energy consumption rates are due to air conditioning and heating. Solar thermal systems for domestic hot water production have an increased penetration in the residential sector as they are installed in 91% of dwellings.

The measures implemented in the residential sector taken into consideration are the following:

- Residential new buildings
- Residential buildings energy upgrade
- Residential solar panels replacement

The policies and measures that will stimulate investments in the renovation of existing buildings may be divided into: legislative measures and policies, incentives, training measures and awareness raising measures. Details on the measures implemented are available in Strategy for encouraging investments in the renovation of buildings Under Article 4 of Directive 2012/27/EU on energy efficiency (2014)[13].

Box 5. Key information

Competent authority

Energy Service, Ministry of Energy, Commerce, Industry and Tourism

Other involved authorities

[13] Energy Service, 2014, Strategy for encouraging investments in the renovation of buildings Under Article 4 of Directive 2012/27/EU on energy efficiency; Annex F of 3rd National Energy Efficiency Action Plan (NEEAP) of Cyprus available at https://ec.europa.eu/energy/sites/ener/files/documents /CuprusArt42014.pdf

- Ministry of Interior
- Municipalities
- Department of Environment

Type

Legislative, compulsory

National legislation

Law No. 142 (I)/2006 regulating energy efficiency of buildings and amending Laws N. 30(I)2009, N. 210 (I)2012, N. 15 (I)2017

Relevant EU legislation

- Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings
- Decision 406/209/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

Measures towards attainment

- Implementation of national action plan on energy efficiency
- Implementation of national legislation

2.3.1.3.3. 4.1.2.3.3. Non-residential buildings – E7-E8

Non-residential buildings include various types of buildings, the most important of which are offices, retail shops, restaurants, hotels and hospitals. There are no statistics on this building category. However, in 2012 the Electricity Authority of Cyprus (EAC) had 85,198 commercial customers, i.e., buildings and building units owned by enterprises and organisations. Table 4 provides an analysis of EAC's commercial customers per category of use, which reflects to a great extent the relevant number of buildings and building units per type.

Table 4. Electricity consumers per category

Type of consumer	Number of consumers
Wholesale and retail sale, repair of vehicles	24,788
Accommodation premises and establishments serving food	10,097
Public administration and defence	1,671
Education	2,454
Human health and social work activities	2,143
Culture, entertainment and recreation	2,907
Other services	41,138

The vast majority of customers under category 'other services' represent buildings and building units used as offices, which rank first in terms of number followed by retail shops. Despite the fact that there are no statistics on the age of these

buildings, it may be assumed that they have a distribution over time which is similar to the one of dwellings, as commercial and other buildings had the same peak period as dwellings. Both in the case of dwellings and other buildings, there was no obligation to apply thermal insulation or any other energy-saving measures at the time they were built. Approaches to envelope construction were the same for all building categories.

The sector of non-residential buildings uses two-thirds of total final consumption of electricity from the grid. The use of RES is reduced as compared to households, with solar energy showing the highest penetration. In some building types, such as hotels, where 50% uses solar energy for hot water production, there is an increased penetration of RES, as compared to the average penetration in buildings of the tertiary sector. One- to five-star hotels in Cyprus number 224, of which 20 are located in mountainous regions.

The measures implemented in the non-residential (tertiary) sector taken into consideration are the following:

- Tertiary new buildings
- Tertiary buildings energy upgrade

The policies and measures that will stimulate investments in the renovation of existing buildings may be divided into: legislative measures and policies, incentives, training measures and awareness raising measures. Details on the measures implemented are available in Strategy for encouraging investments in the renovation of buildings Under Article 4 of Directive 2012/27/EU on energy efficiency (2014)[14].

Box 6. Key information

Competent authority

Energy Service, Ministry of Energy, Commerce, Industry and Tourism

Other involved authorities

- Ministry of Interior
- Municipalities
- Department of Environment

Type

Legislative, compulsory

National legislation

Law No. 142 (I)/2006 regulating energy efficiency of buildings and amending Laws N. 30(I)2009, N. 210 (I)2012, N. 15 (I)2017

[14] Energy Service, 2014, Strategy for encouraging investments in the renovation of buildings Under Article 4 of Directive 2012/27/EU on energy efficiency; Annex F of 3rd National Energy Efficiency Action Plan (NEEAP) of Cyprus available at https://ec.europa.eu/energy/sites/ener/files/documents /CuprusArt42014.pdf

Relevant EU legislation

- Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings
- Decision 406/209/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

Measures towards attainment

- Implementation of national action plan on energy efficiency
- Implementation of national legislation

2.3.1.3.4. Public buildings – E9

The term "public buildings", means buildings used by:

- Central government authorities such as Ministries, the Police and the General Prosecutor's Office;
- Local Administration, such as Municipalities and Communities
- Public schools, public universities and other public educational institutions;
- The military.

Central governmental authorities means all administrative services whose competence extends to the whole territory of the Republic of Cyprus, which are laid down in Annex II to the 2006 Coordination of the Public Procurement, Works and Services Contracting Procedures and Relevant Matters Act. These authorities use 1,066 buildings and building units of which only 572 are property of the public sector. As a rule, they use only electricity to cover their energy needs.

In the areas under the effective control of the Republic of Cyprus, Local Administration consists of 30 Municipalities and 350 Communities. Most Municipalities and large communities have only one building, used for administrative purposes and events. However, large Municipalities own more buildings which are being used to serve the public, as well as other building types, such as libraries and sports centres.

In Cyprus there are 833 public schools of primary and secondary education. The Technical Department of the Ministry of Education and Culture is responsible for the implementation of projects related to the construction of new school units and the maintenance and extension of already existing ones. Regarding public universities, the University of Cyprus, which is the largest public university, owns most of the buildings that have been constructed in recent years within the Campus. The Technological University of Cyprus uses mainly historical buildings and leased buildings in the historical center of Limassol, whereas the Open University of Cyprus uses a building in Nicosia. Public universities have technical departments which are responsible for the maintenance and the smooth operation of their building infrastructures.

Box 7. Key information

Competent authority
Energy Service, Ministry of Energy, Commerce, Industry and Tourism

Other involved authorities
-

Type
Legislative, Compulsory

National legislation
Law No. 142 (I)/2006 regulating energy efficiency of buildings and amending Laws N. 30(I)2009, N. 210 (I)2012, N. 15 (I)2017

Relevant EU legislation
Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

Measures towards attainment
-

2.3.1.4. Promotion of biomass and alternative fuels in industry

Cement is considered one of the most important building materials around the world. Cement production is an energy-intensive process consuming considerable amounts of thermal energy. Globally, historically, the primary fuel used in cement industry is coal[15]. A wide range of other fuels such as gas, oil, liquid waste materials, solid waste materials and petroleum coke have all been successfully used as sources of energy for firing cement-making kilns, either on their own or in various combinations. In Cyprus the predominant fuel used in cement production is pet-coke, while biomass and the non-biomass fraction of waste are also used.

The new cement producing installation in Cyprus installed in 2011 has the capability of using considerable amounts of alternative fuels and biomass. This advantage should be exploited by encouraging the installation to use non-conventional fuels.

2.3.2. Sectoral policies and measures: Transport

In 2015, road transport emissions contributed 22% of the total national emissions excluding LULUCF (Department of Environment, 2017). The emissions of road transport increased by 56% compared to 1990. According to information from the International Road Federation, Cyprus has the highest car ownership rate in the world with 742 cars per 1,000 people. Other means of transport are very low compared to other countries: 3% public transport and bicycle less than 2% (Ministry of Communications and Public Works, 2010).

[15] Chinyama, 2011, Alternative Fuels in Cement Manufacturing, available at https://www.intechopen.com/books/alternative-fuel/alternative-fuels-in-cement-manufacturing

In addition to the importance for emissions, transport has been an issue of particularly great interest to the society of Cyprus, due to the very large growth of the number of privately owned cars and the associated problems in traffic that are experienced, especially in the capital, Nicosia. Even though many studies have been completed since the 1990s on how to deal with traffic in the urban areas of Cyprus and especially Nicosia, only recently (end of 2009) action has been taken and measures are implemented.

The energy intensity in the transport sector is among the highest in the EU, mainly due to the large percentage of road transport operations. However, there has been a remarkable improvement in this sector in recent years. The increase in the energy efficiency of private vehicles and the import of smaller and more efficient cars have led to better results although public transport in Cyprus are not adequately developed. The transport sector, along with the electricity generation and building sectors, is one of those sectors that offer a significant potential for energy efficiency improvement.

According to the 2013 (Amending) Law on Motor Vehicles and Road Traffic, which entered into force on 1 January 2014, the annual circulation tax for each category M1 motor vehicle and the annual circulation tax for each category N1 motor vehicle, resulting from a category M1 motor vehicle and classified under the category of light lorry (VAN type), is calculated on the basis of the carbon dioxide emissions of the vehicle's engine. In addition, as from 1 January 2014, category N2 and N3 vehicles (lorries) and M2 and M3 vehicles (buses) are registered in so far as they have been proven to comply with the 'EURO VI' requirements on the emission of pollutants.

The launch of the 4th Old Vehicle Scrapping and Replacement Scheme was announced on 11 October 2010, whereas the scheme was implemented in 2011. Applications were admitted for a period of 2 months with final date on 13 December 2010. The 4th Scheme related to the payment of a grant equal to EUR 1 800 and covered the scrapping of M1 category motor vehicles, older than 15 years old, under the condition that a new car with CO2 mass emissions lower or equal to 165gr/km would be purchased.

The new public transportation system was put in force in the second half of 2010. The new public transportation bodies replaced part of their vehicles with new ones that have low fuel consumption and pollutant emissions, as compared to the old vehicles that were replaced. Provincial urban companies have re-organised their routes, aiming to optimise their efficiency in this sector. Their websites contain a detailed map of the routes and the timetable of buses in order to facilitate passengers.

Before the end of 2011, the widening of the motorway linking the Alambra and the GSP intersections (entry to Nicosia) from four to six circulation lanes was completed. Works started on 11 January 2010 against the amount of EUR 32.4 million + VAT and were co-financed by the Trans-European Transport Networks Fund.

In the context of the implementation of EU Regulation (EC) No 1222/2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters, delegated inspectors of the Energy Department perform market surveillance checks in order to identify cases of noncompliance with these provisions. In addition, presentations on energy savings in the transport sector and on eco-driving are made in the context of the seminars addressed to unemployed engineers of all specialisations organised by the Energy Department and the Productivity Centre, with the support of the Human Resources Development Authority of Cyprus.

The municipalities of Nicosia have founded the Inter-municipal Bicycle Company of Nicosia (DEPL), aiming to change the way things work on Cypriot roads via an automated 3rd generation bike rental system. The installation of this innovative system will be combined with the design of new bicycle lanes, which will be used by a large part of the population and by tourists to commute from and to the city centre. In particular, the Nicosia Municipality has installed 100 bicycles in 5 stations, the Aglantzia Municipality, 50 bicycles in 4 stations, the Strovolos Municipality, 80 bicycles in 8 stations, the Dali Municipality, 20 bicycles in 3 stations, the Aghios Dometios Municipality, 20 bicycles in 2 stations, the Latsia Municipality, 15 bicycles in 2 stations and the Engomi Municipality, 30 bicycles in 3 stations. There is one single system for all municipalities that participate in the programme, whereas each user can take a bicycle from the station of one municipality and return it to the station of another municipality. The programme aims to promote the use of bicycles among citizens as an alternative means of transport in the city.

Furthermore, a Grant Scheme for energy saving in the transport sector (purchase of hybrid vehicles, electric vehicles and low-pollutant vehicles), was in force in the period 2004-2009.

The European Directive 2014/94 / EU on the Development of Rural Renewables Infrastructures establishes a common framework for measures to develop the market for alternative fuels in the transport sector and the implementation of relevant infrastructure within the Union in order to minimize dependence on liquid minerals to reduce the environmental impact in the transport sector. Within the framework of the directive, which sets practical goals, the development of the market and related infrastructure for the use of electricity, liquefied natural gas (LNG), compressed natural gas (CNG) and hydrogen in transport is specifically promoted. Directive 2014/94 / EC is a tool to meet the mandatory 2020 target for road transport, i.e. (a) 10% energy from RES in transport (Directive 2009/28 / EC) and b) 6 % reduction in greenhouse gas emission intensity in the life cycle of road transport fuels (Directive 2009/30/EC) the competent authority is the Ministry of Energy, Trade, Industry and Tourism. A National Policy Framework describing national targets and targets, guidelines, support actions and policies for the development of alternative fuels and developing the necessary infrastructures was prepared by the Ministry of Transport, Communications and Works in cooperation with the Ministry of Energy, Commerce, Industry and Tourism.

Charging points and infrastructures for electric vehicles have been installed in public buildings and in public roads, whereas installation costs in private buildings, single-family houses and undertakings will be subsidised under specific criteria and specifications. There are currently 20 charging stations in Cyprus: 7 charging stations in Nicosia, 6 in Limassol, 2 in Larnaca, 2 in Ammochostos and 3 in Paphos. Although the numbers are still very small, the expectation is that the registration of electric cars will increase considerably over the next five years. New electric car sales are expected to comprise 25%-50% of total vehicles on the road by 2040.

The installation of LPG systems in vehicles has also started in 2017 and will reduce the emission of pollutants and fuel consumption in old vehicles.

For the reduction of emissions from road transport the competent authorities are considering the implementation in the immediate future of further measures in the fields of Traffic demand management, Improvement of road traffic flow, Reduction in transport demand, Switch in transport modes and Alternative fuels and technologies.

The continuation and further development of measures such as the above and additional measures such as improvement of infrastructure for further encouragement of use of public transport, cycling and walking and financial incentives to encourage new vehicles with low to zero emissions and discourage vehicles with high emissions, can reduce the emissions of one of the most important sectors in Cyprus with respect to mitigation.

Biofuels

Biofuels are liquid or gaseous transport fuels such as biodiesel and bioethanol which are made from biomass. They serve as a renewable alternative to fossil fuels in the EU's transport sector, helping to reduce greenhouse gas emissions and improve the EU's security of supply. By 2020, the EU aims to have 10% of the transport fuel of every EU country come from renewable sources such as biofuels. Fuel suppliers are also required to reduce the greenhouse gas intensity of the EU fuel mix by 6% by 2020 in comparison to 2010.

Box 8. Key information

Competent authority
Energy Service, Ministry of Energy, Commerce, Industry and Tourism

Other involved authorities
-

Type
Legislative, Compulsory

National legislation
Law N. 112 (I)/2013 – 2015(transposition of EU Directive 2009/28/EC)

Relevant EU legislation

Directive 2009/28/EC of the European Parliament and the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

Measures towards attainment

-

2.3.3. Sectoral policies and measures: Industry

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 provisions of Art. 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 forward a national Law regarding a producer's responsibility scheme. The main provision of this Law will follow the "polluter pays" principle and each producer will have to participate in an appropriate scheme for management of f-gases that have been recovered for any reason.

At the same time, under the provisions of the same scheme, certified technicians will be encouraged to return to the scheme any fluorinated gases the have recovered, for a pre-decided profit.

Box 9. Key information

Competent authority
Department of Environment, Ministry of Agriculture, Rural Development and Environment

Other involved authorities
-

Type
Legislative, compulsory

National legislation
Fluorinated greenhouse gases Law (No. 62(I)/2016 and 46(I)/2017)

Relevant EU legislation
Regulation on fluorinated greenhouse gases 517/2014

Measures towards attainment

- Implementation of “polluter pays” principle; each producer will have to participate in an appropriate scheme for management of f-gases that have been recovered

2.3.4. Sectoral policies and measures: Agriculture

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.

2.3.5. Sectoral policies and measures: Waste

With the EU Landfill Directive being the main guiding force, in combination to the improvement of the infrastructure of the country, Cyprus has developed and implementing during the recent years the revised strategy for municipal solid waste management. The implementation of the strategy 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 establishing separate collection systems by local authorities,
- Establishment of extended producer responsibility (EPR) in 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 adaptations of the strategy that are envisaged:

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 was constructed and operated from 01/04/2010 serving 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 Limassol district is expected to be operated by the year 2018.
b) The construction of the Green Point Network (22 collection points for the depositing of various waste streams out of households – bulky waste, green, textile, furniture, WEEE, etc.) is competed. The 4 Green Points, serving Paphos district are operated and the rest expected to be operated by 2018.
c) Separate collection at source was promoted at households, from the existing collective system for the packing waste serving also and all types of paper, created under the packaging directive while the competent authority promotes the separate collection from other household streams such as other organic waste e.g. food and green waste.
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.

Two (2) landfills are still active in Cyprus but arrangements are made in order to be closed and restored. According to recent data, these two landfills are 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 contacted 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
- Reduction of organics to landfills
- Increase of amount of organic wastes treated by composting
- Promotion of anaerobic digestion for the treatment of the organic fraction of the municipal solid waste

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

2.4. Information on planned additional national policies and measures envisaged with a view to limiting greenhouse gas emissions beyond Cyprus' commitments under Decision 406/2009/EC and in view of the implementation of an international agreement on climate change (MMR Art. 13(1)(d))

There are no planned additional national policies and measures envisaged with a view to limiting greenhouse gas emissions beyond Cyprus' commitments under Decision 406/2009/EC.

2.5. Information on the extent to which the Cyprus' action constitutes a significant element of the efforts undertaken at national level as well as the extent to which the projected use of joint implementation, of the CDM and of international emissions trading is supplemental to domestic action in accordance with the relevant provisions of the Kyoto Protocol and the decisions adopted thereunder (MMR Art. 13(1)(e))

Cyprus does not intend to use joint implementation (JI), the clean development mechanism (CDM) and international emissions trading (IET) under the Kyoto Protocol (the Kyoto mechanisms) to meet its quantified limitation or reduction commitment pursuant to the Kyoto Protocol - in meeting the 2013-2020 targets.

3. Projections (MMR Art. 14)

3.1. Introduction

This Chapter describes a “without measures” or “business as usual” (BaU) scenario, a “with measures” or “with existing measures” (WEM) scenario and a “with additional measures” (WAM) scenario concerning the national projections of greenhouse gas emissions by sources and their removals by sinks for the years 2020, 2030 and 2040. The “without measures” scenario assumes that no emission reduction policies are implemented. The “with measures” scenario assumes that no additional emission reduction policies and measures are adopted than the existing ones (implemented and adopted). The “with additional measures” scenarios assume the implementation of additional policies (planned). The three scenarios are presented in the following sections.

3.2. Projections

This section describes a “without measures” or “business as usual” (BaU) scenario, a “with measures” scenario, and a “with additional measures” (WAM) scenario concerning the national projections of greenhouse gas emissions by sources and their removals by sinks for the year 2040.

The “without measures” scenario assumes that no additional emission reduction policies and measures are implemented than the existing ones. 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 three scenarios are presented in the following sections.

The policies and measures included in each scenario are presented in Table 6 and the resulting impact is presented in Figure 2 and Table 5.

Three important things that should be noted for these projections are the following:

a) The change noticed during the recent years in the types 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.

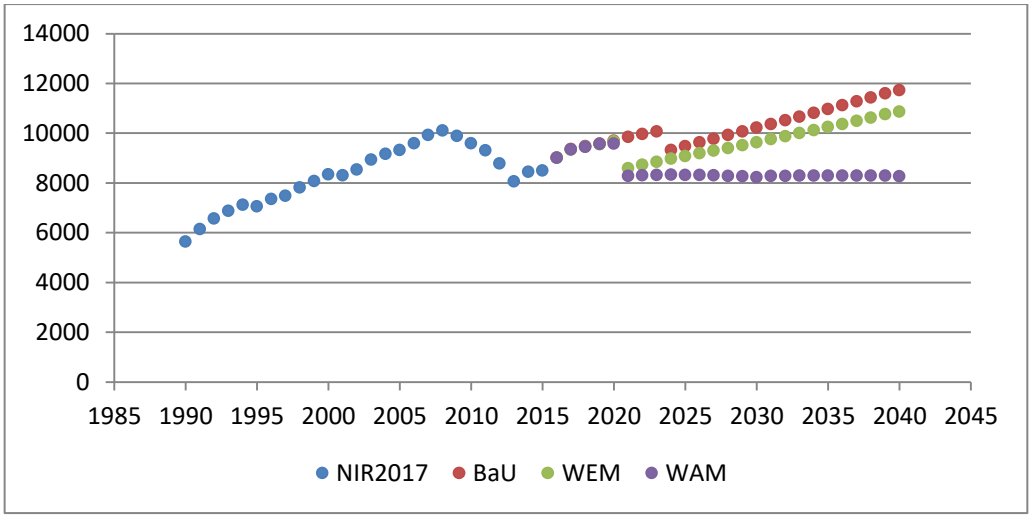

Figure 2. BaU, WEM and WAM Projections of total national GHG emissions (excluding LULUCF)

Table 5. Projections of national GHG emissions disaggregated by sector (excluding LULUCF)

	1990	2000	2010	2015	2020	2030	2040
BaU							
Energy	2740	4552	5181	4181	4599	4308	4980
Transport	1200	1792	2313	1887	2247	2788	3398
IPPU	765	888	942	1325	1548	1575	1592
Agriculture	543	647	651	589	691	726	694
Waste	385	460	499	515	608	824	1056
TOTAL	5634	8339	9586	8496	9692	10221	11720
WEM							
Energy	2740	4552	5181	4181	4331	3811	4272
Transport	1200	1792	2313	1887	2247	2788	3398
IPPU	765	888	942	1325	1546	1555	1551
Agriculture	543	647	651	580	682	717	692
Waste	385	460	499	515	620	533	620
TOTAL	5634	8339	9586	8487	9425	9404	10533
WAM							
Energy	2740	4552	5181	4181	4358	3473	3797
Transport	1200	1792	2313	1887	2175	1757	1553
IPPU	765	888	942	1325	1529	1535	1530
Agriculture	543	647	651	580	681	713	685
Waste	385	460	499	515	608	428	256
TOTAL	5634	8339	9586	8487	9351	7906	7820

Table 6. Summary of policies and measures included in each scenario

		BaU			WM			WAM		
	Short	**2020**	**2030**	**2040**	**2020**	**2030**	**2040**	**2020**	**2030**	**2040**
Energy										
E1	Natural Gas	2024			2021			2021		
E2	RES[16] in electricity	10%	13%	20%	13%	20%	27%	16%	27%	35%
E3	EE[17] in industry (existing companies)				97	8	8	97	97	97
E4	Residential new buildings				4073	1983	1983	4073	4073	4073
E5	Residential buildings energy upgrade				120	120	120	120	120	120
E6	Residential solar panels replacement				4	4	4	4	4	4
E7	Tertiary new buildings				467	298	298	467	467	467
E8	Tertiary buildings energy upgrade				198	198	198	198	198	198
E9	Public buildings				6	6	6	6	6	6
E10	Promotion of biomass and alternative fuels in industry				10%+10%	10%+12%	10%+14%	10%+10%	10%+15%	10%+20%
E11	RES in residential (heating & cooling)	32%	35%	37%	35%	38%	42%	35%	40%	45%
E12	RES in commercial (heating & cooling)	25%	27%	28%	25%	28%	32%	25%	30%	35%
Transport										
T1	Biofuels	6%	6%	6%	6%	6%	6%	6%	10%	10%
T2	Infrastructure							start from 2030; 5% reduction of emissions 2040		
T3	New technologies and other measures							25% reduction of emissions 2030; 40% reduction of emissions 2040		
T4	Renewable energy sources in sources								10%	10%
IPPU										

[16] RES: Renewable energy source (% contribution to total energy)
[17] EE: Energy Efficiency (TJ savings)

		BaU			WM			WAM		
	Short	**2020**	**2030**	**2040**	**2020**	**2030**	**2040**	**2020**	**2030**	**2040**
I1	F-gases Recovery of F-gases from old equipment				start from 2020; 5% reduction of emissions 2030; 10% by 2040			5% reduction of emissions 2020; 10% reduction of emissions 2030; 15% by 2040		
Agriculture										
A1	Promotion of anaerobic digestion for treatment of animal waste	cattle +0.25% annually; swine 70% 2040; sheep & goats 5% in 2040 from 2020; poultry 70% 2040			cattle +0.5% annually; swine 75% 2040; sheep & goats 10% in 2040 from 2020; poultry 75% 2040			cattle +0.75% annually; swine 80% 2040; sheep & goats 20% in 2040 from 2020; poultry 80% 2040		
Waste										
W1	Sorting				2021 40%; constant->2040			2021 40%; 2025 55%; 2030 60%; 2035 65%		
W2	Landfilling				from 2020 15% to landfill constant			from 2020 15% to landfill ->10% 2035		
W3	Composting	Constant % as 2016			From 2021 5% constant			from 5% 2021 -> 10% 2035		
W4	Anaerobic digestion				from 2021 10% constant			from 10% 2021 -> 40% 2035		
W5	Biogas recovery				20% reduction of emissions from deep unmanaged			30% reduction of emissions from deep unmanaged		

3.3. Assessment of aggregate effect of policies and measures

The effect of currently implemented and adopted policies and measures (that is incorporated in the WEM projections scenario) is presented in Table 7 in terms of GHG emissions avoided on a CO_2 equivalent basis, while the effect of planned policies and measures is illustrated in Table 8. The aggregate impact is not equal to the sum of the reductions from each measure, as when combined they produce different results.

Table 7. Aggregate effect of currently implemented and adopted policies and measures (Gg CO2 eq.)

Gg CO2 eq.	2020	2030	2040
E1 - natural gas	0.00	0.00	0.00
E2 - RES in electricity	1.16	215.33	262.55
E3 - EE in industry	8.44	0.68	0.68
E4 - EE residential new buildings	185.44	112.27	135.52
E5 - EE residential energy upgrade	7.44	32.52	58.55
E6 - EE residential solar panels replacement	2.24	27.58	53.78
E7 - EE tertiary new buildings	20.47	12.61	12.39
E8 - EE tertiary energy upgrade	8.67	8.38	8.23
E9 - EE in public buildings	0.24	0.24	0.23
E10 - industry (alternative fuels)	12.43	33.24	62.25
E11 - RES in residential	22.09	52.26	104.11
E12 - RES in commercial	0.00	1.91	9.31
T1 - biofuels	0.00	0.00	0.00
I1 - F-gases	1.73	20.06	41.56
A1 - Anaerobic digestion	0.26	1.62	2.93
W1 - sorting	0.00	57.01	100.44
W2 - organics to landfill	0.00	145.67	277.60
W3 - composting	0.00	-0.88	-0.60
W4 - anaerobic digestion	0.00	1.49	1.62
W5 - biogas recovery	0.00	89.24	58.65
Aggregate impact	266.86	816.91	1186.94

Table 8. Aggregate effect of planned policies and measures (Gg CO2 eq.)

