Malta's 2030
National Energy and Climate Plan

Draft 2018

CONTENTS

LIST OF ABBREVIATIONS

CCGT	Combined Cycle Gas Turbine
CHP	Combined Heat and Power
DSO	Distribution System Operator
EED	Energy Efficiency Directive
EIA	Environmental Impact Assessment
EMD	Electricity Market Directive
EPBD	Energy Performance of Buildings Directive
ESR	Effort Sharing Regulation
EU ETS	EU Emissions Trading System
EU	European Union
EWA	The Energy & Water Agency
FAME	Fatty Acid Methyl Esters
FEC	Final energy consumption
FIT	Feed-in-Tariff
GHG	Greenhouse Gas
GWh	Gigawatt hour
H&C	Heating and cooling
HVAC	High Voltage Alternating Current
HVO	Hydrotreated vegetable oil
ICE	Internal Combustion Engines
IMSC	Inter-Ministerial Steering Committee
kWh	Kilowatt hour
kWp	Kilowatt peak
LN	Legal Notice
LNG	Liquified Natural Gas
MCCAA	Malta Competition and Consumer Affairs Authority
MCST	Malta Council for Science and Technology
MESDC	Ministry for Environment, Sustainable Development and Climate Change
MMR	Monitoring Mechanism Regulation
MRA	Malta Resources Authority
MS	Member State
MTIP	Ministry for Transport, Infrastructure and Capital Projects
NECP	National Energy and Climate Plan
NEEAP	National Energy Efficiency Action Plan
NREAP	National Renewable Energy Action Plan
NSO	National Statistics Office
PA	Planning Authority
PAMs	Policies and measures
PEC	Primary energy consumption

PV	Photovoltaic
R&I	Research and innovation
RED	Renewable Energy Directive
RES	Renewable Energy Sources
REWS	Regulator for Energy and Water Services
SEA	Strategic Environmental Assessment
SME	Small and Medium-Sized Enterprise
SWH	Solar Water Heater
TSO	Transmission System Operator
UNFCCC	United Nations Framework Convention on Climate Change
WSC	Water Services Corporation
WSM	WasteServ Malta

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1 OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1 EXECUTIVE SUMMARY

i. Political, economic, environmental and social context of the plan

Malta's first Draft National Energy and Climate Plan (NECP) is presented at a time when the legislative foundation for a Governance mechanism of the objectives and targets of the Energy Union is being adopted and comes into force. The Governance Regulation aims to ensure the achievement of the Union's 2030 and long-term objectives and targets in line with the Union's international commitments under the Paris Agreement on climate change, whereby all Member States are urged to ensure and propose their fair and ambitious efforts and contributions towards a decarbonised energy system and towards mitigating climate action. It is crucial that the Governance Regulation is considered within the European Union's energy policy framework as a whole, in particular as new legislation in sectoral energy policy targeting energy efficiency, renewable energy and market design from the Clean Energy for all Europeans package is being finalized and is expected to be transposed into national legislation in the upcoming months.

Malta's National Energy and Climate Plan follows the scope of the Energy Union and covers its five dimensions: energy security; internal energy market; energy efficiency; decarbonisation; and research, innovation and competitiveness. The five dimensions are, within the context of the Governance of the Energy Union, as well as the context of Malta's NECP, considered as being closely related and mutually reinforcing and are correspondingly treated as such. The underlying requirement of the plan's integrated and holistic nature was fully considered during the development of the NECP and is reflected as much as possible.

Annex I of the Governance Regulation provides the structure for Malta's NECP. The Plan sets out Malta's national objectives and contributions for 2030 in the respective dimensions and contains a description of the foreseen policies and measures that need to be implemented in order to reach these objectives. This is supplemented by an analytical basis consisting of a description of the current situation in the five dimensions as well as projections until 2040 which are based on robust and consistent data, assumptions and modelling exercises. Thus, Malta's draft NECP presents two main scenarios: a reference and a policy scenario. While the former provides a snapshot of the current situation in Malta with implemented and adopted measures as of end of 2017, the latter scenario consists of planned policies and measures and portrays Malta's projected achievement once planned policies and measures are implemented.

The NECP serves as a strategic planning framework and policy document that will guide Malta's contribution to achieving the Union's 2030 objectives and targets falling under the Energy Union, while setting out a strategy on how these targets are expected to be attained in the period until 2030, with an outlook until 2040. The Plan aims to support Malta's economic, environmental and social

development and sustainability, while also focusing on providing clear benefits for citizens, businesses and investors in the Maltese Islands. It must be noted that all financial estimates included in Malta's first Draft National Energy and Climate Plan are still to be reviewed and endorsed by the Ministry responsible for finance and budget.

It is crucial that the current social, economic and environmental context of the Maltese Islands and its impact on the energy system and climate change mitigation is kept in mind when reading this plan. Malta's first NECP arrives at a time of high annual GDP and population growth driven by an expanding service-based economy and a corresponding increased demand for labour force, leading to high immigration. Although fully reflecting the European Union's policy framework in the areas of energy and climate, Malta's NECP is designed and adapted to fit and reflect national specificities, unique to the environment of a Mediterranean island-state with an area of 316 km² but a population density of over 1,500 people per square kilometer, the highest in the European Union. Spatial, and other economic, social, geophysical and climatic challenges and conditions impacting the five Energy Union dimensions are elaborated within the respective sections.

ii. Strategy relating to the five dimensions of the Energy Union

Malta's strategy under the Decarbonisation dimension promotes the transition to a low-carbon economy, primarily through the pursuit of upholding national GHG emissions reduction commitments, and by continuing to deploy all viable indigenous renewable energy sources. Malta's efforts towards climate change mitigation and adaptation are enacted in the Climate Action Act, established in 2015, and further strengthened through the ratification of the Paris Agreement, whereby Malta reaffirmed its commitment to address climate issues to its fullest potential and contribute to towards achieving the EU's collective target of 40% reduction of GHG emissions by 2030 compared to 1990 levels.

In the area of renewable energy, Malta will continue its efforts to increase its renewable energy share even though full exploitation of RES within the present technical and geographical limitations will hinder Malta's progress in a race against an expected steep increase in overall energy demand. Nevertheless, Malta will extend its current policy framework in the area of RES to the period until 2030 and launch new initiatives tailored to local specificities to ensure that all technically and economically viable indigenous sources of RES are exploited, while seeking to support the private sector in similar endeavours.

The specific characteristics of Malta's energy system and market, such as its small nature, the existence of a single electricity distributor/supplier, the absence of natural gas and district heating and cooling networks, and the small size of petroleum distribution companies substantially limit the range of measures available to meet energy savings obligations. Steep population and GDP growth in recent years has made it difficult to restrain energy consumption. Nevertheless, Malta's efforts in the area of energy efficiency post-2020 will seek to achieve energy savings in proportion to the final energy consumption of respective sectors.

Malta's strategy under the Energy Security dimension will continue to emphasize the Government's commitment to achieving greater security of supply through the diversification of energy sources in terms of procurement channels, exporting country and supplier, as well as contingency planning in case of a disruption in supply. Security of supply will be strengthened through the realisation of the Gas Pipeline project with Italy which will connect Malta to the Trans-European Natural Gas Network by 2024.

The underlying energy policy rooted at the core of Malta's plan is the necessity to ensure affordable, sustainable and secure forms of energy for Maltese citizens and businesses. Since the electricity network of Malta is linked to Italy through an interconnector, the level of Malta's electricity interconnectivity is expected to remain well above the EU-wide target of 15%. The interconnector contributes to the robustness of the electricity system and strengthens Malta's security of supply. Malta does not have an electricity transmission system or a liquid wholesale market and is eligible to derogate from the application of a number of provisions of the Electricity Market Directive due to the small size and peripheral position of Malta's electricity system, which stands at the edge of the EU grid. Policies and measures under the internal energy market and energy security dimensions are driven primarily by the delivery of the gas pipeline project, but also focus on increasing the flexibility of the energy system and ensuring that vulnerable and energy poor consumers are protected.

Malta will endeavour to boost the research, innovation and competitiveness aspect of its energy and climate policy framework in the period post-2020. A new national R&I strategy is expected to be developed by the end of the time period covered by the present strategy, therefore by the end of 2020, with smart specialization remaining a key component. In order to foster research & innovation specifically in the area of energy and low-carbon technologies, a separate strategy for R&I specific to the energy sector will be developed by the end of 2019. This new strategy will aim to boost research and innovation efforts by the public and private sectors in the next decade.

iii. Overview table with key objectives, policies and measures of the plan

Dimension		Key objectives	Key policies and measures
Decarbonisation	**GHG emissions and removals**	-19% GHG emissions reduction target under the Effort Sharing Regulation (ESR).	Cross-cutting across all Dimensions.
	Renewable Energy	10/13% share of Renewable energy in gross final energy consumption in 2030.	Measures exploiting all technically and economically viable indigenous RES sources; Extension of current policy framework in the area of RES for the period until 2030 whilst providing new initiatives tailored to local specificities.
Energy Efficiency		Energy intensity of 0.08 toe/€ in 2030.	Energy savings obligations and incentives for all energy end-use sectors.
Energy Security		Generation adequacy based on the N-1 principle; and Continued diversification of energy sources	Delivery of gas pipeline PCI project.
Internal energy market		Ensure competitive electricity prices for households, commercial and industrial sectors.	Measures targeting an increase in the flexibility of the energy system and the protection of energy consumers.

Research & Innovation and competitiveness	Develop a specific strategy for R&I for energy and water by the end of 2019.	Delivery of national strategy to boost and foster research and innovation in areas falling under the dimensions of the Energy Union.

1.2 OVERVIEW OF CURRENT POLICY SITUATION

i. National and EU energy system and policy context of the plan

Recent years proved to be a period of rapid enhancement of the energy sector in Malta. The direction of the Government's policy for energy can be summarized as working towards providing Maltese citizens and businesses with affordable, sustainable and secure forms of energy; this is a reflection of the overarching policy fundamentals expressed by the EU Energy Union. The fundamental objectives guiding Malta's energy policy decisions are comprised of:

- Reducing Malta's dependence on the importation of oil through the achievement of a diversified energy mix;
- Reducing the carbon footprint and greenhouse gas emissions of Malta through improved efficiency in generation capacity, and through the replacement of heavy fuel oil with natural gas, gas oil, and renewable sources;
- Enhancing and strengthening the security of supply of the country whilst ensuring the availability of appropriate back up capacity;
- Stimulating investment in renewable energy sources through the provision of appropriate incentives;
- Achieving a degree of interconnection for electricity supply; and
- Overhauling the generation capacity of the country with a view to achieving higher efficiency gains whilst stimulating investment in natural gas infrastructures.

A number of these objectives have been successfully addressed. With Malta's Energy Policy published in 2012, a clear roadmap was delineated to ensure that Malta's energy sector meets these objectives. Priority was given to the swift upgrading of inefficient conventional electricity production infrastructure and the introduction of LNG as fuel for power generation, which until then was reliant on heavy fuel oil. Malta closed the inefficient Marsa Power Station; completed and placed in operation the 200MW interconnector with the European grid; and has commissioned a new 205MW gas-fired, high efficiency combined cycle gas turbine (CCGT) power plant as well as an LNG facility for the

provision of natural gas. In addition, the recently built 149MW power plant which comprises eight diesel engines has been converted to run on natural gas instead of heavy fuel oil. Four of these engines can also run on diesel oil, a feature sought to contribute towards the desired level of security of supply. The developments in the generation sector that have taken place have been given the highest priority as these will result in significant primary energy savings and in substantial reductions in GHG emissions from the energy sector. Investments in the power generation sector were guided by the Energy Efficiency first principle and indeed managed to increase the overall conversion efficiency from 25-30% to more than 50%.

The Distribution System Operator (DSO) executed a number of upgrades in its Distribution Centres to consolidate the national electricity distribution grid. It also invested more than €100 million[1] over the period 2014-2017 to upgrade and expand major nodes of the national electricity network and improve the quality of service.

Malta's energy policy also focuses on maximizing Malta's effective renewable energy potential. The Government increased its efforts to support the deployment of renewable energy, especially photovoltaics and solar water heating systems (which are particularly well suited to Malta's geographic location), and whilst acknowledging the technical, geographical and spatial barriers limiting renewable energy potential, Malta continues to emphasize the full exploitation of all technically and economically viable indigenous sources of renewable energy.

ii. Current energy and climate policies and measures relating to the five Energy Union dimensions

The policy framework for energy and climate in the Maltese Islands is described in the following key documents:

- The National Energy Policy, published in 2012;
- The National Renewable Energy Action Plan for 2020, published in 2017;
- The National Energy Efficiency Action Plan for 2020, published in 2017;
- National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions, published in 2009; and
- Malta's Low Carbon Development Vision, 2017.

There are other subsidiary documents that amplify some aspects of these framework policies. All documents contain measures designed to implement the various policies.

National Energy Policy (2012)

The major policy areas set out in the 2012 National Energy Policy are listed below, broadly annotated under the five dimensions of the Energy Union. These policy areas remain generally valid within the

[1] https://www.enemalta.com.mt/upgrading-your-network/2014-2017/

current policy framework until 2030, even though priorities and emphases may have changed, and various major projects have been implemented.

- **Decarbonisation**: The 2012 Energy Policy focused on Government support targeting the sustainable development of renewable energy sources, including commitments to reduce GHG emissions related to the production, distribution and consumption of energy. The reduction of GHG and other emissions was to be reflected in policy, legislation and implementation of projects.

- **Energy efficiency**: Government focused on encouraging and facilitating the achievement of increased energy efficiency in electricity generation and distribution, and in energy end-use, and leading by example.

- **Energy security**: The Government's focus was placed on diversification away from reliance on oil products, replacement of ageing power plants, and ensuring that contingency plans are in place to cater for short-term disruption of oil or LNG supply. The government continued to support the sustainable deployment of viable indigenous renewable energy sources.

- **Internal energy market**: The Government's efforts targeted providing an interconnection with the European electricity system and pursuing, within the context of the EU single energy market, the realisation of the necessary natural gas supply infrastructure. The Government also aimed to ensure that the legal and regulatory frameworks result in affordable energy pricing, whilst encouraging competition within the limits imposed by the market size and structure. Social measures are also in place to support vulnerable consumers.

- **Research, innovation and competitiveness**: The Government committed that its fiscal policy and its education and research policies support the general objectives of ensuring security of supply, environmental protection and national competitiveness.

As a consequence of the changed priorities and of major projects undertaken in recent years, various measures arising out of the Energy Policy (2012) have been implemented, others superseded or rendered irrelevant. Several, certainly the more important, were achieved earlier than planned in 2012.

The National Renewable Energy Action Plan (2017)[2]

The need for an updated action plan covering the period 2015 to 2020 arose after reconsideration of the RES options triggered by technological, social and economic developments. The plan includes a revision of the national RES perspective while remaining faithful to the underlying Energy Policy of 2012 and Malta's commitments to meet the 10% Renewable Energy Target in line with Directive 2009/28/EC.

[2] https://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans

The Policy measures set out in 2015 and updated in 2017 are listed below. These are classified under the dimension 'Decarbonisation' in the NECP framework.

- **Indigenous sources of RES to be prioritised**: Malta will seek to reasonably exploit indigenous sources of RES to reduce the country's dependence on foreign energy sources and thus add to security of energy supply, green job creation and foreign investment.
- **'Cooperation Mechanisms with other Countries' as a fallback solution**: Malta will consider Cooperation Mechanisms with other countries to meet its 2020 Renewable Energy target only as fall-back in the case that there will be a minor shortfall in meeting its 2020 target.
- **Malta's RES mix to be diverse and multi-faceted to counter natural constraints**: Malta will exploit all cost-effective sources of RES that can make a contribution, however small, to the final target. This is to counter its specific geographic, environmental and spatial constraints (limited land area and high population density and its rich but fragile natural environment).
- **RES and conventional energy are to be considered holistically**: Government and competent authorities will ensure in their decisions that all the components of the local energy sector, of which RES is part, must holistically contribute to reach the objectives of the energy policy.
- **Impact of investment in RES on the economy to be controlled**: Government will ensure that investment and incentives in RES are staggered in such a way as to avoid creating shocks and economic bubbles, while achieving targets in a timely manner.
- **Investment in Renewable Energy will be incentivised**: Government will put forward incentive schemes, consistent with national and EU legislation, to make up for the cost premium over conventional energy and that are optimised to achieve their objectives at the lowest cost. The cost of energy delivered will be a non-exclusive criterion for the adoption of a particular type/category of RES.
- **Energy efficiency to be prioritised**: Government will robustly and effectively promote efficient use of energy resources, in line with the framework in Directive 2012/27/EU of the European Parliament and of the Council and the Energy Efficiency First principle.
- **Building a Knowledge base and support Research**: Government supports indigenous research, development and innovation (RDI), intended to address specific challenges faced by Malta by virtue of its particular geographic specificities, while contributing towards building the competence and prestige of local institutions. Government supports the development of appropriate technology to harness renewable marine energy. This is of particular relevance to Malta given the limited landmass.

The National Energy Efficiency Action Plan (2017)[3]

The NEEAP of 2017, revising that of 2014, describes the policies and measures until 2020 targeting end–use efficiency in Malta. The Plan was drawn up as required by, and in line with Directive 2012/27/EU.

The Policies guiding that NEEAP were the following:

- **Energy Efficiency Obligation Scheme** upon the national electricity supplier, to apply a progressive (rising block) residential tariff system which is inductive of efficient use of electricity.
- **Financing schemes/instruments and fiscal incentives** to incentive target sectors to adopt more energy efficient technologies. Measures aim to target the residential, industrial, commercial and transport sectors.
- **Regulations and voluntary agreements** with relatively high consumers of energy, encouraging them to adopt more energy efficient technologies.
- **Public Sector leading by example** whereby Government and public entities are being seen to actively pursue energy efficient measures and projects.

The National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions (2009)[4]

This strategy, commonly referred to as Malta's Mitigation Strategy, provides a policy framework to address Greenhouse gases across all sectors. It includes a national governance structure for management of greenhouse gases, as well as outlining actions to instil a cultural shift in mindsets in that responsibility for securing our climate is a responsibility that each person has to assume. These principles were later enshrined in the Climate Action Act 2015 (CAP543) which provided a solid basis in the form of a legal structure for governance of Greenhouse Gas (GHG) emissions.

The Mitigation Strategy primarily addresses the decarbonisation pillar of the Energy Union Strategy but, in doing so, has considered other aspects including energy efficieny and R&I, as described below.

- **Decarbonisation**: In general, the strategy addresses measures contributing towards a general unquantified reduction for Greenhouse gas emissions. It also envisaged the basic governance and administrative structure currently in place.
- **Energy efficiency**: The strategy included provisions regarding energy efficiency, especially in the building and electricity sector.

[3] https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive/national-energy-efficiency-action-plans

[4]https://msdec.gov.mt/en/Document%20Repository/Malta%20Climate%20Change%20Adaptation%20Strategy/National%20Climate%20Change%20MITIGATION%20Strategy.pdf

- **Research, innovation and competitiveness**: The strategy embodied actions that addressed Research and Development and Innovation (RDI), especially in the local scene and with specific sectoral scopes.

Malta's Low Carbon Development Vision (2017)[5]

This document was prepared as a stepping-stone to Malta's Low Carbon Development Strategy, which in turn crystalizes Malta's response to the requirements of the UNFCCC, the Paris Agreement, EU legislation and the obligations under the Climate Change Act 2015 (CAP543). The Vision focuses on ways and means to transform Malta into a low-carbon and climate resilient country through symbiotic societal and economic collective actions by 2050.

The Vision has, at its core, a focus on integrating various mitigation and adaptive measures to reduce local greenhouse gas emissions. The Vision identifies a number of key areas, where there is an improved potential to reduce carbon emissions and where diversification is possible. The areas identified for action include energy, transport, waste, agriculture, water, enterprise, tourism, information and communication technologies (ICT), infrastructure (planning and monitoring of existence infrastructure), finance and expert knowledge.

Through the Vision, Malta commits to:

- Uphold national GHG emissions reduction targets as required by EU legislation by 2020;
- To move towards a reduction of national GHG emissions as opposed to pursuing a continued limited increase in emission levels post 2020;
- Reduce national GHG emissions post-2030 in accordance with Malta's economic development priorities of the time;
- Set sector specific GHG emission reduction targets post-2020 to contribute to meeting national targets; and
- Identify and implement opportunities to enhance climate resilience in Malta.

Energy Performance of Buildings

The main piece of legislation related to the energy performance of buildings is Legal Notice 47 of 2018 transposing Directive 2010/31/EU on the energy performance of buildings (recast).

Following the transposition of the first Directive on the energy performance of buildings (Directive 2002/91/EC) locally, 'Technical Guidance F – Minimum Energy Performance of Buildings in Malta 2006' regulating the minimum energy performance of buildings was issued in 2006. This first technical guidance on the energy performance of buildings only specified certain aspects of energy performance, such as the maximum building element U-value and design parameters, for instance the maximum allowable glazing to wall ratio or the building services efficiency, without specifying any

[5] https://meae.gov.mt/en/Public_Consultations/MSDEC/Documents/MSDEC%20LCDS%20Vision.PDF

energy thresholds. In 2015, a new document 'Technical Document F – Minimum Energy Performance Requirements for Buildings in Malta 2015' was issued, updating the existing minimum energy performance requirements, and listing the overall energy thresholds for residential buildings and offices.

In 2015, Malta published its first plan on how Nearly Zero Energy Buildings will be addressed in Malta. In this first policy, targets for new nearly zero energy buildings, both for residential and other buildings, together with what possible barriers may be encountered are listed and discussed.

A number of policies and measures have been put in place to promote energy-efficiency in buildings. Predominantly, these have taken the form of financial incentives or grants. For example, as of 2018, REWS offers a grant on the purchase of roof insulation and double-glazing products for domestic use that reduce the consumption of energy. As part of a process to preserve and restore the built heritage of the Maltese Islands and promote sustainable regeneration, the restoration grant scheme *Irrestawra Darek*[6], aimed at privately owned residential buildings within urban conservation areas, was launched to promote investment. Other policies and measures focused on financial incentives and grants for the deployment of renewable energy, soft loans for green or energy efficiency investments, as well as financial investments assisting businesses in becoming more energy-efficient and education campaigns.

iii. Key issues of cross-border relevance

Issues of cross-border relevance relate primarily to commercial contracts relevant to importation of electricity via the electricity interconnector and LNG for fuelling of the power station.

As from April 2015, the Maltese electricity system has been synchronised with the Italian system, with scheduled imports through the 200MW HVAC 220kV electricity interconnector. The interconnector is operated by Enemalta plc in coordination with the transmission system operator in Italy, Terna. According to this arrangement, the Maltese electricity system is being treated as a virtual consumption and production point connected to the Italian transmission grid. The interconnector is prevalently used for imports of electricity.

The planned gas pipeline interconnection between Malta and Gela (Sicily, Italy) has reached the permitting stage and technical, financial and environmental studies are underway. Once these studies are complete, the project promoter will proceed to issue the necessary tenders for works. The pipeline is scheduled for commissioning in 2024.

iv. Administrative structure of implementing national energy and climate policies

An Inter-Ministerial Steering Committee (IMSC) was established through Cabinet Decision CAB/90/XIII/17 with the objective to deliver Malta's first National Energy and Climate Plan. The IMSC

[6] More information available at: https://www.pa.org.mt/en/irrestawra-darek

was established to ensure that all national stakeholders contribute effectively towards the National Plan, as the development of the Plan requires coordination and contributions from several entities. Each Ministry forming part of the IMSC designated a high-level political representative to sit on the Committee. Under the IMSC, two Technical Working Groups were established, one on energy modelling and another on non-energy, climate-related modelling, tasked with the relevant quantitative assessments and providing technical input to the IMSC. The main role of the IMSC is that of aligning diverse Ministerial priorities so as to develop a holistic and integrated NECP. By the end of 2018, the deadline for the submission of Malta's Draft NECP, the IMSC had met eight times. It is foreseen that the IMSC will continue to operate during the course of 2019 in order to ensure the timely development and completion of any remaining sections required for the submission of Malta's Final Plan. There is a possibility that the IMSC structure will remain in place post-2019 to overlook the implementation of policies and measures which have been established as part of the NECP.

Given that the legal basis of the Governance Proposal is within the remit of the Directorate-General for Energy, the Ministry for Energy and Water Management is the leading Ministry in the development of the NECP. The following Ministries, all of which are represented on the IMSC, are considered as important contributors to the drafting of the Plan and have been tasked with providing input to sections falling under their remit.

- The Office of the Prime Minister
- Ministry for the Environment, Sustainable Development and Climate Change
- Minister for Transport, Infrastructure and Capital Projects
- Ministry for the Economy, Investment and Small Business
- Ministry for Finance
- Ministry for European Affairs and Equality
- Ministry for Education and Employment
- Ministry for Justice, Culture and Local Government
- Parliamentary Secretary for Financial Services, Digital Economy and Innovation

Apart from the individual Ministries sitting on the IMSC which are listed above, other national governmental entities are considered being key stakeholders responsible for the implementation of specific sections of national energy and climate policies falling under their remit.

1.3 CONSULTATIONS AND INVOLVEMENT OF NATIONAL AND EU ENTITIES AND THEIR OUTCOME

i. Involvement of Parliament

Malta's national law does not require formal endorsement of Malta's National Energy and Climate Plan by the Parliament.

As outlined in Section 1.2, through Cabinet Decision CAB/90/XIII/17, the IMSC on the NECP was established to ensure a coordinated approach of all Ministries relevant to the development of the

Plan. The Cabinet of Ministers has been regularly updated on the status quo of the development of the Plan. The Draft Plan, as well as options for policy scenarios establishing the direction of Malta's national energy and climate policies post-2020, were presented to Cabinet on the 4th December 2018 and the NECP subsequently endorsed, in time for the Plan's submission to the European Commission by the end of 2018.

ii. Involvement of local and regional authorities

Given Malta's size, regional authorities do not exist. Local Councils form the most basic form of local government; however, their role is primarily administrative and their involvement in energy and climate policy design is marginal. The Local Government Division at the Ministry for Justice, Culture and Local Government is responsible for assisting the Ministry in the formulation of strategies, policies and legislation as required. Nevertheless, Local Councils are invited to voice their concerns on Malta's NECP as part of the formal online consultation process, which is further explained in the section below.

iii. Consultations with stakeholders, social partners, and engagement of civil society and the general public

The involvement of local authorities, social partners, civil society organisation, the business community, industry and other stakeholders as well as the general public are considered key processes under the Regulation on the Governance of the Energy Union. The importance of providing stakeholders with a platform for discussing different options for future national energy and climate policies is rooted in Article 11 of the Governance Regulation. Article 10 of the Regulation also requires that Member States ensure that the general public is given early and effective opportunities to participate in the preparation of the plans.

It was determined that stakeholder involvement and public consultations for Malta's draft NECP would be carried out in two stages:

- **Early stakeholder consultations** (during the drafting stage); and
- **Public consultation** (after finalization of Draft NECP).

Early consultations with key stakeholders

Early consultations with key stakeholders were held from April 2018 until October 2018. The aim of consultations with stakeholders such as licensed fuel suppliers, academia and the business and industry community in the early stages of drafting of the NECP was to provide stakeholders with an opportunity to discuss issues of interest and to ensure that sufficient time was provided for the submission of feedback, whether formal or informal, which could then be effectively considered in the preparation of the draft plan. Stakeholders were presented with the legislative background of the EU Energy Union and its five dimensions, the Union's 2030 targets, the requirements of the Governance Regulation and the NECP, and were given an opportunity to comment on the direction of Malta's

policies in the five Energy Union dimensions for the forthcoming decade and beyond. It was highlighted to the stakeholders that the National Energy and Climate Plan adopts a bottom-up approach and provides each member state the opportunity to come up with justifiable, ambitious and realistic national contributions to the Union's collective 2030 targets.

Individual meetings were held with the following entities which were considered as key stakeholders to Malta's national energy and climate policies:

- Building Industry Consultative Council (BICC)
- Malta Developers Association (MDA)
- Malta Business Bureau (MBB)
- Institute for Climate Change and Sustainable Development (University of Malta)
- Institute for Sustainable Energy (University of Malta)
- Malta College for Art and Science
- Malta Hotels & Restaurants Association
- The Commission for Environment of CURIA (Il-Kummissjoni Ambjent tal-Knisja)
- Malta Chamber of Commerce
- EneMalta Plc
- EneMed Ltd
- Liquigas Malta Ltd
- Easygas Ltd
- Electrogas Ltd

Additionally, a number of stakeholders were invited but declined.

Public consultation

The public consultation process shall be initiated in early 2019. The process will follow the already established national procedure for online public consultations.[7] The Government, through this platform, which is administered by the Ministry for European Affairs and Equality, encourages the general public, civil society organisations, trade unions, business organizations, political parties, government institutions and the general public to participate in the process of online public consultation. Malta's online public consultation process is made up of three main stages:

- **Open consultation**: Public is requested to submit comments within a stipulated timeframe;
- **Closed consultation**: Consultation is closed and comments received are filtered through the moderation process; and
- **Publication of feedback and Outcome report**: Feedback and detailed report of the outcome are made available to the public.

[7] Online public consultation platform: www.konsultazzjoni.gov.mt

In order to comply with Article 10 of the Governance Regulation, which requires Member States to set reasonable timeframes allowing sufficient time for the public to be informed, to participate and express its views, and to limit the administrative complexity, the outcome of the public consultation process for Malta's NECP will be included as part of the Final NECP submission. A summary of the public's views on the draft NECP shall also be submitted to the Commission.

iv. Consultations with other Member States

Malta is well aware of the requirements stipulated in Article 12, paragraph 2 of the Governance Regulation, whereby Member States are required to identify opportunities for regional cooperation and consult neighbouring Member States, including in regional cooperation fora. Due to Malta's insular geographical position, consultations with other Member States are largely confined to its neighbouring Member States with maritime borders.

Malta plans to fulfil the obligations stemming from Article 12 after the submission of the draft NECP. It is envisaged that such consultations will primarily focus on bilateral discussions with Italy, with whom Malta has an electricity interconnector and through which Malta will connect to the Trans-European Gas Network via the gas pipeline project. These consultations will take place during 2019 and the results, including possible comments on Malta's NECP made by Italy and any other Member States consulted, will be integrated in the Final NECP.

v. Iterative process with the European Commission

The iterative process with the European Commission is expected to take place after Malta's submission of the draft NECP. Discussions for the preparation and coordination of Member States' Draft NECPs were held within the framework of the Commission's Technical Working Group on NECPs.

1.4 REGIONAL COOPERATION IN PREPARING THE PLAN

i. Elements subject to joint or coordinated planning with other Member States

As explained in Section 1.3 iv. above, Malta's insular geographical position limits the potential and the need for joint and coordinated planning with other Member States within the framework for the development of the NECP. Nevertheless, Malta considers regional cooperation as a key element of its NECP. The importance of regional cooperation is present primarily in the Energy Security dimension of the plan, with the gas pipeline interconnection to the European Gas network being the predominant cross-border cooperation project in the foreseeable future. Cooperation on this project at government level, in technical and environmental studies and in permitting procedures is explained in more detail throughout the relevant sections of the Energy Security dimension and specifically under Section 3.3.ii.

ii. Explanation of how regional cooperation is considered in the plan

As referred to in the point (i) above, regional cooperation is considered primarily within the framework of the ongoing cooperation on the Malta-Sicily gas pipeline. Regional consultations on Malta's NECP will take place during 2019 primarily in the form of bilateral consultations on the plan with Italy. The outcome and results of these consultations, including possible comments on Malta's NECP made by Italy will be taken into account prior to the submission of the final NECP.

2 NATIONAL OBJECTIVES AND TARGETS

2.1 DIMENSION DECARBONISATION

2.1.1 GHG emissions and removals

i. Binding national target for GHG emissions and annual binding national limits pursuant to Effort Sharing Regulation

Malta has been at the forefront in advocating climate action. Malta requested the 43rd session of the United Nations General Assembly (UNGA) to discuss climate change at the highest international political level in 1988. Malta, together with a group of like-minded States, piloted the formulation of the Resolution UNGA 43/53 declaring *Climate Change as a Common Concern of Humankind.* The Resolution was adopted unanimously at UNGA's 43rd session. This legacy is proudly ingrained in the history of our nation as one of most salient contributions Malta has made to the International community of States and future generations.

Throughout the years, Malta continued in its effort to address climate action. These efforts culminated in 2015 with the development and enactment of the Climate Action Act. This provides the legal framework within which climate action is pursued and establishes a governance structure. Climate mitigation and adaptation strategies were devised with programmes of measures to address the local context.

Through the ratification of the Paris Agreement, Malta reaffirmed its commitment to address climate issues to their fullest potential and to contribute towards the European Union's collective target of 40% reduction of its GHG emissions by 2030 compared to 1990 levels.

Malta's climate and energy policy features prominently in the political agenda as reflected through the recent major infrastructural investments in the energy sector. In terms of Malta's GHG emission profile, electricity generation had historically been the primary emitter in Malta. Malta experienced a significant reduction of approximately 50% in emissions from the energy sector due to the shift from heavy fuel oil to natural gas and as a result of interconnection with mainland Europe.

Malta also recognises climate finance as one of the core issues related to the climate discussion. Malta's contributions could be defined as modest due to its size and domestic needs. Nonetheless, Malta considers that there is a lot more potential in reaching out to others, particularly through academia. As a matter of fact, Malta offered technical support through scholarship programmes to nationals from various states, particularly those most vulnerable to climate change. These programmes helped such states to further enhance specific skill sets required to address climate changes challenges. Malta has additionally made financial contributions towards international climate funding and will continue to uphold these commitments.

Malta is bound to reduce its GHG emissions by -19% below its 2005 emissions. Malta's limited mitigation potential with resultant high mitigation cost has led us to seek the most flexible options available in line with the provisions under the Effort Sharing Regulation (ESR).

On the other hand, Malta remains committed to continue working towards mitigation action, however, considering the geophysical realities including our climatic conditions, Malta does not have an array of options for modal shifts to reduce carbon emissions. Sectoral challenges are various, from economies of scale and low mitigation potential (as in the case of the agricultural sector) to more challenging technology and innovation issues (e.g. refrigeration and cooling) to land use conflicts due to the geophysical reality of our islands (e.g. transport/renewables).

Malta is currently working on the formulation of the Low Carbon Development Strategy in accordance with international, EU and national obligations. In 2017, the Maltese Government published the Vision Document highlighting its aspirations for socio-economic development in a low-carbon and climate resilient manner. This transition is possible through symbiotic societal and economic collective actions by 2050. The Vision is the basis for the development of Malta's long-term strategy, which will enable mitigation of GHG emissions, thereby reducing its vulnerability and increasing its adaptive capacity to climate change. This provides a structure through which Malta will contribute towards the objective of the Paris Agreement and fulfil the requirements set out in the same agreement. As such the Maltese Government is committed to:

- Uphold national GHG emission reduction commitments in the EU up to 2020;
- Move towards a reduction of national GHG emissions as opposed to pursing a continued limited increase in emission level post-2020;
- Progress in reducing national GHG emissions post-2030 in full cognisance of Malta's economic development and priorities of the time;
- Set sector-specific GHG emission reduction targets post-2020 to contribute to meeting reduction commitments made at the national level; and
- Identify and implement opportunities to enhance climate resilience in Malta.

Furthermore, Malta's Sustainable Development Vision for 2050 sets out aspirations and priorities towards a low-carbon economy, sustainable mobility, transition towards low-carbon energy and sustainable buildings and urban development, amongst others. It also sets a precedence for mainstreaming sustainable development up till the year 2050 and is set to become Malta's main guiding principle for developing policies when planning and implementing projects.

This Vision acknowledges the fact that the transition to a low-carbon economy is central to our future economic development model in view of its win-win opportunities. This in turn provides an opportunity for the business sector to take advantage of the favourable economic policy towards low-carbon investment. This will shore up the competitiveness of the country and contribute to lower emissions, improved air quality and health benefits.

Malta has identified the formulation of a long-term Low Carbon Development Strategy as a useful tool in the implementation of the objectives of the Paris Agreement, and has given this process due priority. Malta has initiated the process of developing a national Low Carbon Development Strategy in accordance with requirements under the UNFCCC, European Union legislation, the Climate Action Act 2015 (CAP543), and in line with the decarbonisation ambitions of the Energy Union. This strategy aims to consider national circumstances and realities, especially those aspects that link socio-economic development with climate action.

In 2014, Ministers responsible for the environment and climate change, and other Heads of Delegation, under the Union for the Mediterranean (UfM), endorsed the Declaration on Environment

and Climate Change. With this declaration, the signatories aimed at establishing areas of common interest to strengthen regional co-operation in the following areas:

- The Horizon 2020 Initiative to depollute the Mediterranean;
- Climate Change;
- Sustainable Consumption and Production (SCP)

Various expert groups, one of which is the UfM Climate Change Expert Group, have been established to implement this declaration, by:

- Addressing regional, national and local concerns on common climate change challenges across the region through the promotion of better knowledge on such;
- Sharing information and best practices through multilateral and multi-stakeholder exchanges on cross-border and regional cooperation on climate change;
- Stimulating discussions on climate change priority actions on adaptation and mitigation including, but not limited to, low-emission and climate-resilient development in the region and related costs, co-benefits, and feasibility;
- Catalysing the identification, development and support of concrete projects and initiatives related to low-emission and climate-resilient development (such as green growth with key stakeholders and potential public and private donors/ investors) to foster the elaboration of Low Emission Development Strategies (LEDS) including basic supporting tools (e.g., monitoring, reporting and verification systems), Nationally Appropriate Mitigation Actions (NAMAs), National Adaptation Plans (NAPs) and adaptation policies, including scenario development and impact assessments, and, where relevant, in close synergies with disaster risk management actions; and
- Supporting climate-relevant work of local and regional authorities, as well as civil society, the private sector, the Covenant of Mayors and sustainable cities.

ii. National commitments pursuant to LULUCF Regulation 2018/841

The Regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry (LULUCF) into the 2030 climate and energy framework (Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU) requires Malta to ensure that greenhouse gas emissions from land use, land use change or forestry are offset by at least an equivalent removal of CO_2 from the atmosphere, the so-called 'no debit' rule, in the period 2021 to 2030. Accounting under the LULUCF Regulation is split over two compliance periods, 2021 to 2025 and 2026 to 2030, with Malta being required to show that over each of these compliance periods, it is abiding, at least, by the no debit rule. If this cannot be achieved by actions in the sector, the Regulation also provides for flexibility mechanisms by which Malta can close any gaps that it may have in respect of the no debit rule: the use of annual emission allowances allocated to Malta under the Effort Sharing Regulation or buying net removals from other Member States who have successfully increased their rate of net removals beyond their respective commitment. This Regulation should incentivize Malta to enhance removals or reduce emissions in the LULUCF sector.

It is to note that at present Malta is reporting net emissions for the LULUCF sector. Efforts are ongoing, through capacity building support being provided by the European Commission on the implementation of the LULUCF Regulation, to revise the methodology for the determination of emissions and, or, removals, from Malta's LULUCF activities, which may in future result in a recalculation of Malta's LULUCF sector showing a net removal rate. This would however reflect a methodological change; policies and measures in the LULUCF sector will still remain a requirement for Malta to ensure that at least, compliance with the no debit rule can be maintained.

iii. [If applicable] Other objectives and targets, including sector targets and adaptation goals to meet objectives and targets of the Energy Union and the long-term Union GHG emissions commitments consistent with the Paris Agreement

The Government is the main influencer in defining climate policy, and thus driving a shift towards a low-carbon economy as is anticipated to be charted out in Malta's Low Carbon Development Strategy. This is of primary importance for the Government to mainstream across all economic sectors as it will shape national consumption and production patterns, thus reducing emissions without hindering economic growth.

2.1.2 Renewable Energy

i. National contribution in terms of share of energy from RES in gross final energy consumption in 2030, including indicative trajectory and reference points in 2022, 2025 and 2027

Article 5(1)(e) of the Governance Regulation requires Member States to indicate in their integrated national energy and climate plan the relevant circumstances affecting renewable energy deployment that have been taken into account. Malta's potential for renewable energy deployment is mainly affected by physical and spatial limitations, technological advancement and resource potential, with availability and cost of land being the predominant restrictions for further deployment.

Solar PV

Various studies have concluded that solar energy is the predominant viable renewable energy source in Malta. The geology and topology of the island does not lend itself to the production of hydro or geothermal energy, and wave energy production is still at the research stage. Water and agricultural land are both scarce, thus biomass production is not an option. Wind was assessed thoroughly pre-2010, but as explained further below, conventional wind technology has been found to be largely incompatible with the local context. The current focus is therefore on the deployment of photovoltaic systems. The total area of the Maltese Islands (316km^2), coupled with a population density of over 1,500 persons per square km largely restricts the availability of suitable green field sites, and therefore Government policy was designed to take full advantage of rooftops and brown field sites such as disused quarries and landfills. For this purpose, the Planning Authority, in collaboration with the Ministry for Energy and Water Management, published in 2017 a policy framework for the development of solar farms[8]. This provides guidance for the location of new solar farms and identifies environmentally-relevant specifications that need to be integrated into solar farm development.

Land scarcity is reflected in the relatively high land costs; land is typically rented at rates in the region of 2-3€ per square metre per year if it cannot be developed for any other use. Areas (including rooftops) within industrial zones are typically rented at much higher rates. At the current rate of PV deployment, which is estimated to reach around 160MW by the end of 2020, even fewer sites will remain available for development and this is expected to lead to even higher land costs.

An extensive assessment of Malta's **technical potential for further deployment of solar PV installations** post-2020 shows that this is limited to a number of suitable rooftops within the residential, commercial and industrial sectors, as well as a handful of brownfield sites (ground-mounted). Dwellings considered to have potential for PV installations are terraced, semi- and fully-detached houses; in some cases, maisonettes are also considered to be suitable for PV installations.

[8] https://www.pa.org.mt/en/supplementary-guidance-details/file.aspx?f=12083

The majority of residential buildings currently being developed in Malta are apartments and, to a lesser extent, maisonettes[9], which are in general not suitable to host photovoltaic installations due to limited available roof space[10]. Multi-family dwellings are prioritised in construction to accommodate the rapidly growing population and the surge in demand for a larger labour force, driven by strong economic growth; GDP increased by 6.6% in real terms in 2017. In order to cater for the increased demand for accommodation, planning policies are encouraging redevelopment of two or three storey buildings into multi-storey apartment blocks. This leads to an increase in the frequency and depth of shadowing of rooftops, which further reduces the number of buildings considered suitable for PV installations. By 2040, apartments and maisonettes are expected to constitute almost 70% of Malta's building stock.

Wind Energy

Wind energy projects, both onshore and offshore, cannot be successfully implemented in Malta due to significant restrictions in the local context. High population density and limited land area inhibit the development of **onshore wind power.** Planning constraints include the potential interference with the safety of airport operations as well as the significant negative visual impact and proximity to inhabited areas. Lack of possible environmental mitigation strategies to reduce impacts on protected bird colonies, such as the Yelkouan shearwater, further contribute to the unfeasibility of onshore wind farms.

With regards to **offshore wind turbines,** the deep bathymetry of the Maltese marine area is a major drawback (Figure 1). In nearshore coastal areas and reefs with depths of less than 50m, constituting potential areas for the development of fixed-bottom wind farms, environmental and economic concerns remain significant. There are significant potential conflicting uses for these zones, especially in view of Malta's reliance on tourism, maritime and shipping activities (Figure 2). Furthermore, a significant portion of the sea around Malta is a designated as a Special Protected Area and Special Area of Conservation under Government Notice 682.18. Indeed, assessments on the environmental impacts of the proposed offshore wind farm at Sikka l-Bajda[11] determined that adverse impacts on bird species, the marine environment and marine life could not be effectively mitigated; this constituted one of the compelling reasons for the rejection of this project. In light of restrictions imposed by bathymetry, the intensity of commercial activity, and the concentration of marine protected areas, conventional offshore wind energy cannot be considered economically, socially or environmentally viable based on current technologies.

[9] Currently, new maisonettes are being built integrated into multi-apartment buildings and are therefore not considered suitable for PV installations for the above mentioned reasons.

[10] Rooftops in Malta have to accommodate water tanks, TV antennae/aerials and other building services, besides an access room, and the area is also used for natural drying and airing of clothes and as a place for family leisure. Therefore, roofs of multi-family buildings often have very limited space for RES installations.

[11] Sikka l-Bajda was identified, through a study by Mott McDonald (2005) commissioned by the Malta Resources Authority, as the only viable offshore site with a depth of less than 50m in Maltese waters for the deployment of offshore wind.

The potential for **deep offshore wind energy** via floating platforms remains in its infancy; this, combined with the associated high capital investment costs implies that floating offshore wind does not constitute a viable short- or medium-term option for Malta. While certain studies point to the potential commercialisation of floating offshore wind in the short- to medium-term, the LCOE of a floating offshore wind farm installed in Maltese waters would not be competitive compared to other local RES and would require significant financial support. This is a result of two factors:

- **High CAPEX**: The cost of the wind turbines generally constitutes less than half the initial costs while the rest is heavily location dependent, determined by water depth, seabed conditions, distance to shore, grid connection expenses, among others[12]. Therefore, although average total installed costs of floating wind farms are projected to decrease once the technology is commercialised, it is likely that costs for those installed in Maltese waters would remain high given the deep bathymetry and factors which require significant marine installations to be located far from the coast.

- **Low capacity factor:** The average recorded wind speed at Sikka l-Bajda, selected as the site with the best potential for offshore wind turbines, is 7.16m/s at a height of 80 metres[13]. Wind speeds of less than 8m/s are typical of the Central Mediterranean, denoting that wind farms installed in the area would have a relatively low capacity factor, negatively impacting their financial viability. In fact, studies which identify potential hotspots for offshore wind energy in the Mediterranean exclude the Central Mediterranean due to its deep bathymetry and limited wind resource availability[14,15]. Indeed, WindEurope[16] projected limited deployment of offshore wind technology in the Mediterranean until 2030 (Figure 3Figure 3 WindEurope projections on 2016 and 2030 offshore wind installations per sea basin (Source: WindEurope, 2017)).

In light of the above, neither onshore nor offshore wind energy are included in Malta's renewable energy objectives for the EU's 2030 target. Nevertheless, Malta shall continue to monitor developments in floating offshore solar and wind technologies, and will seek to attract pilot projects implementing floating solar or wind in view of their potential in the longer-term.

[12] IRENA (2018), Renewable Power Generation Costs in 2017, International Renewable Energy Agency, Abu Dhabi.
[13] Farrugia, R.N. and Sant, T., 2016. A wind resource assessment at Aħrax Point: A node for central Mediterranean offshore wind resource evaluation. Wind Engineering, 40(5), pp.438-446.
[14] Soukissian, T., Karathanasi, F., Axaopoulos, P., Voukouvalas, E. and Kotroni, V., 2018. Offshore wind climate analysis and variability in the Mediterranean Sea. International Journal of Climatology, 38(1), pp.384-402.
[15] Bray, L., Reizopoulou, S., Voukouvalas, E., Soukissian, T., Alomar, C., Vázquez-Luis, M., Deudero, S., Attrill, M.J. and Hall-Spencer, J.M., 2016. Expected effects of offshore wind farms on Mediterranean Marine life. Journal of Marine Science and Engineering, 4(1), p.18.
[16] WindEurope (2017). Wind energy in Europe: Scenarios for 2030. Available at: https://windeurope.org/wp-content/uploads/files/about-wind/reports/Wind-energy-in-Europe-Scenarios-for-2030.pdf

Figure 1 Bathymetric map of the Maltese Islands.

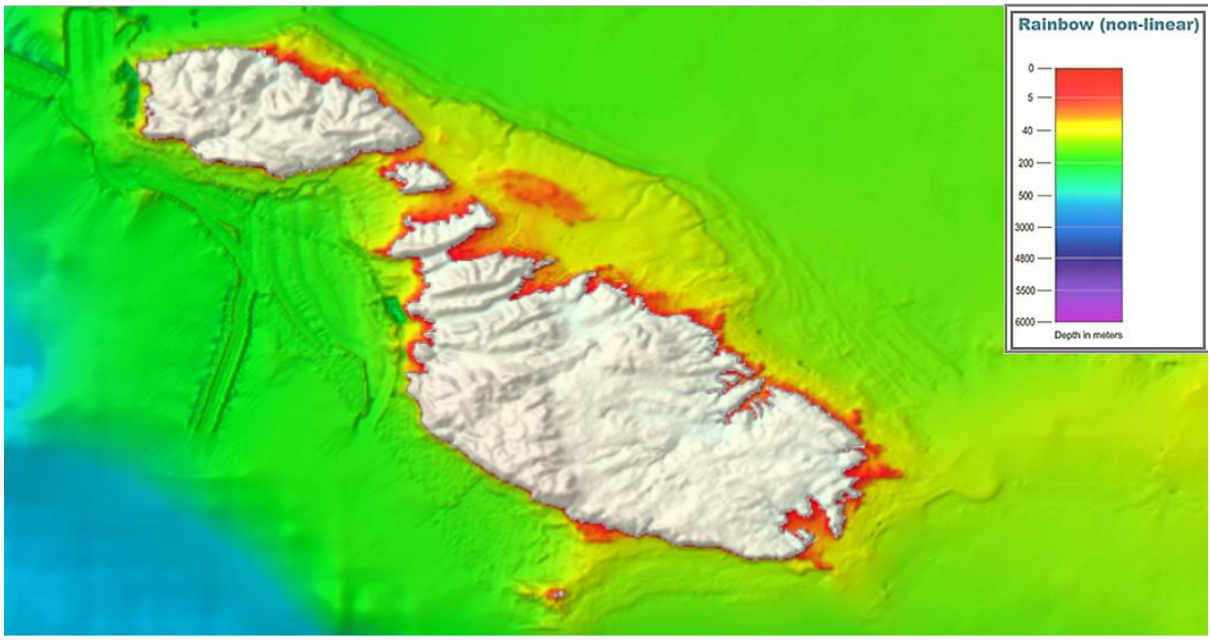


Figure 2 Overview of major maritime activities in Maltese waters (Source: Strategic Plan for Environment and Development of Malta, 2015).