Gg CO2 eq.	**2020**	**2030**	**2040**
E1 - natural gas	0.00	0.00	0.00
E2 - RES in electricity	2.41	430.16	561.80
E3 - EE in industry	8.44	8.44	8.44
E4 - EE residential new buildings	185.44	201.69	221.82
E5 - EE residential energy upgrade	7.44	32.52	58.55
E6 - EE residential solar panels replacement	2.24	27.58	53.78
E7 - EE tertiary new buildings	0.24	0.24	0.23

Gg CO2 eq.	2020	2030	2040
E8 - EE tertiary energy upgrade	8.67	8.38	8.23
E9 - EE in public buildings	0.24	0.24	0.23
E10 - industry (alternative fuels)	12.43	59.98	127.43
E11 - RES in residential	22.09	68.84	134.42
E12 - RES in commercial	81.41	93.97	105.00
T1 - biofuels	0.00	49.84	60.76
T2 - Infrastructure	0.00	12.67	169.91
T3 - New technologies and other	51.07	696.94	1359.31
T4 - RES in transport	21.03	287.02	349.87
I1 - F-gases	18.98	40.12	62.34
A1 - Anaerobic digestion	0.51	3.81	7.02
W1 - sorting	0.00	105.56	466.73
W2 - organics to landfill	0.00	161.59	255.13
W3 - composting	0.00	-4.98	-7.56
W4 - anaerobic digestion	0.00	4.36	6.50
W5 - biogas recovery	0.00	133.85	86.23
Aggregate impact	341.62	2314.76	3900.10

3.4. Progress in achievement of the ESD targets

Cyprus is committed to reducing its emissions in sectors covered under the Effort Sharing Decision (ESD, non-ETS) by 5% compared to 2005 emissions. The quantified annual reduction targets set by EU Decisions[18] for Cyprus are 5.92 million AEA in 2013, reducing to 3.97 million in 2020 (according to AR4 GWPs). The cumulative amount of AEAs for the period 2013-2020 is set at 40.0 Mt CO_2 eq. The annual allocation is presented in Table 9 and Figure 3.

[18] Commission Decision of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (2013/162/EU) available at http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013D0162;
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 available at http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2017.209.01.0053.01.ENG

Table 9. Cyprus' ESD annual emission allocations (t CO_2 eq.) for the period 2013–2020, using GWPs calculated applying GWP from the AR4, according to Commission Decision 2017/1471

Year	Annual Emission Allocations (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
TOTAL	**40 040 948**

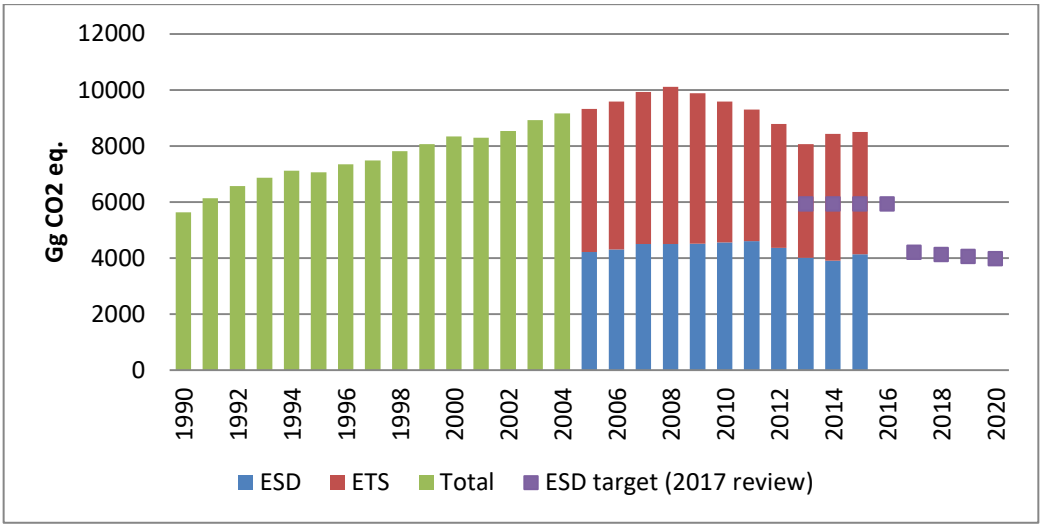

Figure 3. Cyprus' total greenhouse gas emissions for the period 1990-2015, including a breakdown of the emissions 2008-2015 in emissions under ETS and emissions under ESD (non-ETS) and the ESD target for 2013-2020 (Gg CO_2 eq).

3.5. Without measures (BaU)

The BaU emissions by sector are presented in Table 10 and Figure 4. Emissions for LULUCF have not been estimated. The latest inventory year used as reference is 2015. Emissions data was also available for 2016 since during the preparation of the report 2018 submission had already been made to the European Commission. BaU emissions are projected to increase by 108% in 2040 compared to 1990 and by 26% compared to 2005.

Table 10. Total BaU GHG emissions aggregated by source category (Gg CO2 eq.) 1990-2040

	1990	2005	2015	2020	2030	2040
ENERGY	**3940.5**	**7128.7**	**6067.3**	**6846.2**	**7095.7**	**8377.8**
1A1 Energy Industries	1767.0	3483.3	3032.9	3310.0	2712.4	3036.9
1A2 Manufacturing Industries & Construction	514.8	912.0	575.6	675.1	837.6	1021.0
1A3a ii Domestic Aviation	11.1	12.6	0.9	0.6	0.8	1.0
1A3b Road Transport	1200.4	2089.4	1886.8	2247.0	2787.8	3398.3
1A3d ii Domestic water-borne navigation	2.2	2.4	1.6	2.6	3.3	4.0
1A4a Commercial / Institutional	75.8	99.5	107.5	90.6	108.5	130.0
1A4b Residential	302.3	420.7	356.7	405.6	503.2	613.4
1A4c Agriculture / Forestry / Fishing / Fish farms	55.8	89.5	83.0	89.9	111.6	136.0
1A5 Non-Specified	11.1	19.2	22.4	24.6	30.5	37.2
INDUSTRY	**764.9**	**1067.8**	**1324.7**	**1547.7**	**1575.2**	**1592.1**
2A1 Cement production	667.7	821.8	877.1	1071.7	1071.7	1071.7
2A2 Lime Production	5.5	12.4	2.4	3.6	6.0	6.0
2A4a Ceramics	43.8	60.0	7.0	19.9	19.9	19.9
2A4b Other Uses of Soda Ash	0.3	0.3	0.1	0.2	0.3	0.5
2D1: Lubricant Use	0.0	5.9	4.7	4.7	4.7	4.7
2D2: Paraffin Wax Use	0.1	0.0	0.1	0.2	0.2	0.2
2D3 Solvent Use	5.2	10.0	4.8	4.8	4.8	4.8
Urea-based catalysts	1.0	1.6	1.1	1.3	1.3	1.3
2F1: Refrigeration and Air Conditioning	0.0	98.4	353.7	365.3	386.0	399.9
2F2: Foam Blowing Agents	0.0	0.9	1.6	1.7	1.8	1.8
2F3: Fire Protection	0.0	1.2	3.7	3.8	4.0	4.2
2F4a: Metered Dose Inhalers	0.0	2.8	8.4	8.7	9.2	9.5
2G1: Electrical Equipment	0.0	0.1	0.2	0.2	0.2	0.2
2G3a: Medical Applications	3.9	4.9	5.6	5.8	6.1	6.3
2G3b: Propellant for Pressure & Aerosol Products	37.4	47.4	54.1	55.9	59.0	61.2
AGRICULTURE	**543.3**	**638.3**	**589.5**	**690.7**	**725.6**	**693.8**
3A1 Enteric Fermentation	196.9	228.4	224.4	296.4	320.8	320.8
3B2 Manure Management	152.7	215.5	175.3	185.5	189.0	188.3
3B2.5 Indirect N2O emissions	30.1	36.7	26.4	30.8	32.5	32.5
3C3 Urea application	1.8	1.0	0.4	0.4	0.4	0.4
3C4 Direct N2O emissions - managed soils	62.5	43.6	39.4	40.3	40.3	40.3
3C5 Indirect N2O emissions - managed soils	19.9	13.8	34.0	36.5	36.6	5.4
3C6 Indirect N2O emissions - manure management	12.3	14.2	31.9	36.4	38.4	38.3
3D1.2. Organic Fertilisers	66.6	84.8	57.3	63.9	67.1	67.2
3F Field burning of agricultural residues	0.5	0.2	0.4	0.5	0.5	0.5
WASTE	**385.1**	**485.8**	**514.8**	**607.7**	**824.2**	**1056.0**
4A Solid Waste Disposal	258.3	359.9	458.2	507.5	625.6	747.5
4B Biological Treatment of Solid Waste	0.0	0.0	7.5	8.1	9.4	10.7
4D1 Domestic Wastewater Treatment & Discharge	102.2	99.7	22.5	59.7	140.2	225.1
4D2 Industrial Wastewater Treatment & Discharge	24.5	26.1	26.6	32.4	49.0	72.8
BaU TOTAL (excl. LULUCF)	**5634**	**9321**	**8496**	**9694**	**10227**	**11730**
Change compared to 1990		**65%**	**51%**	**72%**	**82%**	**108%**
Change compared to 2005			**-9%**	**4%**	**10%**	**26%**
Change compared to 2015				**14%**	**20%**	**38%**

Table 11. Total BaU GHG emissions aggregated by gas (Gg CO2 eq.) 1990-2040

Gg CO2 eq.	1990	2005	2015	2020	2030	2040
CO2	4621	7962	6887	7860	8101	9361
CH4	692	883	877	1046	1283	1513
N2O	321	372	356	398	427	430
HFCs	0.03	103	368	380	401	416
TOTAL	5634	9321	8487	9684	10213	11719

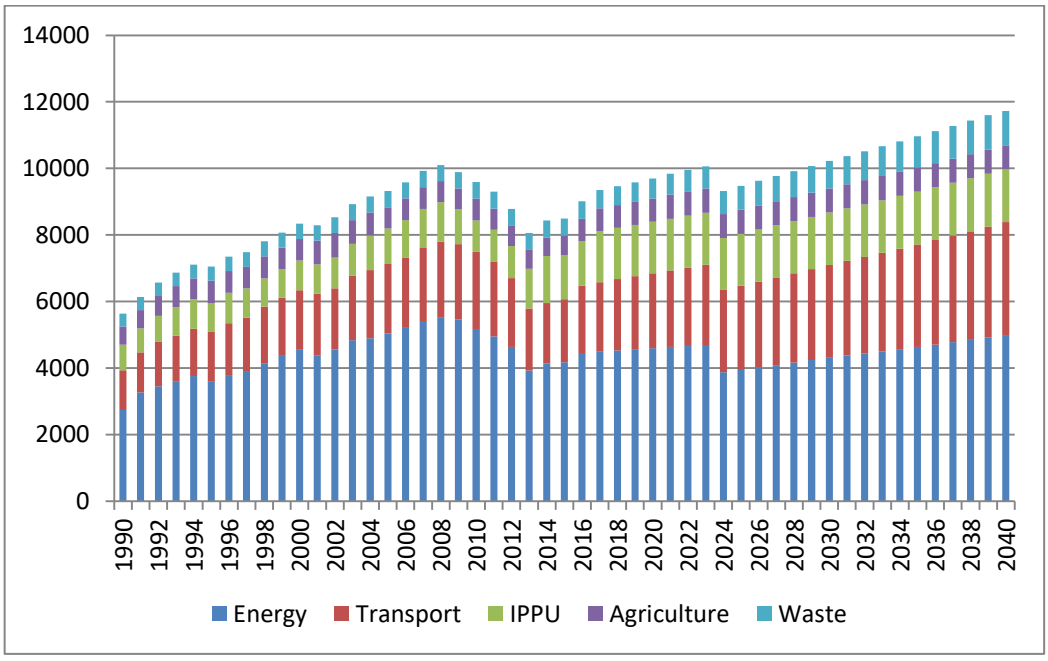

Figure 4. Total BaU GHG emissions by sector (Gg CO2 eq.) 1990-2040

The methodologies applied are the same as those used for the preparation of the 2017 submission of National Greenhouse Gas emissions inventory of Cyprus to the UNFCCC[19] and projected activity data (Annex I).

For electricity demand projections five different projections were compared to determine the most appropriate for GHG projections (Figure 5). It was considered the most suitable to use the EAC real demand until 2016 projected with the real GDP forecast[20] (Annex I). Other key assumptions for electricity is the introduction of natural gas in 2024 and 10% RES in 2020, 13% RES in 2030 and 20% RES in 2040. It should also be noted that all RES is assumed to be for electricity production.

[19] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/cyp-2017-nir-08may17.zip

[20] GDP forecast as prepared by the Ministry of Finance in October 2017; Maria Matsi, Economic Officer, Directorate of Economic Research and EU Affairs, Ministry of Finance, 1439 Nicosia – Cyprus, Tel. no.: +35722601231, Email: mmatsi@mof.gov.cy

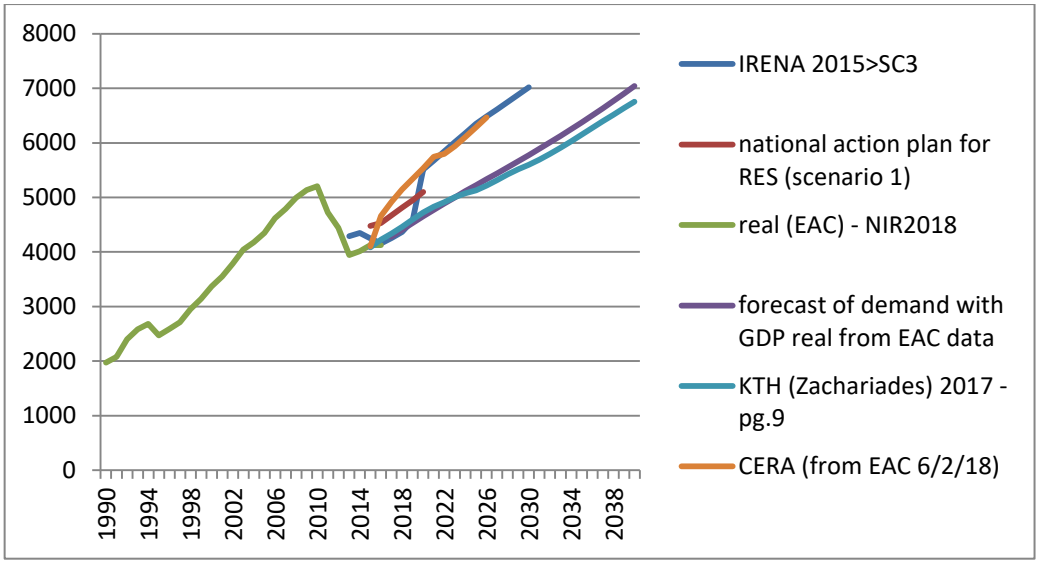

Figure 5. Options examined for the determination of electricity demand

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

The total ETS / ESD emissions for the BaU projections are presented in Table 12 and Figure 6.

Table 12. ETS and ESD emissions according to the BaU scenario

Gg CO2 eq.	2015	2020	2030	2040
Total ETS GHGs	4395	4932	4473	4944
Total ESD GHGs	4092	4751	5739	6774
Total GHGs	8487	9684	10212	11718

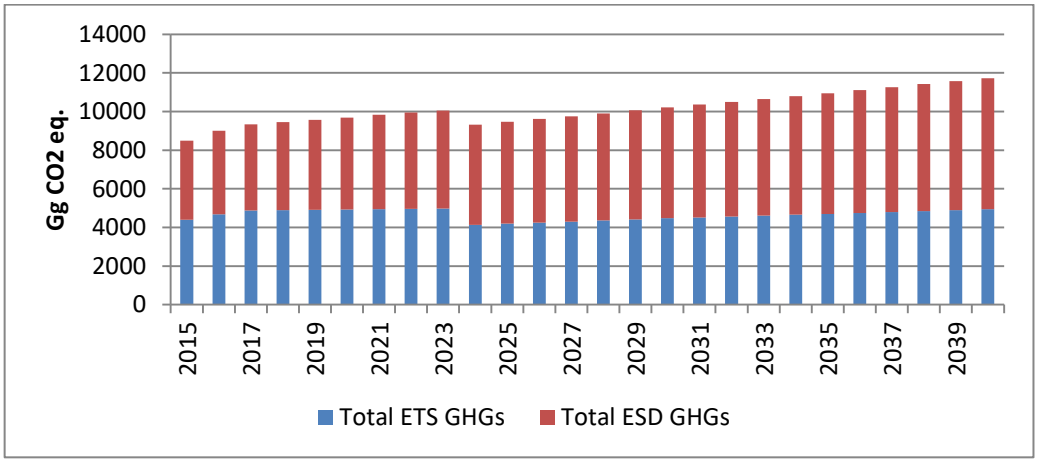

Figure 6. ETS and ESD emissions according to the BaU scenario

3.6. With existing measures (WEM)

A description of the measures included in the WEM scenario are listed in Table 13. The activity data used for the calculations is presented in Annex II. Reduction in the emissions caused by each measure is presented in Table 14.

The methodologies applied are the same as those used for the preparation of the 2017 submission of National Greenhouse Gas emissions inventory of Cyprus to the UNFCCC[21]. The impact in the emissions is presented in Table 15 and Figure 7.

The difference in the total emissions between the BaU and the WEM scenario are presented in Figure 8. Emissions based on the WEM scenario are projected to increase by 87% in 2040 compared to 1990 and by 13% compared to 2005. In 2040 the difference between WEM and BaU is -10%.

Table 13. Measures included in the WEM scenario

	Name	Description	2020	2030	2040
Energy					
E1	Natural Gas	According to the relevant political decisions and legislation the import of natural gas in Cyprus is anticipated in 2020. However, due to the delays noticed during the recent years in the realization of this project, it was decided to use 2021 as the start of natural gas utilization in Cyprus if measures are taken in comparison to 2024 that was used in BaU. Once natural gas is available, the majority of electricity production will be produced with natural gas.			
E2	RES in electricity	Even though the national target for RES in electricity is 16% by 2020, it was considered that this will not be achieved and additional measures are necessary for its achievement. For 2030 and 2040 there are currently no plans or policies from the competent authorities. However, in view of the 2030 EU national target for reduction of GHG by 24%, further promotion of RES has been allowed towards that end.	13%	20%	27%
E3	EE in industry (existing companies)	As with RES, there are currently no measures planned to be implemented after 2020. However, in view of the 2030 EU national target for reduction of GHG by 24%, promotion of EE has been allowed to	Savings 97 TJ	Savings 8 TJ	Savings 8 TJ
E4	Residential new buildings		Savings 4073	Savings 1983 TJ	Savings 1983 TJ

21 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/cyp-2017-nir-08may17.zip

	Name	Description	2020	2030	2040
		maintain some energy savings.	TJ		
E5	Residential buildings energy upgrade		Savings 120 TJ	Savings 120 TJ	Savings 120 TJ
E6	Residential solar panels replacement		Savings 4 TJ	Savings 4 TJ	Savings 4 TJ
E7	Tertiary new buildings		Savings 467 TJ	Savings 298 TJ	Savings 298 TJ
E8	Tertiary buildings energy upgrade		Savings 198 TJ	Savings 198 TJ	Savings 198 TJ
E9	Public buildings		Savings 6 TJ	Savings 6 TJ	Savings 6 TJ
E10	Promotion of biomass and alternative fuels in industry	The larger consumer of biomass and the only consumed of alternative fuels in industry is the cement installation. It is recognized that the large capacity of the installation should be further exploited and the necessary policies should be developed towards that end. Emphasis should be given in biomass.	10%+10%	10%+12%	10%+14%
E11	RES in residential (heating & cooling)	The national energy target for RES in heating and cooling for 2020 is 23.4%. However, this is overachieved according the energy balance of 2016, especially in the residential sector. Recognizing the additional potential, it was decided to further increase the contribution of RES in residential and commercial sectors.	35%	38%	42%
E12	RES in commercial (heating & cooling)		25%	28%	32%
Transport					
T1	Biofuels	This is the national target according to the relevant EU and national legislation. No additional measures have been considered other continuation of the current practice.	6%	6%	6%
IPPU					
I1	F-gases Recovery of F-gases from old equipment	This is an obligation according to EU and national legislation. It is however still not properly implemented. WEM considers that the necessary implementing measures will be taken so that in 2020 proper recovery of F-gases in old equipment is performed.	start from 2020; 5% reduction of emissions 2030; 10% by 2040		
Agriculture					
A1	Promotion of anaerobic digestion for treatment of	Promotion of anaerobic digestion in existing biogas plants; New biogas plants to exploit organic waste from livestock breeding	cattle +0.5% annually; swine 75% 2040; sheep & goats 10% in 2040 from 2020; poultry 75% 2040		

	Name	Description	2020	2030	2040
	animal waste				
Waste					
W1	Sorting	This will be achieved by reorganization of the currently implemented Municipal Waste Collection Scheme; waste will be separately collected with the goal to reduce the amounts of waste going to landfills.	2021 40%; constant->2040		
W2	Landfilling	According to the waste management hierarchy, landfilling is the least preferable option and should be limited to the necessary minimum and this is encouraged by the relevant national and EU legislation. This is an obligation and measures should be taken for its implementation.	from 2020 15% to landfill constant		
W3	Composting*	Composting and anaerobic digestion will be further exploited to treat the organic waste that will be diverted from the landfill	From 2021 5% constant		
W4	Anaerobic digestion		from 2021 10% constant		
W5	Biogas recovery	Part of the contracts for the recovery of old and currently operating landfills is biogas recovery. However, it is not possible to collect biogas from all landfills; the conservative collection rate of 20% has been chosen from deep unmanaged.	20% reduction of emissions from deep unmanaged		

* composting is anticipated and has been estimated to produce non-CO2 emissions from its implementation; however, these emissions are saved from not landfilling the organics

Table 14a. Reduction in the emissions caused by each measure of WEM scenario 2017-2028

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
E1 - natural gas	0.00	0.00	0.00	0.00	995.25	945.80	899.97	0.00	0.00	0.00	0.00	0.00
E2 - RES in electricity	0.28	0.57	0.86	1.16	1.33	1.51	1.69	125.33	139.10	153.40	168.08	183.28
E3 - EE in industry	8.75	8.65	8.54	8.44	7.66	6.89	6.11	5.33	4.56	3.78	3.01	2.23
E4 - EE residential new buildings	184.56	184.83	185.12	185.44	177.28	169.30	161.52	153.93	146.51	139.28	132.24	125.38
E5 - EE residential energy upgrade	5.88	6.37	6.89	7.44	9.51	11.70	13.97	16.35	18.80	21.36	23.99	26.73
E6 - EE residential solar panels replacement	0.66	1.16	1.68	2.24	4.34	6.55	8.85	11.25	13.73	16.31	18.97	21.74
E7 - EE tertiary new buildings	20.83	20.71	20.59	20.47	19.67	18.86	18.06	17.27	16.48	15.70	14.92	14.15
E8 - EE tertiary energy upgrade	8.82	8.77	8.72	8.67	8.64	8.61	8.58	8.55	8.52	8.49	8.46	8.43
E9 - EE in public buildings	0.55	0.44	0.34	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
E10 - industry (alternative fuels)	3.18	6.56	10.11	12.43	14.21	16.08	17.99	19.98	22.02	24.13	26.29	28.53
E11 - RES in residential	1.88	8.27	15.00	22.09	24.69	27.42	30.20	33.10	36.04	39.10	42.22	45.45
E12 - RES in commercial	0.00	0.00	0.00	0.00	0.16	0.32	0.50	0.68	0.86	1.06	1.26	1.47
T1 - biofuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I1 - F-gases	0.00	0.00	0.00	1.73	3.47	5.24	7.03	8.84	10.67	12.52	14.38	16.26
A1 - Anaerobic digestion	0.05	0.09	0.14	0.26	0.43	0.56	0.69	0.83	0.96	1.09	1.22	1.35
W1 - sorting	0.00	0.00	0.00	0.00	0.00	7.13	14.03	20.71	27.20	33.48	39.60	45.54
W2 - organics to landfill	0.00	0.00	0.00	0.00	0.00	2.81	22.77	42.05	60.69	78.72	96.19	113.14
W3 - composting	0.00	0.00	0.00	0.00	-1.21	-1.17	-1.13	-1.09	-1.05	-1.01	-0.98	-0.95
W4 - anaerobic digestion	0.00	0.00	0.00	0.00	1.36	1.37	1.38	1.39	1.41	1.42	1.43	1.45
W5 - biogas recovery	0.00	0.00	0.00	0.00	134.43	128.39	122.63	117.15	111.92	106.94	102.19	97.67
Aggregate impact	243.71	254.76	266.34	266.86	1492.96	1461.43	1451.59	588.15	624.83	662.08	699.71	738.00

Table 14b. Reduction in the emissions caused by each measure of WEM scenario 2029-2040

	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
E1 - natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E2 - RES in electricity	199.02	215.33	219.64	224.04	228.53	233.11	237.78	242.54	247.39	252.35	257.40	262.55
E3 - EE in industry	1.46	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
E4 - EE residential new buildings	118.73	112.27	114.21	116.23	118.33	120.52	122.79	125.15	127.60	130.14	132.78	135.52
E5 - EE residential energy upgrade	29.57	32.52	34.74	37.04	39.42	41.89	44.43	47.07	49.80	52.62	55.53	58.55
E6 - EE residential solar panels replacement	24.61	27.58	29.82	32.13	34.53	37.01	39.58	42.23	44.98	47.81	50.75	53.78
E7 - EE tertiary new buildings	13.38	12.61	12.61	12.61	12.61	12.61	12.61	12.61	12.61	12.61	12.61	12.39
E8 - EE tertiary energy upgrade	8.41	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.23
E9 - EE in public buildings	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23
E10 - industry (alternative fuels)	30.84	33.24	35.73	38.29	40.95	43.70	46.54	49.48	52.52	55.66	58.90	62.25
E11 - RES in residential	48.80	52.26	56.69	61.27	66.01	70.92	76.00	81.25	86.69	92.30	98.11	104.11
E12 - RES in commercial	1.69	1.91	1.95	1.99	2.03	2.07	2.11	2.15	2.19	2.24	2.28	9.31
T1 - biofuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I1 - F-gases	18.15	20.06	22.16	24.27	26.39	28.52	30.67	32.82	34.99	37.17	39.36	41.56
A1 - Anaerobic digestion	1.49	1.62	1.75	1.88	2.01	2.14	2.28	2.41	2.54	2.67	2.80	2.93
W1 - sorting	51.34	57.01	52.02	57.90	63.64	69.24	74.72	80.08	85.33	90.47	95.50	100.44
W2 - organics to landfill	129.62	145.67	150.81	166.41	181.58	196.35	210.74	224.76	238.45	251.80	264.85	277.60
W3 - composting	-0.91	-0.88	-0.85	-0.82	-0.79	-0.76	-0.73	-0.70	-0.68	-0.65	-0.62	-0.60
W4 - anaerobic digestion	1.47	1.49	1.49	1.51	1.52	1.54	1.55	1.57	1.58	1.59	1.61	1.62
W5 - biogas recovery	93.35	89.24	87.13	83.31	79.67	76.20	72.90	69.77	66.78	63.93	61.23	58.65
Aggregate impact	777.04	816.91	834.82	872.89	911.17	949.70	988.51	1027.64	1067.12	1106.99	1147.27	1186.94