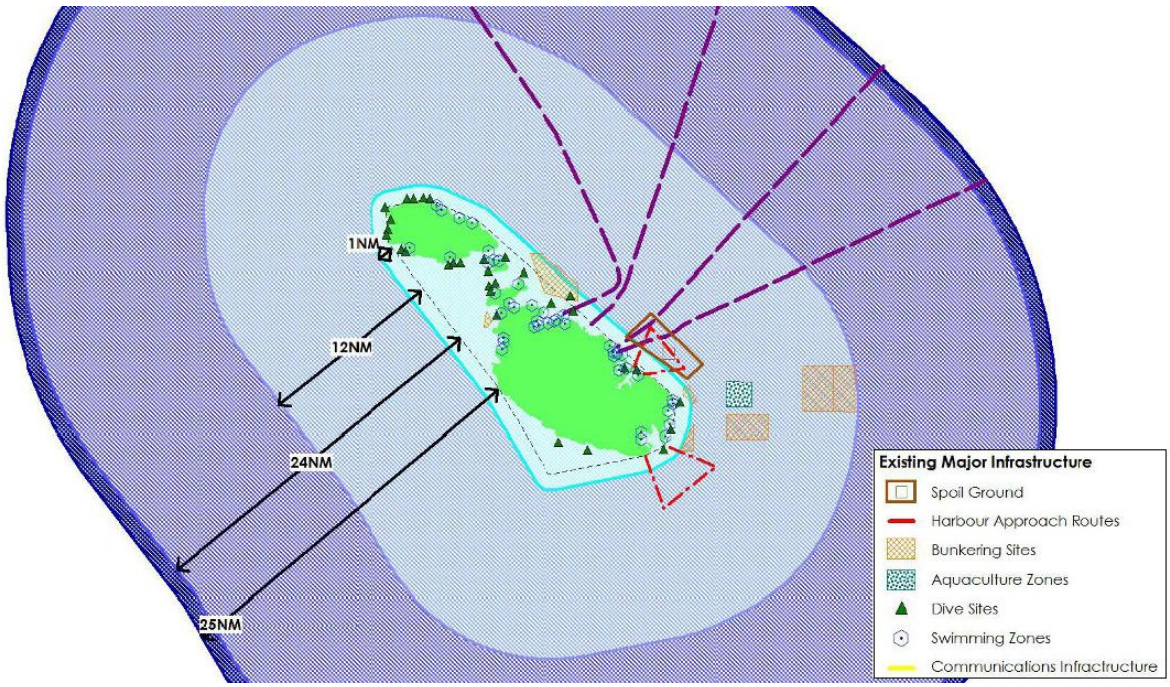
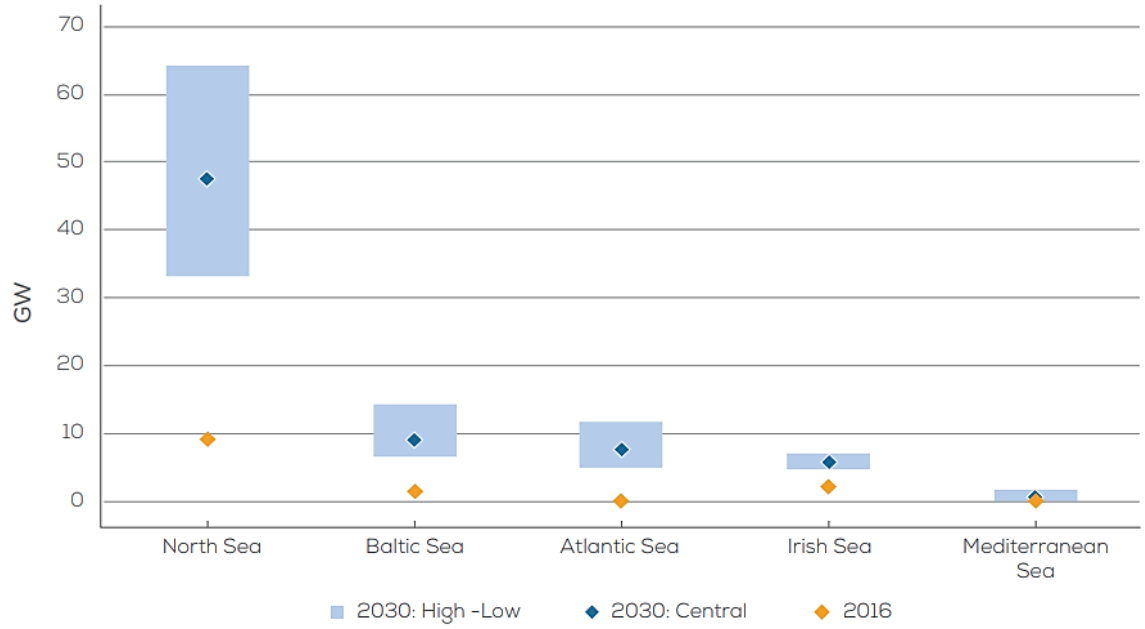


Figure 3 WindEurope projections on 2016 and 2030 offshore wind installations per sea basin (Source: WindEurope, 2017).



Grid Stability Considerations

Malta's RES potential post-2020 is limited by **grid integration constraints inherent in small, peripheral, electricity systems**. The highest contribution towards Malta's renewable energy target is expected to come from solar PVs, (estimated at approximately 37% of RES generation in 2020, increasing to 42% of the total RES share in 2030). The installations shall be concentrated within a very limited space (Malta's footprint), and is therefore highly susceptible to rapid fluctuations in output due to cloud coverage. A preliminary assessment shows that even with 100MW of installed capacity, cloud cover can cause rapid variation in output of up to 30MW. These rapid fluctuations already pose a significant risk to the grid, as at times of high insolation PVs will by 2020, be covering more than half of Malta's electricity demand (especially on weekends during the shoulder months). Ensuring system stability will either require significant spinning capacity, utility scale battery storage or flexible balancing services over the electricity interconnector with Sicily. However, the latter is limited to 200MW (the capacity of the interconnector) and would in practice be lower if already meeting part of the load. Malta has no utility scale battery storage facilities, and keeping large spinning capacity is highly inefficient and may not be technically viable at all times. An assessment is being carried out by the DSO to estimate the additional system costs involved to integrate further PV capacity. The results of this study shall be included in the final plan. However, it is already clear that the capacity of the interconnector is one of the main limiting factors.

As regards the **interconnection level** it is necessary to highlight that Malta's load and generation profile are very similar to that of Sicily, to which it is interconnected. This means that any excess RES

generation in Malta would coincide with times of high RES generation in Sicily, reducing its effective market value.

Overview of RES Share 2021-2030

In line with Directive 2009/28/EC, Malta is required to meet a 10% renewable energy share in gross final consumption of energy by 2020. Malta is expected to meet its target mainly through indigenous sources, but also through the use of statistical transfers. This is mainly due to a higher-than-envisaged increase in electricity and energy demand in the very short term that reflects the overall increase in population and economic and tourist activity. Efforts by Government to increase the renewable energy share are ongoing, but the full exploitation of RES within the technical and geographical limitations referred above is not enough keep up with the steep increase in demand. Furthermore, interest in investment in RES appears to be waning, as other investment opportunities are being prioritised at a time of rapid economic growth, such as real estate and various business ventures. These tend to present the advantage of shorter payback periods and perceived longer-term benefits. This was demonstrated by the response to the calls issued by the Government under the competitive bidding process for solar PV installations of more than 1MW[17]. The total capacity offered under the second call was 35MW but the total bids received amounted to less than 18MW.

Malta has prepared two policy scenarios for its contribution in terms of the share of energy from renewable energy in gross final consumption in 2030 (Table 1). The difference between the two scenarios is the inclusion of RES ambient cool captured by air-to-air heat pumps in Policy Scenario 2. The RES cooling share included in Policy Scenario 2 is an expert judgement estimation which takes into consideration the Commission methodology establishing the contribution of heating from heat pumps[18]. This scenario is subject to revision once the Commission establishes the methodology for calculating renewable energy for cooling by the 31 December 2021 deadline in line with the recast of the Renewable Energy Directive.

Table 1 Indicative RES share trajectory for policy scenarios between 2021-2030, %.

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Policy scenario 1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.2	10.4	10.6
Policy scenario 2	10.8	11.2	11.4	11.6	11.8	12.1	12.4	12.8	13.1	13.3

[17] Under this scheme, support is provided for solar farms through a competitive process in which investors need to bid for support. The allocation of capacity is based on the bid price, provided that the submission is administratively compliant.

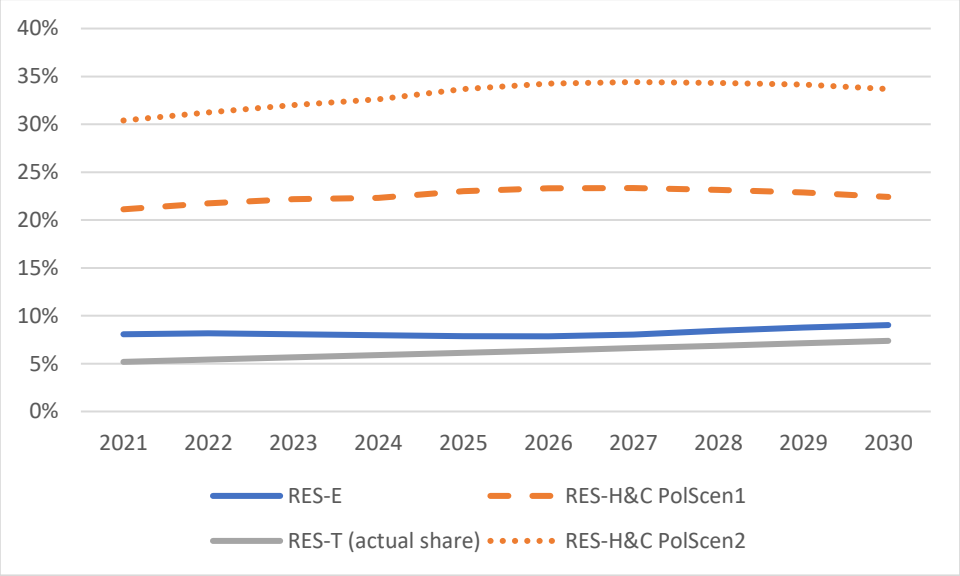
[18] Commission Decision 2013/114/EU and the related Corrigendum published on 6 March 2013.

It must be noted that under Policy Scenario 1, Malta shall commit to use statistical transfers or other types of cooperation mechanisms within the period 2021-2030 in order to keep the minimum 2020 RES share of 10% post-2020 as well as meet the interim targets.

ii. Estimated trajectories for the sectorial share of renewable energy in final energy consumption from 2021 to 2030 in electricity, H&C and transport sectors

Estimated trajectories for electricity, H&C and transport are provided in Figure 4.

Figure 4 Estimated trajectories for sectoral share of RES under Policy Scenarios 1&2 between 2021-2030, %.



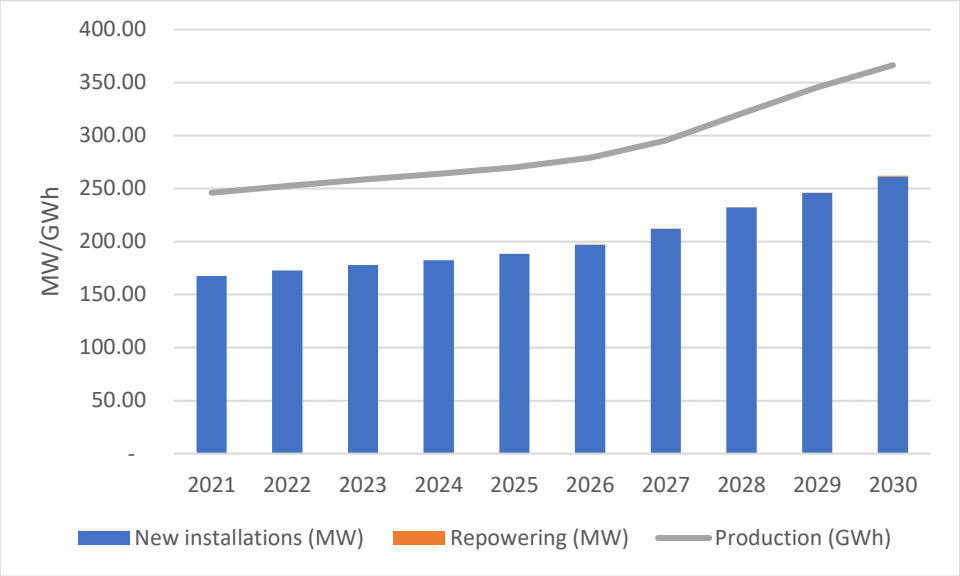
iii. Estimated trajectories by renewable energy technology including expected total gross final energy consumption per technology and sector and total planned installed capacity per technology and sector

RES-Electricity

RES-E trajectory is predominantly composed of RES generation from PV. Figure 5 illustrates the projected capacity of solar PV from 2021-2030, based on the Government's commitment to maintain increased penetration of solar PV through financial support schemes and other measures to facilitate uptake. Under the policy scenario, solar PV is expected to reach just over 260 MWp by 2030. This implies a total footprint of approximately 3.4km^2. Both rooftop and brownfield sites will continue to be given priority for installations. From 2026 onwards, repowering is projected to begin; however, this is to a very small extent prior to 2030 as installations of solar PV predominantly took place from 2010 onwards.

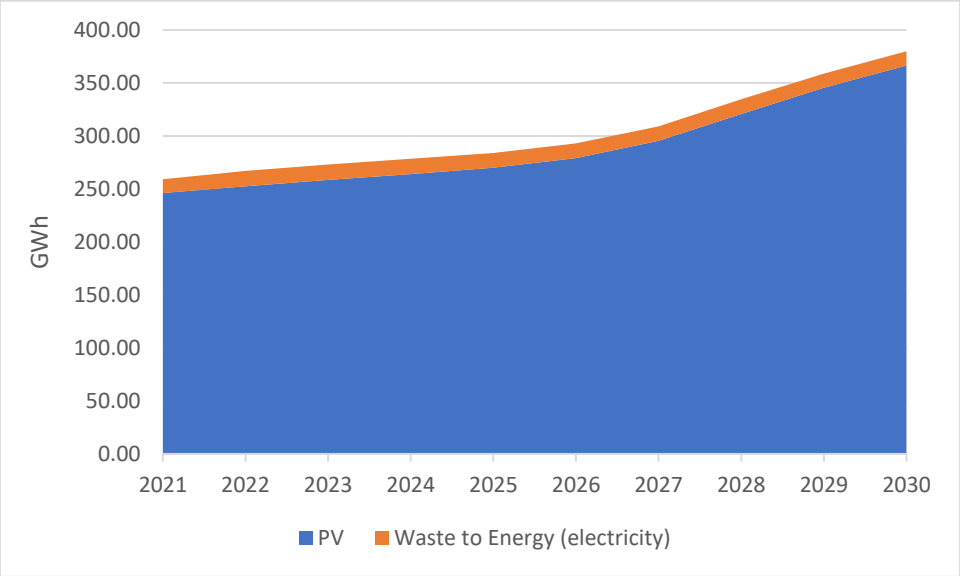
PV technology is projected to contribute to between 30-40% (depending on the policy scenario) of Malta's RES contribution in 2030.

Figure 5 PV capacity and production under policy scenario between 2021 - 2030, MW/GWh.



Electricity generation from waste-to-energy plants is expected to contribute a relatively small share to the RES-E trajectory as shown in Figure 6.

Figure 6 RES Electricity trajectory between 2021-2030, GWh.



RES-Heating and Cooling

Renewable energy in the heating and cooling sector is projected to contribute to 40-54% (depending on the policy scenario) of Malta's RES contribution in 2030.

Figure 7 RES Heating & Cooling under Policy Scenario 1, GWh.

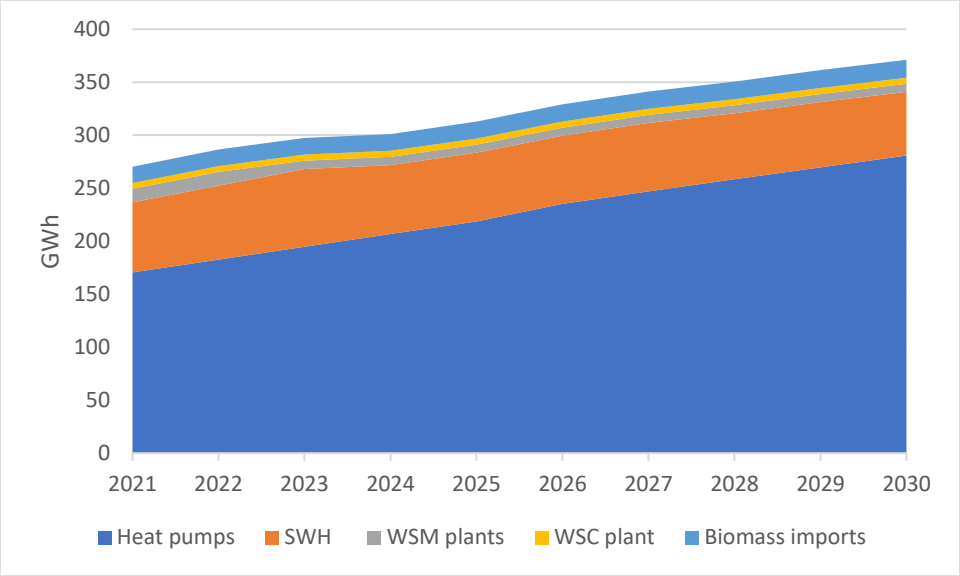
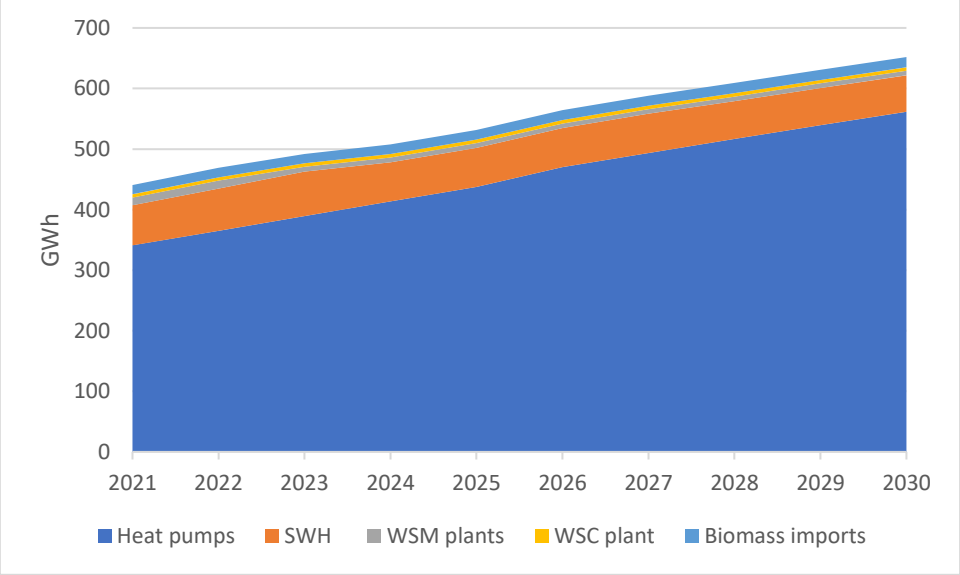


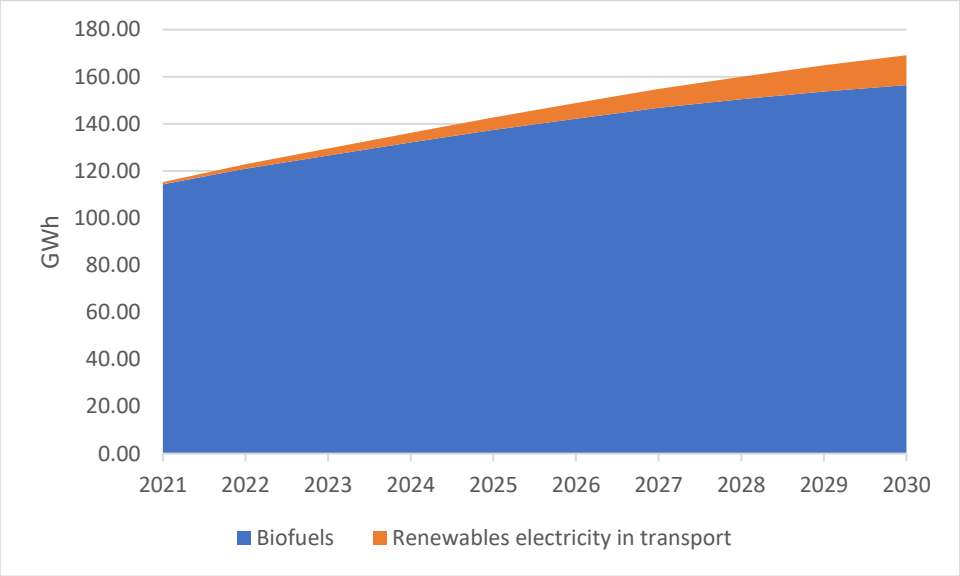
Figure 8 RES Heating & Cooling under Policy Scenario 2, GWh.



RES-Transport

The RES-T trajectory (Figure 9) is expected to be predominantly composed of biofuels, to be achieved mainly through the extension of the present substitution obligation on importers of road diesel and petrol who will be required to further increase the share of biofuels in the fuel mix. The share of renewable energy from electricity in transport is due to a projected increase in the share of electric vehicles in the road transport vehicle fleet. It must be noted that there is no rail system in Malta.

Figure 9 RES trajectory in Transport under policy scenario, GWh.



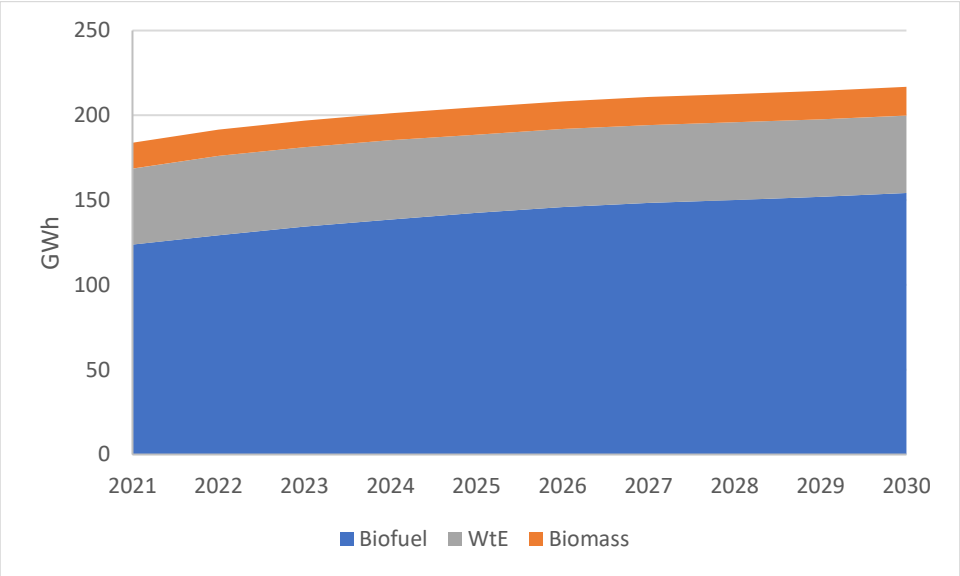
iv. [If applicable] Other national long-term or sectorial trajectories and objectives

The Maltese Government is in the process of determining a cut-off date for the importation and registration of Internal Combustion Engine (ICE) passenger vehicles in Malta. For this purpose, an ad hoc committee was formed in 2017 with the goal of identifying this date and the associated policies and measures which will be required to support such a transition.

v. Estimated trajectories on bioenergy demand, disaggregated between heat, electricity, and transport, and on biomass supply by feedstocks and origin

Bioenergy is projected to grow slightly between 2021-2030 (**Figure 10**), largely due to an increasing percentage of biofuels in road fuels in line with the substitution obligation on fuel suppliers which will reach 14% in 2030. Production of bioenergy from waste treatment facilities and the use of biomass for space heating in the residential sector are expected to remain largely stable.

Figure 10 Estimated trajectory for bioenergy under policy scenario, GWh.

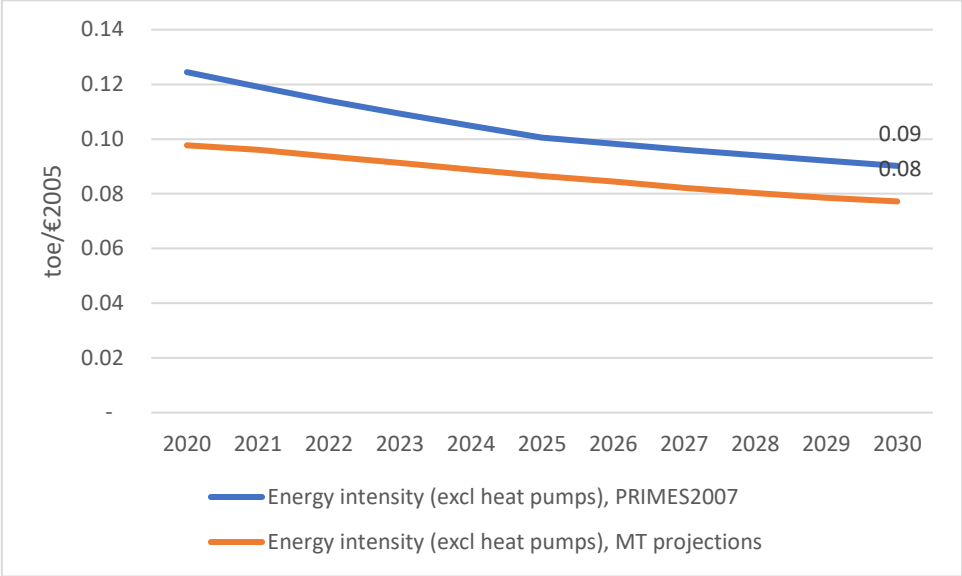


2.2 DIMENSION ENERGY EFFICIENCY

i. Indicative national Energy Efficiency contribution to achieving Union target

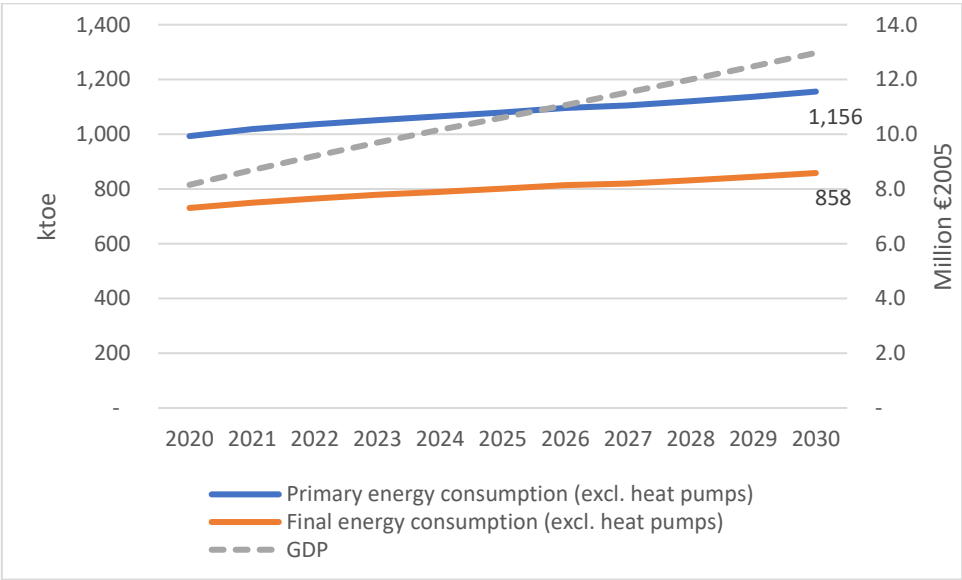
The EU's 2030 energy efficiency target of 32.5% is measured with reference to the projections performed by PRIMES in 2007. Malta's indicative energy efficiency contribution to the 2030 target is an energy intensity level of 0.08 toe/€$_{2005}$ as compared to a level of 0.15 toe/€$_{2005}$ in 2005. Both trends project a decoupling between energy and GDP; however, the energy intensity projected in this Plan is lower than that projected by PRIMES (Figure 11).