Table 15. Total WEM GHG emissions aggregated by source category (Gg CO2 eq.) 1990-2040

	1990	2005	2015	2020	2030	2040
ENERGY	**3940.5**	**7128.7**	**6067.3**	**6577.5**	**6598.7**	**7670.2**
1A1 Energy Industries	1767.0	3483.3	3032.9	3308.9	2497.1	2774.3
1A2 Manufacturing Industries & Construction	514.8	912.0	575.6	654.3	803.7	958.1
1A3a ii Domestic Aviation	11.1	12.6	0.9	0.6	0.8	1.0
1A3b Road Transport	1200.4	2089.4	1886.8	2247.0	2787.8	3398.3
1A3d ii Domestic water-borne navigation	2.2	2.4	1.6	2.6	3.3	4.0
1A4a Commercial / Institutional	75.8	99.5	107.5	61.2	85.4	99.8
1A4b Residential	302.3	420.7	356.7	188.4	278.6	261.5
1A4c Agriculture / Forestry / Fishing / Fish farms	55.8	89.5	83.0	89.9	111.6	136.0
1A5 Non-Specified	11.1	19.2	22.4	24.6	30.5	37.2
INDUSTRY	**764.9**	**1067.8**	**1324.7**	**1546.0**	**1555.2**	**1550.6**
2A1 Cement production	667.7	821.8	877.1	1071.7	1071.7	1071.7
2A2 Lime Production	5.5	12.4	2.4	3.6	6.0	6.0
2A4a Ceramics	43.8	60.0	7.0	19.9	19.9	19.9
2A4b Other Uses of Soda Ash	0.3	0.3	0.1	0.2	0.3	0.5
2D1: Lubricant Use	0.0	5.9	4.7	4.7	4.7	4.7
2D2: Paraffin Wax Use	0.1	0.0	0.1	0.2	0.2	0.2
2D3 Solvent Use	5.2	10.0	4.8	4.8	4.8	4.8
Urea-based catalysts	1.0	1.6	1.1	1.3	1.3	1.3
2F1: Refrigeration and Air Conditioning	0.0	98.4	353.7	363.7	366.7	359.9
2F2: Foam Blowing Agents	0.0	0.9	1.6	1.7	1.7	1.6
2F3: Fire Protection	0.0	1.2	3.7	3.8	3.8	3.7
2F4a: Metered Dose Inhalers	0.0	2.8	8.4	8.7	8.8	8.6
2G1: Electrical Equipment	0.0	0.1	0.2	0.2	0.2	0.2
2G3a: Medical Applications	3.9	4.9	5.6	5.8	6.1	6.3
2G3b: Propellant for Pressure & Aerosol Products	37.4	47.4	54.1	55.9	59.0	61.2
AGRICULTURE	**543.3**	**638.3**	**589.5**	**681.9**	**716.8**	**692.1**
3A1 Enteric Fermentation	196.9	228.4	224.4	296.4	320.8	320.8
3B2 Manure Management	152.7	215.5	175.3	185.5	189.0	188.3
3B2.5 Indirect N2O emissions	30.1	36.7	26.4	30.8	32.5	32.5
3C3 Urea application	1.8	1.0	0.4	0.4	0.4	0.4
3C4 Direct N2O emissions - managed soils	62.5	43.6	39.4	40.3	40.3	40.3
3C5 Indirect N2O emissions - managed soils	19.9	13.8	34.0	32.0	32.3	8.8
3C6 Indirect N2O emissions - manure management	12.3	14.2	31.9	15.6	16.4	15.9
3D1.2. Organic Fertilisers	66.6	84.8	57.3	80.5	84.6	84.6
3F Field burning of agricultural residues	0.5	0.2	0.4	0.5	0.5	0.5
WASTE	**385.1**	**485.8**	**514.8**	**620.0**	**533.2**	**619.9**
4A Solid Waste Disposal	258.3	359.9	458.2	519.8	333.7	310.8
4B Biological Treatment of Solid Waste	0.0	0.0	7.5	8.1	10.3	11.2
4D1 Domestic Wastewater Treatment & Discharge	102.2	99.7	22.5	59.7	140.2	225.1
4D2 Industrial Wastewater Treatment & Discharge	24.5	26.1	26.6	32.4	49.0	72.8
WEM TOTAL (excl. LULUCF)	**5634.0**	**9321.0**	**8496.0**	**9425.5**	**9403.9**	**10532.8**
Change compared to 1990		**65%**	**51%**	**67%**	**67%**	**87%**
Change compared to 2005			**-9%**	**1%**	**1%**	**13%**
Change compared to 2015				**11%**	**11%**	**24%**
Compared to BaU				**-3%**	**-8%**	**-10%**

Table 16. Total WEM GHG emissions aggregated by gas (Gg CO2 eq.) 1990-2040

Gg CO2 eq.	1990	2005	2015	2020	2030	2040
CO2	4621	7962	6887	7594	7606	8655
CH4	692	883	877	1056	990	1073
N2O	321	372	356	397	426	428
HFCs	0.03	103	368	378	381	374
TOTAL	5634	9321	8487	9425	9402	10530

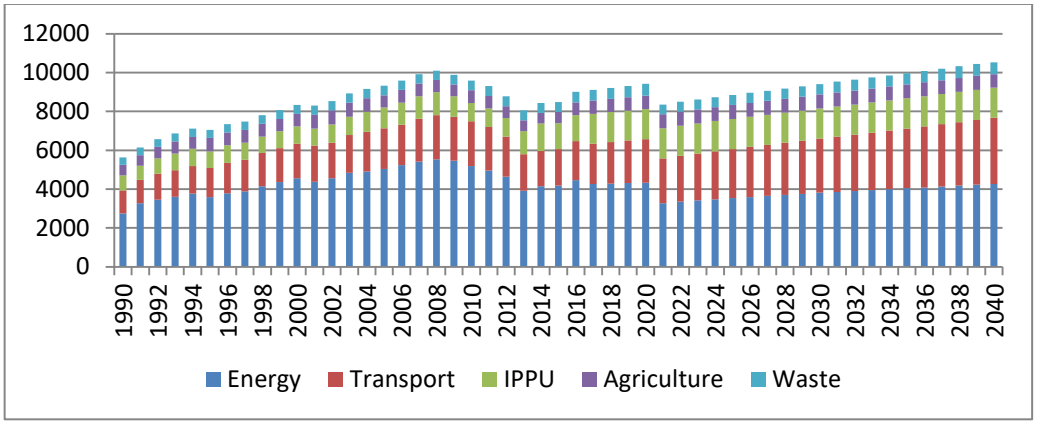

Figure 7. Total WEM GHG emissions by sector (Gg CO2 eq.) 1990-2040

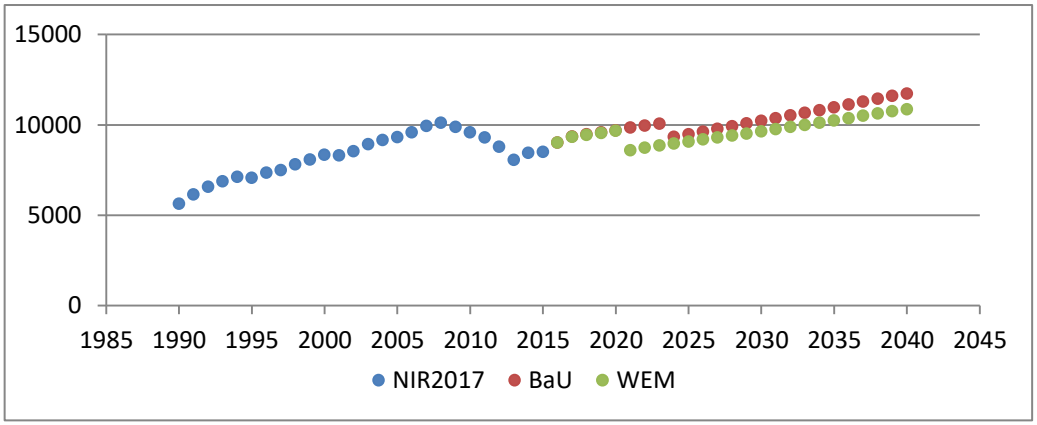

Figure 8. Total WEM GHG emissions compared to BaU (Gg CO2 eq.) 1990-2040

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

The total ETS / ESD emissions for the WEM projections are presented in Table 17 and Figure 9.

Table 17. ETS and ESD emissions according to the WEM scenario

Gg CO2 eq.	2015	2020	2030	2040
Total ETS GHGs	4405	4925	4233	4634
Total ESD GHGs	4082	4501	5171	5899
Total GHGs	8487	9425	9404	10533

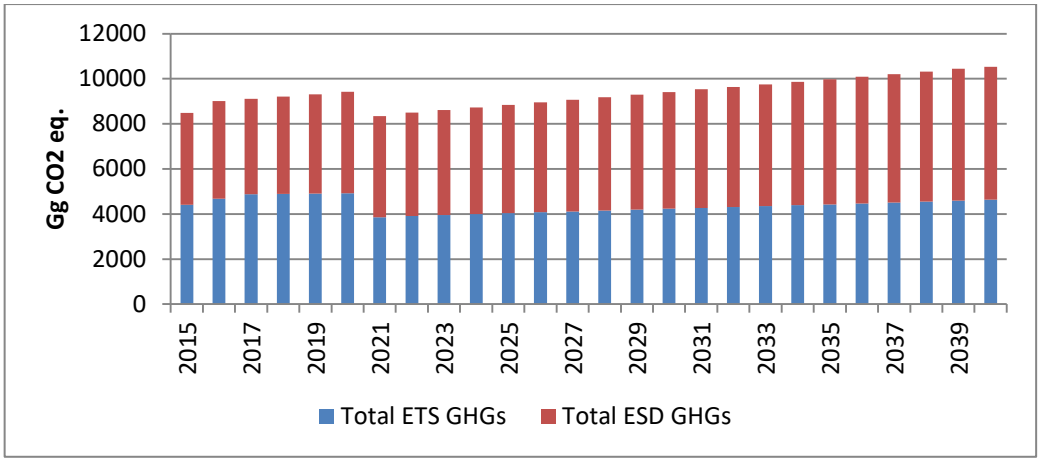

Figure 9. ETS and ESD emissions according to the WEM scenario

3.6.2. WEM sensitivity analysis

Sensitivity analysis was carried out using the change in the total at 1% change of each measure. The results of the calculations for the WEM scenario are presented in Table 18 and Figure 10. the impact of introduction of natural gas appears zero for all years in the table as for those years there is no difference from the BaU.

Table 18. Change in total of WEM scenario at 1% change of each measure

	2020	2030	2040
E1 - natural gas	0.00%	0.00%	0.00%
E2 - RES in electricity	0.00%	0.27%	0.22%
E3 - EE in industry	0.03%	0.00%	0.00%
E4 - EE residential new buildings	0.69%	0.14%	0.11%
E5 - EE residential energy upgrade	0.03%	0.04%	0.05%
E6 - EE residential solar panels replacement	0.01%	0.03%	0.05%
E7 - EE tertiary new buildings	0.08%	0.02%	0.01%
E8 - EE tertiary energy upgrade	0.03%	0.01%	0.01%
E9 - EE in public buildings	0.00%	0.00%	0.00%
E10 - industry (alternative fuels)	0.05%	0.04%	0.05%
E11 - RES in residential	0.08%	0.06%	0.09%
E12 - RES in commercial	0.00%	0.00%	0.01%
T1 - biofuels	0.00%	0.00%	0.00%
I1 - F-gases	0.01%	0.02%	0.03%
A1 - Anaerobic digestion	0.00%	0.00%	0.00%
W1 - sorting	0.00%	0.07%	0.08%
W2 - organics to landfill	0.00%	0.18%	0.23%
W3 - composting	0.00%	0.00%	0.00%
W4 - anaerobic digestion	0.00%	0.00%	0.00%
W5 - biogas recovery	0.00%	0.11%	0.05%

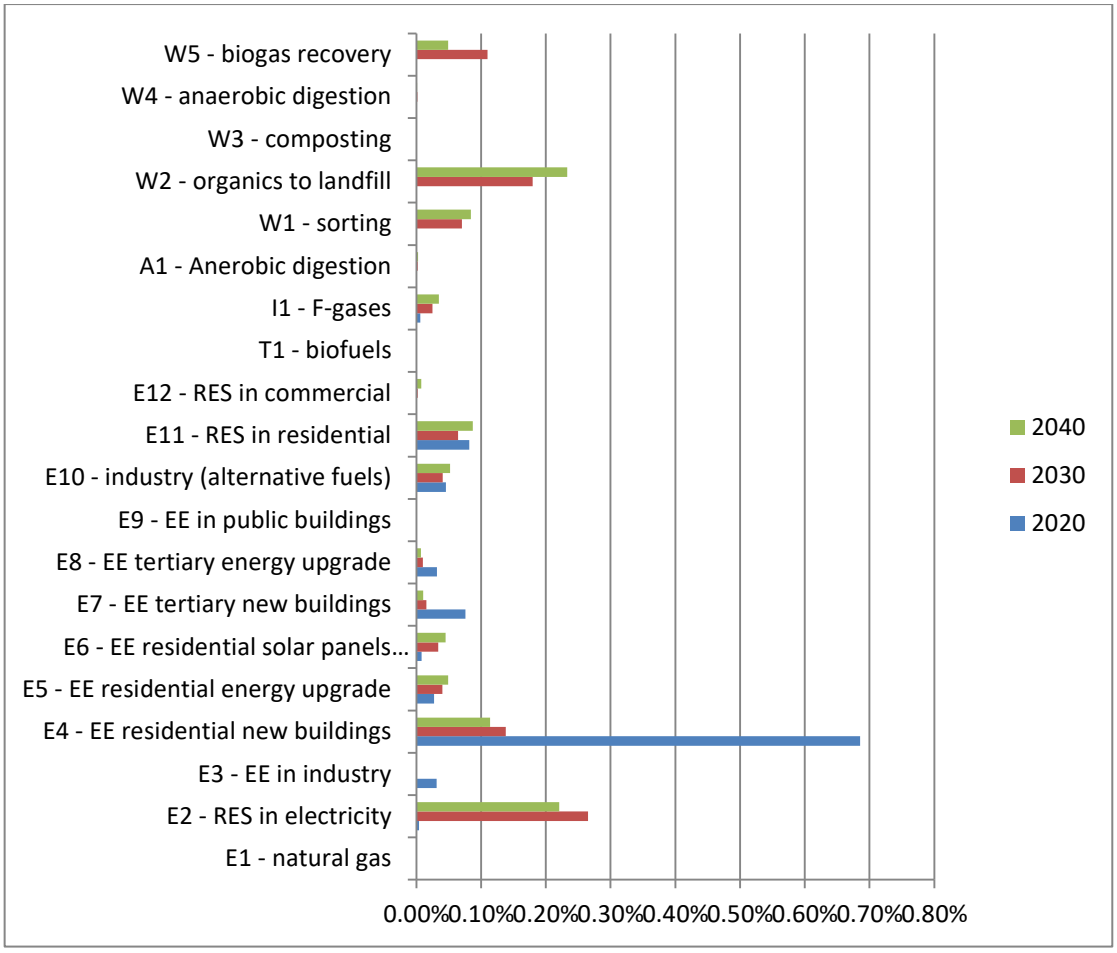

Figure 10. Change in total of WEM scenario at 1% change of each measure

3.7. With additional measures (WAM)

A description of the measures included in the WAM scenario are listed in Table 19. The activity data used for the calculations is presented in Annex III. Reduction in the emissions caused by each measure is presented in Table 20.

The methodologies applied are the same as those used for the preparation of the 2017 submission of National Greenhouse Gas emissions inventory of Cyprus to the UNFCCC[22]. The impact in the emissions is presented in Table 21 and Figure 11.

The difference in the total emissions between the BaU and the WAM scenario are presented in Figure 12. Emissions based on the WAM scenario are projected to increase by 39% in 2040 compared to 1990 and decrease by 16% compared to 2005. In 2040 the difference between WAM and BaU is -33%, while the difference between WAM and WEM is -26%.

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http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/cyp-2017-nir-08may17.zip

Table 19. Measures included in the WAM scenario

	Name	Description	2020	2030	2040
Energy					
E1	Natural Gas	According to the relevant political decisions and legislation the import of natural gas in Cyprus is anticipated in 2020. However, due to the delays noticed during the recent years in the realization of this project, it was decided to use 2021 as the start of natural gas utilization in Cyprus if measures are taken in comparison to 2024 that was used in BaU. Once natural gas is available, the majority of electricity production will be produced with natural gas.			
E2	RES in electricity	16% is the national target for RES in electricity according to relevant EU directive; it was considered that the necessary additional measures for its achievement will be implemented. For 2030 and 2040 there are currently no plans or policies from the competent authorities. However, in view of the 2030 EU national target for reduction of GHG by 24%, further promotion of RES has been allowed towards that end.	16%	27%	35%
E3	EE in industry (existing companies)	As with RES, there are currently no measures planned to be implemented after 2020. However, in view of the 2030 EU national target for reduction of GHG by 24%, promotion of EE has been allowed to maintain some energy savings.	Savings 97 TJ	Savings 97 TJ	Savings 97 TJ
E4	Residential new buildings		Savings 4073 TJ	Savings 4073 TJ	Savings 4073 TJ
E5	Residential buildings energy upgrade		Savings 120 TJ	Savings 120 TJ	Savings 120 TJ
E6	Residential solar panels replacement		Savings 4 TJ	Savings 4 TJ	Savings 4 TJ
E7	Tertiary new buildings		Savings 467 TJ	Savings 467 TJ	Savings 467 TJ
E8	Tertiary buildings energy upgrade		Savings 198 TJ	Savings 198 TJ	Savings 198 TJ
E9	Public buildings		Savings 6 TJ	Savings 6 TJ	Savings 6 TJ
E10	Promotion of biomass and alternative fuels in	The larger consumer of biomass and the only consumed of alternative fuels in industry is the cement installation. It is recognized that the large capacity of the	10%+10%	10%+15%	10%+20%

	Name	Description	2020	2030	2040
	industry	installation should be further exploited and the necessary policies should be developed towards that end. Emphasis should be given in biomass.			
E11	RES in residential (heating & cooling)	The national energy target for RES in heating and cooling for 2020 is 23.4%. However, this is overachieved according the energy balance of 2016, especially in the residential sector. Recognizing the additional potential, it was decided to further increase the contribution of RES in residential and commercial sectors.	35%	40%	45%
E12	RES in commercial (heating & cooling)		25%	30%	35%
Transport					
T1	Biofuels	6% is the national target according to the relevant EU and national legislation for 2020. There are currently no measures planned to be implemented after 2020. However, in view of the 2030 EU national target for reduction of GHG by 24%, promotion of EE has been allowed to maintain some energy savings.	6%	10%	10%
T2	Infrastructure	Promotion of public transport, cycling, walking	start from 2030; 5% reduction of emissions 2040		
T3	New technologies and other measures	Promotion of vehicles of new technology with low to zero emissions; Revision of taxation for all vehicles, measures for fleets with high emissions and high mileage	25% reduction of emissions 2030; 40% reduction of emissions 2040		
T4	Renewable energy sources in sources	Renewable energy sources in transport to reach 10% in 2020 (according to the National Renewable Energy Action Plan)		10%	10%
IPPU					
I1	F-gases Recovery of F-gases from old equipment	This is an obligation according to EU and national legislation. It is however still not properly implemented. WEM considers that the necessary implementing measures will be taken so that in 2020 proper recovery of F-gases in old equipment is performed.	5% reduction of emissions 2020; 10% reduction of emissions 2030; 15% by 2040		
Agriculture					
A1	Promotion of anaerobic digestion for treatment of animal waste	Further promotion of anaerobic digestion in existing biogas plants; New biogas plants to exploit organic waste from livestock breeding	cattle +0.75% annually; swine 80% 2040; sheep & goats 20% in 2040 from 2020; poultry 80% 2040		
Waste					
W1	Sorting	This will be achieved by reorganization of the currently implemented Municipal Waste Collection Scheme; waste will be separately collected with the goal to	2021 40%; 2025 55%; 2030 60%; 2035 65%		

	Name	Description	2020	2030	2040
		reduce the amounts of waste going to landfills.			
W2	Landfilling	According to the waste management hierarchy, landfilling is the least preferable option and should be limited to the necessary minimum and this is encouraged by the relevant national and EU legislation. This is an obligation and measures should be taken for its implementation.	from 2020 15% to landfill - >10% 2035		
W3	Composting*	Composting and anaerobic digestion will be further exploited to treat the organic waste that will be diverted from the landfill	from 5% 2021 -> 10% 2035		
W4	Anaerobic digestion		from 10% 2021 -> 40% 2035		
W5	Biogas recovery	Part of the contracts for the recovery of old and currently operating landfills is biogas recovery. However, it is not possible to collect biogas from all landfills; the conservative collection rate of 20% has been chosen from deep unmanaged.	30% reduction of emissions from deep unmanaged		

* composting is anticipated and has been estimated to produce non-CO2 emissions from its implementation; however, these emissions are saved from not landfilling the organics

Table 20a. Reduction in the emissions caused by each measure of WAM scenario 2017-2028

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
E1 - natural gas	0.00	0.00	0.00	0.00	995.25	945.80	899.97	0.00	0.00	0.00	0.00	0.00
E2 - RES in electricity	0.57	1.16	1.77	2.41	2.78	3.16	3.55	250.47	277.98	306.54	335.84	366.19
E3 - EE in industry	8.75	8.65	8.54	8.44	8.44	8.44	8.44	8.44	8.44	8.44	8.44	8.44
E4 - EE residential new buildings	184.56	184.83	185.12	185.44	186.64	187.94	189.33	190.82	192.39	194.06	195.81	197.67
E5 - EE residential energy upgrade	5.88	6.37	6.89	7.44	9.51	11.70	13.97	16.35	18.80	21.36	23.99	26.73
E6 - EE residential solar panels replacement	0.66	1.16	1.68	2.24	4.34	6.55	8.85	11.25	13.73	16.31	18.97	21.74
E7 - EE tertiary new buildings	0.55	0.44	0.34	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
E8 - EE tertiary energy upgrade	8.82	8.77	8.72	8.67	8.64	8.61	8.58	8.55	8.52	8.49	8.46	8.43
E9 - EE in public buildings	0.55	0.44	0.34	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
E10 - industry (alternative fuels)	3.18	6.56	10.11	12.43	16.42	20.60	24.94	29.46	34.11	38.94	43.92	49.08
E11 - RES in residential	1.88	8.27	15.00	22.09	26.06	30.22	34.51	38.97	43.54	48.28	53.15	58.20
E12 - RES in commercial	74.80	77.13	79.26	81.41	82.92	84.44	85.80	87.17	88.35	89.55	90.65	91.75
T1 - biofuels	0.00	0.00	0.00	0.00	4.12	8.44	12.95	17.67	22.55	27.63	32.88	38.32
T2 - Infrastructure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T3 - New technologies and other	0.00	0.00	0.00	51.07	104.69	160.96	219.55	280.75	343.98	409.73	477.63	548.08
T4 - RES in transport	0.00	0.00	0.00	21.03	43.11	66.29	90.42	115.62	141.66	168.74	196.70	225.71
I1 - F-gases	0.00	0.00	0.00	18.98	21.02	23.07	25.15	27.24	29.35	31.48	33.62	35.78
A1 - Anaerobic digestion	0.07	0.15	0.22	0.51	0.92	1.24	1.56	1.88	2.20	2.53	2.85	3.17
W1 - sorting	0.00	0.00	0.00	0.00	0.00	7.13	15.82	26.05	37.81	51.08	64.47	78.00
W2 - organics to landfill	0.00	0.00	0.00	0.00	0.00	20.65	40.53	59.67	78.12	95.93	113.14	129.78
W3 - composting	0.00	0.00	0.00	0.00	-1.21	-1.59	-1.98	-2.37	-2.77	-3.19	-3.62	-4.06
W4 - anaerobic digestion	0.00	0.00	0.00	0.00	1.36	1.66	1.97	2.29	2.61	2.94	3.28	3.63
W5 - biogas recovery	0.00	0.00	0.00	0.00	201.64	192.58	183.95	175.73	167.89	160.41	153.29	146.50
Aggregate impact	215.03	226.58	238.68	341.62	1802.77	1897.12	2000.83	1257.08	1418.38	1586.17	1758.04	1935.07

Table 20b. Reduction in the emissions caused by each measure of WAM scenario 2029-2040

	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
E1 - natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E2 - RES in electricity	397.62	430.16	441.90	453.94	466.28	478.93	491.90	505.20	518.83	532.80	547.12	561.80
E3 - EE in industry	8.44	8.44	8.44	8.44	8.44	8.44	8.44	8.44	8.44	8.44	8.44	8.44
E4 - EE residential new buildings	199.63	201.69	203.32	205.03	206.82	208.70	210.66	212.70	214.84	217.07	219.40	221.82
E5 - EE residential energy upgrade	29.57	32.52	34.74	37.04	39.42	41.89	44.43	47.07	49.80	52.62	55.53	58.55
E6 - EE residential solar panels replacement	24.61	27.58	29.82	32.13	34.53	37.01	39.58	42.23	44.98	47.81	50.75	53.78
E7 - EE tertiary new buildings	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23
E8 - EE tertiary energy upgrade	8.41	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.23
E9 - EE in public buildings	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23
E10 - industry (alternative fuels)	54.43	59.98	65.72	71.67	77.83	84.21	90.82	97.65	104.72	112.04	119.60	127.43
E11 - RES in residential	63.42	68.84	74.44	80.24	86.24	92.45	98.87	105.52	112.39	119.49	126.83	134.42
E12 - RES in commercial	92.86	93.97	96.03	98.13	100.27	102.45	104.67	106.95	109.26	111.62	114.03	105.00
T1 - biofuels	43.98	49.84	50.84	51.85	52.89	53.95	55.03	56.13	57.25	58.40	59.56	60.76
T2 - Infrastructure	0.00	12.67	25.85	39.55	53.79	68.58	83.94	99.89	116.45	133.62	151.44	169.91
T3 - New technologies and other	621.16	696.94	753.53	812.11	872.73	935.45	1000.32	1067.42	1136.81	1208.54	1282.68	1359.31
T4 - RES in transport	255.81	287.02	292.76	298.61	304.58	310.67	316.89	323.23	329.69	336.28	343.01	349.87
I1 - F-gases	37.94	40.12	42.30	44.49	46.69	48.90	51.11	53.34	55.57	57.82	60.07	62.34
A1 - Anaerobic digestion	3.49	3.81	4.13	4.45	4.77	5.09	5.41	5.74	6.06	6.38	6.70	7.02
W1 - sorting	91.69	105.56	131.63	168.78	206.09	243.57	281.23	319.07	356.53	393.61	430.34	466.73
W2 - organics to landfill	145.92	161.59	140.54	154.87	168.74	182.18	195.22	207.86	220.15	232.12	243.77	255.13
W3 - composting	-4.51	-4.98	-5.42	-5.89	-6.38	-6.87	-7.38	-7.41	-7.45	-7.49	-7.52	-7.56
W4 - anaerobic digestion	3.99	4.36	4.69	5.06	5.43	5.81	6.20	6.26	6.32	6.38	6.44	6.50
W5 - biogas recovery	140.03	133.85	127.97	122.36	117.03	111.95	107.12	102.52	98.14	93.97	90.01	86.23
Aggregate impact	2117.46	2314.76	2416.95	2568.85	2723.81	2881.90	3043.23	3208.35	3376.35	3547.32	3721.38	3900.10

Table 21. Total WAM GHG emissions aggregated by source category (Gg CO2 eq.) 1990-2040

	1990	2005	2015	2020	2030	2040
ENERGY	**3940.5**	**7128.7**	**6067.3**	**6532.9**	**5229.7**	**5349.2**
1A1 Energy Industries	1767.0	3483.3	3032.9	3307.6	2282.3	2475.1
1A2 Manufacturing Industries & Construction	514.8	912.0	575.6	662.7	777.6	893.6
1A3a ii Domestic Aviation	11.1	12.6	0.9	0.6	0.8	1.0
1A3b Road Transport	1200.4	2089.4	1886.8	2174.9	1757.1	1552.5
1A3d ii Domestic water-borne navigation	2.2	2.4	1.6	2.6	3.3	4.0
1A4a Commercial / Institutional	75.8	99.5	107.5	81.4	94.0	105.0
1A4b Residential	302.3	420.7	356.7	188.4	172.6	144.8
1A4c Agriculture / Forestry / Fishing / Fish farms	55.8	89.5	83.0	89.9	111.6	136.0
1A5 Non-Specified	11.1	19.2	22.4	24.6	30.5	37.2
INDUSTRY	**764.9**	**1067.8**	**1324.7**	**1528.8**	**1535.1**	**1529.8**
2A1 Cement production	667.7	821.8	877.1	1071.7	1071.7	1071.7
2A2 Lime Production	5.5	12.4	2.4	3.6	6.0	6.0
2A4a Ceramics	43.8	60.0	7.0	19.9	19.9	19.9
2A4b Other Uses of Soda Ash	0.3	0.3	0.1	0.2	0.3	0.5
2D1: Lubricant Use	0.0	5.9	4.7	4.7	4.7	4.7
2D2: Paraffin Wax Use	0.1	0.0	0.1	0.2	0.2	0.2
2D3 Solvent Use	5.2	10.0	4.8	4.8	4.8	4.8
Urea-based catalysts	1.0	1.6	1.1	1.3	1.3	1.3
2F1: Refrigeration and Air Conditioning	0.0	98.4	353.7	347.1	347.4	339.9
2F2: Foam Blowing Agents	0.0	0.9	1.6	1.6	1.6	1.6
2F3: Fire Protection	0.0	1.2	3.7	3.6	3.6	3.5
2F4a: Metered Dose Inhalers	0.0	2.8	8.4	8.3	8.3	8.1
2G1: Electrical Equipment	0.0	0.1	0.2	0.1	0.1	0.1
2G3a: Medical Applications	3.9	4.9	5.6	5.8	6.1	6.3
2G3b: Propellant for Pressure & Aerosol Products	37.4	47.4	54.1	55.9	59.0	61.2
AGRICULTURE	**543.3**	**638.3**	**579.8**	**681.4**	**713.0**	**685.1**
3A1 Enteric Fermentation	196.9	228.4	224.4	296.4	320.8	320.8
3B2 Manure Management	152.7	215.5	175.3	185.2	186.7	183.9
3B2.5 Indirect N2O emissions	30.1	36.7	26.4	30.8	32.2	31.9
3C3 Urea application	1.8	1.0	0.4	0.4	0.4	0.4
3C4 Direct N2O emissions - managed soils	62.5	43.6	39.4	40.3	40.3	40.3
3C5 Indirect N2O emissions - managed soils	19.9	13.8	29.6	32.0	32.3	8.8
3C6 Indirect N2O emissions - manure management	12.3	14.2	12.4	15.4	15.3	13.9
3D1.2. Organic Fertilisers	66.6	84.8	71.5	80.5	84.6	84.6
3F Field burning of agricultural residues	0.5	0.2	0.4	0.5	0.5	0.5
WASTE	**385.1**	**485.8**	**514.9**	**607.7**	**428.2**	**255.5**
4A Solid Waste Disposal	258.3	359.9	458.3	507.5	224.6	-60.6
4B Biological Treatment of Solid Waste	0.0	0.0	7.5	8.1	14.4	18.2
4D1 Domestic Wastewater Treatment & Discharge	102.2	99.7	22.5	59.7	140.2	225.1
4D2 Industrial Wastewater Treatment & Discharge	24.5	26.1	26.6	32.4	49.0	72.8
WAM TOTAL (excl. LULUCF)	**5633.7**	**9320.6**	**8486.8**	**9350.7**	**7906.1**	**7819.6**
Change compared to 1990						
Change compared to 2005		**65%**	**51%**	**66%**	**40%**	**39%**
Change compared to 2015			**-9%**	**0.3%**	**-15%**	**-16%**

Compared to BaU				**10%**	**-7%**	**-8%**

Table 22. Total WAM GHG emissions aggregated by gas (Gg CO2 eq.) 1990-2040

Gg CO2 eq.	1990	2005	2015	2020	2030	2040
CO2	4621	7962	6887	7551	6269	6393
CH4	692	883	877	1044	877	694
N2O	321	372	356	395	399	380
HFCs	0.03	103	368	361	361	353
TOTAL	5634	9321	8487	9351	7906	7820

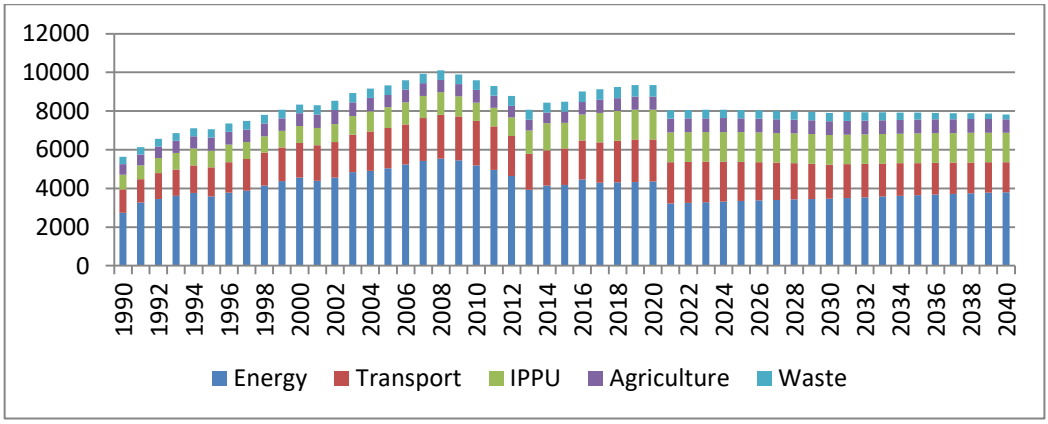

Figure 11. Total WAM GHG emissions by sector (Gg CO2 eq.) 1990-2040

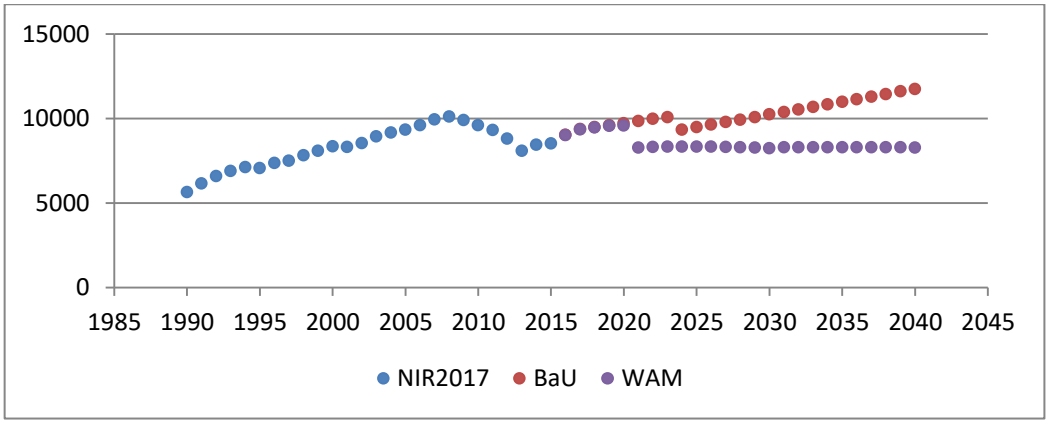

Figure 12. Total WAM GHG emissions compared to BaU (Gg CO2 eq.) 1990-2040

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

The total ETS / ESD emissions for the WAM projections are presented in Table 23 and Figure 13.

Table 23. ETS and ESD emissions according to the WAM scenario

Gg CO2 eq.	2015	2020	2030	2040
Total ETS GHGs	4405	4925	4233	4634
Total ESD GHGs	4082	4501	5171	5899
Total GHGs	8487	9425	9404	10533

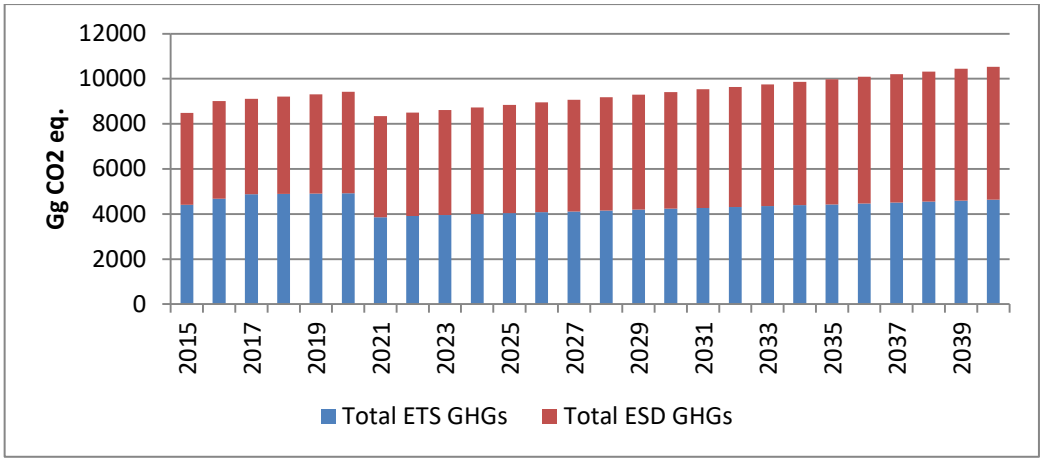

Figure 13. ETS and ESD emissions according to the WAM scenario

3.7.2. WAM sensitivity analysis

Sensitivity analysis was carried out using the change in the total at 1% change of each measure. The results of the calculations for the WAM scenario are presented in Table 24 and Figure 14.

Table 24. Change in total of WAM scenario at 1% change of each measure

	2020	2030	2040
E1 - natural gas	0.00%	0.00%	0.00%
E2 - RES in electricity	0.01%	0.18%	0.14%
E3 - EE in industry	0.02%	0.00%	0.00%
E4 - EE residential new buildings	0.44%	0.08%	0.05%
E5 - EE residential energy upgrade	0.02%	0.01%	0.01%
E6 - EE residential solar panels replacement	0.01%	0.01%	0.01%
E7 - EE tertiary new buildings	0.00%	0.00%	0.00%
E8 - EE tertiary energy upgrade	0.02%	0.00%	0.00%
E9 - EE in public buildings	0.00%	0.00%	0.00%
E10 - industry (alternative fuels)	0.03%	0.02%	0.03%
E11 - RES in residential	0.05%	0.03%	0.03%
E12 - RES in commercial	0.19%	0.04%	0.03%
T1 - biofuels	0.00%	0.02%	0.01%
T2 - Infrastructure	0.00%	0.01%	0.04%
T3 - New technologies and other	0.12%	0.29%	0.33%
T4 - RES in transport	0.05%	0.12%	0.09%
I1 - F-gases	0.04%	0.02%	0.02%
A1 - Anaerobic digestion	0.00%	0.00%	0.00%
W1 - sorting	0.00%	0.04%	0.11%
W2 - organics to landfill	0.00%	0.07%	0.06%
W3 - composting	0.00%	0.00%	0.00%
W4 - anaerobic digestion	0.00%	0.00%	0.00%
W5 - biogas recovery	0.00%	0.06%	0.02%

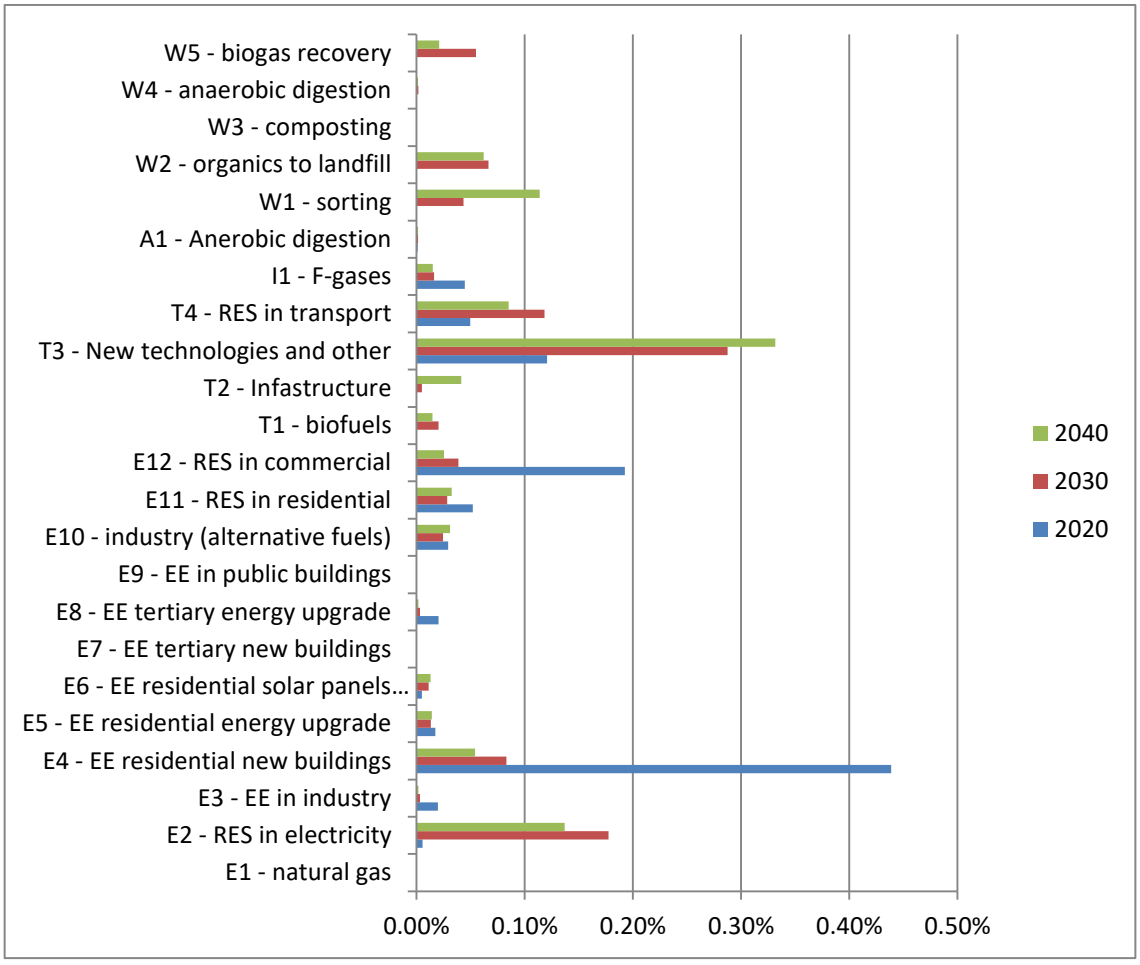

Figure 14. Change in total of WAM scenario at 1% change of each measure

3.8. Information available to the public (MMR Art. 13(3) and Art. 14(4))

Assessment of the costs and effects of national policies and measures is not available.

Table 4 of Annex XII in MMR has not been applied because a model has not been applied for the purposes of these projections.

Implementation of Union policies and measures that limit or reduce greenhouse gas emissions by sources or enhance removals by sinks is available in the report "Cyprus' climate policies and measures and GHG projections, March 2016" accessible in Greek at the website of the Department of Environment[23].

National projections of greenhouse gas emissions by sources and removals by sinks along with relevant technical reports that underpin those projections, including descriptions of the models and methodological approaches used, definitions and

[23] http://www.moa.gov.cy/moa/environment/environment.nsf/EC029F8F560B17B0C2257F61004BEAFB/$file/PaMs&PROJ-public%20information.pdf

underlying assumptions are available in the report “Cyprus’ climate policies and measures and GHG projections, March 2016” accessible in Greek at the website of the Department of Environment[7].

Annex I: BaU scenario - activity data

Table III1. BaU scenario - activity data (2016-2023)

	2016	2017	2018	2019	2020	2021	2022	2023
GDP real	3.03	3.6	3	2.7	2.7	2.5	2.5	2.3
ENERGY								
ELECTRICITY (%)								
RES	10%	10%	10%	10%	10%	10%	11%	11%
Natural gas	0%	0%	0%	0%	0%	0%	0%	0%
HFO	76%	76%	76%	76%	76%	76%	75%	75%
Diesel	14%	14%	14%	14%	14%	14%	14%	14%
ELECTRICITY - PRIMARY FUEL CONSUMPTION (TJ)								
RES	1535	1604	1666	1726	1787	1887	1991	2094
Natural gas	0	0	0	0	0	0	0	0
HFO	35877	35757	35751	35745	35739	35718	35696	35673
Diesel	6406	6526	6532	6538	6544	6566	6588	6610
TOTAL	43818	43887	43950	44009	44071	44170	44274	44377
INDUSTRY FUEL CONSUMPTION (TJ)								
LPG	273	283	292	300	308	316	323	331
Diesel	429	445	458	471	484	496	508	520
RFO	959	994	1024	1052	1081	1108	1136	1162
Pet-coke	3976	4121	4246	4363	4482	4594	4709	4818
Coal	21	21	22	23	23	24	24	25
Industrial waste (non RES)	662	686	707	727	747	765	784	803
Biomass	555	575	593	609	626	641	657	672
RESIDENTIAL FUEL CONSUMPTION (TJ)								
Other kerosene	613	636	655	673	691	709	726	743
Diesel/gas oil	2795	2891	2972	3047	3124	3174	3225	3271
LPG	1656	1716	1768	1817	1866	1913	1961	2006
Solid Biomass	130	135	139	143	147	150	154	158
Charcoal	236	245	252	259	266	273	280	286
RES	2519	2618	2704	2785	2868	2967	3069	3169
COMMERCIAL FUEL CONSUMPTION (TJ)								
diesel	645	662	676	687	699	712	726	738
LPG	520	539	555	571	586	601	616	630

	2016	2017	2018	2019	2020	2021	2022	2023
solid biomass	15	16	16	16	17	17	18	18
gas biomass	12	12	13	13	14	14	14	15
charcoal	207	215	221	227	233	239	245	251
solar thermal	433	455	476	496	516	534	551	568
ROAD TRANSPORT FUEL CONSUMPTION (TJ)								
Gasoline (TJ)	15682	16254	16749	17209	17681	18123	18576	19003
Diesel (TJ)	11739	12075	12347	12588	12833	13154	13483	13793
Biodiesel (TJ)	370	476	586	699	819	840	861	880
IPPU								
Total Clinker (tn)	1648256	2000000	2000000	2000000	2000000	2000000	2000000	2000000
slaked lime production (t)	3502	3824	4145	4466	4787	5109	5430	5751
ceramics (t)	111561	150000	163918	186509	209100	209100	209100	209100
imports soda ash (t)	447	470	489	510	534	558	583	609
Lubricant (kt)	8	8	8	8	8	8	8	8
Paraffin Wax (TJ)	13	13	13	13	13	13	13	13
Solvent Use NMVOCs (kt)								
dry cleaning	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672
coating applications	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346
chemical products	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988
asphalt roofing	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806
domestic solvent use	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744
road paving with asphalt	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263
printing	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197
Population forecast	854802	859982.6	865255.4	870654.4	876257.8	881841.1	887353.3	892781.4
AGRICULTURE								
kg milk/ day	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027
% pregnant	72	72	72	72	72	72	72	72
dairy cattle population	28502	29785	29785	29785	29785	34202	34202	34202
other cattle population	64408	66663	66663	66663	66663	70849	70849	70849
sheep population	304187	313313	316354	319396	319396	334606	334606	334606
goats population	246624	254023	256489	258955	258955	271286	271286	271286
horses population	401	401	401	401	401	401	401	401

	2016	2017	2018	2019	2020	2021	2022	2023
mules & asses population	349	349	349	349	349	349	349	349
swine population	352179	355701	359223	359223	362744	373310	373310	373310
Poultry population	64408454	66662750	66662750	66662750	66662750	70849299	70849299	70849299
manure management								
dairy cattle								
solid storage	95%	95%	95%	94%	94%	94%	94%	93%
anaerobic digester	5%	5%	6%	6%	6%	6%	7%	7%
other cattle								
solid storage	95%	95%	95%	94%	94%	94%	94%	93%
anaerobic digester	5%	5%	6%	6%	6%	6%	7%	7%
market swine								
anaerobic digester	50%	49%	48%	48%	47%	46%	45%	44%
aerobic treatment	50%	51%	52%	53%	53%	54%	55%	56%
breeding swine								
anaerobic digester	50%	49%	48%	48%	47%	46%	45%	44%
aerobic treatment	50%	51%	52%	53%	53%	54%	55%	56%
sheep								
solid storage	100%	100%	100%	100%	99.8%	99.5%	99.3%	99.0%
anaerobic digester					0.2%	0.5%	0.7%	1.0%
goats								
solid storage	100%	100%	100%	100%	99.8%	99.5%	99.3%	99.0%
anaerobic digester					0.2%	0.5%	0.7%	1.0%
horses								
solid storage	100%	100%	100%	100%	100%	100%	100%	100%
mules & asses								
solid storage	100%	100%	100%	100%	100%	100%	100%	100%
poultry								
solid storage	85%	84%	84%	83%	83%	82%	81%	81%
anaerobic digester	15%	16%	16%	17%	18%	18%	19%	19%
Crop production (t/yr)								
Wheat	6902	36774	37482	38189	38896	38896	38896	38896
Barley	2907	2907	2907	2907	2907	2907	2907	2907

	2016	2017	2018	2019	2020	2021	2022	2023
Oats	352	352	352	352	352	352	352	352
Beans & pulses (legumes)	4000	4000	4000	4000	4000	4000	4000	4000
Potatoes (tubers)	122803	122803	122803	122803	122803	122803	122803	122803
cultivated area (ha)								
Wheat	8386	12448.8	12688.2	12927.6	13167	13167	13167	13167
Barley	14536	14536	14536	14536	14536	14536	14536	14536
Oats	367	367	367	367	367	367	367	367
Beans & pulses (legumes)	498	498	498	498	498	498	498	498
Potatoes (tubers)	5041	5041	5041	5041	5041	5041	5041	5041
FracBURN (kg N/kg crop-N)	10%	10%	10%	10%	10%	10%	10%	10%
FSN (kg N in fertilizer)	8073000	8073000	8073000	8073000	8073000	8073000	8073000	8073000
dry sludge applied on land (kg)	5453697	5453697	5453697	5453697	5453697	5453697	5453697	5453697
WASTE								
Municipal solid waste production								
Total MSW production (1000t) - wet mass	545	563.79	573.07	581.43	589.52	598.37	607.2	616.31
Annual per capita production (kg/cap)	642	655.58	662.31	667.81	672.77	678.55	684.28	690.33
Total permanent population at the end of year	854800	859982.6	865255.4	870654.4	876257.8	881841.1	887353.3	892781.4
MSW to disposal sites (1000t wet mass)	409.96	423.78	430.75	437.03	443.12	449.77	456.40	463.25
MSW to disposal sites (% of total)	75%	75%	75%	75%	75%	75%	75%	75%
composting (1000t)	26.72	32.12	32.45	32.72	32.96	33.24	33.52	33.82
composting (%)	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%
Compost for backfilling (1000t)	16.77	20.16	20.36	20.53	20.69	20.86	21.04	21.23
composting (%)	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
TOTAL composting (1000t)	43.49	52.27	52.81	53.25	53.65	54.11	54.56	55.05
composting (%)	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
recycling (1000t)	73.25	88.05	88.95	89.69	90.35	91.13	91.90	92.71
recycling (%)	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%
per capita production to disposal sites (kg/cap)	483	493	498	502	506	510	514	519
POPULATION								
Regional Population (1000 persons)								
Lefkosia	332.2	334.2	336.3	338.4	340.5	342.7	344.9	347.0
Ammochostos	47	47.3	47.6	47.9	48.2	48.5	48.8	49.1