Figure 11 Malta projections of energy intensity compared to those from PRIMES 2007 database.



The primary energy and final energy consumption levels in absolute terms are projected to be 1,156 ktoe and 858 ktoe respectively (Figure 12).

Figure 12 Projected primary and final energy consumption levels in absolute terms, ktoe.



Projections for primary and final energy consumption are in line with Eurostat reports of energy balances of 2016, that is, excluding energy in ambient air captured by heat pumps. Energy intensity is being defined as the ratio between primary energy consumption and gross domestic product at 2005 constant prices. For translating from final electricity consumption to primary energy consumption, the share of distribution losses is assumed to be constant for the period 2021-2030 as per 2017. It is also assumed that renewable electricity is dispatched first, followed by a mix of conventional plants

running on natural gas and electricity imported over the interconnector. The share of units generated by conventional plants is in the range of 57% to 73% as compared to 20% to 34% for the interconnector during the 2021-2030 period.

ii. Cumulative amount of energy savings to be achieved over period 2021 – 2030 under Article 7(1)(b) of EED on energy savings obligations

Malta's energy market exhibits specific characteristics such as the existence of a single electricity distributor, the absence of natural gas or district heating and cooling networks as well as the small size of petroleum distribution companies which substantially limit the range of measures available to meet the energy savings obligations. These specific characteristics are compounded by the small size of the energy market. This is fully recognised under article 7(1)(b) of the revised Energy Efficiency Directive, whereby Malta is required to achieve new savings each year from 1 January 2021 to 31 December 2030 equivalent to 0.24% of annual final energy consumption averaged over the most recent three-year period prior to 1 January 2019.

Malta is experiencing remarkable growth in terms of both economy and population. Real economic growth in Malta in 2016 stood at 5.5%, underpinned by a 2.2% growth in the total population. In line with the sustained economic growth, Malta has also seen an improvement in employment figures which registered a 3.8% increase in 2016. The growth in population, employment and economic activity was accompanied by a more subdued 2% increase in total final energy consumption, implying an element of energy decoupling. However, the steep increase in population and GDP in such a relatively short time span has made it difficult to restrain energy consumption and it is expected that final energy consumption for 2017 and 2018 will still show an increase over previous years. Estimates for final energy consumption are provided in Table 2.

Table 2 Final energy consumption, ktoe.

Year	Final Energy Consumption [ktoe]
2016	584[19]
2017	628[*1]
2018	672[*2]

[*1] provisional

[*2] estimate

The provisional average final energy consumption for 2016-2018 amounts to 628 ktoe. This translates into an average of 1.5 ktoe of new savings required each year (based on an indicative linear trajectory) from 1 January 2021 to 31 December 2030 reaching 83 ktoe of cumulative energy savings by end 2030.

[19] Eurostat – Database updated 31/05/2018

iii. Indicative milestones of the long-term strategy for the renovation of the national stock of residential and non-residential private and public buildings

Malta is aware of its commitments to develop a long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, in accordance with Article 2a of Directive 2010/31/EU. As per the derogation, the first long-term renovation strategy shall be submitted by 10 March 2020. In view of this, no indicative milestones of the long-term renovation strategy are included as part of the Draft NECP.

iv. Total floor area to be renovated or equivalent annual energy savings to be achieved from 2021 to 2030 under Article 5

The total floor area to be renovated or equivalent annual energy savings to be achieved from 2021 to 2030 under Article 5 on the exemplary role of public bodies' buildings of Directive 2012/27/EU has yet to be calculated. The total floor area to be renovated by 2020 is established at 5,237 square metres/annum, which is estimated to amount to total energy savings of 555,390 kWh.

v. [If applicable] Other national objectives in areas such as energy efficiency in the transport sector and with regard to heating and cooling

Not applicable.

2.3 DIMENSION ENERGY SECURITY

i. The elements set out in Article 4(c)

Malta's National Energy Policy (2012) underlines the Government's commitment to the diversification of energy sources and contingency planning in the case of supply disruption, in order to achieve greater security of supply. The emphasis on diversification seeks to ensure diversification in terms of energy source, procurement sources, exporting country and supplier.

The following sections provide an overview of initiatives being undertaken by the Government with the goal of improving energy security through increasing diversification of energy sources and supply, and increasing the flexibility of the national energy system. The capacity for and policies on coping with constrained or interrupted supply are discussed under section 3.3.

ii. National objectives with regard to increasing the diversification of energy sources and supply from third countries

The Gas Pipeline Project between Malta and Sicily, Italy

The completed installation of the Malta-Italy Interconnector connected the Maltese national grid to the European electricity network in 2015. In addition, and in line with the Energy Union Strategy calling for an end to energy isolation particularly for peripheral regions, the Maltese Government is committed to establishing a connection to the Trans-European Natural Gas Network. The Gas Pipeline Project between Malta and Gela (Sicily, Italy) is a designated European Project of Common Interest (PCI 5.19) as per European Union Regulation No. 347/2013 on the guidelines for Trans-European energy infrastructure (TEN-E regulation). The construction and commissioning phase is expected to be finalised by 2024. Table 3 provides an overview of the preliminary project implementation plan.

Table 3 Gas pipeline project implementation plan.

Timeline	Description
November 2017	Start of pre-application permitting procedures in Malta and Italy
Q2 2018- Q2 2019	Conduct preliminary marine route survey (PMRS) and EIA studies
2019	Submission of Full Application Files to Maltese and Italian Competent Authorities
2020	Issuance of Comprehensive Decisions and CBCA Decision => Final Investment Decision
2020	Publishing of Tender for EPC Contract
2021	EPC Contract Award
2024	Construction & commissioning completed

Malta's connection to the Trans-European Natural Gas Network will lead to better gas market integration and contribute to improved security and diversification of energy supply for the island. The 159km pipeline between Malta and Gela shall be primarily used for the importation of gas from the Italian National Gas Network for local electricity generation, while also being designed for bi-directional flow capability. The gas pipeline will replace the Floating Storage Unit of LNG which is currently being used for supply and storage for electricity generation. This would also contribute towards the reduction of GHG emissions as the current need for liquefaction, shipping and regasification would be eliminated. Both Malta and Italy see the project as delivering mutual benefits and there exists a high degree of cooperation at all levels of government. Indeed, the ten-year development plan (2016-2025) of Snam Rete Gas S.p.A (Italian TSO) also takes the project into account; it declares that Snam Rete Gas is ready to implement the measures necessary to facilitate the connection of the gas pipeline to Italy's national gas network.

A Government owned company, Melita TransGas Co. Ltd has been established to take the role of the Project Promoter and will eventually be designated as the Transmission System Operator responsible for the construction and subsequently the operation of the gas pipeline.

Preparatory Studies

The Gas Pipeline Project has already benefitted from co-financing of studies through the TEN-E and Connecting Europe Facility (CEF) Programmes with more than €4.5 million in EU grants allocated for the preparatory studies, including those completed and the ones to be conducted in the next stages of the project implementation. It is envisaged that the application for funding for the construction will be submitted by 2020 at the latest.

A TEN-E funded pre-feasibility study and cost-benefit analysis, completed in April 2015, determined that the project is feasible and that the most economically feasible solution for the first phase of the PCI as being a gas pipeline interconnection between Gela (Sicily-Italy) and Delimara (Malta), with a diameter of 22 inches (560mm) and a length of ~155km and an annual capacity of 2 billion cubic meters per annum.

A Connecting Europe Facility co-funded study completed in June 2017 identified the optimal 1.2km wide offshore route corridor, landfall areas, on-shore routes, connection points and sites and areas of the terminal stations in both Delimara (Malta) and Gela (Sicily), the basic design of the pipeline and all related land-based infrastructure. The study confirmed the 22inch (560mm) diameter pipeline with a slight increase in length to 159km (151km offshore route, 7km onshore route in Gela and a 1km onshore route in Delimara). The scoping reports and other documentation required to initiate the permitting granting process have also been delivered as part of this study.

A CEF grant of €3.68 million was awarded in January 2018 to conduct detailed technical, environmental studies and financial engineering studies in order to obtain the necessary permits, prepare a tender dossier for an EPC contract and obtain a CBCA decision. This will require a number of environmental studies, a preliminary marine route survey and the front-end engineering design to be conducted in the next two years, which will enable a Final Investment Decision to be taken and a proposal for CEF funding for works to be submitted.

Cooperation in studies

The execution of the technical and environmental studies for the development of the PCI are being conducted in close consultation with the Italian TSO, PCI one-stop shop (MISE) and Central Government Authorities (MATTM), the Sicilian Regional Authorities including the Gela Council, as well as the concerned Sicilian stakeholders. Such continuous cooperation will ensure that any critical issues raised at this early stage of the project, especially in relation to the permitting process, will be considered in the planning and design stages. Public consultations in Marsaxlokk (Malta), Rome, Palermo & Gela were also held in April 2018 for this purpose. A second public consultation will be held during the statutory procedure of the permitting process.

Cooperation in the permitting process

Inter-Ministerial discussions with the Ministry of Economic Development (Ministero Dello Sviluppo Economico 'MISE') of Italy, which has been designated as the 'one stop shop' for the PCI permit process in Italy, commenced in May 2014 through a high-level meeting held in Rome between the Maltese Government and MISE, with representation from Snam Rete Gas, the Italian Regulatory Authority, the Maltese Regulatory Authority and presided by the Maltese Ambassador for Italy. Following this initial meeting, a number of follow-up meetings were held during the past two years with various authorities and stakeholders. In May 2017, a letter of intent was also signed between Government of Malta and the Sicily Region formalising the intention of both parties for collaboration in terms of permit granting.

iii. [If applicable] National objectives with regard to reducing energy import dependency from third countries

Not applicable.

iv. National objectives with regard to increasing the flexibility of the national energy system, in particular by means of deploying domestic energy sources, demand response and storage

Domestic Energy Sources

Malta has no indigenous energy sources that would provide a secure energy supply for the immediate future and is dependent on imported fuels and electricity to meet its national demand. Domestic extraction of natural gas would enhance diversification of primary sources of energy, and exploitation of crude oil would reduce Malta's dependence on foreign sources for this commodity, although a reliance on foreign refinery capacity would likely remain. In this regard, the Government will continue to promote petroleum exploration opportunities, seeking to attract more investment in this sector, and thus intensify offshore exploration around Malta. Where disputed boundaries exist, the Government will continue to negotiate with neighbouring countries to arrive at mutually acceptable solutions that would enable oil exploration to take place.

Although exploration for petroleum has been ongoing since 1954 when the first onshore exploration licence was granted, no commercial discovery has yet been made. However, the level of interest shown by oil companies in Malta attests to the potential of its petroleum geology. Indeed, Malta's central location in the Mediterranean and its proximity to proven petroleum systems with producing oil and gas fields in offshore Sicily, Libya and Tunisia makes Malta's acreage attractive for petroleum exploration.

Most of the past exploration activity has been focused offshore in an area of over 75,000 km^2 subdivided into areas and blocks, most of which are open to the oil industry for exploration. So far, 13 exploration wells have been drilled, two of them onshore. Such exploration activity has identified

good, drillable prospects in the sedimentary basins offshore Malta, analogous to existing producing fields in the Central Mediterranean. Most of these prospects are yet untested, making the possibility of a commercial discovery reasonably good.

Under national legislation, subsoil natural petroleum resources belong to the Government. According to the Petroleum (Production) Act (Cap. 156), the Government has the right to issue licences to companies to explore and produce petroleum. Two licences are available under the Petroleum (Production) Regulations (S.L. 156.01): (i) an exploration licence which gives rights to suitably qualified oil companies to execute a technical work programme, including the acquisition of geophysical data but with no rights to produce petroleum; and (ii) an exploration and production licence which gives rights to oil companies to drill exploration wells and, in case of a commercial discovery, to produce such petroleum. Exploration and production of petroleum in Malta enjoys a favourable legal regime. Under current legislation, the administrative process of granting exploration and production licences is short and of a duration compatible with the decision-making process of oil and gas companies.

Energy Storage

In Malta, the national emergency stock holding obligation is delegated to fuel importers and calculated on the gross inland consumption attributed to each importer. The national emergency stock holding obligation on aviation kerosene (Jet A1) constitutes an exception whereby the emergency stock is held by the Regulator on behalf of the Government.

The emergency stock holding obligation must be met through emergency stock holding tickets in Malta or any other EU country, except in those cases where the importer has a legal title to storage (ownership or lease) and may claim emergency stocks held as physical stocks. The composition and location of the security stock holdings may vary. For instance, during the first and second quarters of 2017, approximately 92% of the total amount of emergency stocks was in the form of tickets located abroad, while physical stock and tickets held locally amounted to around 8% of the total composition. In contrast, during the third and fourth quarters of 2017, 51% of the emergency stocks were located in Malta while 49% were held as tickets abroad.

Demand Management

Demand side management is currently limited to differentiated night and day tariffs for non-residential consumers with an annual consumption of 5 GWh or more.

Enemalta shall be closely monitoring the development of the energy storage market as this provides the scope for increased installation of photovoltaic capacity that, while not adversely affecting the local distribution grid system, will provide opportunities for peak demand shaving. This may postpone the requirement for new conventional generation facilities.

2.4 DIMENSION INTERNAL ENERGY MARKET

2.4.1 Electricity interconnectivity

i. The level of electricity interconnectivity aimed for in 2030

The electricity networks in Malta and Sicily (Italy) are linked by a 200MW HVAC interconnector, connecting Malta to the European electricity grid, which came into full operation in 2015. This contributes to the robustness of the electricity system and hence the security of supply in Malta, while enabling the trading (predominantly for import and balancing) of electricity on the Italian electricity wholesale market. Malta is considered as a foreign virtual consumption/production zone within the Italian market. The interconnector is operated by Enemalta and considered as part of its distribution system.

Electricity imported over the interconnector is projected to meet between 24-35% of Malta's electricity demand during the period 2021-2030. Enemalta is currently undertaking an assessment to determine infrastructure requirements in the medium-term to ensure the desired level of generation adequacy.

Indicators of urgency of action:

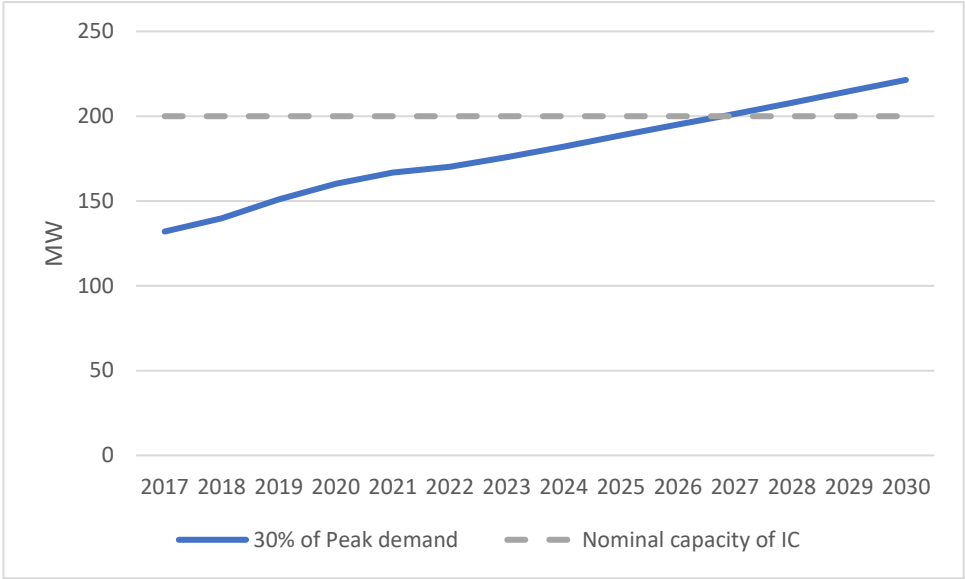
1) **Price differential in the wholesale market exceeding an indicative threshold of 2EUR/MWh between Member States, regions or bidding zones**

Enemalta is obliged to dispatch electricity from local generation plants and from the interconnector based on their order of economic merit. Any imbalances between the volumes determined on the day-ahead market and actual electricity flows over the interconnector are settled at the prices calculated using the methodology determined by AEEGSI (now ARERA) through its decision 549/2015/R/EEL (Deliberazione 20 Novembre 2015: Disciplina degli sbilanciamenti effettivi applicabile all'interconnessione Italia-Malta). In the absence of a liquid wholesale market in Malta, the Regulator (REWS) determines a proxy of the wholesale market price on an annual basis by estimating the variable cost of meeting the demand forecast for a given year from local fossil fuel generation and imported electricity, excluding that portion of forecasted demand which is not expected to be met by conventional sources or imported electricity. The proxy is published annually in Schedule 4 of SL. 545.27 and was included in the State Aid decision issued in relation to the notified competitive bidding process for the granting of aid to generators producing electricity from RES with capacity of 1MWp or more. However, given the structure of the electricity system in Malta, the proxy for the market price is not deemed to be an appropriate indicator to benchmark against the 2EUR/MWh indicative threshold.

2) Capacity of interconnector in relation to Malta's Peak Electricity Demand

The nominal transmission capacity of the interconnector is 200 MW. Based on projections of national peak load, it is expected that the capacity of the interconnector shall remain above the indicative threshold of 30% of peak load until 2027 (Figure 13). This is being taken into account in the assessment currently being conducted by Enemalta, and the best level of interconnectivity will be reviewed once this is concluded.

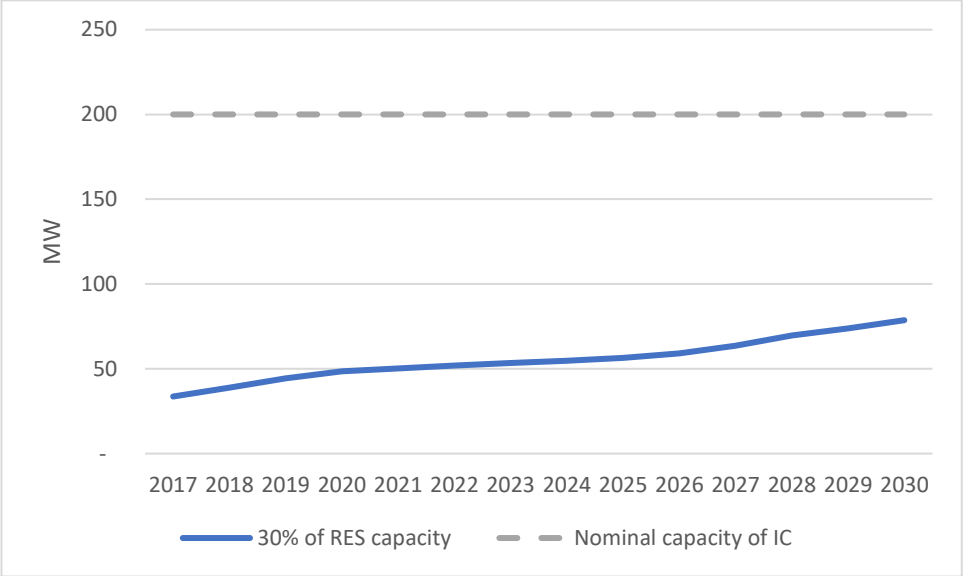
Figure 13 Capacity of interconnector compared to 30% peak load, MW.



3) Capacity of interconnector in relation to installed RES

The capacity of the interconnector is not expected to be exceeded by the indicative threshold of 30% of projected peak renewable electricity generation (nominal capacity) between 2021-2030 (Figure 14).

Figure 14 Capacity of the interconnector compared to 30% of installed RES capacity, MW.



2.4.2 Energy transmission infrastructure

i. Key electricity and gas transmission infrastructure projects and modernisation projects

Electricity transmission infrastructure

There is no electricity transmission system in Malta and hence no transmission system operator (TSO). Malta was granted derogations pursuant to Article 44 of the Electricity Market Directive 2009/72/EC from the requirements of Article 9 (Unbundling of transmission systems and TSOs), Article 26 (Unbundling of DSO), Article 32 (Third party access), and Article 33 (Market opening and reciprocity).

In the recast of Directive 2009/72/EC, Malta is being accorded derogations from Article 4 (Free choice of electricity supplier), Article 6 (Third party access), Article 36 (Unbundling of DSO), and Article 43 (Ownership unbundling of Transmission Systems and TSO).

Natural Gas Transmission Infrastructure Projects

The Malta-Italy Natural Gas Pipeline (Project of Common Interest 5.19) is described in Section 2.3.ii.

Modernisation projects

Malta's electricity generation infrastructure recently underwent major modernisation. This included new, upgraded and more efficient generation capacity which allows the DSO to meet future demand with significantly higher efficiency and lower emissions. Between 2014-2017, the DSO invested over

€100 million to upgrade and expand major nodes of the national electricity network and improve quality of service. Therefore, no other major modernisation projects are envisaged in the short-term.

ii. [If applicable] Main infrastructure projects envisaged other than Projects of Common Interest

LNG storage as a back-up in case of gas disruption

The Energy and Water Agency, in cooperation with Transport Malta, conducted a feasibility study, funded under the CEF Synergy, to assess the potential of LNG as marine fuel in Malta. The first part of the study concluded that while the demand for LNG bunkering in the Central Mediterranean is expected to increase at a rather modest rate during the next decade, medium- to long-term solutions will rely on access to LNG storage facilities.

Based on the outcomes of this study, synergies with the power sector and the option of having an LNG storage facility to cater for potential gas disruptions shall be explored in the framework of the ongoing study by Enemalta and further studies.

2.4.3 Market integration

i. National objectives related to other aspects of internal energy market, such as increasing system flexibility, market integration and coupling, smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching, curtailment and real-time price signals

There is no liquid wholesale market in Malta. Malta is also eligible to derogate from the application of a number of provisions of the Electricity Market Directive. These acknowledge the specificities of the Maltese electricity system, in particular its size (consumption of circa 2.4TWh per year) and its peripherality at the edge of the EU grid. These features also contribute to a well above average costs to ensure the desired level of generation adequacy as manifested in the EU Commission's decision which approved availability payments as part of a Power Purchase Agreements and Gas Supply Agreement for the provision of additional generation capacity and gas supply. Enemalta plc is designated as the sole supplier of electricity in Malta.

ii. [If applicable] National objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets including a timeframe for when the objectives should be met

The Electricity Market Regulations (SL. 545.13), subject to the fulfilment of requirements related to the maintenance of reliability, safety and stability of the distribution system oblige the DSO to:

- Guarantee the distribution of electricity produced from RES wherever technically feasible and with regard to system stability;
- Provide for priority access to the distribution system of electricity produced from RES;
- Give priority to generating installations using RES; and
- Ensure that appropriate distribution systems and market-related operational measures are taken in order to minimise the curtailment of electricity produced from RES.

Given that there is no liquid wholesale market, generators producing electricity from RES do not have balancing responsibilities.

iii. [If applicable] National objectives with regard to ensuring that consumers participate in the energy system and benefit from self-generation and new technologies, including smart meters

In line with its programme to ensure an efficient distribution system, Enemalta has equipped 99% of its consumers with smart meters and has adopted a tariff system that favours the prudent use of energy. Objectives concerning renewable self-generation are discussed in section 3.1.2.vi.

iv. [If applicable] National objectives with regard to ensuring electricity system adequacy, as well as for the flexibility of energy system with regard to renewable energy production, including a timeframe for when the objectives shall be met

Measures related to the flexibility of the energy system with regard to renewable energy production are set out in Section 3.3.i. Enemalta is responsible to ensure the desired level of electricity system adequacy. Given the small size of Malta's electricity system which includes two power plants (at the same site), a peaking power plant (also at the same site), an interconnector with Sicily, and several small-scale PV generators, Enemalta adopts a N-1 approach when establishing generation system adequacy. In other words, Enemalta aims to be in a position to still meet the peak demand in the event of the failure of the largest generator. Enemalta shall continue to abide by the national objective to maintain the same level of generation adequacy, based on the present approach.

Furthermore, in view of current grid integration issues of renewables on the low voltage side, Enemalta shall continue to upgrade its sub-stations with transformers integrated with voltage tap-changers, as well as take onboard new technologies which mitigate against these issues and allow further deployment of small scale PV systems on rooftops.

v. [If applicable] National objectives to protect energy consumers and improve the competitiveness of the retail energy sector

Competition in the supply of fuels is ensured through existing legislation enforced by the Regulator for Energy and Water Services and the Malta Competition and Consumer Affairs Authority. A number of suppliers are active in this sector.

There is only one supplier of electricity in Malta.

Details about policies and measures addressing vulnerable and energy poor consumers is provided under Section 3.4.3 iv. and under Section 4.5.4 related to Malta's assessment of energy poverty.

2.4.4 Energy poverty

i. [If applicable] National objectives with regard to energy poverty

Malta's assessment of the number of households in energy poverty, in line with Article 3(3)(d) of the Governance Regulation is described in a new section 4.5.4.

2.5 DIMENSION RESEARCH, INNOVATION AND COMPETITIVENESS

i. National objectives and funding targets for public and private research and innovation relating to the Energy Union

Malta's current research and innovation (R&I) strategy until 2020 gives priority to capacity building in research through enhancing the number of researchers and injecting more investment into facilities and infrastructures for research.

A new general R&I strategy will be in place by the end of the time period covered by the present strategy. Therefore, it is foreseen that the national R&I strategy will be available by the end of 2020. Smart specialisation, guided by the Entrepreneurial Discovery Process, will remain a key component of Malta's next strategy. This implies that a bottom-up approach, focused on stakeholder consultations, will be the prevalent approach for selecting future areas of investment for R&I. The adoption of this approach and its continuation post-2020 is a conditionality for Malta to access the R&I portion of its ERDF allocation. The inclusion or otherwise of low-carbon technologies in the next national general R&I strategy covering the period up to 2030 will depend on the outcome of the Smart Specialisation and Entrepreneurial Discovery Process. Similarly, it is not possible to foresee expenditure on R&I in this area post-2020.

Discussions with stakeholders within this context will be held during the preparatory phase of the new R&I Strategy. For instance, in November 2018, the Malta Council of Science and Technology (MCST) organised a public consultation on Malta's national Smart Specialisation Strategy which forms part of Malta's National R&I Strategy for 2030. Stakeholders were given the opportunity to express opinions, raise issues and provide feedback on Malta's current Smart Specialisation Strategy and the Entrepreneurial Discovery Process, as well as discuss the identification of new ideas and priority areas for a Strategy post-2020.[20]

Due to the uncertainty surrounding the possible inclusion of energy and low-carbon technologies in the national R&I strategy post-2020 at this stage, it was determined and agreed between the

[20] http://mcst.gov.mt/future-smart-specialisation/

Parliamentary Secretariat for Financial Services, Digital Economy & Innovation (the national entity responsible for policy direction in the area of innovation) and the Ministry for Energy and Water Management that a separate, specific strategy for R&I in the area of energy and water will be developed by the end of 2019, in time for the completion and submission of Malta's final NECP. The main aim of this new strategy will be to boost and foster R&I in the area of energy, targeting low-carbon technologies and areas falling under the dimensions of the Energy Union. This new strategy will also provide more clarity with regards to the expected expenditure on R&I in this area post-2020.

ii. [Where available] National 2050 objectives related to the promotion of clean energy technologies and [if appropriate] national objectives including long-term targets for decarbonising energy and carbon-intensive industrial sectors

Malta does not have 2050 objectives related to the promotion of clean energy technologies. Additionally, there are no long-term targets for the decarbonisation of energy and carbon-intensive industrial sectors as Malta does not have an energy and carbon-intensive industry.

iii. [If applicable] National objectives with regard to competitiveness

Malta does not have national objectives with regard to competitiveness.

3 POLICIES AND MEASURES

3.1 DIMENSION DECARBONISATION

3.1.1 GHG emissions and removals

i. Policies and measures to achieve target set under ESR as referred to in 2.1.1 and policies and measures to comply with LULUCF Regulation

Agriculture

In agriculture, future GHG emission trends may be influenced both by measures taken to directly address emissions or measures that indirectly contribute towards decreasing emissions, and by inherent trends in activity in the sector. In animal husbandry for example, the restructuring of the sector to conform to animal welfare, food safety, veterinary and waste management requirements, particularly those arising from EU legislation, will lead directly to a decrease in emissions due to reduced activity or reduction in emissions from the realization of the requirements already mentioned. Land under cultivation is also decreasing and water scarcity could further compound this trend; this could have a beneficial effect in terms of GHG emissions.

National Agriculture Policy for the Maltese Islands (2018-2028)[21]

The Agricultural Policy for the Maltese Islands 2018-2028 is intended to provide direction to all relevant stakeholders ranging from public entities involved with certification, permitting and decision-making to private entities directly involved in the agricultural scenario who intend to invest or diversify their business.

As the overarching objective for this Agricultural Policy, a 'vision' for the Maltese agriculture sector was identified and agreed between government entities, representatives of the private sector and the farming community. This vision entailed the development of a policy that targets the following critical targets:

- Increasing the competitiveness of active farmers and livestock breeders by focusing on quality and embracing diversification;
- Facilitating the entry of young farmers by creating a cost-effective agri-business sector;
- Fostering sustainability of farming activities by adapting to the local geo-climatic conditions; and
- Ensuring that farmland is managed by genuine farmers for agricultural purposes and related activities.

[21] https://agriculture.gov.mt/en/agricultural_directorate/Documents/nationalAgriculturalPolicy/napFinal.pdf

Following a wide consultation process, the consultants identified six strategic policy objectives which stood as the basis for a comprehensive evaluation process and the development of policy measures for the upcoming decade. These strategic policy objectives include:

- Food presentation, labelling and traceability;
- Consolidation of land holdings;
- Sustaining water and key resources;
- Competitiveness and diversification;
- Adaptation to and mitigation of geo-climatic conditions; and
- Research and development.

This policy document presents a total of seventy policy measures organised in four sets of operational objectives, namely: (i) Economic objectives; (ii) Social regeneration; (iii) Resources; and (iv) Governance.

Agricultural Waste Management in the Maltese Islands (2015-2030)

The Agriculture Waste Management in the Maltese Islands is a plan which caters for the management of agricultural waste in Malta. In particular, farm waste management in Malta is governed by the requirements of several EU Directives. Of relevance is the Nitrates Directive as transposed by Legal Notice 343 of 2001 and by the Protection of Waters against Pollution Caused by Nitrates from Agricultural Sources Regulations, 2003. These instruments provide for the designation of the entire territory of Malta and Gozo as Nitrate Vulnerable Zones, the formulation of Code/s of Good Agricultural Practice and the preparation of Action Programmes in respect of designated vulnerable zones. The Waste Framework Directive 2008/98/EC as transposed by the Waste Regulations 2011 (L.N. 184 of 2011) is also to be complied with.

The plan proposes the development of a national system for manure management which will address a number of market failures, including the insufficient availability of cultivated land where manure can be applied, the vulnerability of the entire territory to nitrates contamination and the practical difficulties faced in terms of appropriate manure management by the typically small and fragmented farm holdings in Malta.

Manure Management Research

The Governance of Agricultural Bio-resources Agency are currently conducting several research studies to analyse possible ways of diverting manure for the agriculture steam. Regretfully, this research is still ongoing and thus is not being considered in this draft reporting of the NECP; however, depending on the outcomes and the results achieved, additional measures under the Agriculture sector could be included in the final NECP.

A model was developed in 2017 to estimate the activity of sectors from which methane and nitrous oxide from agriculture waste and managed soils are emitted. The activity data consisted of the number

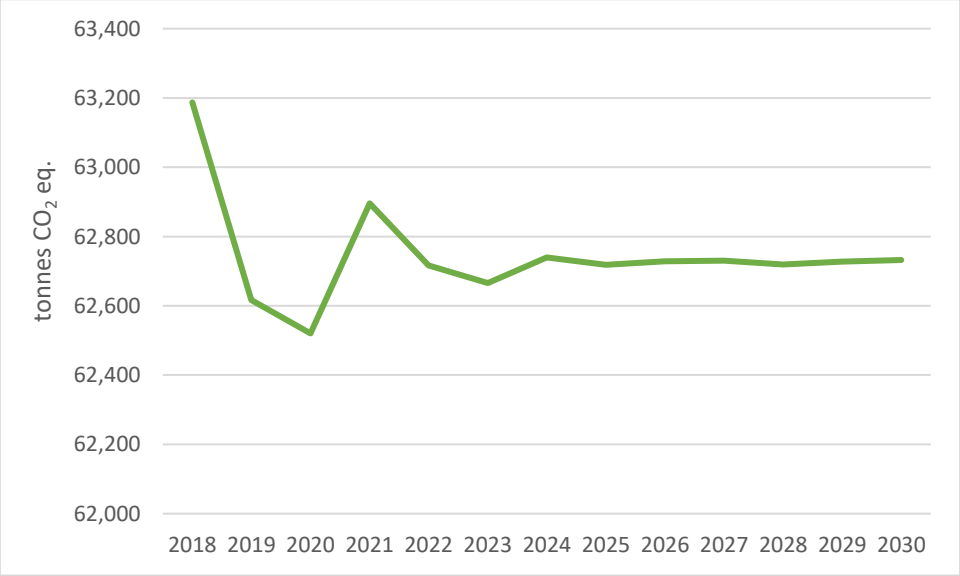
of animal heads including cattle, swine, sheep, goats, horses, poultry and rabbits, milk production and agriculture land area. The projections are based on a three-year moving average taking actual data for 2016 as the base year. The various animal heads were subsequently sub-divided by age group and/or by type, for example cattle was first sub-divided between dairy and non-dairy and subsequently each division was sub-divided again for cattle aged less than 1 year, between 1 and 2 years of age and over 2 years of age. This approach allowed for greater precision in the estimation of emissions from livestock. The model covers projections of GHG emissions over a period spanning 1990 – 2050.

The Malta North facility started its operations in 2016. The plant, which has a capacity of 76,000 tonnes per year, includes an anaerobic digester and a bulky waste plant able to handle a further 47,000 tonnes per year, while its waste transfer station can handle 11,800 tonnes per year. In terms of manure treatment, only liquid manure produced in cattle farms (35 kt/annum) and dry manure from layer/poultry and broilers farms (4 kt/annum) are treated (an estimated 80kt/a surplus is projected to require treatment in the future; however, this will not take place in the MBT). 52,069 tonnes are sent to the Mechanical Biological Treatment Plant (MBT), which is able to process either mixed municipal waste or, ideally, source-separated bio-waste in a series of mechanical and biological treatment steps. The input received by the MBT is: (i) landfilled (35,155 tonnes); (ii) further treated in the anaerobic digester (17,420 tonnes); or (iii) sent to the Material Recovery Facility (MRF) which treats recyclable waste like plastic and carton.

Methodology

The projections of cattle and poultry manure treated and manure remaining were calculated based on the projected reference cattle and poultry populations and the projected N excretion. The N excretion is calculated by multiplying the default Nrate (given in the 2006 IPCC guidelines) by the weight of the animal/1000 * 365 days. Since animal weight and Nrate remain constant throughout the time-period, there is no projection of the value.

Figure 15 ESR total sector emissions unde the policy scenario from 2018-2030, tCO_2 eq.



LULUCF Projections

Malta is currently working on the formulation of the Forest Reference Level which will enable Malta to project LULUCF emission; however, in view of timings, these projections will be presented for the final submission of the NECP.

Waste

The waste sector will see a relevant decrease in the waste going to landfill, especially for municipal wastes which will be diverted to either biological treatment or incineration. The advent of the incineration of municipal waste will appear as a net increase in emissions for the year of application, with a gradual but constant decrease in emissions from landfilling becoming more accentuated in the later period. This trade off comes due to the obligation on Malta to address other targets in the waste sector, and land space issues caused by ever expanding landfill sites.

Waste Measures under the Policy Scenario

- **Waste Management Plan for the Maltese Islands 2014-2020 (2014)**

Malta's national waste management plan and national waste strategy have been reviewed and amended in accordance with the provisions of Article 28 of Directive 2008/98/EC on waste. Both the plan and strategy have been amalgamated into one document, the "Waste Management Plan for the Maltese Islands – A Resource Management Approach 2014 – 2020" as published in January 2014. The Plan also incorporates Malta's national waste prevention programme. The new plan proposes measures to be implemented over the period 2014 – 2020 to move ahead from the status quo towards the achievement of national and EU set targets.

The Waste Management Plan for the Maltese Islands (2014-2020) provides a roadmap for Malta that envisages waste management in Malta moving up the waste hierarchy through increased prevention, re-use, recycling and recovery. The document is divided into two plans. The first deals with waste prevention, which focuses mainly on behavioural aspects, characteristics and habits of both the domestic and the commercial/industrial waste producer. The second part, which deals with waste management strategies, also focuses on behavioural aspects as well as waste management strategies of generated waste streams.

Both plans are aimed at addressing key issues and challenges being:

- Low rates of recycling;
- High landfilling rates;
- Unsustainable waste management;
- Breaking the link between economic growth and waste generation;
- Moving waste up the waste hierarchy; and

- Moving towards sustainable waste management through waste prevention, increased recycling and recovery.

This strategy affects emissions of GHGs and low carbon development by putting forward proposals that will lead to sustainable lower waste generation rates and thereby improve Malta's standing vis-a-vis the waste hierarchy. Although there are no specific measures that go beyond the objectives of the Landfill Directive (Council Directive 1999/31/EC on the landfill of waste) in the Waste Management Plan, such as the complete or partial bans on landfilling biodegradable waste, the: (i) commissioning of a new Mechanical Biological Treatment Plant which is currently being built for the treatment of municipal waste and cattle and chicken manure; (ii) introduction of separate collection of bio-waste; and (iii) energy recovery from residual waste to reduce landfilling to a minimum, identified in the plan should contribute towards the reduction of emissions from the waste sector.

Several measures, implemented and planned, are aimed at reducing GHG emissions from the closed solid waste landfilling sites as well as the existing landfills, while also seeking to exploit the renewable energy potential of waste and, at the same time, addressing Malta's obligations under the EU environmental acquis, notably the Landfill Directive and Urban Waste Water Treatment Directive.

Furthermore, measures aimed at diverting waste from landfilling will be achieved through increased recycling and waste-to-energy options. Apart from complying with requirements of EU legislation, this direction is sought to reduce the stress on the land-use capacity of the country. Waste diversion does not have an immediate net-saving effect of GHG emissions since emissions from landfills at any point in time are the result of dumping of material in landfills over the previous two or three decades and full closure of a landfill site does not mean immediate ceasing of emissions. However, the reduction of waste going to landfills will bring about savings at a faster rate than would be the case if volumes of landfilled waste remain the same or, even worse, increase.

The Government is also working to consolidate as much as possible all the waste streams generated, including agricultural waste which includes manure. This will have direct effects on the emissions from manure management, the organic fraction of MSW and sewage sludge.

- **Separate Waste Collection for the Organic Fraction**

The organic waste collection is in line with the circular economy provisions, currently being developed within the environmental legislative framework. The main aims of circular economy are to generate value out of waste resources and reducing the negative impact from waste. Organic waste is the material that is biodegradable and comes from either an animal or a plant. This is normally broken down by micro-organisms over time to produce methane, which can be used as a fuel, and compost, which can be used to fertilise the soil.

On the way to being able to assess the impact of separate organic waste collection on Maltese households, a pilot project was launched in July 2015. A total of 9 localities took part in this pilot project, with WasteServ Malta Ltd carrying out the project. Primarily, this project facilitated the diversion of food waste and other organic fractions away from the mixed municipal waste collections,

and subsequently directed it to existing Anaerobic Digestion facilities. From recent waste composition analyses studies, it was determined that circa 50% of mixed municipal solid waste generated in Malta is organic. This further highlights the importance of such separate collection in enabling a reduction in landfilling of degradable organic carbon, and subsequently reducing GHG emissions.

On 31st of October 2018, the Organic Waste Pilot Project was upscaled and rolled out nationwide, with the separate organic collection being given high priority nationwide. In the first week of nationwide collection, over 440 tonnes of organic waste were collected.

- **Waste to Energy Facility**

In 2014, the waste management strategy 2014-2020 included the provision for the assessment of options for residual waste, including a cost benefit analysis commissioned in 2015 to determine the financial feasibility of the options considered. This study concluded that the best option is local waste-to-energy recovery. A second study, finalised in 2018, analysed existing reports and studies and projected needed capacity for waste management to elucidate the required plant characteristics (technology, siting, size, throughput ect.). The salient outcomes include the following:

- The plant will be able to process around 114,000 tons of waste and recover a substantial amount of energy of about 69000 MWh per year;
- The Waste-to-Energy plant will use a robust technology known as Moving Grate Incineration, which is used in several European cities and countries (about 80% of Waste-to-Energy facilities use this technology). The moving grate incineration technology has the advantage of being lenient in that it does not need prior MSW sorting or shredding and can accommodate copious quantities and variations of MSW composition and calorific value. The technology has a long track record of operation for mixed MSW treatment;
- This will leave a balance of nearly 190,000 tonnes of waste that is currently being landfilled and needs to be diverted through improved recycling and recovery solutions; and
- The land area that will be needed for the plant is circa 5,000sqm excluding ancillary installations.

It was proposed that this facility should be built in the Maghtab complex, largely for the reason that part of the infrastructure is already available at this site. Any development will be subject to permits and other necessary studies required by planning and environmental requirements.

Currently, the process is looking into options for investment in the facility, including Public Private Partnership and EU Funding.

- <u>Projection Methodology</u>

The projection of waste generation is based on the relation between a relevant driver trend between 2013 and 2016, and the actual trend in waste generation 2013-2016. This relation is represented by a constant which is multiplied by the projected macroeconomic driver to result in a projected waste

generation for that particular year. This exercise has been repeated for all waste streams as published in the National Statistics Office waste statistics, with each waste stream associated with a specific relevant driver (Table 4).

Table 4 EWC-STAT driver association

EWC-Stat code	Description	Selected Driver
1.1	Spent solvents	Gross Domestic Product
1.3	Used oils	Gross Domestic Product
1.4, 2, 3.1	Chemical wastes	Gross Domestic Product
1.4, 2, 3.1	Chemical wastes	Gross Domestic Product
3.2	Industrial effluent sludges	Gross Domestic Product
3.2	Industrial effluent sludges	Gross Domestic Product
3.3	Sludges & liquid wastes from waste treatment*	Population
5	Health care and biological wastes	Population
5	Health care and biological wastes	Population
7.2	Paper and cardboard wastes	Disposable Income
7.3	Rubber wastes	Gross Domestic Product
7.4	Plastic wastes	Gross Domestic Product
7.5	Wood wastes	Gross Domestic Product
7.6	Textile wastes	Disposable Income
8 (excl. 8.1, 8.41)	Discarded equipment	Disposable Income
8 (excl. 8.1, 8.41)	Discarded equipment	Gross Domestic Product
8.1	Discarded vehicles	Disposable Income
8.41	Batteries and accumulators wastes	Gross Domestic Product
8.41	Batteries and accumulators wastes	Gross Domestic Product
9.1	Animal and mixed food waste	Population
9.2	Vegetal wastes	Population
9.3	Animal faeces, urine and manure	Gross Domestic Product
10.1	Household and similar wastes	Disposable Income
10.2	Mixed and undifferentiated materials	Population
10.2	Mixed and undifferentiated materials	Population
10.3	Sorting residues*	Gross Domestic Product
11	Common sludges	Gross Domestic Product
12.1	Mineral waste from construction & demolition	Gross Domestic Product
12.1	Mineral waste from construction & demolition	Gross Domestic Product
12.2, 12.3, 12.5	Other mineral wastes	Gross Domestic Product
12.2, 12.3, 12.5	Other mineral wastes	Gross Domestic Product
12.4	Combustion wastes	Gross Domestic Product
12.4	Combustion wastes	Gross Domestic Product
12.7	Dredging spoils	Gross Domestic Product
12.8, 13	Mineral waste from waste treatment & stabilised waste*	Gross Domestic Product
12.8, 13	Mineral waste from waste treatment & stabilised waste*	Gross Domestic Product

Following the completion of a waste generation scenario, each waste stream was portioned into the different waste treatment options based on the reference or policy scenario. In the reference scenario, the capacity of existing options is respected, with the remainder being directed to landfilling. In both scenarios, it is assumed that landfilling space will not run out at any moment and that capacity of present plants will be retained all along the period. This means that if any plant included in the reference ceases to operate in the timeframe of the projection, a similar plant in terms of technology and capacity will replace it immediately. The difference between the reference and policy scenarios, is due to shifting of waste streams from one option (e.g. landfilling) to another option higher in the waste hierarchy (e.g. waste to energy, biodigestion or recycling). To date, the model does not account for behavioural changes that induce quantitative waste generation changes, thus waste avoidance is not accounted for at this stage. This is mainly due to the low confidence and inability to model behavioural change induced by measures included both in the reference and policy scenario.

The below charts illustrate the waste distribution per emitting treatment stream.

Table 5 Landfilling profile under the policy scenario from 2017-2050, totals.

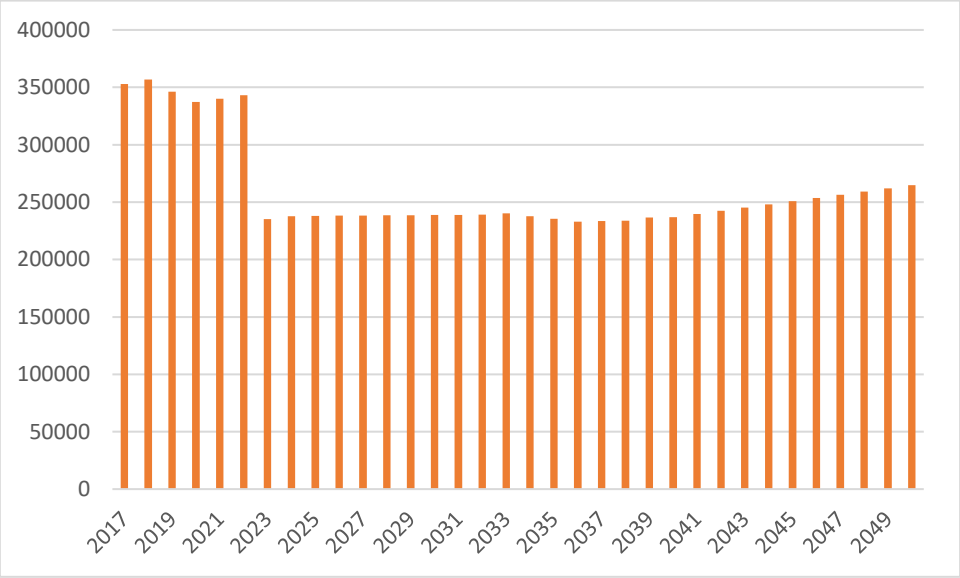


Table 6 Incineration profile projections under the policy scenario from 2017-2050, totals.

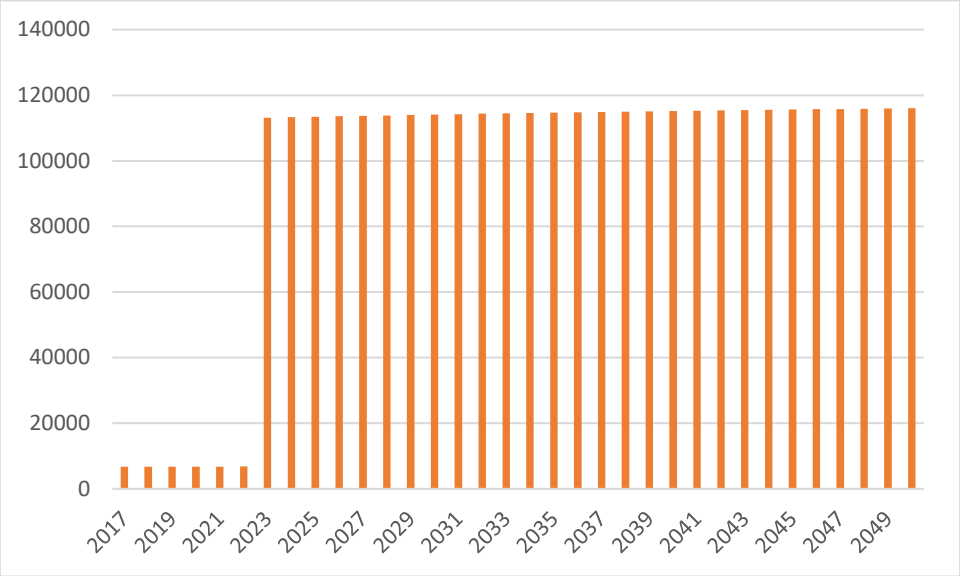
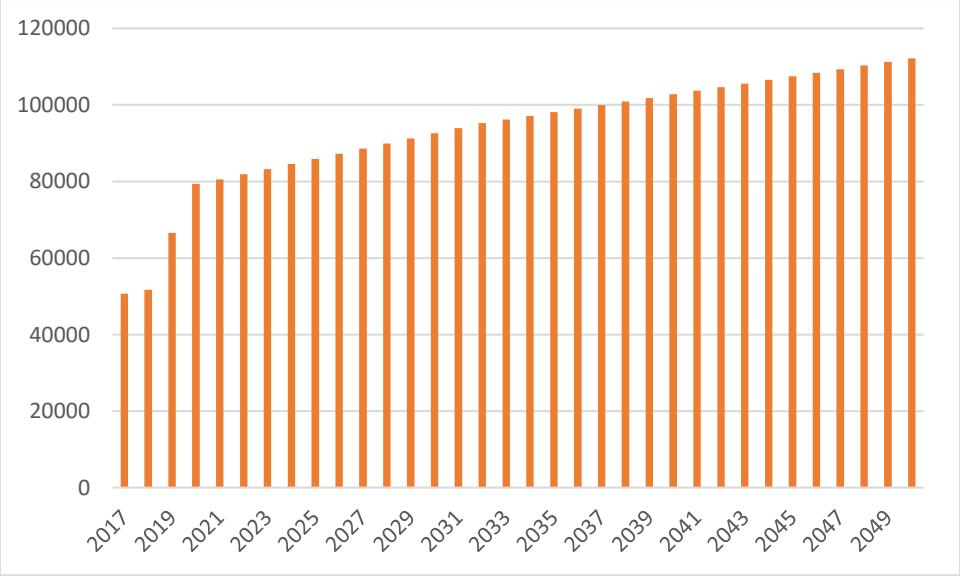


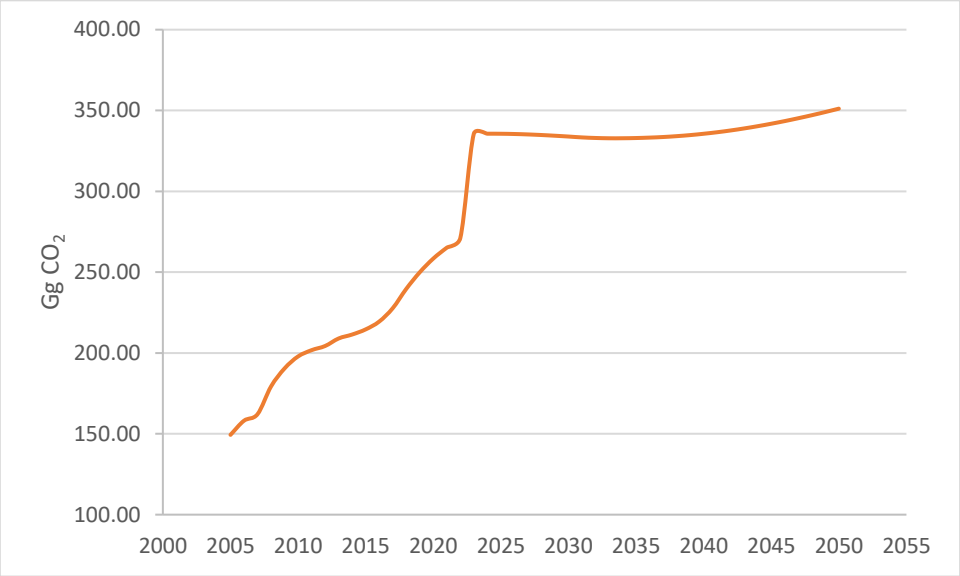
Table 7 Biological treatment under the policy senario from 2017-2050, totals.