	2016	2017	2018	2019	2020	2021	2022	2023
Larnaca	144.9	145.8	146.7	147.6	148.5	149.5	150.4	151.3
Lemesos	239.4	240.9	242.3	243.8	245.4	247.0	248.5	250.0
Pafos	91.3	91.9	92.4	93.0	93.6	94.2	94.8	95.4
TOTAL	854.8	860.0	865.3	870.7	876.3	881.8	887.4	892.8
Urban Population (1000 persons)								
Lefkosia	244.2	245.7	247.2	248.7	250.3	251.9	253.5	255.1
Ammochostos		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Larnaca	85.7	86.2	86.7	87.3	87.9	88.4	89.0	89.5
Lemesos	182.6	183.7	184.8	186.0	187.2	188.4	189.6	190.7
Pafos	64.4	64.8	65.2	65.6	66.0	66.4	66.9	67.3
TOTAL	576.9	580.4	584.0	587.6	591.4	595.1	598.9	602.5
Rural Population (1000 persons)								
Lefkosia	88	88.5	89.1	89.6	90.2	90.8	91.4	91.9
Ammochostos	47	47.3	47.6	47.9	48.2	48.5	48.8	49.1
Larnaca	59.2	59.6	59.9	60.3	60.7	61.1	61.5	61.8
Lemesos	56.8	57.1	57.5	57.9	58.2	58.6	59.0	59.3
Pafos	26.9	27.1	27.2	27.4	27.6	27.8	27.9	28.1
TOTAL	277.9	279.6	281.3	283.1	284.9	286.7	288.5	290.2
composition of waste to disposal sites								
Food	49%	49%	49%	49%	49%	49%	49%	49%
Garden	8%	8%	8%	8%	8%	8%	8%	8%
Paper	27%	27%	27%	27%	27%	27%	27%	27%
Wood	3%	3%	3%	3%	3%	3%	3%	3%
Textile	11%	11%	11%	11%	11%	11%	11%	11%
Nappies	0%	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	2%	2%	2%	2%	2%	2%	2%	2%
Domestic wastewater management								
not well managed, centralised, overloaded aerobic (Ui)	95%	95%	95%	95%	95%	95%	95%	95%
septic system (Ui)	5%	5%	5%	5%	5%	5%	5%	5%
Industrial production (t)								
alcohol	629	629	629	629	629	629	629	629
beer	32764	32764	32764	32764	32764	32764	32764	32764

	2016	2017	2018	2019	2020	2021	2022	2023
soft drinks	10807	10807	10807	10807	10807	10807	10807	10807
dairy products	99762	99762	99762	99762	99762	99762	99762	99762
meat & poultry	79735	79735	79735	79735	79735	79735	79735	79735
soaps & detergents	7300	7300	7300	7300	7300	7300	7300	7300
vegetable oils	12640	12640	12640	12640	12640	12640	12640	12640
vegetables, fruits & juices	57861	57861	57861	57861	57861	57861	57861	57861
wine	11008	11008	11008	11008	11008	11008	11008	11008
not well managed, centralised, overloaded aerobic								
alcohol	97%	97%	97%	97%	97%	97%	97%	97%
beer	80%	80%	80%	80%	80%	80%	80%	80%
soft drinks	96%	96%	96%	96%	96%	96%	96%	96%
dairy products	95%	95%	95%	95%	95%	95%	95%	95%
meat & poultry	94%	94%	94%	94%	94%	94%	94%	94%
soaps & detergents	100%	100%	100%	100%	100%	100%	100%	100%
vegetable oils	99%	99%	99%	99%	99%	99%	99%	99%
vegetables, fruits & juices	99%	99%	99%	99%	99%	99%	99%	99%
wine	100%	100%	100%	100%	100%	100%	100%	100%
Anaerobic								
alcohol	3%	3%	3%	3%	3%	3%	3%	3%
beer	20%	20%	20%	20%	20%	20%	20%	20%
soft drinks	4%	4%	4%	4%	4%	4%	4%	4%
dairy products	5%	5%	5%	5%	5%	5%	5%	5%
meat & poultry	6%	6%	6%	6%	6%	6%	6%	6%
soaps & detergents	0%	0%	0%	0%	0%	0%	0%	0%
vegetable oils	1%	1%	1%	1%	1%	1%	1%	1%
vegetables, fruits & juices	1%	1%	1%	1%	1%	1%	1%	1%
wine	0%	0%	0%	0%	0%	0%	0%	0%

Table III2. BaU scenario - activity data (2024-2031)

	2024	2025	2026	2027	2028	2029	2030	2031
GDP real	2.3	2.1	2.1	2	2	2	2	2
ENERGY								
ELECTRICITY (%)								
RES	11%	12%	12%	12%	12%	13%	13%	14%
Natural gas	88%	88%	87%	87%	87%	86%	86%	85%
HFO	0%	0%	0%	0%	0%	0%	0%	0%
Diesel	1%	1%	1%	1%	1%	1%	1%	1%
ELECTRICITY - PRIMARY FUEL CONSUMPTION (TJ)								
RES	2201	2308	2417	2529	2643	2761	2883	3099
Natural gas	43224	43981	44751	45489	46239	47001	47774	48334
HFO	0	0	0	0	0	0	0	0
Diesel	393	395	396	397	399	400	401	405
TOTAL	45818	46683	47564	48415	49281	50162	51059	51838
INDUSTRY FUEL CONSUMPTION (TJ)								
LPG	338	346	353	360	367	374	382	390
Diesel	532	543	554	565	577	588	600	612
RFO	1189	1214	1239	1264	1289	1315	1341	1368
Pet-coke	4928	5032	5137	5240	5345	5452	5561	5672
Coal	25	26	27	27	28	28	29	29
Industrial waste (non RES)	821	838	856	873	890	908	926	945
Biomass	688	702	717	731	746	761	776	792
RESIDENTIAL FUEL CONSUMPTION (TJ)								
Other kerosene	760	776	792	808	824	841	858	875
Diesel/gas oil	3316	3356	3395	3432	3468	3505	3542	3590
LPG	2052	2095	2139	2182	2226	2270	2316	2362
Solid Biomass	161	165	168	171	175	178	182	185
Charcoal	293	299	305	311	317	324	330	337
RES	3271	3370	3472	3573	3676	3783	3892	3992
COMMERCIAL FUEL CONSUMPTION (TJ)								
diesel	751	762	773	784	794	805	816	832
LPG	645	658	672	685	699	713	727	742

	2024	2025	2026	2027	2028	2029	2030	2031
solid biomass	19	19	19	20	20	21	21	21
gas biomass	15	15	16	16	16	16	17	17
charcoal	257	262	267	273	278	284	290	295
solar thermal	586	603	620	638	655	673	692	706
ROAD TRANSPORT FUEL CONSUMPTION (TJ)								
Gasoline (TJ)	19440	19848	20265	20670	21084	21505	21935	22374
Diesel (TJ)	14110	14406	14709	15003	15303	15609	15921	16240
Biodiesel (TJ)	901	920	939	958	977	996	1016	1037
IPPU								
Total Clinker (tn)	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000
slaked lime production (t)	6072	6394	6715	7036	7357	7679	8000	8000
ceramics (t)	209100	209100	209100	209100	209100	209100	209100	209100
imports soda ash (t)	635	662	689	717	746	776	807	840
Lubricant (kt)	8	8	8	8	8	8	8	8
Paraffin Wax (TJ)	13	13	13	13	13	13	13	13
Solvent Use NMVOCs (kt)								
dry cleaning	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672
coating applications	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346
chemical products	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988
asphalt roofing	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806
domestic solvent use	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744
road paving with asphalt	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263
printing	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197
Population forecast	898068.2	903198.7	908137.8	912879.6	917398	921705	925816.6	929721.8
AGRICULTURE								
kg milk/ day	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027
% pregnant	72	72	72	72	72	72	72	72
dairy cattle population	34202	34202	34202	34202	34202	34202	34202	34202
other cattle population	70849	70849	70849	70849	70849	70849	70849	70849
sheep population	334606	334606	334606	334606	334606	334606	334606	334606
goats population	271286	271286	271286	271286	271286	271286	271286	271286
horses population	401	401	401	401	401	401	401	401

	2024	2025	2026	2027	2028	2029	2030	2031
mules & asses population	349	349	349	349	349	349	349	349
swine population	373310	373310	373310	373310	373310	373310	373310	373310
Poultry population	70849299	70849299	70849299	70849299	70849299	70849299	70849299	70849299
manure management								
dairy cattle								
solid storage	93%	93%	93%	92%	92%	92%	92%	91%
anaerobic digester	7%	7%	8%	8%	8%	8%	9%	9%
other cattle								
solid storage	93%	93%	93%	92%	92%	92%	92%	91%
anaerobic digester	7%	7%	8%	8%	8%	8%	9%	9%
market swine								
anaerobic digester	43%	43%	42%	41%	40%	39%	38%	38%
aerobic treatment	57%	58%	58%	59%	60%	61%	62%	63%
breeding swine								
anaerobic digester	43%	43%	42%	41%	40%	39%	38%	38%
aerobic treatment	57%	58%	58%	59%	60%	61%	62%	63%
sheep								
solid storage	98.8%	98.6%	98.3%	98.1%	97.9%	97.6%	97.4%	97.1%
anaerobic digester	1.2%	1.4%	1.7%	1.9%	2.1%	2.4%	2.6%	2.9%
goats								
solid storage	98.8%	98.6%	98.3%	98.1%	97.9%	97.6%	97.4%	97.1%
anaerobic digester	1.2%	1.4%	1.7%	1.9%	2.1%	2.4%	2.6%	2.9%
horses								
solid storage	100%	100%	100%	100%	100%	100%	100%	100%
mules & asses								
solid storage	100%	100%	100%	100%	100%	100%	100%	100%
poultry								
solid storage	80%	79%	79%	78%	78%	77%	76%	76%
anaerobic digester	20%	21%	21%	22%	23%	23%	24%	24%
Crop production (t/yr)								
Wheat	38896	38896	38896	38896	38896	38896	38896	38896
Barley	2907	2907	2907	2907	2907	2907	2907	2907

	2024	2025	2026	2027	2028	2029	2030	2031
Oats	352	352	352	352	352	352	352	352
Beans & pulses (legumes)	4000	4000	4000	4000	4000	4000	4000	4000
Potatoes (tubers)	122803	122803	122803	122803	122803	122803	122803	122803
cultivated area (ha)								
Wheat	13167	13167	13167	13167	13167	13167	13167	13167
Barley	14536	14536	14536	14536	14536	14536	14536	14536
Oats	367	367	367	367	367	367	367	367
Beans & pulses (legumes)	498	498	498	498	498	498	498	498
Potatoes (tubers)	5041	5041	5041	5041	5041	5041	5041	5041
FracBURN (kg N/kg crop-N)	10%	10%	10%	10%	10%	10%	10%	10%
FSN (kg N in fertilizer)	8073000	8073000	8073000	8073000	8073000	8073000	8073000	8073000
dry sludge applied on land (kg)	5453697	5453697	5453697	5453697	5453697	5453697	5453697	5453697
WASTE								
Municipal solid waste production								
Total MSW production (1000t) - wet mass	625.52	634.91	644.69	654.77	665.46	676.68	688.54	693.73
Annual per capita production (kg/cap)	696.52	702.96	709.90	717.26	725.38	734.16	743.71	746.17
Total permanent population at the end of year	898068.2	903198.7	908137.8	912879.6	917398	921705	925816.6	929721.8
MSW to disposal sites (1000t wet mass)	470.18	477.23	484.58	492.16	500.20	508.63	517.54	521.44
MSW to disposal sites (% of total)	75%	75%	75%	75%	75%	75%	75%	75%
composting (1000t)	34.12	34.44	34.78	35.14	35.54	35.97	36.43	36.56
composting (%)	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%
Compost for backfilling (1000t)	21.42	21.61	21.83	22.05	22.30	22.57	22.87	22.94
composting (%)	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
TOTAL composting (1000t)	55.54	56.05	56.61	57.19	57.84	58.54	59.30	59.50
composting (%)	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
recycling (1000t)	93.54	94.41	95.34	96.33	97.42	98.60	99.88	100.21
recycling (%)	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%
per capita production to disposal sites (kg/cap)	524	528	534	539	545	552	559	561
POPULATION								
Regional Population (1000 persons)								
Lefkosia	349.0	351.0	352.9	354.8	356.5	358.2	359.8	361.3
Ammochostos	49.4	49.7	49.9	50.2	50.4	50.7	50.9	51.1

	2024	2025	2026	2027	2028	2029	2030	2031
Larnaca	152.2	153.1	153.9	154.7	155.5	156.2	156.9	157.6
Lemesos	251.5	253.0	254.3	255.7	256.9	258.1	259.3	260.4
Pafos	95.9	96.5	97.0	97.5	98.0	98.4	98.9	99.3
TOTAL	898.1	903.2	908.1	912.9	917.4	921.7	925.8	929.7
Urban Population (1000 persons)								
Lefkosia	256.6	258.0	259.4	260.8	262.1	263.3	264.5	265.6
Ammochostos	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Larnaca	90.0	90.6	91.0	91.5	92.0	92.4	92.8	93.2
Lemesos	191.8	192.9	194.0	195.0	196.0	196.9	197.8	198.6
Pafos	67.7	68.0	68.4	68.8	69.1	69.4	69.8	70.0
TOTAL	606.1	609.6	612.9	616.1	619.1	622.1	624.8	627.5
Rural Population (1000 persons)								
Lefkosia	92.5	93.0	93.5	94.0	94.4	94.9	95.3	95.7
Ammochostos	49.4	49.7	49.9	50.2	50.4	50.7	50.9	51.1
Larnaca	62.2	62.6	62.9	63.2	63.5	63.8	64.1	64.4
Lemesos	59.7	60.0	60.3	60.7	61.0	61.2	61.5	61.8
Pafos	28.3	28.4	28.6	28.7	28.9	29.0	29.1	29.3
TOTAL	292.0	293.6	295.2	296.8	298.3	299.7	301.0	302.3
composition of waste to disposal sites								
Food	49%	49%	49%	49%	49%	49%	49%	49%
Garden	8%	8%	8%	8%	8%	8%	8%	8%
Paper	27%	27%	27%	27%	27%	27%	27%	27%
Wood	3%	3%	3%	3%	3%	3%	3%	3%
Textile	11%	11%	11%	11%	11%	11%	11%	11%
Nappies	0%	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	2%	2%	2%	2%	2%	2%	2%	2%
Domestic wastewater management								
not well managed, centralised, overloaded aerobic (Ui)	95%	95%	95%	95%	95%	95%	95%	95%
septic system (Ui)	5%	5%	5%	5%	5%	5%	5%	5%
Industrial production (t)								
alcohol	629	629	629	629	629	629	629	629
beer	32764	32764	32764	32764	32764	32764	32764	32764

	2024	2025	2026	2027	2028	2029	2030	2031
soft drinks	10807	10807	10807	10807	10807	10807	10807	10807
dairy products	99762	99762	99762	99762	99762	99762	99762	99762
meat & poultry	79735	79735	79735	79735	79735	79735	79735	79735
soaps & detergents	7300	7300	7300	7300	7300	7300	7300	7300
vegetable oils	12640	12640	12640	12640	12640	12640	12640	12640
vegetables, fruits & juices	57861	57861	57861	57861	57861	57861	57861	57861
wine	11008	11008	11008	11008	11008	11008	11008	11008
not well managed, centralised, overloaded aerobic								
alcohol	97%	97%	97%	97%	97%	97%	97%	97%
beer	80%	80%	80%	80%	80%	80%	80%	80%
soft drinks	96%	96%	96%	96%	96%	96%	96%	96%
dairy products	95%	95%	95%	95%	95%	95%	95%	95%
meat & poultry	94%	94%	94%	94%	94%	94%	94%	94%
soaps & detergents	100%	100%	100%	100%	100%	100%	100%	100%
vegetable oils	99%	99%	99%	99%	99%	99%	99%	99%
vegetables, fruits & juices	99%	99%	99%	99%	99%	99%	99%	99%
wine	100%	100%	100%	100%	100%	100%	100%	100%
Anaerobic								
alcohol	3%	3%	3%	3%	3%	3%	3%	3%
beer	20%	20%	20%	20%	20%	20%	20%	20%
soft drinks	4%	4%	4%	4%	4%	4%	4%	4%
dairy products	5%	5%	5%	5%	5%	5%	5%	5%
meat & poultry	6%	6%	6%	6%	6%	6%	6%	6%
soaps & detergents	0%	0%	0%	0%	0%	0%	0%	0%
vegetable oils	1%	1%	1%	1%	1%	1%	1%	1%
vegetables, fruits & juices	1%	1%	1%	1%	1%	1%	1%	1%
wine	0%	0%	0%	0%	0%	0%	0%	0%

Table III3. BaU scenario - activity data (2032-2040)

	2032	2033	2034	2035	2036	2037	2038	2039	2040
GDP real	2	2	2	2	2	2	2	2	2
ENERGY									
ELECTRICITY (%)									
RES	14%	15%	16%	17%	17%	18%	19%	19%	20%
Natural gas	85%	84%	83%	83%	82%	81%	81%	80%	79%
HFO	0%	0%	0%	0%	0%	0%	0%	0%	0%
Diesel	1%	1%	1%	1%	1%	1%	1%	1%	1%
ELECTRICITY - PRIMARY FUEL CONSUMPTION (TJ)									
RES	3322	3554	3793	4040	4295	4560	4833	5115	5406
Natural gas	48897	49463	50032	50605	51180	51757	52338	52921	53506
HFO	0	0	0	0	0	0	0	0	0
Diesel	408	411	415	418	422	425	429	433	437
TOTAL	52627	53428	54240	55063	55897	56742	57600	58468	59349
INDUSTRY FUEL CONSUMPTION (TJ)									
LPG	397	405	413	422	430	439	447	456	466
Diesel	624	637	650	662	676	689	703	717	731
RFO	1395	1423	1452	1481	1510	1541	1571	1603	1635
Pet-coke	5786	5901	6019	6140	6263	6388	6516	6646	6779
Coal	30	31	31	32	32	33	34	34	35
Industrial waste (non RES)	964	983	1003	1023	1043	1064	1085	1107	1129
Biomass	807	824	840	857	874	891	909	927	946
RESIDENTIAL FUEL CONSUMPTION (TJ)									
Other kerosene	892	910	928	947	966	985	1005	1025	1046
Diesel/gas oil	3639	3688	3737	3788	3838	3890	3941	3994	4046
LPG	2409	2457	2507	2557	2608	2660	2713	2767	2823
Solid Biomass	189	193	197	201	205	209	213	217	222
Charcoal	343	350	357	364	372	379	387	395	402
RES	4095	4200	4309	4419	4533	4649	4768	4890	5015
COMMERCIAL FUEL CONSUMPTION (TJ)									
diesel	849	866	883	901	919	937	956	975	964
LPG	757	772	787	803	819	835	852	869	887

	2032	2033	2034	2035	2036	2037	2038	2039	2040
solid biomass	22	22	23	23	24	24	25	25	26
gas biomass	17	18	18	19	19	19	20	20	20
charcoal	301	307	313	320	326	333	339	346	353
solar thermal	720	734	749	764	779	795	811	827	875
ROAD TRANSPORT FUEL CONSUMPTION (TJ)									
Gasoline (TJ)	22822	23278	23744	24218	24703	25197	25701	26215	26739
Diesel (TJ)	16564	16896	17234	17578	17930	18288	18654	19027	19408
Biodiesel (TJ)	1057	1078	1100	1122	1144	1167	1191	1215	1239
IPPU									
Total Clinker (tn)	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000	2000000
slaked lime production (t)	8000	8000	8000	8000	8000	8000	8000	8000	8000
ceramics (t)	209100	209100	209100	209100	209100	209100	209100	209100	209100
imports soda ash (t)	874	909	946	984	1024	1065	1108	1153	1200
Lubricant (kt)	8	8	8	8	8	8	8	8	8
Paraffin Wax (TJ)	13	13	13	13	13	13	13	13	13
Solvent Use NMVOCs (kt)									
dry cleaning	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672	0.052672
coating applications	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346	1.617346
chemical products	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988	0.00988
asphalt roofing	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806	0.009806
domestic solvent use	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744	0.202744
road paving with asphalt	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263	0.002263
printing	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197	0.247197
Population forecast	933446.7	936994.3	940408.6	943707.7	946900.7	950017.4	953088.1	956091.7	959063.2
AGRICULTURE									
kg milk/ day	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027	19.26027
% pregnant	72	72	72	72	72	72	72	72	72
dairy cattle population	34202	34202	34202	34202	34202	34202	34202	34202	34202
other cattle population	70849	70849	70849	70849	70849	70849	70849	70849	70849
sheep population	334606	334606	334606	334606	334606	334606	334606	334606	334606
goats population	271286	271286	271286	271286	271286	271286	271286	271286	271286
horses population	401	401	401	401	401	401	401	401	401

	2032	2033	2034	2035	2036	2037	2038	2039	2040
mules & asses population	349	349	349	349	349	349	349	349	349
swine population	373310	373310	373310	373310	373310	373310	373310	373310	373310
Poultry population	70849299	70849299	70849299	70849299	70849299	70849299	70849299	70849299	70849299
manure management									
dairy cattle									
solid storage	91%	91%	91%	90%	90%	90%	90%	89%	89%
anaerobic digester	9%	9%	10%	10%	10%	10%	11%	11%	11%
other cattle									
solid storage	91%	91%	91%	90%	90%	90%	90%	89%	89%
anaerobic digester	9%	9%	10%	10%	10%	10%	11%	11%	11%
market swine									
anaerobic digester	37%	36%	35%	34%	33%	32%	32%	31%	30%
aerobic treatment	63%	64%	65%	66%	67%	67%	68%	69%	70%
breeding swine									
anaerobic digester	37%	36%	35%	34%	33%	32%	32%	31%	30%
aerobic treatment	63%	64%	65%	66%	67%	67%	68%	69%	70%
sheep									
solid storage	96.9%	96.7%	96.4%	96.2%	96.0%	95.7%	95.5%	95.2%	95%
anaerobic digester	3.1%	3.3%	3.6%	3.8%	4.0%	4.3%	4.5%	4.8%	5%
goats									
solid storage	96.9%	96.7%	96.4%	96.2%	96.0%	95.7%	95.5%	95.2%	95%
anaerobic digester	3.1%	3.3%	3.6%	3.8%	4.0%	4.3%	4.5%	4.8%	5%
horses									
solid storage	100%	100%	100%	100%	100%	100%	100%	100%	100%
mules & asses									
solid storage	100%	100%	100%	100%	100%	100%	100%	100%	100%
poultry									
solid storage	75%	74%	74%	73%	73%	72%	71%	71%	70%
anaerobic digester	25%	26%	26%	27%	28%	28%	29%	29%	30%
Crop production (t/yr)									
Wheat	38896	38896	38896	38896	38896	38896	38896	38896	38896
Barley	2907	2907	2907	2907	2907	2907	2907	2907	2907

	2032	2033	2034	2035	2036	2037	2038	2039	2040
Oats	352	352	352	352	352	352	352	352	352
Beans & pulses (legumes)	4000	4000	4000	4000	4000	4000	4000	4000	4000
Potatoes (tubers)	122803	122803	122803	122803	122803	122803	122803	122803	122803
cultivated area (ha)									
Wheat	13167	13167	13167	13167	13167	13167	13167	13167	13167
Barley	14536	14536	14536	14536	14536	14536	14536	14536	14536
Oats	367	367	367	367	367	367	367	367	367
Beans & pulses (legumes)	498	498	498	498	498	498	498	498	498
Potatoes (tubers)	5041	5041	5041	5041	5041	5041	5041	5041	5041
FracBURN (kg N/kg crop-N)	10%	10%	10%	10%	10%	10%	10%	10%	10%
FSN (kg N in fertilizer)	8073000	8073000	8073000	8073000	8073000	8073000	8073000	8073000	8073000
dry sludge applied on land (kg)	5453697	5453697	5453697	5453697	5453697	5453697	5453697	5453697	5453697
WASTE									
Municipal solid waste production									
Total MSW production (1000t) - wet mass	703.18	712.62	722.07	731.52	740.96	750.41	759.86	769.31	778.75
Annual per capita production (kg/cap)	753.31	760.54	767.83	775.15	782.52	789.89	797.26	804.64	811.99
Total permanent population at the end of year	933446.7	936994.3	940408.6	943707.7	946900.7	950017.4	953088.1	956091.7	959063.2
MSW to disposal sites (1000t wet mass)	528.55	535.65	542.75	549.85	556.95	564.05	571.15	578.25	585.35
MSW to disposal sites (% of total)	75%	75%	75%	75%	75%	75%	75%	75%	75%
composting (1000t)	36.91	37.26	37.62	37.98	38.34	38.70	39.06	39.42	39.78
composting (%)	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%
Compost for backfilling (1000t)	23.16	23.38	23.61	23.83	24.06	24.29	24.51	24.74	24.97
composting (%)	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
TOTAL composting (1000t)	60.07	60.64	61.23	61.81	62.40	62.98	63.57	64.16	64.75
composting (%)	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
recycling (1000t)	101.17	102.14	103.12	104.10	105.09	106.08	107.07	108.06	109.05
recycling (%)	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%
per capita production to disposal sites (kg/cap)	566	572	577	583	588	594	599	605	610
POPULATION									
Regional Population (1000 persons)									
Lefkosia	362.8	364.1	365.5	366.8	368.0	369.2	370.4	371.6	372.7
Ammochostos	51.3	51.5	51.7	51.9	52.1	52.2	52.4	52.6	52.7

	2032	2033	2034	2035	2036	2037	2038	2039	2040
Larnaca	158.2	158.8	159.4	160.0	160.5	161.0	161.6	162.1	162.6
Lemesos	261.4	262.4	263.4	264.3	265.2	266.1	266.9	267.8	268.6
Pafos	99.7	100.1	100.4	100.8	101.1	101.5	101.8	102.1	102.4
TOTAL	933.4	937.0	940.4	943.7	946.9	950.0	953.1	956.1	959.1
Urban Population (1000 persons)									
Lefkosia	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
Larnaca	93.6	93.9	94.3	94.6	94.9	95.2	95.6	95.9	96.2
Lemesos	199.4	200.2	200.9	201.6	202.3	202.9	203.6	204.2	204.9
Pafos	70.3	70.6	70.8	71.1	71.3	71.6	71.8	72.0	72.3
TOTAL	630.0	632.4	634.7	636.9	639.1	641.2	643.2	645.3	647.3
Rural Population (1000 persons)									
Lefkosia	96.1	96.5	96.8	97.2	97.5	97.8	98.1	98.4	98.7
Ammochostos	51.3	51.5	51.7	51.9	52.1	52.2	52.4	52.6	52.7
Larnaca	64.6	64.9	65.1	65.4	65.6	65.8	66.0	66.2	66.4
Lemesos	62.0	62.3	62.5	62.7	62.9	63.1	63.3	63.5	63.7
Pafos	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2
TOTAL	303.5	304.6	305.7	306.8	307.8	308.9	309.9	310.8	311.8
composition of waste to disposal sites									
Food	49%	49%	49%	49%	49%	49%	49%	49%	49%
Garden	8%	8%	8%	8%	8%	8%	8%	8%	8%
Paper	27%	27%	27%	27%	27%	27%	27%	27%	27%
Wood	3%	3%	3%	3%	3%	3%	3%	3%	3%
Textile	11%	11%	11%	11%	11%	11%	11%	11%	11%
Nappies	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	2%	2%	2%	2%	2%	2%	2%	2%	2%
Domestic wastewater management									
not well managed, centralised, overloaded aerobic (Ui)	95%	95%	95%	95%	95%	95%	95%	95%	95%
septic system (Ui)	5%	5%	5%	5%	5%	5%	5%	5%	5%
Industrial production (t)									
alcohol	629	629	629	629	629	629	629	629	629
beer	32764	32764	32764	32764	32764	32764	32764	32764	32764

	2032	2033	2034	2035	2036	2037	2038	2039	2040
soft drinks	10807	10807	10807	10807	10807	10807	10807	10807	10807
dairy products	99762	99762	99762	99762	99762	99762	99762	99762	99762
meat & poultry	79735	79735	79735	79735	79735	79735	79735	79735	79735
soaps & detergents	7300	7300	7300	7300	7300	7300	7300	7300	7300
vegetable oils	12640	12640	12640	12640	12640	12640	12640	12640	12640
vegetables, fruits & juices	57861	57861	57861	57861	57861	57861	57861	57861	57861
wine	11008	11008	11008	11008	11008	11008	11008	11008	11008
not well managed, centralised, overloaded aerobic									
alcohol	97%	97%	97%	97%	97%	97%	97%	97%	97%
beer	80%	80%	80%	80%	80%	80%	80%	80%	80%
soft drinks	96%	96%	96%	96%	96%	96%	96%	96%	96%
dairy products	95%	95%	95%	95%	95%	95%	95%	95%	95%
meat & poultry	94%	94%	94%	94%	94%	94%	94%	94%	94%
soaps & detergents	100%	100%	100%	100%	100%	100%	100%	100%	100%
vegetable oils	99%	99%	99%	99%	99%	99%	99%	99%	99%
vegetables, fruits & juices	99%	99%	99%	99%	99%	99%	99%	99%	99%
wine	100%	100%	100%	100%	100%	100%	100%	100%	100%
Anaerobic									
alcohol	3%	3%	3%	3%	3%	3%	3%	3%	3%
beer	20%	20%	20%	20%	20%	20%	20%	20%	20%
soft drinks	4%	4%	4%	4%	4%	4%	4%	4%	4%
dairy products	5%	5%	5%	5%	5%	5%	5%	5%	5%
meat & poultry	6%	6%	6%	6%	6%	6%	6%	6%	6%
soaps & detergents	0%	0%	0%	0%	0%	0%	0%	0%	0%
vegetable oils	1%	1%	1%	1%	1%	1%	1%	1%	1%
vegetables, fruits & juices	1%	1%	1%	1%	1%	1%	1%	1%	1%
wine	0%	0%	0%	0%	0%	0%	0%	0%	0%

NOTES:

- If activity data is not presented in the tables above; projection is made using real GDP forecast (Table I1, first row)
- HFO to diesel ratio assumed same as latest available information (2016)

- remove from HFO increase of RES
- from 2024 only Moni diesel
- assuming 40% for combustion of natural gas
- Cement production: assuming full capacity of 2000000 from first year of projection
- Lime production: increase to 8000 in 2030 - constant thereafter
- Ceramics: full capacity of approx. 2000000 from 2020
- 2F & 2G1: 2014 average per capita emissions (t/cap) of the four countries with cyprus population forecast
- 2G4: assuming constant emissions as 2015
- Population forecast from Ministry of Finance (Maria Matsi)
- MSW production: 2017-2030 from strategic plan for municipal solid waste (table VI, pg. 167); 2031-2040 continue trend
- Annual per capita production (kg/cap): divide total waste production by total population forecast
- diesel consumption road transport (Gg) for Urea-based catalysts: same as diesel consumption from transport

Annex II: WEM scenario - activity data

Table IV1. WEM scenario - activity data (2016-2024)

	2016	2017	2018	2019	2020	2021	2022	2023	2024
E1 - natural gas									
RES	9.7%	9.8%	9.8%	9.9%	10%	10.3%	10.6%	10.9%	11.2%
Natural gas	0.0%	0.0%	0.0%	0.0%	0.0%	88.9%	88.6%	88.3%	88.0%
HFO	76.4%	76.3%	76.2%	76.2%	76.1%	0.0%	0.0%	0.0%	0.0%
Diesel	13.9%	13.9%	13.9%	13.9%	13.9%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY									
RES	1535	1604	1666	1726	1787	1887	1991	2094	2201
Natural gas	0	0	0	0	0	40707	41584	42396	43224
HFO	35877	35757	35751	35745	35739	0	0	0	0
Diesel	6406	6526	6532	6538	6544	389	391	392	393
E2 - RES in electricity									
RES	9.7%	10.5%	11.3%	12.2%	13%	13.7%	14.4%	15.1%	15.8%
Natural gas	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	83.4%
HFO	76.4%	75.6%	74.7%	73.9%	73.1%	72.4%	71.7%	71.0%	0.0%
Diesel	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	0.8%
WM (TJ) PRIMARY									
RES	1535	1727	1920	2117	2324	2510	2704	2901	3105
Natural gas	0	0	0	0	0	0	0	0	40964
HFO	35877	35702	35640	35578	35514	35459	35403	35346	0
Diesel	6406	6581	6643	6705	6769	6824	6880	6937	415
E3 - EE in industry									
LPG	269	279	288	296	304	312	320	328	336
Diesel	423	438	452	465	478	490	503	515	528
RFO	945	980	1010	1038	1068	1096	1125	1152	1180
Pet-coke	3917	4063	4189	4306	4426	4543	4663	4777	4893
Coal	20	21	22	22	23	24	24	25	25
Industrial waste (non RES) and other fuels	652	677	698	717	737	757	777	796	815
Biomass	547	567	585	601	618	634	651	667	683
E4 - EE residential new buildings									

	2016	2017	2018	2019	2020	2021	2022	2023	2024
Residential new buildings	4073	4073	4073	4073	4073	3864	3655	3446	3237
consumption with E4 (TJ)	3876	4166	4417	4650	4889	5322	5761	6186	6617
TJ									
Other kerosene	299	321	341	359	377	411	444	477	510
Diesel/gas oil	1363	1462	1546	1624	1704	1839	1973	2101	2227
LPG	807	868	920	968	1018	1108	1200	1288	1378
Solid Biomass	63	68	72	76	80	87	94	101	108
Charcoal	115	124	131	138	145	158	171	184	196
RES	1229	1324	1407	1484	1565	1719	1878	2035	2197
E5 - EE residential energy upgrade									
Residential new buildings	120	120	120	120	120	120	120	120	120
consumption with E5 (TJ)	7829	8119	8370	8603	8842	9066	9296	9513	9734
TJ									
Other kerosene	604	626	646	664	682	699	717	734	751
Diesel/gas oil	2753	2849	2930	3005	3082	3133	3184	3230	3276
LPG	1631	1691	1743	1792	1842	1888	1936	1981	2027
Solid Biomass	128	133	137	141	145	148	152	156	159
Charcoal	232	241	249	255	263	269	276	282	289
RES	2481	2580	2666	2746	2830	2928	3030	3130	3232
E6 - EE residential solar panels replacement									
Residential solar panels replacement	4	4	4	4	4	4	4	4	4
consumption with E6 (TJ)	7945	8235	8486	8719	8958	9182	9411	9628	9850
TJ									
Other kerosene	613	635	655	673	691	708	726	743	760
Diesel/gas oil	2794	2889	2971	3046	3122	3173	3224	3269	3315
LPG	1655	1715	1767	1816	1866	1912	1960	2005	2051
Solid Biomass	130	135	139	143	146	150	154	157	161
Charcoal	236	244	252	259	266	273	279	286	292
RES	2518	2616	2702	2783	2866	2966	3068	3168	3270
E7 - EE tertiary new buildings									
Tertiary new buildings reductions (TJ)	467	467	467	467	467	450	433	416	399

	2016	2017	2018	2019	2020	2021	2022	2023	2024
consumption with E7 (TJ)	1365	1432	1490	1544	1599	1667	1737	1804	1872
TJ									
diesel	481	499	514	528	541	561	581	600	619
RFO	0	0	0	0	0	0	0	0	0
LPG	387	406	423	438	454	473	493	512	531
solid biomass	11	12	12	13	13	14	14	15	15
gas biomass	9	9	10	10	10	11	11	12	12
charcoal	154	162	168	174	181	188	196	204	211
solar thermal	323	343	362	381	400	420	441	462	483
E8 - EE tertiary energy upgrade									
Tertiary buildings energy upgrade	198	198	198	198	198	198	198	198	198
consumption with E8 (TJ)	1634	1701	1759	1813	1868	1919	1972	2022	2073
TJ									
diesel	575	593	607	620	632	646	660	672	685
RFO	0	0	0	0	0	0	0	0	0
LPG	464	483	499	514	530	545	560	574	588
solid biomass	13	14	14	15	15	16	16	17	17
gas biomass	11	11	12	12	12	13	13	13	14
charcoal	185	192	199	205	211	217	223	228	234
solar thermal	386	408	428	447	467	484	501	518	535
E9 - EE in public buildings									
Public buildings	14	12	10	8	6	6	6	6	6
consumption with E9 (TJ)	1818	1887	1947	2003	2060	2112	2165	2215	2266
TJ									
diesel	640	658	672	685	697	710	724	736	749
RFO	0	0	0	0	0	0	0	0	0
LPG	516	535	553	568	585	599	614	629	643
solid biomass	15	15	16	16	17	17	18	18	19
gas biomass	12	12	13	13	13	14	14	15	15
charcoal	205	213	220	226	233	239	245	250	256
solar thermal	430	452	473	494	515	532	550	567	585

	2016	2017	2018	2019	2020	2021	2022	2023	2024
E10 - industry (alternative fuels)									
LPG	4%	4%	4%	4%	4%	4%	4%	4%	4%
Diesel	6%	6%	6%	6%	6%	6%	6%	6%	6%
RFO	14%	14%	14%	14%	14%	14%	14%	14%	14%
Pet-coke	58%	57%	57%	56%	56%	55%	55%	55%	55%
Coal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Industrial waste (non RES) and other fuels	10%	10%	10%	10%	10%	10%	10%	10%	10%
Biomass	8%	9%	9%	10%	10%	10.2%	10.4%	10.6%	10.8%
TJ									
LPG	273	283	292	300	308	316	323	331	338
Diesel	429	445	458	471	484	496	508	520	532
RFO	959	994	1024	1052	1081	1108	1136	1162	1189
Pet-coke	3976	4086	4175	4253	4304	4396	4490	4576	4665
Coal	21	21	22	23	23	24	24	25	25
Industrial waste (non RES) and other fuels	662	686	707	727	775	794	814	833	852
Biomass	555	609	663	718	775	810	847	883	920
E11 - RES in residential									
RES heating and cooling	31%	32%	33%	34%	35%	35%	36%	36%	36%
WM consumption (%)									
Other kerosene	8%	8%	8%	8%	8%	8%	8%	8%	8%
Diesel/gas oil	35%	35%	34%	33%	32%	32%	31%	31%	31%
LPG	21%	21%	21%	21%	21%	21%	21%	21%	21%
Solid Biomass	2%	2%	2%	2%	2%	2%	2%	2%	2%
Charcoal	3%	3%	3%	3%	3%	3.0%	3.0%	3.0%	3.0%
RES	32%	32%	33%	34%	35%	35.3%	35.6%	35.9%	36.2%
TJ									
Other kerosene	613	636	655	673	691	709	726	743	760
Diesel/gas oil	2795	2872	2874	2866	2855	2899	2943	2982	3021
LPG	1656	1716	1768	1817	1866	1913	1961	2006	2052
Solid Biomass	130	135	139	143	147	150	154	158	161
Charcoal	236	245	252	259	266	273	280	286	293

	2016	2017	2018	2019	2020	2021	2022	2023	2024
RES	2519	2636	2802	2966	3137	3243	3352	3458	3567
E12 - RES in commercial									
RES heating and cooling	21%	22%	23%	24%	25%	25%	26%	26%	26%
WM consumption (%)									
Diesel/gas oil	35%	35%	35%	34%	34%	34%	33%	33%	33%
RFO	0%	0%	0%	0%	0%	0%	0%	0%	0%
LPG	28%	28%	28%	28%	28%	28%	28%	28%	28%
solid biomass	1%	1%	1%	1%	1%	1%	1%	1%	1%
gas biomass	1%	1%	1%	1%	1%	0.7%	0.7%	0.7%	0.7%
charcoal	11%	11%	11%	11%	11%	11.3%	11.3%	11.3%	11.3%
solar thermal	24%	24%	24%	25%	25%	25.3%	25.6%	25.9%	26.2%
TJ									
diesel	645	662	676	687	699	710	721	731	741
RFO	0	0	0	0	0	0	0	0	0
LPG	520	539	555	571	586	601	616	630	645
solid biomass	15	16	16	16	17	17	18	18	19
gas biomass	12	12	13	13	14	14	14	15	15
charcoal	207	215	221	227	233	239	245	251	257
solar thermal	433	455	476	496	516	536	556	575	595
T1 - biofuels									
Gasoline (TJ)	15682	16254	16749	17209	17681	18123	18576	19003	19440
Total Diesel (TJ)	12109	12551	12933	13288	13652	13993	14343	14673	15011
Diesel (TJ)	11739	12075	12347	12588	12833	13154	13483	13793	14110
Biodiesel (TJ)	370	476	586	699	819	840	861	880	901
Biodiesel (%)	3.1%	3.8%	4.5%	5.3%	6%	6%	6%	6%	6%
I1 - F-gases									
reduction of emissions	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
A1 - Anerobic digestion									
waste management									
dairy cattle									
solid storage	95%	95%	94%	94%	93%	93%	92%	92%	91%

	2016	2017	2018	2019	2020	2021	2022	2023	2024
anaerobic digester	5%	6%	6%	7%	7%	8%	8%	9%	9%
other cattle									
solid storage	95%	95%	94%	94%	93%	93%	92%	92%	91%
anaerobic digester	5%	6%	6%	7%	7%	8%	8%	9%	9%
market swine									
anaerobic digester	50%	49%	48%	47%	46%	45%	44%	43%	42%
aerobic treatment	50%	51%	52%	53%	54%	55%	56%	57%	58%
breeding swine									
anaerobic digester	50%	49%	48%	48%	47%	46%	45%	44%	43%
aerobic treatment	50%	51%	52%	53%	53%	54%	55%	56%	57%
sheep									
solid storage	100%	100%	100%	100%	99.5%	99.0%	98.6%	98.1%	97.6%
anaerobic digester					0.5%	1.0%	1.4%	1.9%	2.4%
goats									
solid storage	100%	100%	100%	100%	99.5%	99.0%	98.6%	98.1%	97.6%
anaerobic digester					0.5%	1.0%	1.4%	1.9%	2.4%
poultry									
solid storage	85%	85%	84%	84%	83%	83%	83%	82%	82%
anaerobic digester	15%	15%	16%	16%	17%	17%	18%	18%	18%
W1 - sorting									
40% sorting at source from 2021									
MSW to disposal sites (1000t wet mass)	410	424	431	437	443	450	456	463	470
reduction of waste to landfill from 2021 due to sorting (W1)						40%	40.0%	40.0%	40.0%
W1 MSW to disposal sites (1000t wet mass)						270	274	278	282
W1 MSW to disposal sites (%)						60%	60%	60%	60%
W2 - organics to landfill									
15% of organics to landfill from 2021									
BaU waste per capita (kg)						679	684	690	697
W2 composition of waste to disposal sites									
Food						14%	14%	14%	14%
Garden						2%	2%	2%	2%

	2016	2017	2018	2019	2020	2021	2022	2023	2024
Paper						52%	52%	52%	52%
Wood						6%	6%	6%	6%
Textile						21%	21%	21%	21%
Nappies						0%	0%	0%	0%
Plastics, other inert						4%	4%	4%	4%
W2 MSW to disposal sites (%)						33%	33%	33%	33%
W3 - composting									
increase composting						5%	5.0%	5.0%	5.0%
W3 composting (1000t)						34	34	35	35
BaU Compost for backfilling (1000t)	17	20	20	21	21	21	21	21	21
W3 TOTAL composting (1000t)	17	20	20	21	21	55	55	56	56
W4 - anaerobic digestion									
increase AD to 5% in 2021 and keep constant						10%	10.0%	10.0%	10.0%
W4 AD (1000t)						67.85	68.43	69.03	69.65
W5 - biogas recovery									
biogas recovery from deep unmanaged and managed anaerobic disposal sites (%)						20%	20%	20%	20%

Table IV2. WEM scenario - activity data **(2025-2033)**

	2025	2026	2027	2028	2029	2030	2031	2032	2033
E1 - natural gas									
RES	11.5%	11.8%	12.1%	12.4%	12.7%	13%	13.7%	14.4%	15.1%
Natural gas	87.7%	87.4%	87.1%	86.8%	86.5%	86.2%	85.5%	84.8%	84.1%
HFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diesel	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY									
RES	2308	2417	2529	2643	2761	2883	3099	3322	3554
Natural gas	43981	44751	45489	46239	47001	47774	48334	48897	49463
HFO	0	0	0	0	0	0	0	0	0

	2025	2026	2027	2028	2029	2030	2031	2032	2033
Diesel	395	396	397	399	400	401	405	408	411
E2 - RES in electricity									
RES	16.5%	17.2%	17.9%	18.6%	19.3%	20%	20.7%	21.4%	22.1%
Natural gas	82.7%	82.0%	81.3%	80.6%	79.9%	79.2%	78.5%	77.8%	77.1%
HFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diesel	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY									
RES	3311	3524	3741	3965	4196	4435	4682	4937	5201
Natural gas	41473	41985	42459	42935	43414	43894	44376	44859	45345
HFO	0	0	0	0	0	0	0	0	0
Diesel	418	422	425	429	433	437	440	444	448
E3 - EE in industry									
LPG	344	351	359	366	374	382	389	397	405
Diesel	540	552	563	575	587	600	612	624	636
RFO	1206	1233	1259	1286	1313	1340	1367	1394	1422
Pet-coke	5002	5112	5220	5330	5442	5556	5668	5781	5897
Coal	26	26	27	28	28	29	29	30	31
Industrial waste (non RES) and other fuels	833	852	870	888	907	926	944	963	982
Biomass	698	713	729	744	759	775	791	807	823
E4 - EE residential new buildings									
Residential new buildings	3028	2819	2610	2401	2192	1983	1983	1983	1983
consumption with E4 (TJ)	7033	7453	7867	8286	8709	9135	9358	9585	9816
TJ									
Other kerosene	543	575	607	639	672	705	722	739	757
Diesel/gas oil	2346	2464	2577	2689	2800	2910	2962	3015	3068
LPG	1465	1552	1638	1726	1814	1903	1949	1996	2044
Solid Biomass	115	122	129	136	142	149	153	157	161
Charcoal	209	221	234	246	259	271	278	285	291
RES	2356	2519	2683	2850	3022	3197	3294	3393	3495
E5 - EE residential energy upgrade									
Residential new buildings	120	120	120	120	120	120	120	120	120

	2025	2026	2027	2028	2029	2030	2031	2032	2033
consumption with E5 (TJ)	9941	10152	10358	10567	10781	10999	11221	11448	11680
TJ									
Other kerosene	767	783	799	815	832	848	866	883	901
Diesel/gas oil	3316	3356	3393	3430	3467	3504	3552	3601	3650
LPG	2070	2114	2157	2201	2245	2291	2337	2384	2432
Solid Biomass	163	166	169	173	176	180	184	187	191
Charcoal	295	301	308	314	320	327	333	340	347
RES	3330	3431	3532	3635	3741	3850	3950	4053	4158
E6 - EE residential solar panels replacement									
Residential solar panels replacement	4	4	4	4	4	4	4	4	4
consumption with E6 (TJ)	10056	10268	10473	10683	10896	11114	11337	11564	11795
TJ									
Other kerosene	776	792	808	824	841	857	875	892	910
Diesel/gas oil	3354	3394	3430	3467	3504	3541	3589	3637	3687
LPG	2094	2138	2181	2225	2269	2315	2361	2408	2457
Solid Biomass	164	168	171	175	178	182	185	189	193
Charcoal	299	305	311	317	324	330	337	343	350
RES	3369	3471	3571	3675	3781	3890	3991	4094	4199
E7 - EE tertiary new buildings									
Tertiary new buildings reductions (TJ)	382	365	349	332	315	298	298	298	298
consumption with E7 (TJ)	1936	2002	2066	2132	2198	2265	2316	2368	2422
TJ									
diesel	636	654	670	687	704	721	738	754	771
RFO	0	0	0	0	0	0	0	0	0
LPG	550	568	586	605	624	643	657	672	687
solid biomass	16	16	17	17	18	19	19	19	20
gas biomass	13	13	14	14	14	15	15	16	16
charcoal	219	226	233	241	248	256	262	268	274
solar thermal	503	525	546	567	589	612	625	639	654
E8 - EE tertiary energy upgrade									
Tertiary buildings energy upgrade	198	198	198	198	198	198	198	198	198

	2025	2026	2027	2028	2029	2030	2031	2032	2033
consumption with E8 (TJ)	2121	2170	2217	2265	2315	2365	2416	2468	2522
TJ									
diesel	697	708	719	730	742	753	769	786	803
RFO	0	0	0	0	0	0	0	0	0
LPG	602	616	629	643	657	671	686	701	716
solid biomass	17	18	18	19	19	19	20	20	21
gas biomass	14	14	15	15	15	15	16	16	17
charcoal	240	245	250	256	262	267	273	279	285
solar thermal	551	568	585	603	620	639	652	666	681
E9 - EE in public buildings									
Public buildings	6	6	6	6	6	6	6	6	6
consumption with E9 (TJ)	2313	2362	2409	2458	2507	2557	2608	2661	2714
TJ									
diesel	760	771	782	792	803	814	831	847	864
RFO	0	0	0	0	0	0	0	0	0
LPG	657	670	684	698	712	726	740	755	770
solid biomass	19	19	20	20	21	21	21	22	22
gas biomass	15	15	16	16	16	17	17	17	18
charcoal	261	267	272	278	283	289	295	301	307
solar thermal	601	619	636	654	672	690	704	718	733
E10 - industry (alternative fuels)									
LPG	4%	4%	4%	4%	4%	4%	4%	4%	4%
Diesel	6%	6%	6%	6%	6%	6%	6%	6%	6%
RFO	14%	14%	14%	14%	14%	14%	14%	14%	14%
Pet-coke	55%	54%	54%	54%	54%	54%	53%	53%	53%
Coal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Industrial waste (non RES) and other fuels	10%	10%	10%	10%	10%	10%	10%	10%	10%
Biomass	11.0%	11.2%	11.4%	11.6%	11.8%	12%	12.2%	12.4%	12.6%
TJ									
LPG	346	353	360	367	374	382	390	397	405
Diesel	543	554	565	577	588	600	612	624	637

	2025	2026	2027	2028	2029	2030	2031	2032	2033
RFO	1214	1239	1264	1289	1315	1341	1368	1395	1423
Pet-coke	4745	4827	4905	4985	5066	5148	5231	5316	5402
Coal	26	27	27	28	28	29	29	30	31
Industrial waste (non RES) and other fuels	870	888	906	924	943	962	981	1000	1020
Biomass	957	995	1033	1072	1112	1154	1197	1240	1286
E11 - RES in residential									
RES heating and cooling	37%	37%	37%	37%	38%	38%	38%	39%	39%
WM consumption (%)									
Other kerosene	8%	8%	8%	8%	8%	8%	8%	8%	8%
Diesel/gas oil	30%	30%	30%	29%	29%	29%	28%	28%	28%
LPG	21%	21%	21%	21%	21%	21%	21%	21%	21%
Solid Biomass	2%	2%	2%	2%	2%	2%	2%	2%	2%
Charcoal	3.0%	3.0%	3.0%	3.0%	3.0%	3%	3.0%	3.0%	3.0%
RES	36.5%	36.8%	37.1%	37.4%	37.7%	38%	38.4%	38.8%	39.2%
TJ									
Other kerosene	776	792	808	824	841	858	875	892	910
Diesel/gas oil	3054	3087	3118	3148	3178	3208	3227	3245	3263
LPG	2095	2139	2182	2226	2270	2316	2362	2409	2457
Solid Biomass	165	168	171	175	178	182	185	189	193
Charcoal	299	305	311	317	324	330	337	343	350
RES	3672	3780	3887	3997	4110	4225	4355	4488	4625
E12 - RES in commercial									
RES heating and cooling	27%	27%	27%	27%	28%	28%	28%	28%	28%
WM consumption (%)									
Diesel/gas oil	32%	32%	32%	31%	31%	31%	31%	31%	31%
RFO	0%	0%	0%	0%	0%	0%	0%	0%	0%
LPG	28%	28%	28%	28%	28%	28%	28%	28%	28%
solid biomass	1%	1%	1%	1%	1%	1%	1%	1%	1%
gas biomass	0.7%	0.7%	0.7%	0.7%	0.7%	1%	0.7%	0.7%	0.7%
charcoal	11.3%	11.3%	11.3%	11.3%	11.3%	11%	11.3%	11.3%	11.3%
solar thermal	26.5%	26.8%	27.1%	27.4%	27.7%	28%	28.0%	28.0%	28.0%

	2025	2026	2027	2028	2029	2030	2031	2032	2033
TJ									
diesel	750	759	767	775	783	790	806	822	839
RFO	0	0	0	0	0	0	0	0	0
LPG	658	672	685	699	713	727	742	757	772
solid biomass	19	19	20	20	21	21	21	22	22
gas biomass	15	16	16	16	16	17	17	17	18
charcoal	262	267	273	278	284	290	295	301	307
solar thermal	614	634	654	675	696	718	732	747	761
T1 - biofuels									
Gasoline (TJ)	19848	20265	20670	21084	21505	21935	22374	22822	23278
Total Diesel (TJ)	15326	15648	15961	16280	16605	16937	17276	17622	17974
Diesel (TJ)	14406	14709	15003	15303	15609	15921	16240	16564	16896
Biodiesel (TJ)	920	939	958	977	996	1016	1037	1057	1078
Biodiesel (%)	6%	6%	6%	6%	6%	6%	6%	6%	6%
I1 - F-gases									
reduction of emissions	0.0%	0.0%	0.0%	0.0%	0.0%	5%	5.0%	5.0%	5.0%
A1 - Anerobic digestion									
waste management									
dairy cattle									
solid storage	91%	90%	90%	89%	89%	88%	88%	87%	87%
anaerobic digester	10%	10%	11%	11%	12%	12%	13%	13%	14%
other cattle									
solid storage	91%	90%	90%	89%	89%	88%	88%	87%	87%
anaerobic digester	10%	10%	11%	11%	12%	12%	13%	13%	14%
market swine									
anaerobic digester	41%	40%	39%	38%	36%	35%	34%	33%	32%
aerobic treatment	59%	60%	61%	63%	64%	65%	66%	67%	68%
breeding swine									
anaerobic digester	43%	42%	41%	40%	39%	38%	38%	37%	36%
aerobic treatment	58%	58%	59%	60%	61%	62%	63%	63%	64%
sheep									