Following this distribution, the waste quantities were converted into emissions through inventory models based on the IPCC 2006 guidelines (Table 8). The methodologies are described in the National GHG inventory 2018 submission.[22]

[22]http://cdr.eionet.europa.eu/mt/eu/mmr/art07_inventory/ghg_inventory/envws9gua/Malta_NIR_1990-2016_Apr_2018_submission_Version2_final.pdf

Table 8 Emission projections in the waste sector under the policy scenario from 2005-2055, Gg CO_2.



ii. Regional cooperation in this area

This information will be provided in the final plan.

iii. [If applicable] Financing measures, including EU support and the use of EU funds in this area at national level

This information will be provided in the the final plan.

3.1.2 Renewable energy

i. Policies and measures to achieve national contribution to the binding EU-level 2030 and trajectories including sector and technology-specific measures

Malta's contribution to the EU's 2030 renewable energy target will require the extension of current policies and measures and the development of new initiatives tailored to local developments. The Government seeks to fully exploit all technically and economically viable indigenous sources of RES and support the private sector in similar endeavours. In this regard, policies and measures will predominantly focus on solar PV, solar water heaters and biofuels. The shift towards a higher share of renewable heating (and cooling) from heat pump technology is not driven by a specific measure but indirectly benefits from competitive household electricity prices.

Share of RES in Electricity

Solar PV

Solar PV continues to be the most viable and robust form of indigenous sources of RES and has penetrated all sectors successfully. A study on Malta's technical potential for solar PV indicates that, post-2020, there will be potential for further deployment of solar PV on rooftops and brownfield sites. Therefore, the Government intends to extend its current policy framework to cover the period from 2021-2030 and adopt new measures where appropriate, with the goal of increasing the consumption of electricity generated from solar PV installations.

Support for solar PV is regulated through Subsidiary Legislation 545.27 which allocates support to new solar PV installations which are connected to the grid in order to help investors in the residential and non-residential sectors overcome existing cost barriers. Support is currently available in the form of operating aid, and also in the form of a grant on capital investment for households. Schemes have been successful, and well-received and accepted by potential investors. In light of further potential for increasing the energy generated by solar PV, the Government intends to extend the present support framework beyond 2020 to continue encouraging investors. Further details on the additional financial support required is included under point 3.1.2.iii.

A system of fast track permitting, taking the form of a notification process, was adopted by the Regulator (REWS) for PVs not larger than 16 Amps per phase to facilitate the installation of such systems and their connection to the grid; this also covers small repowered systems. In line with Article 16 of the recast of Directive 2009/28/EC on the promotion of the use of energy from renewable sources, Malta also intends to adopt a simplified procedure for repowered systems of larger capacity (greater than 16 Amps per phase).

PV systems larger than 16 Amps per phase require an authorisation and a licence to operate from the REWS prior to construction and connection to the grid respectively. In order to maintain the integrity of the grid, applicants may be requested to commission a grid connection study to be carried out by the DSO to ensure that the system is seamlessly integrated into the network. The grid connection study is performed free of charge for systems having a capacity not exceeding 40kW. The DSO has published a manual detailing the process flow for the processing of applications for grid connections of distributed RES to facilitate the process in such cases[23].

Non-government entities play an important role in the development of local renewable energy capacities. In parallel, the Government is increasing its efforts to ensure that public rooftop spaces are fully utilised, where possible. For instance, Malta Industrial Parks, which manages state-owned industrial premises, is promoting the use of roofs in industrial zones for the installation of PV systems, and is in the process of developing a framework which should address the substantial barriers to investment in RES as a result of issues of ownership of the rooftop space. It is expected that most of these public rooftops suitable to host PV will be exploited by 2020.

[23]https://www.enemalta.com.mt/wp-content/uploads/2018/08/Enemalta-process-flow-for-processing-applications-for-grid-connection-of-distributed-RES.pdf

The Government will continue to engage with key stakeholders to encourage their involvement in the increased deployment of renewable energy technologies, particularly solar PV. This includes, but is not limited to:

- Engaging in discussions with banks to include incentives for the installation of solar PVs and SWH in their loan policies and other relevant areas;
- Following the success of the Government's communal photovoltaic farm project at the site Il-Fiddien, the Government will encourage private enterprises and investors to adopt and refine the initial model which provides the possibility for consumers who do not have access to a private roof, and thus cannot install a PV, to participate in the shift towards renewable energy generation; and
- Discussing with local developers and real estate agents incentive schemes for the installation of PVs on new or newly refurbished buildings, including multi-apartment buildings and offices.

The second and third points are of particular importance in light of development trends which highlight the prioritisation of multi-apartment dwellings and high rises, that is, buildings with limited roof space. The Government therefore aims to develop tailored measures to, in as much as possible, overcome this technical barrier to the further deployment of RES. While such buildings usually have limited rooftop area available for PV installations, discussions with key stakeholders may identify ways in which to better incorporate PV systems, thus increasing local renewable capacity and the energy performance of the building.

Waste-to-energy plants

No change is expected in terms of renewable electricity and/or heat generated by waste-to-energy plants from biodegradable waste content. A new thermal treatment plant is expected to be commissioned in 2023. The share of the bio-origin content of the waste input is yet to be determined, but given that the input stream is expected to be mainly refuse-derived fuel and rejects, the bio-fraction is expected to be minimal. Thus, for the scope of the RES scenarios, the RES share from this new plant is not being considered.

Share of RES in Heating and Cooling

The share of RES-H&C is made up of different technologies, which apart from the heat generated by the waste-to-energy plants referred to above, also include solar water heaters, heat pumps and biomass imports.

Solar Water Heaters

Given the high solar intensity prevalent in Malta, solar water heaters (SWH) are considered a viable source of RES. The existing grant scheme led to a high rate of new installations annually, but this has dwindled in recent years. The current downward trend in SWH installations indicates a change in consumer preference of PV systems over SWH, limited roof space, and market saturation at current levels of support. In 2018, the SWH scheme provided a grant of up to 50% of the eligible costs up to €700.

Malta is committed to increasing its share of RES in heating and cooling; therefore, the existing financial support and incentives offered will be revised with the aim of overcoming recently observed barriers. The Government aims to provide support for the installation of 1,500 SWH each year from 2021-2030, the number including the repowering of systems; the latter is projected to begin in 2024/25. However, it must be noted that it is difficult to predict the actual uptake of SWH given current preferences of consumers towards PV systems due to their versatility.

To overcome the declining uptake of domestic SWH, the Government plans to amend and further simplify the application process such that the beneficiary would not have to await endorsement of his application for support to acquire a SWH before purchasing the unit. This would make SWH a viable option for replacement of electric water heaters when the latter fail. Furthermore, the amount of financial assistance which can be claimed will be increased from 50% of eligible costs to a maximum of 80% of eligible costs. The projected Government budget to support the deployment of 1,500 each year from 2021-2030 under this scheme will reach approximately €2,000,000 annually. As the capital cost of SWH is assumed to remain high compared to conventional electric or gas water heaters in the short- to medium-term, the support scheme is projected to continue throughout the ten-year period covered by the NECP.

In addition, the Government is in discussions with key stakeholders in the building sector on a possible obligation on developers for new buildings to incorporate at least one SWH. This obligation would apply for all new or newly refurbished dwellings being placed on the market. However, it must be noted that current trends which prioritise the development of high rises and multi-apartment buildings limits the technical potential of SWH; SWH are deemed to be largely ineffective on such buildings due to the height as well as limited roof space and accessibility. Nevertheless, the SWH could be installed for use by the tenants on the top floor of the building.

Heat Pumps

Reversible heat pumps are a well-established technology in Malta and considered by many to be essential for thermal comfort. As a result, the number of heat-pumps is projected to increase without the need for policy intervention. More details on the methodology and assumptions used in the RES contribution of heat pumps can be found in section 4.2.2.

Biomass

Malta possesses no sustainable sources of biomass and does not have the land area or resources required to cultivate energy crops to any practical extent. Furthermore, given Malta's limited heating demand, targeting increased efficiency in heating and cooling is deemed more appropriate than promoting the importation of biomass.

Share of RES in Transport

Biofuels

Malta already has in place a substitution obligation on importers of petrol and diesel to blend an increasing share of biofuels in their mix[24]. In line with Article 25 of the recast of Directive 2009/28/EC on the promotion of the use of energy from renewable sources, the Government intends to extend the current substitution obligation to 2030 and increase the obligation to at least 14% share of renewable energy supplied for final consumption in the road transport sector, with advanced biofuels contributing at least 3.5% of this share by 2030.

Bioethanol is currently not available for consumption in Malta. This is due to the Maltese hot climate which creates technical difficulties for the blending of bioethanol with petrol. The addition of bioethanol to petrol in low percentages increases the vapour pressure of the fuel blend and therefore increases the possibility of emissions of benzene and volatile organic compounds, particularly in high ambient temperatures. Therefore, unless petrol with a sufficiently low reid vapour pressure (RVP) is readily available in relatively small volumes and competitive prices, the warm climate in Malta would drive the vapour pressure of bioethanol-petrol blends above the limit determined by EN 228.

Local importers and wholesalers of petrol and diesel will likely meet their substitution obligation by blending EN 590 diesel with Fatty Acid Methyl Esters (FAME) biodiesel (EN 14214) and hydrotreated vegetable oil (HVO) (EN 15940), as is the current practice. In recent years, the latter has been prioritised by local fuel suppliers as it offers several advantages over FAME biodiesel. HVO parameters are within EN 590 specifications (except for lower density), it has a higher energy content and good solvency when blending, without any temperature issues. It can be typically blended with EN 590 up to 30% by volume, whereas FAME biodiesel can be blended with EN 590 diesel up to a maximum of 7% by volume[25].

Malta is currently assessing the available options, in terms of fuel standards and additional costs, for the incorporation of advanced biofuels into the mix. However, the cost and availability of such fuels has been noted by research and lobby groups alike as significant barriers to their integration in

[24] Subsidiary Legislation 545.17

[25] Neste Corporation (2016). Neste Renewable Diesel Handbook. Available at: https://www.neste.com/sites/default/files/attachments/neste_renewable_diesel_handbook.pdf

national fuel mixes. Advanced biofuels tend to be available in relatively small volumes globally[26,27] and their price projections demonstrate a sustained substantially higher cost over conventional biofuels and mineral fuels[28,29].

Both conventional and advanced biofuels are more expensive than mineral diesel and petrol per unit of energy. Projections from DG Agriculture and Rural Development in the EU Agricultural Outlook 2017-2030[30] indicate that the prices of biofuels will remain largely constant in the medium-term. Given that reported prices are similar to local landed costs, it can be assumed that the current price difference between mineral diesel and biodiesel imported locally will remain. This also applies to advanced biofuels which the same report notes are unlikely to experience significant changes in costs in the short- to medium-term. Furthermore, it must be noted that given the relatively small market, Malta cannot take advantage of economies of scale in procurement and shipping, therefore the landed costs tend to be higher than for larger markets.

Malta, through the REWS, will continue to ensure that all biofuels placed on the market fulfil the necessary sustainable criteria.

Electric vehicles

Please refer to section 4.2.2 and section 3.1.3iii.

ii. Specific measures for regional cooperation

Development of indigenous renewable capacities will continue to be prioritised. However, given Malta's limited technical capacity for renewable energy installations as well as a sustained increase in demand, Malta envisages the need to acquire renewable energy credits to meet the 2020 RES share target. This plan foresees the need for Malta to avail itself of cooperation mechanisms should the need arises to meet the 10% renewable energy share threshold. Any higher commitments would be subject to an equitable sharing of costs and tangible benefits.

iii. Specific measures on financial support for the promotion of the production and use of energy from RES in electricity, H&C and transport

In line with Article 4 of the recast of Directive 2009/28/EC on the promotion of the use of energy from renewable sources, the Government plans to extend existing support schemes, in the form of

[26] ECOFYS (2017). Crude Tall Oil Low ILUC Risk Assessment: Comparing Global Supply and Demand.
[27] Greenea (2018). Waste-based feedstock and biodiesel market in the EU: How new regulations may influence the market. In: PLATTS Geneva: Biofuel Conference. [online] Geneva.
[28] DG Mobility and Transport, Sub Group on Advanced Biofuels (2018). Building up the Future: Cost of Biofuel.
[29] Ethanol Europe (2018). Biofuels and RED II: At What Cost? Available at: https://www.euractiv.com/wp-content/uploads/sites/2/2018/03/Advanced-biofuel-cost-projections-Ethanol-Europe-1.pdf
[30] DG Agriculture and Rural Development & the Joint Research Centre. EU Agricultural Outlook: For the Agricultural Markets and Income 2017-2030.

EU/national capital grant incentives and operating aid for the promotion of electricity from RES,[31] beyond 2020 in order to increase penetration of RES, with a focus on solar PV and SWH.

With regards to solar PV, while costs are decreasing, national projections denote that there will remain a need to address financial barriers in the residential and non-residential sector. The LCOE of residential PV systems is likely to remain higher than the proxy for the market price of electricity until 2030, indicating that few consumers would invest without financial support. This is the same for the commercial sector, in which based on current projections, the LCOE will not reach grid parity until around 2025. Furthermore, it is likely that the financial and technical barriers experienced by those consumers who have not yet installed a PV system are likely to be higher than those who have already invested in this technology.

Thus, the Government intends to maintain financial support schemes to encourage the deployment of renewable energy. The grant and operating aid for the promotion of electricity from RES will continue to be revised on a regular basis to ensure a reasonable return on investment and avoid overcompensation as system costs and electricity prices evolve, while taking into account all relevant costs. The Government also intends to design schemes to encourage battery integration in PV systems where appropriate.

It is being estimated that, on average, an additional estimated €5.6 million annually will be required to finance grants and feed-in tariffs, and to support the installation of new PV systems and Solar Water Heaters post-2020. These estimates are sensitive to the evolution of electricity wholesale prices. For instance, should the proxy for the market price of electricity diverge from projections, the budgetary impact of support schemes would change depending on whether the Government would be required to bridge a larger or smaller cost gap.

iv. [Where applicable] Assessment of the support for electricity from renewable sources pursuant to Article 6 (1b) of RED

Malta currently provides operational aid and support on capital investment to PV systems; these are in line with existing state aid rules. A re-assessment of the support level is performed at least once a year to ensure that changing costs are fully reflected.

Following the transposition of the recast of Directive 2009/28/EC on the promotion of the use of energy from renewable sources, Malta will carry out an assessment of the effectiveness of support schemes for the promotion of electricity from renewable sources every five years in line with Article 6 (1b). This will be included in relevant updates of the national integrated energy and climate plan and progress reports.

[31] Any schemes post-2020 will be subject to the applicable state aid rules

v. Specific measures to introduce one or more contact points, streamline administrative procedures, provide information and training and facilitate the uptake of power purchase agreements

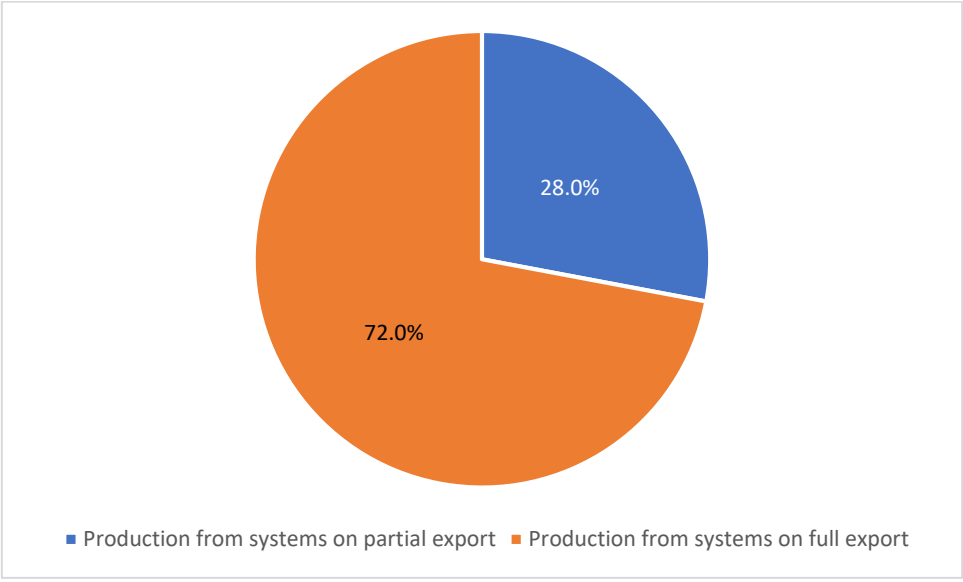
On a national level, discussions are ongoing on how best to implement the requirements of Article 16 and 17 of the recast of Directive 2009/28/EC on the promotion of the use of energy from renewable sources. Following its transposition, Malta will implement the necessary regulatory and administrative changes required by the Directive.

vi. Summary of policies and measures under the enabling framework pursuant to Article 21(4) and 22(5) of the RED to promote and facilitate the development of renewable self-consumption and renewable energy communities

Existing schemes supporting the installation of PV systems cater for the option of self-consumption of renewable electricity in both the residential and non-residential sector. Under existing support schemes, the applicant may opt to sell all electricity generated by the PV system to the DSO (full export) or export only the surplus electricity (partial export). Furthermore, in the case where the installation operator does not apply for support, Regulation 4A of SL 545.27 ensures that solar PVs may be installed primarily for self-consumption and that any surplus electricity supplied to the DSO through the grid will be bought at the proxy for the market price. However, the option for self-consumption is not applicable for PV installations owned by third parties. In this case, full export is the only option.

In 2016, systems on partial export generated 28% of total electricity from solar PV (Figure 16). Between 2015 and 2016, the proportion of electricity generated by these systems that was consumed on-site was 61% and 65% respectively.

Figure 16 Electricity production in 2016 from systems on full or partial export, %.



Since the introduction of support schemes in the form of feed-in tariffs, Malta's regulatory framework supported self-consumption and ensured that there would be no legal or technical barriers to renewable self-consumption. Systems which prioritise self-consumption face no additional charges when selling their excess production of renewable electricity to the grid. Self-consumption is promoted as a way in which consumers can offset their consumption of electricity from the grid and thus, reduce their electricity bills, particularly in cases where such offsetting places the consumer in a lower electricity tariff band.

The Government will continue to promote renewable self-consumption of electricity from solar PV systems and ensure that no discriminatory or disproportionate procedures and charges apply. In this regard, and in line with future requirements under Article 21(4) once the recast of Directive 2009/28/EC on the promotion of the use of energy from renewable sources is transposed, Malta will be conducting an assessment to explore any potential unidentified barriers to renewable self-consumption.

In view of the structure of the Maltese electricity system in which there is no electricity supply market (Enemalta is designated as an exclusive supplier in Malta), it is not foreseen that renewable energy communities will develop.

vii. Assessment of the necessity to build new infrastructure for district heating and cooling produced from RES

Malta does not have a district heating and cooling network. A comprehensive assessment of Malta's heating and cooling demand was commissioned in 2015, titled '*An Energy Roadmap- Towards Achieving Decarbonization for the Maltese Islands – Analysis for a Cost-Effective and Efficient Heating and Cooling'*[32]*,* and carried out in accordance with the provisions of Article 14(1) of the Energy Efficiency Directive 2012/27/EU, which sought to identify the potential of technically and economically feasible applications of high efficiency cogeneration and efficient district heating and cooling. Information regarding the outcome of the assessment is elaborated in Section 4.3.ii on the current potential for the application of high-efficiency cogeneration and efficient district heating and cooling.

viii. [If applicable] Specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation

Not applicable.

[32] Figure estimated based on 2013 data. Source: An Energy Roadmap- Towards Achieving Decarbonization for the Maltese Islands – Analysis for a Cost-Effective and Efficient Heating and Cooling

3.1.3 Other elements of the dimension

i. [If applicable], national policies and measures affecting the EU ETS sector and assessment of the complementarity and impacts on the EU ETS

Not applicable.

ii. Policies and measures to achieve other national targets, if applicable

No other policies and measures are foreseen at the time of submission of the draft NECP.

iii. Policies and measures to achieve low-emission mobility (including electrification of transport)

In 2016, Malta's Government adopted a **Transport Master Plan** with a horizon up to 2025. A number of measures indicated in the Master Plan have been implemented since 2017 and will continue to be realised throughout 2018, 2019 and 2020. Other measures are expected to be implemented and completed in the post-2020 period leading up to 2025.

Measures, such as free school transport for all primary and secondary school students and free use of public transport for youths and students between 16-20 years old, took off in October 2018. Although the effect of these measures on emissions reductions has yet to be assessed, it is estimated that this measure has led to a reduction of circa 6,300 cars. Free public transport fares for youths and students is expected to be extended to students of ages between 14 – 20 as well as full-time students of all ages by the end of 2020.

Emissions are expected to decrease as a result of a number of infrastructure projects on the TEN-T network, such as:

- TEN-T Kappara (completed in 2017): expected CO_2 emission reduction of 1,700 tonnes per year;
- TEN-T Santa Venera (completed in 2018): expected CO_2 emission reduction of 3,000 tonnes per year;
- TEN-T Marsa (to be completed in 2020): expected CO_2 emission reduction of 7,000 tonnes per year from 2020.

Ongoing implementation of the 2025 Master Plan relates to a number of measures falling under the **Sustainable Multimodal Intelligent Transport Hubs Project** known as SMITHs Project. The concept revolves around the identification and the setting up of local transport hubs to provide multi-modal transport services for transport users in lieu of the use of the private personal car. In this respect, the work so far has been preparatory in nature in terms of project design, engagement of third party consultancy services and preparation/publication of procurement processes.

The main objective of the SMITHs is to provide different inter-modal services in conjunction with Public Transport to essentially complete the last mile of one's journey. Thus, in effect, apart from Public Bus Transport stops in a given local transport hub, one will also find electric car sharing services, pedelec sharing, bicycle sharing, electric motor cycle sharing and scooter sharing. In some localities, especially in maritime towns and villages, maritime public transport is being provided and the service will be extended to other localities due to increased popularity.

In 2018, the Government has rolled out a car-sharing scheme consisting of 150 cars at 450 different locations spread around Malta, which allows citizens to book an electric vehicle (EV) through an online app.[33]

In addition, the Government will also carry out a pilot project in Gozo to demonstrate and test Transport on Demand using electric buses and electric mini cabs which will be operated by the Ministry of Gozo. This project, which is expected to be implemented by 2020, will introduce 8 electric buses in Gozo.

Through the investment of bicycle and pedelec sharing operating companies, Malta registered a steady increase in the use of these modes for commuting purposes, and this encouraged the Government to invest more in related infrastructure, including **Safe Cycling Routes**. Two pilot projects are being prepared for implementation which involve 26km of Safe Cycle Routes under the concept of sharing the road. The idea behind the concept is to make these road sections safer for cyclists without the need to implement dedicated cycle lanes where road width does not permit this. Malta's objective is to have a national safe cycling route network which will be intersecting local transport hubs. It is expected that in 2020 a National Bicycle Strategy, which shall include the provision of additional cycle lanes and increase connectivity to these routes, will be developed.

Low Emission Zone Study

Transport Malta has started a project to study the feasibility of the introduction of Low Emission Zones (LEZ). Transport Malta is working with the Controlled Vehicular Access (CVA) operator who manages the Valletta Congestion Charge to use its existing infrastructure and additional CCTV to carry out a study in real conditions of an LEZ. Transport Malta has purchased additional CCTVs and at the moment are allocating different charges to all vehicles of the fleet based on the emission levels of each type of vehicle and according to the Euro levels of the respective engines. EVs will not be assigned any charges and Transport Malta will run various scenarios with the collected data including pricing scenarios and ghost-billing to each vehicle.

National Traffic Control Centre

A new National Traffic Control Centre (NTCC) to manage traffic and enforce bus corridors is being set up. Infrastructural work is currently underway. The new NTCC will be completed in the course of 2019.

[33] https://www.goto.com.mt

This will also include an Intelligent Transport Systems (ITS) Platform to enable all of ITS sub-systems to communicate. Transport Malta is currently in the tendering process of this measure.

An example of innovation in the area of transport, specifically the utilisation of technology, involves a **Real Time Journey Planner** including the back-end of the system (that has been launched). The Real Time Journey planner will be operated from the National Traffic Control Centre. The app will give real time information on all modes of transport and scheduling services for all modes of transport including bus public transport, inter-harbour maritime services, inter-island ferry services, Malta-Sicily maritime transport, and air transport in conjunction with the Malta International Airport.

In order to further enhance ferry transportation, Malta is planning **an upgrade of Existing Landing Ferry Sites** and introducing three new facilities and Maritime Routes. Following a number of studies carried out in 2017 and a number of other studies undertaken in 2018, procurement is currently underway for the upgrading of the quays. Structural works on two of the sites is expected to commence. Tenders for the superstructures to serve as the passenger waiting facilities are being prepared. The facilities will be equipped with the provision of real time information between various modes of transport. The improvement of Ferry Landing Places is expected to impact Bormla, Sliema as well as Spinola, Ta 'Xbiex and Bugibba in the period post-2020. Additionally, a fast-ferry from Gozo to Valletta is being planned.

Electrification of Transport

With reference to the electrification of transport systems, procurement is currently underway for the installation of 118 medium-fast EV chargers and 22 Rapid EV chargers. This **EV charging infrastructure** will be placed and installed in the SMITHS to promote the electrification of transport. This project is also being carried out in part for the fulfilment of the Directive for the Deployment of Alternative Fuel Infrastructure for Transport (Directive 2014/94) and the respective national targets. All the measures indicated above fall under the SMITHs Project which is being funded through ERDF and National Funds.