	2025	2026	2027	2028	2029	2030	2031	2032	2033
solid storage	97.1%	96.7%	96.2%	95.7%	95.2%	94.8%	94.3%	93.8%	93.3%
anaerobic digester	2.9%	3.3%	3.8%	4.3%	4.8%	5.2%	5.7%	6.2%	6.7%
goats									
solid storage	97.1%	96.7%	96.2%	95.7%	95.2%	94.8%	94.3%	93.8%	93.3%
anaerobic digester	2.9%	3.3%	3.8%	4.3%	4.8%	5.2%	5.7%	6.2%	6.7%
poultry									
solid storage	81%	81%	80%	80%	80%	79%	79%	78%	78%
anaerobic digester	19%	19%	20%	20%	20%	21%	21%	22%	22%
W1 - sorting									
40% sorting at source from 2021									
MSW to disposal sites (1000t wet mass)	477	485	492	500	509	518	521	529	536
reduction of waste to landfill from 2021 due to sorting (W1)	40%	40.0%	40.0%	40.0%	40.0%	40%	40.0%	40.0%	40.0%
W1 MSW to disposal sites (1000t wet mass)	286	291	295	300	305	311	313	317	321
W1 MSW to disposal sites (%)	60%	60%	60%	60%	60%	60%	60%	60%	60%
W2 - organics to landfill									
15% of organics to landfill from 2021									
BaU waste per capita (kg)	703	710	717	725	734	744	746	753	761
W2 composition of waste to disposal sites									
Food	14%	14%	14%	14%	14%	14%	14%	14%	14%
Garden	2%	2%	2%	2%	2%	2%	2%	2%	2%
Paper	52%	52%	52%	52%	52%	52%	52%	52%	52%
Wood	6%	6%	6%	6%	6%	6%	6%	6%	6%
Textile	21%	21%	21%	21%	21%	21%	21%	21%	21%
Nappies	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	4%	4%	4%	4%	4%	4%	4%	4%	4%
W2 MSW to disposal sites (%)	33%	33%	33%	33%	33%	33%	33%	33%	33%
W3 - composting									
increase composting	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
W3 composting (1000t)	35	35	36	36	37	37	37	38	38
BaU Compost for backfilling (1000t)	22	22	22	22	23	23	23	23	23
W3 TOTAL composting (1000t)	57	57	58	59	59	60	60	61	61

	2025	2026	2027	2028	2029	2030	2031	2032	2033
W4 - anaerobic digestion									
increase AD to 5% in 2021 and keep constant	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
W4 AD (1000t)	70.30	70.99	71.73	72.54	73.42	74.37	74.62	75.33	76.05
W5 - biogas recovery									
biogas recovery from deep unmanaged and managed anaerobic disposal sites (%)	20%	20%	20%	20%	20%	20%	20%	20%	20%

Table IV3. WEM scenario - activity data (2034-2040)

	2034	2035	2036	2037	2038	2039	2040
E1 - natural gas							
RES	15.8%	16.5%	17.2%	17.9%	18.6%	19.3%	20%
Natural gas	83.4%	82.7%	82.0%	81.3%	80.6%	79.9%	79.2%
HFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diesel	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY							
RES	3793	4040	4295	4560	4833	5115	5406
Natural gas	50032	50605	51180	51757	52338	52921	53506
HFO	0	0	0	0	0	0	0
Diesel	415	418	422	425	429	433	437
E2 - RES in electricity							
RES	22.8%	23.5%	24.2%	24.9%	25.6%	26.3%	27%
Natural gas	76.4%	75.7%	75.0%	74.3%	73.6%	72.9%	72.2%
HFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diesel	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY							
RES	5473	5754	6044	6343	6652	6970	7299
Natural gas	45832	46320	46809	47300	47791	48283	48776
HFO	0	0	0	0	0	0	0
Diesel	452	456	461	465	469	474	478

	2034	2035	2036	2037	2038	2039	2040
E3 - EE in industry							
LPG	413	421	430	438	447	456	465
Diesel	649	662	675	689	703	717	731
RFO	1451	1480	1509	1539	1570	1602	1634
Pet-coke	6015	6135	6258	6383	6511	6641	6774
Coal	31	32	32	33	34	34	35
Industrial waste (non RES) and other fuels	1002	1022	1042	1063	1085	1106	1128
Biomass	839	856	873	891	909	927	945
E4 - EE residential new buildings							
Residential new buildings	1983	1983	1983	1983	1983	1983	1983
consumption with E4 (TJ)	10052	10293	10538	10789	11044	11305	11570
TJ							
Other kerosene	775	794	813	832	852	872	893
Diesel/gas oil	3122	3176	3230	3286	3341	3398	3454
LPG	2093	2144	2195	2247	2300	2354	2410
Solid Biomass	164	168	172	176	181	185	189
Charcoal	298	306	313	320	328	336	344
RES	3599	3705	3815	3927	4042	4160	4281
E5 - EE residential energy upgrade							
Residential new buildings	120	120	120	120	120	120	120
consumption with E5 (TJ)	11916	12156	12402	12652	12908	13168	13434
TJ							
Other kerosene	919	938	957	976	996	1016	1036
Diesel/gas oil	3700	3751	3802	3853	3905	3958	4011
LPG	2482	2532	2583	2635	2688	2742	2798
Solid Biomass	195	199	203	207	211	215	220
Charcoal	354	361	368	376	383	391	399
RES	4266	4376	4489	4605	4724	4846	4971
E6 - EE residential solar panels replacement							
Residential solar panels replacement	4	4	4	4	4	4	4
consumption with E6 (TJ)	12031	12272	12517	12768	13023	13284	13549

	2034	2035	2036	2037	2038	2039	2040
TJ							
Other kerosene	928	947	966	985	1005	1025	1045
Diesel/gas oil	3736	3786	3837	3888	3940	3992	4045
LPG	2506	2556	2607	2659	2712	2767	2822
Solid Biomass	197	201	205	209	213	217	222
Charcoal	357	364	372	379	387	394	402
RES	4307	4418	4531	4647	4766	4888	5013
E7 - EE tertiary new buildings							
Tertiary new buildings reductions (TJ)	298	298	298	298	298	298	298
consumption with E7 (TJ)	2476	2532	2588	2646	2705	2765	2826
TJ							
diesel	789	806	824	843	861	880	872
RFO	0	0	0	0	0	0	0
LPG	703	719	735	751	768	785	802
solid biomass	20	21	21	22	22	23	23
gas biomass	16	17	17	17	18	18	19
charcoal	280	286	292	299	306	312	319
solar thermal	669	684	699	714	730	747	791
E8 - EE tertiary energy upgrade							
Tertiary buildings energy upgrade	198	198	198	198	198	198	198
consumption with E8 (TJ)	2576	2632	2688	2746	2805	2865	2926
TJ							
diesel	820	838	856	874	893	912	903
RFO	0	0	0	0	0	0	0
LPG	731	747	763	779	796	813	831
solid biomass	21	22	22	22	23	23	24
gas biomass	17	17	18	18	18	19	19
charcoal	291	297	304	310	317	324	331
solar thermal	696	711	726	741	757	774	819
E9 - EE in public buildings							
Public buildings	6	6	6	6	6	6	6

	2034	2035	2036	2037	2038	2039	2040
consumption with E9 (TJ)	2768	2824	2880	2938	2997	3057	3118
TJ							
diesel	882	899	917	936	954	974	962
RFO	0	0	0	0	0	0	0
LPG	786	801	818	834	851	868	885
solid biomass	23	23	24	24	25	25	26
gas biomass	18	18	19	19	20	20	20
charcoal	313	319	325	332	339	345	352
solar thermal	747	762	778	793	809	825	873
E10 - industry (alternative fuels)							
LPG	4%	4%	4%	4%	4%	4%	4%
Diesel	6%	6%	6%	6%	6%	6%	6%
RFO	14%	14%	14%	14%	14%	14%	14%
Pet-coke	53%	53%	52%	52%	52%	52%	52%
Coal	0%	0%	0%	0%	0%	0%	0%
Industrial waste (non RES) and other fuels	10%	10%	10%	10%	10%	10%	10%
Biomass	12.8%	13.0%	13.2%	13.4%	13.6%	13.8%	14%
TJ							
LPG	413	422	430	439	447	456	466
Diesel	650	662	676	689	703	717	731
RFO	1452	1481	1510	1541	1571	1603	1635
Pet-coke	5489	5578	5668	5759	5851	5946	6041
Coal	31	32	32	33	34	34	35
Industrial waste (non RES) and other fuels	1041	1062	1083	1104	1127	1149	1172
Biomass	1332	1380	1429	1480	1532	1586	1641
E11 - RES in residential							
RES heating and cooling	40%	40%	40%	41%	41%	42%	42%
WM consumption (%)							
Other kerosene	8%	8%	8%	8%	8%	8%	8%
Diesel/gas oil	27%	27%	26%	26%	26%	25%	25%
LPG	21%	21%	21%	21%	21%	21%	21%

	2034	2035	2036	2037	2038	2039	2040
Solid Biomass	2%	2%	2%	2%	2%	2%	2%
Charcoal	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3%
RES	39.6%	40.0%	40.4%	40.8%	41.2%	41.6%	42%
TJ							
Other kerosene	928	947	966	985	1005	1025	1046
Diesel/gas oil	3280	3297	3313	3328	3342	3356	3369
LPG	2507	2557	2608	2660	2713	2767	2823
Solid Biomass	197	201	205	209	213	217	222
Charcoal	357	364	372	379	387	395	402
RES	4766	4910	5059	5211	5367	5528	5692
E12 - RES in commercial							
RES heating and cooling	28%	28%	28%	28%	28%	28%	32%
WM consumption (%)							
Diesel/gas oil	31%	31%	31%	31%	31%	31%	27%
RFO	0%	0%	0%	0%	0%	0%	0%
LPG	28%	28%	28%	28%	28%	28%	28%
solid biomass	1%	1%	1%	1%	1%	1%	1%
gas biomass	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	1%
charcoal	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11%
solar thermal	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	32%
TJ							
diesel	856	873	890	908	926	945	839
RFO	0	0	0	0	0	0	0
LPG	787	803	819	835	852	869	887
solid biomass	23	23	24	24	25	25	26
gas biomass	18	19	19	19	20	20	20
charcoal	313	320	326	333	339	346	353
solar thermal	777	792	808	824	841	858	1000
T1 - biofuels							
Gasoline (TJ)	23744	24218	24703	25197	25701	26215	26739
Total Diesel (TJ)	18334	18700	19074	19456	19845	20242	20647

	2034	2035	2036	2037	2038	2039	2040
Diesel (TJ)	17234	17578	17930	18288	18654	19027	19408
Biodiesel (TJ)	1100	1122	1144	1167	1191	1215	1239
Biodiesel (%)	6%	6%	6%	6%	6%	6%	6%
I1 - F-gases							
reduction of emissions	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	10%
A1 - Anerobic digestion							
waste management							
dairy cattle							
solid storage	86%	86%	85%	85%	84%	84%	83%
anaerobic digester	14%	15%	15%	16%	16%	17%	17%
other cattle							
solid storage	86%	86%	85%	85%	84%	84%	83%
anaerobic digester	14%	15%	15%	16%	16%	17%	17%
market swine							
anaerobic digester	31%	30%	29%	28%	27%	26%	25%
aerobic treatment	69%	70%	71%	72%	73%	74%	75%
breeding swine							
anaerobic digester	35%	34%	33%	32%	32%	31%	30%
aerobic treatment	65%	66%	67%	67%	68%	69%	70%
sheep							
solid storage	92.9%	92.4%	91.9%	91.4%	91.0%	90.5%	90%
anaerobic digester	7.1%	7.6%	8.1%	8.6%	9.0%	9.5%	10%
goats							
solid storage	92.9%	92.4%	91.9%	91.4%	91.0%	90.5%	90%
anaerobic digester	7.1%	7.6%	8.1%	8.6%	9.0%	9.5%	10%
poultry							
solid storage	78%	77%	77%	76%	76%	75%	75%
anaerobic digester	23%	23%	23%	24%	24%	25%	25%
W1 - sorting							
40% sorting at source from 2021							
MSW to disposal sites (1000t wet mass)	543	550	557	564	571	578	585

	2034	2035	2036	2037	2038	2039	2040
reduction of waste to landfill from 2021 due to sorting (W1)	40.0%	40%	40%	40%	40%	40%	40%
W1 MSW to disposal sites (1000t wet mass)	326	330	334	338	343	347	351
W1 MSW to disposal sites (%)	60%	60%	60%	60%	60%	60%	60%
W2 - organics to landfill							
15% of organics to landfill from 2021							
BaU waste per capita (kg)	768	775	783	790	797	805	812
W2 composition of waste to disposal sites							
Food	14%	14%	14%	14%	14%	14%	14%
Garden	2%	2%	2%	2%	2%	2%	2%
Paper	52%	52%	52%	52%	52%	52%	52%
Wood	6%	6%	6%	6%	6%	6%	6%
Textile	21%	21%	21%	21%	21%	21%	21%
Nappies	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	4%	4%	4%	4%	4%	4%	4%
W2 MSW to disposal sites (%)	33%	33%	33%	33%	33%	33%	33%
W3 - composting							
increase composting	5.0%	5%	5%	5%	5%	5%	5%
W3 composting (1000t)	38	39	39	39	40	40	41
BaU Compost for backfilling (1000t)	24	24	24	24	25	25	25
W3 TOTAL composting (1000t)	62	63	63	64	64	65	66
W4 - anaerobic digestion							
increase AD to 5% in 2021 and keep constant	10.0%	10%	10%	10%	10%	10%	10%
W4 AD (1000t)	76.78	77.52	78.25	78.99	79.73	80.46	81.20
W5 - biogas recovery							
biogas recovery from deep unmanaged and managed anaerobic disposal sites (%)	20%	20%	20%	20%	20%	20%	20%

Annex III: WAM scenario - activity data

Table V1. WAM scenario - activity data (2016-2024)

	2016	2017	2018	2019	2020	2021	2022	2023	2024
E1 - natural gas									
RES (BaU)	9.7%	9.8%	9.8%	9.9%	10%	10.3%	10.6%	10.9%	11.2%
Natural gas	0.0%	0.0%	0.0%	0.0%	0.0%	88.9%	88.6%	88.3%	88.0%
HFO	76.4%	76.3%	76.2%	76.2%	76.1%	0.0%	0.0%	0.0%	0.0%
Diesel	13.9%	13.9%	13.9%	13.9%	13.9%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY									
RES	1535	1604	1666	1726	1787	1887	1991	2094	2201
Natural gas	0	0	0	0	0	40707	41584	42396	43224
HFO	35877	35757	35751	35745	35739	0	0	0	0
Diesel	6406	6526	6532	6538	6544	389	391	392	393
E2 - RES in electricity									
RES	9.7%	11.3%	12.8%	14.4%	16%	17.1%	18.2%	19.3%	20.4%
Natural gas	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	78.8%
HFO	76.4%	74.8%	73.2%	71.7%	70.1%	69.0%	67.9%	66.8%	0.0%
Diesel	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	0.8%
WM (TJ) PRIMARY									
RES	1535	1851	2174	2509	2860	3133	3418	3708	4009
Natural gas	0	0	0	0	0	0	0	0	38704
HFO	35877	35646	35526	35401	35272	35179	35083	34985	0
Diesel	6406	6637	6757	6882	7011	7104	7200	7298	439
E3 - EE in industry									
EE reduction in industry (existing companies)	102	100	99	98	97	97	97	97	97
consumption with E3 (TJ)	6773	7025	7243	7445	7653	7847	8046	8233	8425
TJ									
LPG	269	279	288	296	304	312	320	327	335
Diesel	423	438	452	465	478	490	502	514	526
RFO	945	980	1010	1038	1068	1095	1122	1148	1175
Pet-coke	3917	4063	4189	4306	4426	4538	4653	4761	4872
Coal	20	21	22	22	23	23	24	25	25

	2016	2017	2018	2019	2020	2021	2022	2023	2024
Industrial waste (non RES) and other fuels	652	677	698	717	737	756	775	793	812
Biomass	547	567	585	601	618	633	649	664	680
E4 - EE residential new buildings									
Residential new buildings	4073	4073	4073	4073	4073	4073	4073	4073	4073
consumption with E4 (TJ)	3876	4166	4417	4650	4889	5113	5343	5559	5781
TJ									
Other kerosene	299	321	341	359	377	394	412	429	446
Diesel/gas oil	1363	1462	1546	1624	1704	1767	1830	1888	1946
LPG	807	868	920	968	1018	1065	1113	1158	1204
Solid Biomass	63	68	72	76	80	84	87	91	95
Charcoal	115	124	131	138	145	152	159	165	172
RES	1229	1324	1407	1484	1565	1652	1742	1829	1919
E5 - EE residential energy upgrade									
Residential new buildings	120	120	120	120	120	120	120	120	120
consumption with E5 (TJ)	7829	8119	8370	8603	8842	9066	9296	9513	9734
TJ									
Other kerosene	604	626	646	664	682	699	717	734	751
Diesel/gas oil	2753	2849	2930	3005	3082	3133	3184	3230	3276
LPG	1631	1691	1743	1792	1842	1888	1936	1981	2027
Solid Biomass	128	133	137	141	145	148	152	156	159
Charcoal	232	241	249	255	263	269	276	282	289
RES	2481	2580	2666	2746	2830	2928	3030	3130	3232
E6 - EE residential solar panels replacement									
Residential solar panels replacement	4	4	4	4	4	4	4	4	4
consumption with E6 (TJ)	7945	8235	8486	8719	8958	9182	9411	9628	9850
TJ									
Other kerosene	613	635	655	673	691	708	726	743	760
Diesel/gas oil	2794	2889	2971	3046	3122	3173	3224	3269	3315
LPG	1655	1715	1767	1816	1866	1912	1960	2005	2051
Solid Biomass	130	135	139	143	146	150	154	157	161
Charcoal	236	244	252	259	266	273	279	286	292

	2016	2017	2018	2019	2020	2021	2022	2023	2024
RES	2518	2616	2702	2783	2866	2966	3068	3168	3270
E7 - EE tertiary new buildings									
Tertiary new buildings	467	467	467	467	467	467	467	467	467
consumption with E7 (TJ)	1365	1432	1490	1544	1599	1650	1703	1753	1804
TJ									
diesel	640	658	672	685	697	710	724	736	749
RFO	0	0	0	0	0	0	0	0	0
LPG	516	535	553	568	585	599	614	629	643
solid biomass	15	15	16	16	17	17	18	18	19
gas biomass	12	12	13	13	13	14	14	15	15
charcoal	205	213	220	226	233	239	245	250	256
solar thermal	430	452	473	494	515	532	550	567	585
E8 - EE tertiary energy upgrade									
Tertiary buildings energy upgrade	198	198	198	198	198	198	198	198	198
consumption with E8 (TJ)	1634	1701	1759	1813	1868	1919	1972	2022	2073
TJ									
diesel	575	593	607	620	632	646	660	672	685
RFO	0	0	0	0	0	0	0	0	0
LPG	464	483	499	514	530	545	560	574	588
solid biomass	13	14	14	15	15	16	16	17	17
gas biomass	11	11	12	12	12	13	13	13	14
charcoal	185	192	199	205	211	217	223	228	234
solar thermal	386	408	428	447	467	484	501	518	535
E9 - EE in public buildings									
Public buildings	14	12	10	8	6	6	6	6	6
consumption with E9 (TJ)	1818	1887	1947	2003	2060	2112	2165	2215	2266
TJ									
diesel	640	658	672	685	697	710	724	736	749
RFO	0	0	0	0	0	0	0	0	0
LPG	516	535	553	568	585	599	614	629	643
solid biomass	15	15	16	16	17	17	18	18	19

	2016	2017	2018	2019	2020	2021	2022	2023	2024
gas biomass	12	12	13	13	13	14	14	15	15
charcoal	205	213	220	226	233	239	245	250	256
solar thermal	430	452	473	494	515	532	550	567	585
E10 - industry (alternative fuels)									
LPG	4%	4%	4%	4%	4%	4%	4%	4%	4%
Diesel	6%	6%	6%	6%	6%	6%	6%	6%	6%
RFO	14%	14%	14%	14%	14%	14%	14%	14%	14%
Pet-coke	58%	57%	57%	56%	56%	55%	55%	54%	54%
Coal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Industrial waste (non RES) and other fuels	10%	10%	10%	10%	10%	10%	10%	10%	10%
Biomass	8%	9%	9%	10%	10%	10.5%	11.0%	11.5%	12.0%
TJ									
LPG	273	283	292	300	308	316	323	331	338
Diesel	429	445	458	471	484	496	508	520	532
RFO	959	994	1024	1052	1081	1108	1136	1162	1189
Pet-coke	3976	4086	4175	4253	4304	4372	4441	4501	4562
Coal	21	21	22	23	23	24	24	25	25
Industrial waste (non RES) and other fuels	662	686	707	727	775	794	814	833	852
Biomass	555	609	663	718	775	834	896	958	1023
E11									
RES heating and cooling	31%	32%	33%	34%	35%	36%	36%	37%	37%
WM consumption (%)									
Other kerosene	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%
Diesel/gas oil	35.2%	34.9%	33.9%	32.9%	31.9%	31.4%	30.9%	30.4%	29.9%
LPG	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%
Solid Biomass	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%
Charcoal	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
RES	31.7%	32.0%	33.0%	34.0%	35.0%	35.5%	36.0%	36.5%	37.0%
TJ									
Other kerosene	613	636	655	673	691	709	726	743	760
Diesel/gas oil	2795	2872	2874	2866	2855	2880	2905	2924	2942

	2016	2017	2018	2019	2020	2021	2022	2023	2024
LPG	1656	1716	1768	1817	1866	1913	1961	2006	2052
Solid Biomass	130	135	139	143	147	150	154	158	161
Charcoal	236	245	252	259	266	273	280	286	293
RES	2519	2636	2802	2966	3137	3261	3390	3516	3646
E12									
RES heating and cooling	21%	22%	23%	24%	25%	26%	26%	27%	27%
WM consumption (%)									
Diesel/gas oil	35.2%	34.9%	34.5%	34.2%	33.8%	33.3%	32.8%	32.3%	31.8%
RFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
LPG	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%
solid biomass	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
gas biomass	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
charcoal	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%
solar thermal	23.6%	24.0%	24.3%	24.7%	25.0%	25.5%	26.0%	26.5%	27.0%
TJ									
diesel	645	662	676	687	699	706	713	718	723
RFO	0	0	0	0	0	0	0	0	0
LPG	520	539	555	571	586	601	616	630	645
solid biomass	15	16	16	16	17	17	18	18	19
gas biomass	12	12	13	13	14	14	14	15	15
charcoal	207	215	221	227	233	239	245	251	257
solar thermal	433	455	476	496	516	540	564	588	613
Transport - T1 (biofuels)									
Gasoline (TJ)	15682	16254	16749	17209	17681	18123	18576	19003	19440
Total Diesel (TJ)	12109	12551	12933	13288	13652	13993	14343	14673	15011
Diesel (TJ)	11739	12075	12347	12588	12833	13098	13368	13617	13870
Biodiesel (TJ)	370	476	586	699	819	896	975	1056	1141
Biodiesel (%)	3.1%	3.8%	4.5%	5.3%	6%	6%	7%	7%	8%
Transport - T4 (RES)									
Gasoline	56%	56%	56%	56%	56%	56%	55%	55%	54%
Diesel	42%	42%	42%	41%	41%	40%	40%	39%	39%

	2016	2017	2018	2019	2020	2021	2022	2023	2024
Biodiesel	1%	2%	2%	2%	3%	3%	3%	3%	3%
RES	0%	0%	0%	0%	0.9%	1.8%	2.7%	3.6%	4.5%
TJ									
Gasoline (TJ)	15682	16254	16749	17209	17538	17831	18127	18391	18657
Diesel (TJ)	11739	12075	12347	12588	12690	12862	13034	13180	13327
Biodiesel (TJ)	370	476	586	699	819	840	861	880	901
Industrial - I1 (F-gases)									
reduction of emissions	0%	0%	0%	0%	5%	5.0%	5.0%	5.0%	5.0%
Agriculture - A1 (Anerobic digestion)									
waste management									
dairy cattle									
solid storage	95%	94%	94%	93%	92%	91%	91%	90%	89%
anaerobic digester	5%	6%	7%	7%	8%	9%	10%	10%	11%
other cattle									
solid storage	95%	94%	94%	93%	92%	91%	91%	90%	89%
anaerobic digester	5%	6%	7%	7%	8%	9%	10%	10%	11%
market swine									
anaerobic digester	50%	49%	48%	46%	45%	44%	43%	41%	40%
aerobic treatment	50%	51%	53%	54%	55%	56%	58%	59%	60%
breeding swine									
anaerobic digester	50%	49%	48%	46%	45%	44%	43%	41%	40%
aerobic treatment	50%	51%	53%	54%	55%	56%	58%	59%	60%
sheep									
solid storage	100%	100%	100%	100%	99.0%	98.1%	97.1%	96.2%	95.2%
anaerobic digester					1.0%	1.9%	2.9%	3.8%	4.8%
goats									
solid storage	100%	100%	100%	100%	99.0%	98.1%	97.1%	96.2%	95.2%
anaerobic digester					1.0%	1.9%	2.9%	3.8%	4.8%
poultry									
solid storage	85%	85%	85%	84%	84%	84%	84%	84%	83%
anaerobic digester	15%	15%	15%	16%	16%	16%	16%	16%	17%