A number of measures have been taken to promote and implement the electrification of transport in Malta. The Government has launched a number of grant packages and these have been improved year on year. In 2018, the grant packages include a grant of €7,000 in connection with a scrappage scheme of an older ICE vehicle and a grant of €6,000 without a scrapping scheme. In addition, as from 2018, full EVs (including plug-in hybrids and electric range extender electric vehicles) are exempt from registration fees which will benefit EV owners with an additional financial assistance of €1,500 to €3,000. In addition, Malta has exempted EVs from registration tax and the annual road license for 5 years from the date of registration. Hybrid vehicles and motorcycles with a capacity of less than 250cc also benefit from incentives such as a lower registration tax and annual circulation tax.

The registration tax and annual circulation tax in Malta is founded on a "polluter pays principle" based on the length of the vehicle, CO_2 and particulate matter which favours cleaner, smaller, newer and low emission vehicles. Private companies can also benefit from up to €200,000 in cash grants to change their car fleets in line with state aid rules.

The year 2018 saw the highest number of EVs registered in Malta. On the national automotive market there is an availability of 90% of all EV models available on the European automotive market.

Malta's National Electromobility Action Plan (MNEAP) is currently undergoing review and being updated to reflect the National Transport Strategy and National Operational Transport Master Plan, including a new action plan up to 2025 and a strategy leading to 2050. The measures to be included in the revised action plan will be tested and simulated through an Interreg Med funded Project.

Earlier this year, the Ministry for Transport, Infrastructure and Capital Projects commissioned a study in order to evaluate **the feasibility of CNG and LNG in road transport**, in line with Directive 2014/94 on the Deployment of Alternative Fuels, and the results are expected early in 2019. Meanwhile, Transport Malta (TM) is working on a pilot project to demonstrate hydrogen propulsion. TM has invited current fuel station owners through an advert in newspapers to gauge the interest of the private sector to join TM in such a pilot project. Five fuel station companies, mostly on the TEN-T and arterial roads, have shown interest in participating in such a pilot.

Sustainable Urban Mobility Plans (SUMP)[34]

TM is currently in the process of compiling an extension to the first ever SUMP in Malta. This will be carried out for Valletta and the Valletta Region which hosts the main commercial districts, popular tourist destinations, the international airport and cruise port terminal. The SUMP is expected to explore innovative solutions in order to improve mobility patterns, meet demands in the transport sector and contribute to making transport more sustainable. The SUMP process includes the engagement of consultants and consultation processes with stakeholders. Transport Malta is in the process of engaging with the respective local councils. The project is being part financed under the Civitas Destinations Project and is expected to be concluded by 2020.

iv. [If applicable] National policies, timelines and measures planned to phase out energy subsidies, in particular for fossil fuels

If applicable, these will be included in the final plan to be submitted in December 2019.

3.2 DIMENSION ENERGY EFFICIENCY

Policies, measures and programmes to achieve the indicative national EE contribution for 2030 as well as other objectives presented in section 2.2:

[34] http://civitas.eu/projects/destinations/measures/sump-valletta

i. Energy efficiency obligation schemes and alternative policy measures under Article 7a and 7b of EED

Figure 17 shows the final energy consumption per capita across all Member States. Malta has the second lowest final energy consumption per capita which is slightly more than half of the EU average.

Figure 17 Final energy consumption per capita in 2016, GJ/capita (Source: Eurostat).

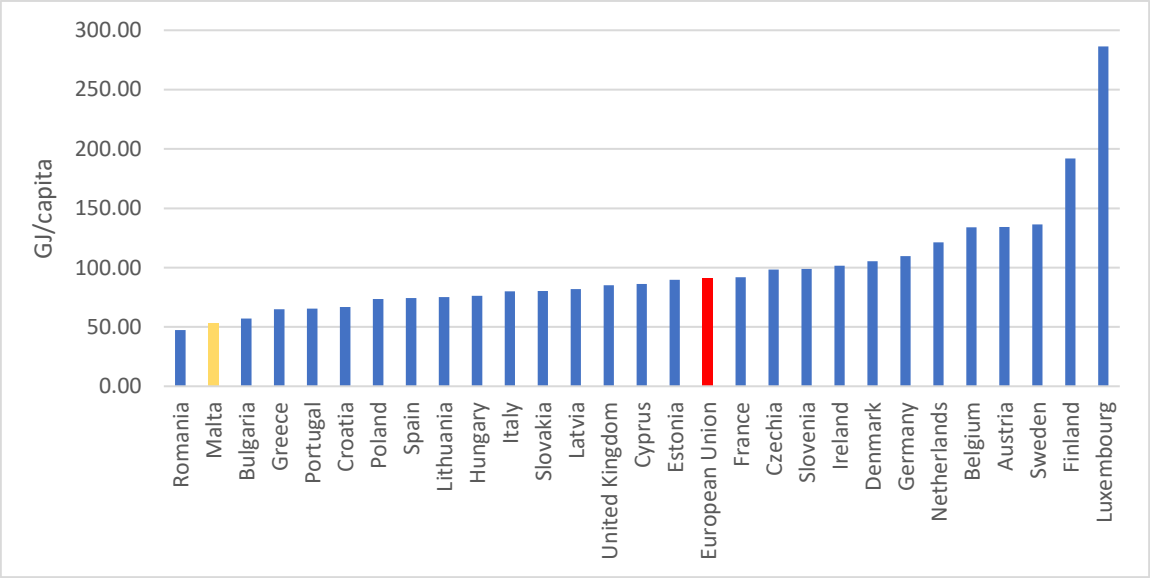


Figure 18 shows the sectoral consumption for the European Union for the year 2016 whilst Figure 19 shows the sectoral consumption for Malta for the same year. It can be highlighted that Malta's share of final energy consumption in transport is much higher than the EU average. This is mainly because of the fact that:

- Malta is an island at the periphery of the European Union, implying a larger than average share of aviation as a mode of transport;
- Malta has no mass-transport infrastructure as studies have so far indicated that Malta does not have the necessary critical mass to justify the operating costs; and
- Temperate climat, implying a lower heating demand.

Figure 18 Final energy consumption by sector in the EU in 2016, % (Source: Eurostat).

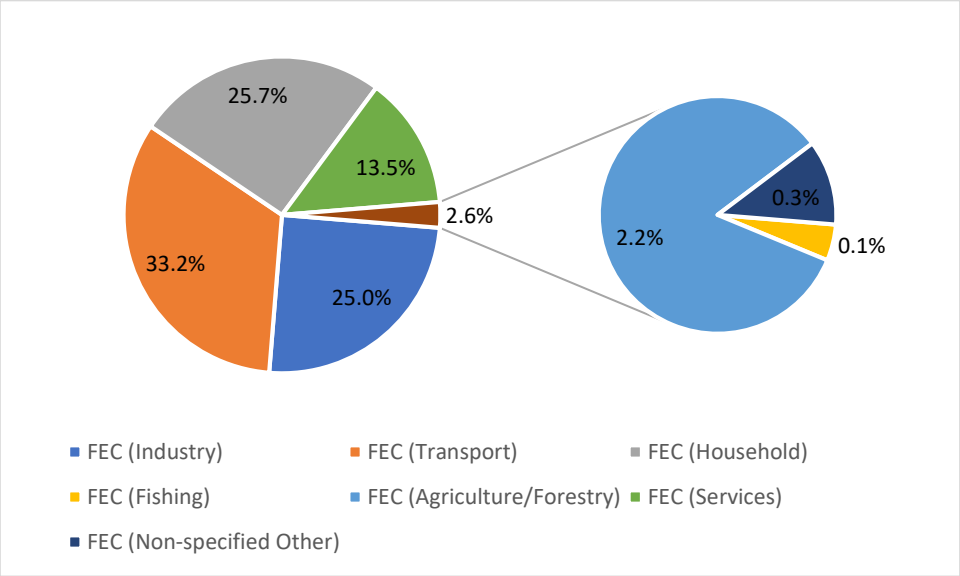
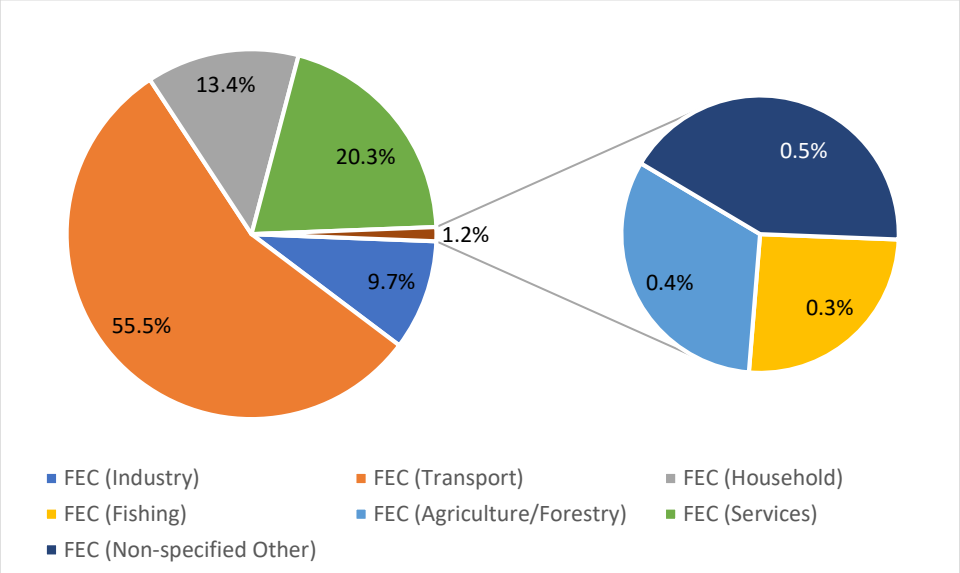


Figure 19 Final energy consumption in Malta by sector in 2016, %.



Transport

The transport sector is responsible for over half of the energy consumption. Malta will be addressing energy efficiency in transport, amongst other, through the measures identified in the 2025 Transport Malta Master plan and through other measures which are currently being assessed.

Industry and Services

Malta's share of final energy consumption in industry is also significantly lower than the EU average as Malta is not an industry-based economy and there are no energy intensive industries. Furthermore,

the sector is already pulling its weight with regards to energy efficiency, as confirmed by an 8% growth in economic activity and a corresponding increase in energy consumption of 1.5% during 2017.

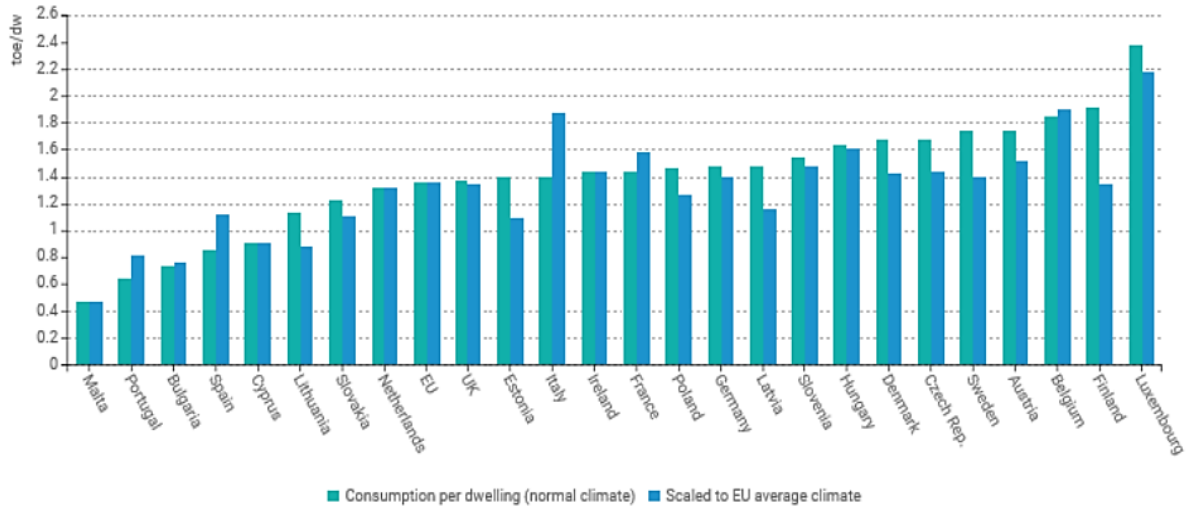
In contrast, Malta's share of final energy consumption by the services sector in 2017 was higher than the EU average reflecting the local service-based economy. Nonetheless, whilst the gross value added (GVA) of the services sectors increased by 9% its energy consumption increased by 4%.

Malta plans to address energy savings in these sectors by setting up a scheme in order to promote and address energy efficiency investment. This scheme is expected to achieve energy savings in proportion to the final energy consumption by corresponding sectors. Enterprises will be encouraged to undertake energy efficiency projects through the availability of investment aid which would be linked to the amount of savings achieved over a specified period. This measure is estimated to result in an investment in energy efficiency of circa €62.5 million over the period 2021-2030. In this regard it is being assumed that the present state aid framework is extended post 2020.

Households

As per Figure 20, Malta's average consumption per dwelling is well below the EU average. Malta has the lowest energy consumption per dwelling.

Figure 20 Average consumption per dwelling (adjusted to EU climate) in 2015, toe/dw (Source: Odyssee-Mure).



Furthermore, as shown in Table 9, Malta has a considerable different share of final energy consumption by type of use. While the European Union has the highest share of energy attributed to space heating, Malta has the highest share of energy used for lighting and appliances. In Malta, there is no gas distribution network or district heating/cooling networks. Construction of such networks has so far been deemed not feasible, mainly due to the limited demand for heating and widespread ise of

distributed alternative efficienct cooling heat-pump technology. Furthermore, the installation of air conditioners employing heat pump technology does not require incentives for its deployment. This is confirmed by the significant growth in the number of installations which is projected to continue to grow. Such a market driven development is a major contributor towards energy efficiency in households but cannot be accounted for under Article 7 as it is not a result of government. In reflection of the temperate climate and the general preference to use natural ventilation when possible, households have typically low energy bills and so find it difficult to justify investment in the renovation of their building.

It is in this context that the most effective approach to reduce the sale of energy to end users, move away from the consumption of fossil fuels and drive savings, is to promote the installation of small-scale renewable energy technologies for own consumption. Malta will therefore launch new schemes post-2020 in order to incentivise the installation of solar water heaters and photovoltaic panels for own consumption.

Table 9 Share of final energy consumption in residential sector by type of end-use in 2016, % (Source: Eurostat).

	Space heating	Space cooling	Water heating	Cooking	Lighting and appliances	Other end uses
EU-28	**64.6**	**0.3**	**14.5**	**5.5**	**13.8**	**1.3**
Belgium	73.3	0.1	11.6	1.7	13.0	0.4
Bulgaria	54.0	0.4	17.4	8.5	19.6	0.1
Czech Republic	68.5	0.1	16.4	6.4	7.2	1.5
Denmark	62.5	0.0	20.8	1.8	14.7	0.2
Germany	69.9	0.2	14.3	5.7	6.6	3.3
Estonia	:	:	:	:	:	:
Ireland	61.1	0.0	18.7	2.3	17.0	0.9
Greece	56.9	4.1	12.4	6.5	20.1	0.0
Spain	43.3	0.9	19.0	7.8	29.0	0.0
France	66.3	0.2	10.6	5.5	17.4	0.0
Croatia	70.2	1.5	9.2	6.2	12.8	0.0
Italy	67.7	0.4	11.7	6.3	12.6	1.3
Cyprus	:	:	:	:	:	:
Latvia	64.2	0.0	18.8	7.2	9.1	0.6
Lithuania	70.8	0.0	9.1	6.3	13.7	0.0
Luxembourg	79.9	0.2	7.1	2.3	10.5	0.0
Hungary	74.0	0.1	12.3	4.4	9.2	0.0
Malta	16.0	6.7	24.6	12.6	39.1	1.1
Netherlands	64.3	0.2	16.3	2.2	17.1	0.0
Austria	70.2	0.0	14.6	2.7	10.1	2.3
Poland	66.4	0.0	15.8	8.1	9.7	0.0
Portugal	21.1	0.7	18.8	39.4	20.0	0.0
Romania	63.9	0.3	13.3	9.2	13.3	0.0
Slovenia	65.0	0.4	15.6	4.0	15.0	0.0
Slovakia	:	:	:	:	:	:
Finland	66.4	0.1	15.1	1.0	12.4	5.0
Sweden	55.3	0.0	15.2	1.4	17.0	11.2
United Kingdom	61.4	0.0	18.3	2.8	17.5	0.0
Norway	37.4	0.0	14.1	0.0	36.4	12.1
Serbia	61.4	0.5	13.8	7.3	17.0	0.0
Albania	32.2	5.4	21.2	29.5	11.6	0.0
Kosovo*	8.7	0.0	8.2	8.1	10.0	65.0
Moldova	69.3	0.1	10.1	11.9	8.5	0.0
Georgia	58.4	0.3	11.6	17.5	12.2	0.0

(*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence.
(:) not available

Government Leading by Example

The Government of Malta is committed to lead by example and will be implementing a number of projects/measures in order to promote energy efficiency and achieve energy savings.

Malta will continue its efforts in order to roll-out energy efficient street lighting. Malta is expected to replace over 33,000 lamps from the present lighting luminaries to LEDs.

Approximately half of the potable water in Malta is produced using reverse osmosis plants and is therefore an important consumption point. The Water Services Corporation, the Government owned water utility, will be carrying out projects in the primary water network and the wastewater treatment plant to improve system efficiency and reduce the electricity consumed per unit of water delivered. These measures are estimated to result in an investment of circa €52 million.

Furthermore, post-2020, electricity tariffs shall continue to incorporate a built-in mechanism which promotes end-use savings. The mechanism incentivizes end-users to reduce consumption below an established threshold and deter high consumption by applying higher tariffs as consumption increases.

ii. Long-term renovation strategy to support the renovation of national stock of residential and non-residential buildings, both public and private

Malta is aware of its commitments to develop a long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, in accordance with Article 2a of Directive 2010/31/EU. As per the derogation from Article 2a, Member States are expected to submit the first long-term renovation strategy by 10 March 2020.

iii. Description of policies and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers that impede the uptake of energy performance contracting and other energy efficiency service models[35]

There are a number of private undertakings operating in Malta that provide an energy service, but the concept of financing investments through the energy savings (ESCO) model has not yet taken off. This is due to the generally low energy intensity of the various economic sectors, and the availability of alternative sources of finance.

The Government has explored the possibility of adopting energy service contracts in the public sector. A study was carried out on three typical public buildings, whereby it resulted that in view of their low energy consumption, the return on investment for energy savings measures was quite low. Except for investments in renewable energy projects, the payback time exceeded the expected lifetime of the measure itself or the building. The private sector is also facing a similar situation and, so far, no concrete results have materialised.

A public consultation on Energy Performance Contracting was also held in February 2017. Respondents highlighted that take up is restricted due to limited savings. Furthermore, potential ESCO

[35] In accordance with Article 18 of Directive 2012/27/EU

providers find it difficult to accumulate a sufficiently large portfolio of interventions to build a suitable business case. Malta is currently analysing whether the development of a financial Special Purpose Vehicle, which would provide off-balance sheet financing for ESCOs and their customers, offer attractive repayment options through low interest rates and have a higher risk tolerance than traditional financing instruments, would achieve the required effectiveness and leverage in the local scenario.

iv. Other planned PAMs and programmes to achieve the indicative national energy efficiency contributions for 2030

The energy consumption of the Maltese Islands has been under the spotlight of the administration in the past years and will continue to be in order to ensure long term decoupling between energy consumption and economic growth. Section 3.2.ii gives an account of the actions envisaged to fulfil the obligations emanating from Article 7 of the Energy Efficiency Directive, which will be at the core of Malta's plan to achieve its goals. These measures address various sectors to ensure a comprehensive decarbonisation of the economy. However, to attain a sustainable economy and environment, actions and attention are to be undertaken by all sectors.

Electricity Generation

By 2017, Malta had closed its inefficient power generation units and was exclusively using natural gas for electricity generation[36] which is delivered as LNG. However, plans are in progress for the construction of a gas pipeline to link Malta to the European gas grid in Sicily. At present, Malta is conducting detailed studies which include a marine route survey, an environmental impact assessment, the front-end engineering design and the financial engineering all of which are funded under the CEF. The plan is to obtain the permits and EU co-funding for the works by 2020 and, following a publication of an Engineering Procurement and Construction tender, proceed with construction; commissioning is expected by end of 2024. The gas pipeline project is described in more detail under the Energy Security dimension of the Plan. Power generation will retain today's best-in-class efficiency standards.

Electricity Distribution

Enemalta plc is the only electricity Distribution System Operator in Malta. In the recent years, Enemalta has embarked on an extensive program to ensure an efficient distribution system that minimises losses, operating the system in an efficient manner in accordance with European Directives and local legislation. It must be noted that Enemalta has installed 99% of its consumers with smart meters and has adopted a tariff system that favours prudent energy use and energy efficiency, with

[36] A diesel-powered plant is kept on standby to achieve the desired level of security of supply.

the aim of fostering such behaviour in its final consumers. Enemalta plc is an enterprise with a majority shareholding by the Government and is committed to further develop and optimize its distribution network post 2020.

Industry and Services Sectors

The industry and services sectors were responsible for circa 29% of the total final energy consumption in 2017. A number of actions and schemes were designed to facilitate interventions in energy efficiency initiatives and promote the introduction of Energy Management Systems. e.g. ISO 50001. In the period 2014 to 2020, the Energy and Water Agency operated a 'voluntary scheme' whereby enterprises would report verified energy savings. This scheme is expected to continue post-2020 and shall be a prerequisite for access to support schemes mentioned in section 3.2.ii. The Government is aware of the importance of standard energy management systems and shall enforce that, over a definite period, non-SMEs with an annual consumption exceeding 800 toe would need to implement an ISO certified Management system (EN ISO 50001, or EN ISO 14001 if an energy audit is included). In line with State Aid Regulations and in consultation with stakeholder organisations, a scheme will be available to support enterprises in acquiring ISO or EN certification. A budget of €100,000 per year shall be allocated for five years to support this scheme. It is further envisaged that local legislation will require that non-SMEs also appoint an Energy Manager.

To further support the industry and services sector, the Government will develop information dissemination programmes that focus on providing better information to decision-makers and engineers in the sector. This campaign will create awareness on the need to invest in energy efficiency, the savings potential, the financial and/or operational benefits of energy efficiency measures, and how to build capacity in energy management. This task is expected to run over a two-year period and will be led by the Energy and Water Agency, with input from the appropriate educational facilitators and sectoral stakeholders. Any courses developed thereafter will be outsourced. The setting up of the dissemination programme will require a budget of €20,000 annually.

Energy Audits

Non- SMEs

Regulation 10 of LN 196 of 2014 makes it mandatory for, and the responsibility of, non-SMEs registered and doing business in Malta to carry out energy audits to the established quality level and frequency. The first audits were submitted in December 2015 and will be repeated every 4 years henceforth. Such audits can only be carried out by internal or external energy auditors who are listed on the website of the REWS or by energy auditors eligible in other Member States. These auditors must have an MQF Level 6 or higher qualification in an applied science discipline and have followed an appropriate training course as per G.N. 13024. The Agency and the Regulator have regularly published a guidance note addressed to enterprises which qualify for the statutory energy audit to

assist in the discharge of this responsibility. This guidance note is updated periodically as it benefits from and builds upon the experience of previous audit programs.

The main objective of the Agency is to ensure that future Energy Audits performed by non-SMEs attain a higher quality and building on lessons learnt from previous cycles. To take the audits a step further, the Agency shall create an online tool through which enterprises can submit their audit outcomes. Using such a tool, the data from the audits can be automatically uploaded and thus facilitate the Agency's work in terms of analysis of the data and feed into policy decisions reflecting the needs of the local industry. The tool is budgeted to cost €50,000 and is expected to be developed in 2020.

SMEs

A scheme was setup in 2018 whereby Small and Medium sized enterprises can benefit from grants to help them carry out Energy Audits of their premises/processes/plants/transport fleet. It is planned to continue the scheme post 2020 (subject to state aid regulations) with an annual budget of €25,000. Such enterprises would also be eligible to schemes mentioned in section 3.2.ii.

Households

Malta has one of the lowest energy intensity figures for households within the EU. Even so, Government has, over the last decade, invested heavily in promoting and fostering energy efficiency. In the case of households and other small consumers, the Government will continue incentivising the uptake of new technologies, as well as fostering behavioural change where necessary. Information campaigns will be run by the Government and these will be coupled by the free service offered by the Energy and Water Agency whereby technical personnel visit households, hold discussions in order to understand energy usage and, as a result, provide tailored energy conservation tips. An annual budget of €10,000 will be required to support this action.

Special focus will be given to vulnerable households. Energy efficiency schemes and grants will specifically address vulnerable households and will also address the shift to technologies which require significant capital outlay, or which result in relatively long payback periods. Malta already has in place an annual budget of approximately €100,000 to support a scheme for vulnerable households under which old appliances are replaced by new efficient units. Action in this sector will continue in the new period addressing similar or new energy needs of this sector.

Other Actions

Regular training sessions and seminars for energy auditors have been organised whereby best practices are shared with the aim to continue to ensure capacity building of national expertise and higher quality audits. These events also target the analysis of grey areas of expertise observed from the ex-post assessments of past audits. Auditors will be encouraged to work together as teams, building a pool of expertise, to provide more comprehensive audits which cover all the various aspects of energy use.