	2016	2017	2018	2019	2020	2021	2022	2023	2024
Waste - W1 (sorting)									
40% sorting at source from 2021									
MSW to disposal sites (1000t wet mass)	10807	10807	10807	10807	10807	10807	10807	10807	10807
reduction of waste to landfill from 2021 due to sorting (W1)						40%	43.8%	47.5%	51.3%
W1 MSW to disposal sites (1000t wet mass)						6484	6079	5674	5268
W1 MSW to disposal sites (%)						60%	56%	53%	49%
Waste - W2 (organics to landfill)									
15% of organics to landfill from 2021; 10% in 2035									
BaU waste per capita (kg)						679	684	690	697
W2 composition of waste to disposal sites									
Food						14%	14%	14%	13%
Garden						2%	2%	2%	2%
Paper						52%	52%	53%	53%
Wood						6%	6%	6%	6%
Textile						21%	21%	21%	21%
Nappies						0%	0%	0%	0%
Plastics, other inert						4%	4%	4%	4%
W2 MSW to disposal sites (%)						33%	33%	33%	33%
Waste - W3 (composting)									
increase composting						5%	5.4%	5.7%	6.1%
W3 composting (1000t)						34	37	39	42
BaU Compost for backfilling (1000t)	17	20	20	21	21	21	21	21	21
W3 TOTAL composting (1000t)	17	20	20	21	21	55	58	61	64
Waste - W4 (anaerobic digestion)									
increase AD to 5% in 2021 and keep constant						10%	12.1%	14.3%	16.4%
W4 AD (1000t)						67.85	83.09	98.62	114.43
Waste - W5 (biogas recovery)									
biogas recovery from deep unmanaged and managed anaerobic disposal sites (%)						30%	30%	30%	30%

Table V2. WAM scenario - activity data (2025-2033)

	2025	2026	2027	2028	2029	2030	2031	2032	2033
E1 - natural gas									
RES (BaU)	11.5%	11.8%	12.1%	12.4%	12.7%	13%	13.7%	14.4%	15.1%
Natural gas	87.7%	87.4%	87.1%	86.8%	86.5%	86.2%	85.5%	84.8%	84.1%
HFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diesel	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY									
RES	2308	2417	2529	2643	2761	2883	3099	3322	3554
Natural gas	43981	44751	45489	46239	47001	47774	48334	48897	49463
HFO	0	0	0	0	0	0	0	0	0
Diesel	395	396	397	399	400	401	405	408	411
E2 - RES in electricity									
RES	21.5%	22.6%	23.7%	24.8%	25.9%	27%	27.8%	28.6%	29.4%
Natural gas	77.7%	76.6%	75.5%	74.4%	73.3%	72.2%	71.4%	70.6%	69.8%
HFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diesel	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY									
RES	4314	4630	4953	5286	5631	5987	6288	6599	6919
Natural gas	38964	39219	39429	39631	39826	40013	40361	40707	41050
HFO	0	0	0	0	0	0	0	0	0
Diesel	445	451	458	464	471	478	484	489	495
E3 - EE in industry									
EE reduction in industry (existing companies)	97	97	97	97	97	97	97	97	97
consumption with E3 (TJ)	8603	8786	8964	9145	9330	9518	9711	9907	10107
TJ									
LPG	342	349	356	363	371	378	386	394	401
Diesel	537	548	559	571	582	594	606	618	631
RFO	1200	1226	1250	1276	1301	1328	1354	1382	1410
Pet-coke	4976	5081	5184	5289	5396	5505	5616	5730	5845
Coal	26	26	27	27	28	28	29	30	30

	2025	2026	2027	2028	2029	2030	2031	2032	2033
Industrial waste (non RES) and other fuels	829	846	864	881	899	917	936	954	974
Biomass	694	709	723	738	753	768	784	800	816
E4 - EE residential new buildings									
Residential new buildings	4073	4073	4073	4073	4073	4073	4073	4073	4073
consumption with E4 (TJ)	5988	6199	6405	6614	6828	7046	7268	7495	7726
TJ									
Other kerosene	462	478	494	510	527	544	561	578	596
Diesel/gas oil	1997	2049	2098	2147	2195	2244	2301	2358	2415
LPG	1247	1291	1334	1377	1422	1467	1514	1561	1609
Solid Biomass	98	101	105	108	112	115	119	123	126
Charcoal	178	184	190	196	203	209	216	223	229
RES	2006	2095	2184	2275	2369	2466	2558	2653	2751
E5 - EE residential energy upgrade									
Residential new buildings	120	120	120	120	120	120	120	120	120
consumption with E5 (TJ)	9941	10152	10358	10567	10781	10999	11221	11448	11680
TJ									
Other kerosene	767	783	799	815	832	848	866	883	901
Diesel/gas oil	3316	3356	3393	3430	3467	3504	3552	3601	3650
LPG	2070	2114	2157	2201	2245	2291	2337	2384	2432
Solid Biomass	163	166	169	173	176	180	184	187	191
Charcoal	295	301	308	314	320	327	333	340	347
RES	3330	3431	3532	3635	3741	3850	3950	4053	4158
E6 - EE residential solar panels replacement									
Residential solar panels replacement	4	4	4	4	4	4	4	4	4
consumption with E6 (TJ)	10056	10268	10473	10683	10896	11114	11337	11564	11795
TJ									
Other kerosene	776	792	808	824	841	857	875	892	910
Diesel/gas oil	3354	3394	3430	3467	3504	3541	3589	3637	3687
LPG	2094	2138	2181	2225	2269	2315	2361	2408	2457
Solid Biomass	164	168	171	175	178	182	185	189	193
Charcoal	299	305	311	317	324	330	337	343	350

	2025	2026	2027	2028	2029	2030	2031	2032	2033
RES	3369	3471	3571	3675	3781	3890	3991	4094	4199
E7 - EE tertiary new buildings									
Tertiary new buildings	467	467	467	467	467	467	467	467	467
consumption with E7 (TJ)	1852	1901	1948	1996	2045	2096	2147	2199	2253
TJ									
diesel	760	771	782	792	803	814	831	847	864
RFO	0	0	0	0	0	0	0	0	0
LPG	657	670	684	698	712	726	740	755	770
solid biomass	19	19	20	20	21	21	21	22	22
gas biomass	15	15	16	16	16	17	17	17	18
charcoal	261	267	272	278	283	289	295	301	307
solar thermal	601	619	636	654	672	690	704	718	733
E8 - EE tertiary energy upgrade									
Tertiary buildings energy upgrade	198	198	198	198	198	198	198	198	198
consumption with E8 (TJ)	2121	2170	2217	2265	2315	2365	2416	2468	2522
TJ									
diesel	697	708	719	730	742	753	769	786	803
RFO	0	0	0	0	0	0	0	0	0
LPG	602	616	629	643	657	671	686	701	716
solid biomass	17	18	18	19	19	19	20	20	21
gas biomass	14	14	15	15	15	15	16	16	17
charcoal	240	245	250	256	262	267	273	279	285
solar thermal	551	568	585	603	620	639	652	666	681
E9 - EE in public buildings									
Public buildings	6	6	6	6	6	6	6	6	6
consumption with E9 (TJ)	2313	2362	2409	2458	2507	2557	2608	2661	2714
TJ									
diesel	760	771	782	792	803	814	831	847	864
RFO	0	0	0	0	0	0	0	0	0
LPG	657	670	684	698	712	726	740	755	770
solid biomass	19	19	20	20	21	21	21	22	22

	2025	2026	2027	2028	2029	2030	2031	2032	2033
gas biomass	15	15	16	16	16	17	17	17	18
charcoal	261	267	272	278	283	289	295	301	307
solar thermal	601	619	636	654	672	690	704	718	733
E10 - industry (alternative fuels)									
LPG	4%	4%	4%	4%	4%	4%	4%	4%	4%
Diesel	6%	6%	6%	6%	6%	6%	6%	6%	6%
RFO	14%	14%	14%	14%	14%	14%	14%	14%	14%
Pet-coke	53%	53%	52%	52%	51%	51%	50%	50%	49%
Coal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Industrial waste (non RES) and other fuels	10%	10%	10%	10%	10%	10%	10%	10%	10%
Biomass	12.5%	13.0%	13.5%	14.0%	14.5%	15%	15.5%	16.0%	16.5%
TJ									
LPG	346	353	360	367	374	382	390	397	405
Diesel	543	554	565	577	588	600	612	624	637
RFO	1214	1239	1264	1289	1315	1341	1368	1395	1423
Pet-coke	4615	4667	4715	4763	4811	4860	4908	4956	5004
Coal	26	27	27	28	28	29	29	30	31
Industrial waste (non RES) and other fuels	870	888	906	924	943	962	981	1000	1020
Biomass	1088	1155	1223	1294	1367	1442	1520	1601	1684
E11									
RES heating and cooling	38%	38%	39%	39%	40%	40%	40.5%	41.0%	41.5%
WM consumption (%)									
Other kerosene	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%
Diesel/gas oil	29.4%	28.9%	28.4%	27.9%	27.4%	26.9%	26.4%	25.9%	25.4%
LPG	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%
Solid Biomass	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%
Charcoal	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
RES	37.5%	38.0%	38.5%	39.0%	39.5%	40.0%	40.5%	41.0%	41.5%
TJ									
Other kerosene	776	792	808	824	841	858	875	892	910
Diesel/gas oil	2953	2964	2971	2977	2982	2986	2989	2991	2992

	2025	2026	2027	2028	2029	2030	2031	2032	2033
LPG	2095	2139	2182	2226	2270	2316	2362	2409	2457
Solid Biomass	165	168	171	175	178	182	185	189	193
Charcoal	299	305	311	317	324	330	337	343	350
RES	3773	3903	4034	4168	4306	4447	4593	4743	4897
E12									
RES heating and cooling	28%	28%	29%	29%	30%	30%	30%	30%	30%
WM consumption (%)									
Diesel/gas oil	31.3%	30.8%	30.3%	29.8%	29.3%	28.8%	28.8%	28.8%	28.8%
RFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
LPG	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%
solid biomass	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
gas biomass	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
charcoal	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%
solar thermal	27.5%	28.0%	28.5%	29.0%	29.5%	30.0%	30.0%	30.0%	30.0%
TJ									
diesel	727	730	733	735	737	739	754	769	784
RFO	0	0	0	0	0	0	0	0	0
LPG	658	672	685	699	713	727	742	757	772
solid biomass	19	19	20	20	21	21	21	22	22
gas biomass	15	16	16	16	16	17	17	17	18
charcoal	262	267	273	278	284	290	295	301	307
solar thermal	638	663	688	714	741	769	784	800	816
Transport - T1 (biofuels)									
Gasoline (TJ)	19848	20265	20670	21084	21505	21935	22374	22822	23278
Total Diesel (TJ)	15326	15648	15961	16280	16605	16937	17276	17622	17974
Diesel (TJ)	14100	14333	14556	14782	15011	15244	15549	15860	16177
Biodiesel (TJ)	1226	1314	1405	1498	1594	1694	1728	1762	1797
Biodiesel (%)	8%	8%	9%	9%	10%	10%	10%	10%	10%
Transport - T4 (RES)									
Gasoline	54%	53%	53%	52%	52%	51%	51%	51%	51%
Diesel	38%	38%	37%	37%	36%	36%	36%	36%	36%

	2025	2026	2027	2028	2029	2030	2031	2032	2033
Biodiesel	3%	3%	3%	3%	3%	3%	3%	3%	3%
RES	5.5%	6.4%	7.3%	8.2%	9.1%	10%	10.0%	10.0%	10.0%
TJ									
Gasoline (TJ)	18889	19122	19338	19555	19773	19992	20392	20799	21215
Diesel (TJ)	13447	13566	13671	13774	13877	13978	14257	14542	14833
Biodiesel (TJ)	920	939	958	977	996	1016	1037	1057	1078
Industrial - I1 (F-gases)									
reduction of emissions	5.0%	5.0%	5.0%	5.0%	5.0%	10%	10.0%	10.0%	10.0%
Agriculture - A1 (Anerobic digestion)									
waste management									
dairy cattle									
solid storage	88%	88%	87%	86%	85%	85%	84%	83%	82%
anaerobic digester	12%	13%	13%	14%	15%	16%	16%	17%	18%
other cattle									
solid storage	88%	88%	87%	86%	85%	85%	84%	83%	82%
anaerobic digester	12%	13%	13%	14%	15%	16%	16%	17%	18%
market swine									
anaerobic digester	39%	38%	36%	35%	34%	33%	31%	30%	29%
aerobic treatment	61%	63%	64%	65%	66%	67%	69%	70%	71%
breeding swine									
anaerobic digester	39%	38%	36%	35%	34%	33%	31%	30%	29%
aerobic treatment	61%	63%	64%	65%	66%	67%	69%	70%	71%
sheep									
solid storage	94.3%	93.3%	92.4%	91.4%	90.5%	89.5%	88.6%	87.6%	86.7%
anaerobic digester	5.7%	6.7%	7.6%	8.6%	9.5%	10.5%	11.4%	12.4%	13.3%
goats									
solid storage	94.3%	93.3%	92.4%	91.4%	90.5%	89.5%	88.6%	87.6%	86.7%
anaerobic digester	5.7%	6.7%	7.6%	8.6%	9.5%	10.5%	11.4%	12.4%	13.3%
poultry									
solid storage	83%	83%	83%	83%	82%	82%	82%	82%	81%
anaerobic digester	17%	17%	17%	18%	18%	18%	18%	18%	19%

	2025	2026	2027	2028	2029	2030	2031	2032	2033
Waste - W1 (sorting)									
40% sorting at source from 2021									
MSW to disposal sites (1000t wet mass)	10807	10807	10807	10807	10807	10807	10807	10807	10807
reduction of waste to landfill from 2021 due to sorting (W1)	55%	56.0%	57.0%	58.0%	59.0%	60%	61.0%	62.0%	63.0%
W1 MSW to disposal sites (1000t wet mass)	4863	4755	4647	4539	4431	4323	4215	4107	3999
W1 MSW to disposal sites (%)	45%	44%	43%	42%	41%	40%	39%	38%	37%
Waste - W2 (organics to landfill)									
15% of organics to landfill from 2021; 10% in 2035									
BaU waste per capita (kg)	703	710	717	725	734	744	746	753	761
W2 composition of waste to disposal sites									
Food	13%	13%	12%	12%	12%	12%	11%	11%	11%
Garden	2%	2%	2%	2%	2%	2%	2%	2%	2%
Paper	53%	53%	53%	54%	54%	54%	54%	55%	55%
Wood	6%	6%	6%	6%	6%	6%	6%	6%	6%
Textile	22%	22%	22%	22%	22%	22%	22%	22%	22%
Nappies	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	4%	4%	4%	4%	4%	4%	4%	4%	4%
W2 MSW to disposal sites (%)	33%	33%	33%	33%	33%	33%	33%	33%	33%
Waste - W3 (composting)									
increase composting	6.4%	6.8%	7.1%	7.5%	7.9%	8.2%	8.6%	8.9%	9.3%
W3 composting (1000t)	45	48	51	54	58	61	64	67	71
BaU Compost for backfilling (1000t)	22	22	22	22	23	23	23	23	23
W3 TOTAL composting (1000t)	67	70	73	77	80	84	87	90	94
Waste - W4 (anaerobic digestion)									
increase AD to 5% in 2021 and keep constant	18.6%	20.7%	22.9%	25.0%	27.1%	29.3%	31.4%	33.6%	35.7%
W4 AD (1000t)	130.55	147.05	163.94	181.34	199.27	217.80	234.51	252.90	271.62
Waste - W5 (biogas recovery)									
biogas recovery from deep unmanaged and managed anaerobic disposal sites (%)	30%	30%	30%	30%	30%	30%	30%	30%	30%

Table V3. WAM scenario - activity data (2034-2040)

	2034	2035	2036	2037	2038	2039	2040
E1 - natural gas							
RES (BaU)	15.8%	16.5%	17.2%	17.9%	18.6%	19.3%	20%
Natural gas	83.4%	82.7%	82.0%	81.3%	80.6%	79.9%	79.2%
HFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diesel	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY							
RES	3793	4040	4295	4560	4833	5115	5406
Natural gas	50032	50605	51180	51757	52338	52921	53506
HFO	0	0	0	0	0	0	0
Diesel	415	418	422	425	429	433	437
E2 - RES in electricity							
RES	30.2%	31.0%	31.8%	32.6%	33.4%	34.2%	35%
Natural gas	69.0%	68.2%	67.4%	66.6%	65.8%	65.0%	64.2%
HFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Diesel	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
WM (TJ) PRIMARY							
RES	7249	7590	7942	8304	8678	9064	9461
Natural gas	41391	41729	42064	42396	42724	43049	43369
HFO	0	0	0	0	0	0	0
Diesel	500	506	512	518	524	531	537
E3 - EE in industry							
EE reduction in industry (existing companies)	97	97	97	97	97	97	97
consumption with E3 (TJ)	10311	10519	10732	10948	11169	11394	11624
TJ							
LPG	410	418	426	435	444	453	462
Diesel	643	656	670	683	697	711	725
RFO	1438	1467	1497	1527	1558	1589	1621
Pet-coke	5963	6084	6207	6332	6460	6590	6723
Coal	31	31	32	33	33	34	35

	2034	2035	2036	2037	2038	2039	2040
Industrial waste (non RES) and other fuels	993	1013	1034	1055	1076	1098	1120
Biomass	832	849	866	884	901	920	938
E4 - EE residential new buildings							
Residential new buildings	4073	4073	4073	4073	4073	4073	4073
consumption with E4 (TJ)	7962	8203	8449	8699	8955	9215	9481
TJ							
Other kerosene	614	633	652	671	691	711	731
Diesel/gas oil	2473	2531	2590	2649	2709	2770	2830
LPG	1658	1708	1760	1812	1865	1919	1975
Solid Biomass	130	134	138	142	146	151	155
Charcoal	236	244	251	258	266	274	281
RES	2851	2953	3058	3166	3277	3391	3508
E5 - EE residential energy upgrade							
Residential new buildings	120	120	120	120	120	120	120
consumption with E5 (TJ)	11916	12156	12402	12652	12908	13168	13434
TJ							
Other kerosene	919	938	957	976	996	1016	1036
Diesel/gas oil	3700	3751	3802	3853	3905	3958	4011
LPG	2482	2532	2583	2635	2688	2742	2798
Solid Biomass	195	199	203	207	211	215	220
Charcoal	354	361	368	376	383	391	399
RES	4266	4376	4489	4605	4724	4846	4971
E6 - EE residential solar panels replacement							
Residential solar panels replacement	4	4	4	4	4	4	4
consumption with E6 (TJ)	12031	12272	12517	12768	13023	13284	13549
TJ							
Other kerosene	928	947	966	985	1005	1025	1045
Diesel/gas oil	3736	3786	3837	3888	3940	3992	4045
LPG	2506	2556	2607	2659	2712	2767	2822
Solid Biomass	197	201	205	209	213	217	222
Charcoal	357	364	372	379	387	394	402

	2034	2035	2036	2037	2038	2039	2040
RES	4307	4418	4531	4647	4766	4888	5013
E7 - EE tertiary new buildings							
Tertiary new buildings	467	467	467	467	467	467	467
consumption with E7 (TJ)	2307	2362	2419	2477	2536	2596	2657
TJ							
diesel	882	899	917	936	954	974	962
RFO	0	0	0	0	0	0	0
LPG	786	801	818	834	851	868	885
solid biomass	23	23	24	24	25	25	26
gas biomass	18	18	19	19	20	20	20
charcoal	313	319	325	332	339	345	352
solar thermal	747	762	778	793	809	825	873
E8 - EE tertiary energy upgrade							
Tertiary buildings energy upgrade	198	198	198	198	198	198	198
consumption with E8 (TJ)	2576	2632	2688	2746	2805	2865	2926
TJ							
diesel	820	838	856	874	893	912	903
RFO	0	0	0	0	0	0	0
LPG	731	747	763	779	796	813	831
solid biomass	21	22	22	22	23	23	24
gas biomass	17	17	18	18	18	19	19
charcoal	291	297	304	310	317	324	331
solar thermal	696	711	726	741	757	774	819
E9 - EE in public buildings							
Public buildings	6	6	6	6	6	6	6
consumption with E9 (TJ)	2768	2824	2880	2938	2997	3057	3118
TJ							
diesel	882	899	917	936	954	974	962
RFO	0	0	0	0	0	0	0
LPG	786	801	818	834	851	868	885
solid biomass	23	23	24	24	25	25	26

	2034	2035	2036	2037	2038	2039	2040
gas biomass	18	18	19	19	20	20	20
charcoal	313	319	325	332	339	345	352
solar thermal	747	762	778	793	809	825	873
E10 - industry (alternative fuels)							
LPG	4%	4%	4%	4%	4%	4%	4%
Diesel	6%	6%	6%	6%	6%	6%	6%
RFO	14%	14%	14%	14%	14%	14%	14%
Pet-coke	49%	48%	48%	47%	47%	46%	46%
Coal	0%	0%	0%	0%	0%	0%	0%
Industrial waste (non RES) and other fuels	10%	10%	10%	10%	10%	10%	10%
Biomass	17.0%	17.5%	18.0%	18.5%	19.0%	19.5%	20%
TJ							
LPG	413	422	430	439	447	456	466
Diesel	650	662	676	689	703	717	731
RFO	1452	1481	1510	1541	1571	1603	1635
Pet-coke	5052	5100	5148	5196	5243	5291	5338
Coal	31	32	32	33	34	34	35
Industrial waste (non RES) and other fuels	1041	1062	1083	1104	1127	1149	1172
Biomass	1769	1858	1949	2043	2141	2241	2344
E11							
RES heating and cooling	42.0%	42.5%	43.0%	43.5%	44.0%	44.5%	45%
WM consumption (%)							
Other kerosene	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%
Diesel/gas oil	24.9%	24.4%	23.9%	23.4%	22.9%	22.4%	21.9%
LPG	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%	20.8%
Solid Biomass	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%
Charcoal	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
RES	42.0%	42.5%	43.0%	43.5%	44.0%	44.5%	45.0%
TJ							
Other kerosene	928	947	966	985	1005	1025	1046
Diesel/gas oil	2991	2990	2987	2983	2977	2970	2962

	2034	2035	2036	2037	2038	2039	2040
LPG	2507	2557	2608	2660	2713	2767	2823
Solid Biomass	197	201	205	209	213	217	222
Charcoal	357	364	372	379	387	395	402
RES	5055	5217	5384	5556	5732	5913	6099
E12							
RES heating and cooling	30%	30%	30%	30%	30%	30%	35%
WM consumption (%)							
Diesel/gas oil	28.8%	28.8%	28.8%	28.8%	28.8%	28.8%	23.8%
RFO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
LPG	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%
solid biomass	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
gas biomass	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
charcoal	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%
solar thermal	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	35.0%
TJ							
diesel	800	816	832	849	866	883	745
RFO	0	0	0	0	0	0	0
LPG	787	803	819	835	852	869	887
solid biomass	23	23	24	24	25	25	26
gas biomass	18	19	19	19	20	20	20
charcoal	313	320	326	333	339	346	353
solar thermal	832	849	866	883	901	919	1093
Transport - T1 (biofuels)							
Gasoline (TJ)	23744	24218	24703	25197	25701	26215	26739
Total Diesel (TJ)	18334	18700	19074	19456	19845	20242	20647
Diesel (TJ)	16500	16830	17167	17510	17860	18218	18582
Biodiesel (TJ)	1833	1870	1907	1946	1984	2024	2065
Biodiesel (%)	10%	10%	10%	10%	10%	10%	10%
Transport - T4 (RES)							
Gasoline	51%	51%	51%	51%	51%	51%	51%
Diesel	36%	36%	36%	36%	36%	36%	36%

	2034	2035	2036	2037	2038	2039	2040
Biodiesel	3%	3%	3%	3%	3%	3%	3%
RES	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10%
TJ							
Gasoline (TJ)	21640	22073	22514	22964	23424	23892	24370
Diesel (TJ)	15130	15432	15741	16056	16377	16704	17039
Biodiesel (TJ)	1100	1122	1144	1167	1191	1215	1239
Industrial - I1 (F-gases)							
reduction of emissions	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	15%
Agriculture - A1 (Anerobic digestion)							
waste management							
dairy cattle							
solid storage	82%	81%	80%	79%	79%	78%	77%
anaerobic digester	19%	19%	20%	21%	22%	22%	23%
other cattle							
solid storage	82%	81%	80%	79%	79%	78%	77%
anaerobic digester	19%	19%	20%	21%	22%	22%	23%
market swine							
anaerobic digester	28%	26%	25%	24%	23%	21%	20%
aerobic treatment	72%	74%	75%	76%	77%	79%	80%
breeding swine							
anaerobic digester	28%	26%	25%	24%	23%	21%	20%
aerobic treatment	72%	74%	75%	76%	77%	79%	80%
sheep							
solid storage	85.7%	84.8%	83.8%	82.9%	81.9%	81.0%	80%
anaerobic digester	14.3%	15.2%	16.2%	17.1%	18.1%	19.0%	20%
goats							
solid storage	85.7%	84.8%	83.8%	82.9%	81.9%	81.0%	80%
anaerobic digester	14.3%	15.2%	16.2%	17.1%	18.1%	19.0%	20%
poultry							
solid storage	81%	81%	81%	81%	80%	80%	80%
anaerobic digester	19%	19%	19%	19%	20%	20%	20%

	2034	2035	2036	2037	2038	2039	2040
Waste - W1 (sorting)							
40% sorting at source from 2021							
MSW to disposal sites (1000t wet mass)	10807	10807	10807	10807	10807	10807	10807
reduction of waste to landfill from 2021 due to sorting (W1)	64.0%	65%	65%	65%	65%	65%	65%
W1 MSW to disposal sites (1000t wet mass)	3891	3782	3782	3782	3782	3782	3782
W1 MSW to disposal sites (%)	36%	35%	35%	35%	35%	35%	35%
Waste - W2 (organics to landfill)							
15% of organics to landfill from 2021; 10% in 2035							
BaU waste per capita (kg)	768	775	783	790	797	805	812
W2 composition of waste to disposal sites							
Food	10%	10%	10%	10%	10%	10%	10%
Garden	2%	2%	2%	2%	2%	2%	2%
Paper	55%	55%	55%	55%	55%	55%	55%
Wood	6%	6%	6%	6%	6%	6%	6%
Textile	22%	22%	22%	22%	22%	22%	22%
Nappies	0%	0%	0%	0%	0%	0%	0%
Plastics, other inert	4%	4%	4%	4%	4%	4%	4%
W2 MSW to disposal sites (%)	33%	33%	33%	33%	33%	33%	33%
Waste - W3 (composting)							
increase composting	9.6%	10%	10%	10%	10%	10%	10%
W3 composting (1000t)	74	78	78	79	80	80	81
BaU Compost for backfilling (1000t)	24	24	24	24	25	25	25
W3 TOTAL composting (1000t)	98	101	102	103	104	105	106
Waste - W4 (anaerobic digestion)							
increase AD to 5% in 2021 and keep constant	37.9%	40%	40%	40%	40%	40%	40%
W4 AD (1000t)	290.68	310.06	313.01	315.96	318.90	321.85	324.80
Waste - W5 (biogas recovery)							
biogas recovery from deep unmanaged and managed anaerobic disposal sites (%)	30%	30%	30%	30%	30%	30%	30%