Training sessions for industry employees on energy efficiency measures shall be organised to target both their place of work as well as the employees' households. This will be part of a holistic campaign to promote energy efficiency and renewable energy, starting in 2019.

v. Description of measures to utilise energy efficiency potentials of gas and electricity infrastructure

Enemalta dispatches the available generating plant and interconnector in a manner to meet demand at minimum cost. The dispatch strategy continually adapts to the hourly prices of the energy available from the European Day-Ahead and Intra-Day markets, eight in all, which may be imported (or exported) over the Interconnector. The main elements – i.e. Delimara 4, Delimara 3, and the Interconnector – are dispatched each hour of the day in a manner which is most economical and least costly.

vi. [If applicable] Regional cooperation in this area

Malta's national authorities responsible for implementing the Energy Efficiency Directive have been actively participating within the **Concerted Action of the Energy Efficiency Directive (CA-EED)** project since its initiation in 2008. Malta considers the CA-EED a useful regional cooperation forum for the sharing of best practices and dissemination of knowledge on the implementation of the Energy Efficiency Directive. Malta has been fostering a working relationship with all CA-EED members, in particular with other Member States with similar geographical specificities, which tackle comparable challenges in implementing energy efficiency measures. In this sense, the CA-EED has proved to be a useful structure for knowledge-sharing between Member States' experts. The CA-EED is currently in its second grant agreement and will continue to run until 2021, financed under the EU's Horizon 2020 research and innovation programme. Maltese authorities will continue their involvement within this forum in view of the transposition requirements of the EED recast following the Directive's entering into force.

Malta's Energy and Water Agency also participates in the **ODYSSEE-MURE project** funded by Horizon 2020. National experts actively contribute to and ensure that the ODYSSEE database is regularly updated with the most recent and detailed national energy-related data. Malta is also taking full advantage of the MURE database, which focuses on the collection and evaluation of all energy efficiency measures implemented in Member States and at EU level. The database contains detailed energy efficiency indicators, including specific data and policy tools which can be used by decision-makers in the area of energy efficiency.

vii. Financing measures, including EU support and the use of EU funds in this area at national level

The predominant source of funding of Malta's energy efficiency measures are national government funds. National authorities responsible for implementing specific energy efficiency measures and carrying out specific projects are responsible for its financing. However, the use of EU funds is and will continue to be used as a complementary financing tool to national funds for energy efficiency measures.

Operational Programme I – *Fostering a competitive and sustainable economy to meet our challenges* for the 2014-2020 period, which falls under the ERDF-CF Programme aims to, among others, enable the shift towards a more low-carbon and environmentally-friendly society in line with Malta's ambition to contribute towards the Europe 2020 targets for smart, sustainable and inclusive growth. Within the Operational Programme, emphasis is placed on environmental sustainability, increasing RES, energy efficiency in buildings as well as promoting a shift to a low-carbon transport sector. Priority Axis 4 of the Programme, tasked with shifting towards a low-carbon economy, enables the allocation of EU funds for specific energy efficiency measures and projects. In 2017, three projects were allocated ERDF funding of over €5 million in total under the category of Energy Efficiency renovation of public infrastructure, demonstration projects and supporting measures. These projects focused primarily on the retrofitting of street lighting and upgrading and retrofitting of public buildings. However, at the stage of drafting of Malta's Draft NECP it is difficult to determine the source of financing measures, including EU support for energy efficiency measures.

To date, the European Commission has been critical in allowing Malta to tap European Regional Development Fund (ERDF) to support renewable energy. Before the 2007-2013 Programming Period, renewable energy as an energy source was negligible, but by the end of said programming period, the total cumulative PV capacity increased from 15.6MWp in 2012 to 74.0MWp in 2015 with figures continuing to rise as a result of the implementation of a domestic scheme funded through ERDF.

Consumer awareness of the benefits which can be reaped from investment in energy efficiency is critical. This is the main challenge for the implementation of this instrument, as otherwise, making money available will not necessarily produce the desired results.

The conclusions of an ex-ante assessment carried out by the EIB on behalf of the Managing Authority confirmed the above, and found that the main existing demand came from the commercial sector. It was made clear that there is a need for a dedicated technical assistance package together with a culture shift. Flexibility is also needed from an eligibility point of view. The nature of the instrument to be offered to the market will need to be confirmed after the results of the ex-ante assessment are discussed with the relevant stakeholders and an investment strategy is drafted to address the identified needs. The form and type of support will be analysed and the calls for Financial Intermediaries that will be responsible for making the instrument available both to residential and non-residential sector will be issued.

viii. [Where applicable] Description of policies and measures to promote the role of local energy communities in contributing to the implementation of policies and measures in points ii, iii, iv, and v

With respect to renewable energy communities, there is limited potential for their development and for establishing targeted policies and measures, mainly as a result of the structure of the electricity distribution and supply system and related derogations for Malta under Directive 2009/72/EC.

ix. Consideration of the 'Energy Efficiency-first' principle

Malta is fully aware of the importance given to the "Energy Efficiency-first" principle within the framework of the Governance Regulation, including the requirement to take into account interlinkages between the five Energy Union dimensions, in particular the "Energy Efficiency-first" principle, as stipulated in Article 3(3)(b) of the Regulation.

The Energy Efficiency-first principle has already been considered in Malta's energy planning, policy and investment decisions. Energy efficiency was treated as a priority element in recent investment decisions in Malta's power generation sector and energy infrastructure which transformed Malta's energy mix from one based on heavy fuel oil to a more sustainable energy mix based on gas, electricity imports through the Malta-Italy interconnector and renewable energy sources (gasoil is used as a backup fuel). The principle is further strengthened in the Malta-Italy gas pipeline project that will connect Malta to the Trans-European Gas Network. Malta's energy policy, previously reflected in consecutive NEEAP and NREAP plans, already takes strong account of "Energy-efficiency first", whereby it remains an underlying principle during the identification and design of policies and measures aimed at achieving cost-effective energy savings in end-use sectors. The implementation of the principle is in itself a very difficult task due to its measure/decision-specific nature and therefore a horizontal application of the principle throughout all five dimensions of Malta's NECP is not explicitly considered. Nevertheless, energy efficiency is considered on par with other options, including renewables and security of supply.

There are, however, other factors that need to be equally considered in energy planning, policy and investment decisions. A Member State can aim to embark on an Energy-efficiency first principle approach, however, there could be cases where security of supply and cost-efficiency drive investment to a different choice. In cases related to national security or national heritage projects, the energy efficiency first principle can therefore only be implemented within constrained parameters.

3.3 DIMENSION ENERGY SECURITY

i. Policies and measures related to elements set out in 2.3

Critical Infrastructure Protection

Critical Infrastructure Protection Unit

In accordance with Article 3 of Legal Notice 434/2011 transposing Directive 2008/114/EC, the Government established the Malta Critical Infrastructure Protection (CIP) Unit within the Ministry for Home Affairs and National Security. Its aim is to strengthen and secure the functioning and resilience of Malta's critical infrastructure and national emergency services. The fundamental role of the CIP Unit is to direct and advise owners and operators of critical infrastructure regarding necessary internal systems to identify vulnerabilities and risks, and the planning for contingencies. It ensures that the necessary risk assessments are carried out, and contingency plans are in place and reviewed on an ongoing basis. It also coordinates and supports general emergency preparedness plans for response to national emergencies, including coordination with other European Member States and the European Commission. LN 434/2011 identified energy as a key critical infrastructure (CI), and specified the following subsectors: electricity, oil and gas.

Operator Security Plans

Under LN 434/2011, every owner or operator of a CI is required to draw up and maintain an Operator Security Plan (OSP). In this regard, Enemalta has developed an OSP for the generation sector and for the distribution sector, with the overall goal of ensuring a reliable supply of energy, identifying measures to ensure the protection of critical assets/systems and ensuring safety measures are in place, and drawing up contingency plans for restoration and recovery times in the case of loss of assets/systems.

Gas Security of Supply

The recent approval of the Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 requests the competent authority of each Member State to carry out a national risk assessment which includes all relevant risks affecting the security of gas supply. The Ministry for Energy and Water Management, as the designated Competent Authority for Malta, is in the process of compiling Malta's National Risk Assessment, which will be submitted to the European Commission by the end of 2018. In line with Annex I of the same regulation, Malta forms part of four risk groups:

- North African gas supply risk groups:
    - Algeria: Greece, Spain, France, Croatia, Italy, Malta, Austria, Portugal and Slovenia
    - Libya: Croatia, Italy, Malta, Austria and Slovenia
- South-East gas supply risk groups:
    - Southern Gas Corridor – Caspian: Bulgaria, Greece, Croatia, Italy, Hungary, Malta, Austria, Romania, Slovenia and Slovakia
    - Eastern Mediterranean: Greece, Italy, Cyprus and Malta

Article 20 (2) of the Regulation states that, for the time being, the obligations related to the work of the South-East gas supply risk groups shall remain on hold and start only from the date when the major infrastructure/pipeline enters the test operation. On the other hand, the Algerian risk group

has completed the common risk assessment and the relevant document has already been submitted to the Commission. The common risk assessment for the Libyan group is in its final stages and the final version will be delivered in the coming months.

Following the completion of the common and national risk assessments, Malta is obliged under the same Regulation to compile the preventive action plan and the emergency plan. These are expected to be finalised and delivered by mid-2019 which, once approved by the European Commission, will be made public.

Risk Assessments for Power Generation Sector

Enemalta plc, as the designated Distribution System Operator in Malta is responsible for ensuring the security of electricity supply within the Maltese Islands. In this sense, Enemalta is obliged to comply with Directive 2005/89/EC concerning measures to safeguard security of electricity supply and infrastructure investment and the Regulation on risk-preparedness in the electricity sector, which will repeal Directive 2005/89/EC. Taking cognizance of these obligations, Enemalta conducted a risk assessment in the second half of 2018. This covered the assets and systems pertaining to power generation and power distribution, together with all the legal obligations imposed on Enemalta in relation to its role in power generation and distribution.

The assessment focused on national risks such as marine oil spills, pandemics, earthquakes, major mass casualty incidents, terrorist attacks, irregular migration, drought, flood, severe weather, release of major hazardous materials, cyber-attacks, and others. In addition, it took into consideration risks identified in the Critical Infrastructure Protection Directorate's National Risk Assessment; this included risks arising from incidents occurring to the company's major assets and systems, as well as third party assets which might affect Enemalta's operation such as risks from accidental fire or explosion at major sites, major damages to plants, etc. The assessment was built on a number of safety reports which have been conducted by Enemalta in this regard in the past.

A specific risk assessment was also conducted in relation to the security of electricity supply, identifying crisis scenarios in relation to system adequacy, system security and fuel security on the basis of the following risks:

- Rare and extreme national hazards;
- Accidental hazards going beyond the N-1 security criterion; and
- Consequential hazards including consequences of malicious attacks and of fuel shortages.

The risk assessment ran multiple crisis scenarios to develop an understanding of the interaction and correlation of risks at national level between different assets, and the interaction and correlation of risks across the border from Sicily in relation to the interconnector. Also, simultaneous crisis scenarios were simulated.

Oil Supply Disruption Emergency Plan

EU Directive 2009/119/EC, which requires Member States to maintain minimum stocks of crude oil and petroleum products, was transposed into national law through Legal Notice 109 of 2013. Regulation 18(2) of this legal notice requires the REWS to develop contingency plans that would be implemented in the event of a major supply disruption. In this regard, REWS prepared the Oil Supply Disruption Emergency plan, to be activated in the event of difficulties arising in the supply of crude oil and petroleum products. This is in the process of being finalised.

The document outlines the strategic approach to be taken in the management of an oil supply disruption emergency in Malta. The Plan ensures that, as far as possible, the institutions, information, hardware and infrastructure are available, ready, and coordinated to perform efficiently and expeditiously in any emergency involving oil supply, while allowing a certain freedom and flexibility to respond effectively to any circumstances as they arise. It also highlights the arrangements to be established between the oil industry, the REWS and the European Commission for the safe and effective management of oil supply emergencies. The scope of the original plan does not cover natural gas. A separate plan on the mitigation of risks and impacts of a gas supply disruption is being drawn up in line with EU Regulation 994/2010.

Under the Contingency Plan, an Oil Supply Disruption Task Force may be appointed on an ad hoc basis, depending on the disruption/interruption event that arises. The Task Force would be made up of high officials representing the Ministries responsible for energy and for finance, the Regulator for Energy and Water Services, and oil suppliers and importers, under the Chairmanship of the Minister. The Task Force would be in a position to collaborate with high fuel consumers potentially affected by an oil supply disruption. If the emergency is the consequence of a natural disaster, the Oil Supply Disruption Task Force would work closely with the Civil Protection Department, which has the overall responsibility for emergency response to such events. The Task Force would also advise the Minister on what measures, proportionate to the situation, to take, monitor, analyse and report to the Minister on the situation and events, during activation of the contingency plan. Finally, when the shortage is declared over, the Task Force is required to take stock of lessons that could be learnt and update the Plan where required.

ii. Regional cooperation

The role of the CIP Unit, in charge of coordinating and supporting general emergency preparedness plans under Legal Notice 434/2011 on the identification and protection of critical infrastructures, includes collaboration with other European Member States and the European Commission.

Malta also cooperates with other European Member States on national emergency stock holdings. In 2017, emergency stocks for Malta in the form of tickets were located in the Netherlands, Spain, Ireland Sweden, Finland, Italy, Slovenia and Belgium in 2017. During this year, Malta held emergency stocks as tickets for the United Kingdom, Sweden and Cyprus. These arrangements are approved by the competent authorities of the Member States, in the case of Malta by REWS.

iii. [If applicable] Financing measures in this area at national level, including EU support and use of EU funds

As explained in previous sections, EU funds are being tapped to develop the Malta-Italy gas pipeline as well as to carry out a Technical study and CBA for LNG as marine fuel in Malta. Future development of storage infrastructure may also seek EU funding to ensure the realization of projects, which whilst providing significant economic benefits, would otherwise turn out to be financially not viable.

3.4 DIMENSION INTERNAL ENERGY MARKET

3.4.1 Electricity infrastructure

i. Policies and measures to achieve the targeted level of interconnectivity

As indicated in section 2.4.1. on the national objectives and targets in the area of electricity interconnectivity, the level of interconnectivity is expected to remain well above the EU-wide target of 15%, as required under the Governance Regulation.

ii. Regional cooperation in this area

Cooperation between the Maltese and Italian authorities on issues of electricity interconnection has always been very strong. Since 2015, continued coordination between Enemalta and the TSO in Italy has ensured the optimal functioning of the electricity interconnector.

iii. [If applicable] Financing measures in this area at national level, including EU support and use of EU funds

There are currently no plans for a second electricity interconnector. However, this is subject to the outcome of an ongoing in-depth study on power system adequacy commissioned by Enemalta for the period 2019-2040. There are no electricity transmission systems and electricity transmission system operators in Malta. Enemalta continues to perform the functions of the DSO and that of the sole supplier of electricity to final consumers. Financing measures in the area of electricity infrastructure are handled by the DSO, which in view of its obligation to supply electricity to all consumers allocates internal funding as required. Should the outcome of the aforementioned study suggest the need for an additional electricity interconnector, Malta would consider EU support and the use of EU funds to supplement national funding.

3.4.2 Energy transmission infrastructure

i. Policies and measures related to elements set out in 2.4.2

The delivery of PCI 5.19, the Malta-Italy gas pipeline, including the regional cooperation aspect and financing measures are described in detail under the Energy Security dimension, in particular in section 3.3 (i) outlining the policies and measures to reach the objectives and targets established under the energy security dimension.

ii. Regional cooperation in this area

Currently, regional cooperation on energy transmission infrastructure is mainly related to cooperation on the Gas Pipeline Project, identified as a Project of Common Interest.

iii. [If applicable] Financing measures in this area at national level, including EU support and use of EU funds

Financing measures for the Gas Pipeline Project are covered under the Energy Security dimension.

3.4.3 Market integration

i. Policies and measures related to elements set out in 2.4.3

The commissioning of the Malta-Italy gas pipeline shall not only lead to the designation of a gas TSO, but also open the possibility for commercial operators to gain access to natural gas supplies. As the main client is expected to be the power generation sector, it is being projected that this will drive average local generation costs to align with those prevalent in Sicily/Italy.

Following ongoing studies with regards to cost-effective options for the deployment of electricity storage units, it is expected that these are supported (either through regulation or financially or both) to allow for better integration of small scale renewable, peak shaving and potentially delaying additional generation capacity requirements and contributing towards the desired level of system adequacy.

Enemalta is required to apply economic dispatch and shall be required to also consider aggregation, demand response, and storage during dispatch subject to technical requirements.

ii. Measures to increase the flexibility of the energy system with regard to renewable energy production

Thus far, the intermittent nature of renewable electricity sources has been mitigated by maintaining backup conventional facilities (such as spinning reserves) or acquiring balancing services over the

interconnector. Distribution system secondary node reinforcements have been implemented to address issues related to system current carrying capacity and voltage drop. However, further installation of renewable energy capacity, particularly large-scale installations, will necessitate the implementation of different mitigating strategies, namely storage, dispatching, and curtailment, which shall be dealt with in the study being commissioned by Enemalta mentioned previously. Any potential arising measures will be included once the conclusions of the assessments are available.

Mechanisms for dispatching, re-dispatching and curtailment

Enemalta's Network Code approved by the Regulator in 2013 does not discriminate between renewable and conventional generators. Generators less than 5MW are not subject to dispatch (automatically dispatched), although there are no renewable energy installations larger than 5MW in Malta. Enemalta is required to dispatch different generation sources on an economic basis and aim to minimize the overall system costs. Enemalta has invested in dispatch optimisation software to improve its capabilities.

No planned measures are envisaged for the establishment of real-time price signals and dynamic prices, largely in view of there being no liquid wholesale market.

iii. [If applicable] Measures to ensure the non-discriminatory participation of RES, demand response and storage, including via aggregation in all energy markets

Not applicable.

iv. Policies and measures to protect consumers, especially vulnerable and where applicable energy poor consumers, and to improve the competitiveness and contestability of the retail energy market

Vulnerable electricity consumers are catered for within the social policy framework. The Department of Social Policy has established criteria whereby certain categories may be eligible to receive energy benefits, which are deducted directly from the consumer's electricity bill. Consumers that are eligible include families with low income, households on social assistance, persons in receipt of unemployment benefits, pensioners or the disabled.[37] In 2017, 20,488 individuals received the energy benefit. Malta's assessment of the number of energy poor households is further described in section 4.5.4.

[37] https://socialsecurity.gov.mt/en/Short-Term-Benefits/Pages/Energy-Benefit.aspx

v. Description of measures to enable and develop demand response including those addressing tariffs to support dynamic pricing

No planned measures are envisaged for the establishment of real-time price signals and dynamic prices due to the absence of a liquid wholesale electricity market in Malta, limited demand, and relatively flat on-island production costs. Demand side management is currently limited to differentiated night and day tariffs for non-residential consumers with an annual consumption of 5 GWh (5.5GVAh) or more.

3.4.4 Energy poverty

i. [If applicable] Policies and measures to achieve the objectives set out in 2.4.4

Malta's assessment of the number of energy poor households is further described in section 4.5.4.

3.5 DIMENSION RESEARCH, INNOVATION AND COMPETITIVENESS

i. Policies and measures related to the elements set out in 2.5

Refer to sections 2.5 and 4.6.

ii. [If applicable] Cooperation with other Member States in this area

Refer to sections 2.5 and 4.6.

iii. [If applicable] Financing measures in this area at national level, including EU support and use of EU funds

Refer to sections 2.5 and 4.6.

4 CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

4.1 PROJECTED EVOLUTION OF MAIN EXOGENOUS FACTORS INFLUENCING ENERGY SYSTEM AND GHG EMISSION DEVELOPMENTS

Malta has developed its own methodology and set of assumptions to forecast the macroeconomic indicators as part of the analytical basis of the NECP. These indicators consist of population figures, Gross Domestic Product, sectoral Gross Value Added, household size, number of households and disposable income. This set of national indicators, carried out by external consultants and endorsed by the Economic Policy Department within the Ministry for Finance[38], was used across the board by the various Ministries in all modelling exercises related to the development of the NECP.

i. Macroeconomic forecasts (GDP and population growth)

Malta's current rise in population amounting to approximately 2% annually can be attributed to rapid economic expansion and an increased demand for labour force leading to high immigration. Table 10 below presents projected population figures in 5-year periods until 2040. The projection is based on data published by the National Statistics Office (NSO) and the Ageing population report, with adjustments for net imligration and natural increase in population. Although an assumption is made regarding the decreasing growth in population which drops down to 0.6% in 2030, it is expected that Malta's population will reach 554,822 in number by 2030. The increased population will inevitably have a major impact on the energy system and future energy demand.

Table 10 Projected total population as five-year average, total population.

5-year period	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040
Total population	478,809	519,286	547,083	562,704	571,232

Table 11 presents projected GDP growth rates until 2040. An assumption is made that the current trend of high annual economic growth will peak in 2017 at 6.6%, and will start to slow down and stabilize in the future, reaching 3.5% by 2030. Table 12 presents the projected evolution of GDP per capita. The outcome of GDP and population projections reported above leads to an increase in GDP per capita from over 20,000 EUR/p.c in 2017 to almost 30,000 EUR/p.c. by 2030.

Table 11 Projected average GDP growth in five-year periods, %.

5-year period	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040
Average GDP growth	5.63%	4.2%	3.70%	3.11%	2.32%

[38] The classification of GVA projections in the sectors required for the NECP (i.e. agriculture & fishing, industry, and services) was carried out by external consultants using autogressive models where required.

Table 12 Projections of GDP per capita, EUR 2016 prices.

5-year period	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040
Average GDP per capita	21,190	24,554	28,209	31,961	35,318

The projected increase in population presented is expected to result in an increase in the number of households. Projections for number of households in 5-year periods until 2040 are shown in Table 13. The source of the actual data for household size is Eurostat on the basis of the EU-SILC Survey (Survey for Income and Living Conditions) while the forecasted data is based on the EU Reference Scenario[39] for 2016 published by the European Commission.

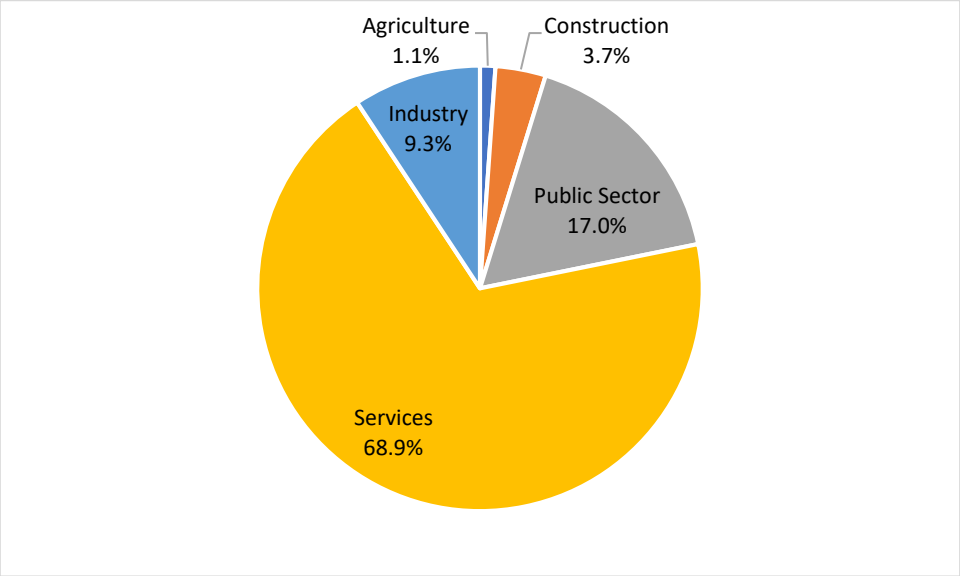
Table 13 Projected number of households in five-year averages.

5-year period	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040
Average number of households	180,003	192,328	210,416	216,425	219,705

ii. Sectorial changes expected to impact the energy system and GHG emissions

The gross value added (GVA) generated in Malta in 2017 stood at €9.7 billion increasing by an average annual rate of 10% over a five-year period. Almost 69% of the total GVA in 2017 was generated by the services sector, followed by the public sector with 17% of total GVA. Figure 21 illustrates the sectoral distribution of economic activity in 2017, indicating the relatively minor roles played by agriculture and energy in the generation of GVA in the economy of Malta.

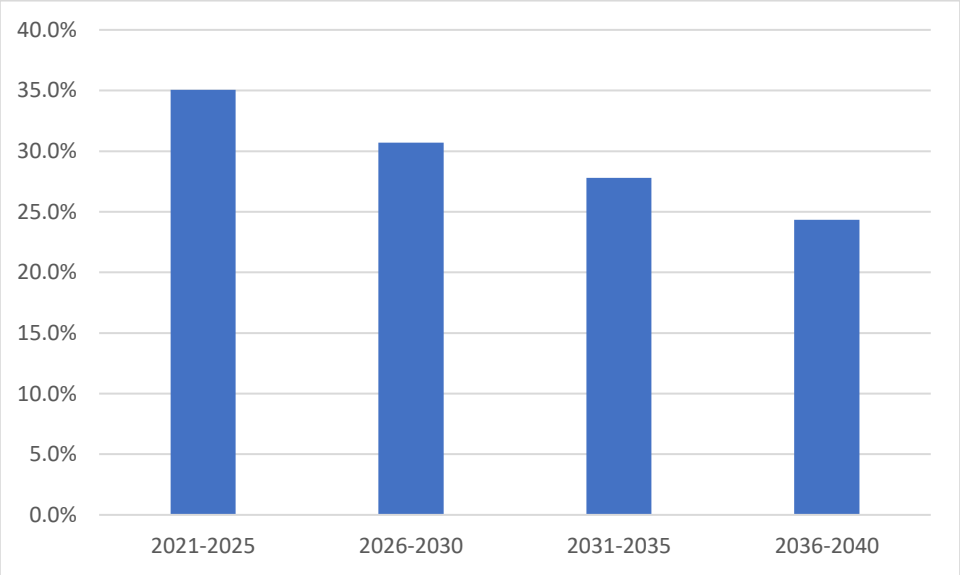
Figure 21 GVA distribution in 2017, %.



[39] EU Reference Scenario 2016: Energy, Transport and GHG Emissions - Trends to 2050.

Reflecting the overall composition of the economy in 2017, growth in GVA over the preceding five-year period was mainly driven by the services sector, which grew at an average annual rate of over 11%, and the public sector, with an average annual growth of around 7%. In terms of future expectations, the GVA is projected to grow by an annual average of around 6% per annum, decelerating to a 5% growth towards 2040 (Figure 22).

Figure 22 Five-year period cumulative growth in total GVA, %.



In comparison to 2017, the share of the services sector by 2040 will increase from 69% to 71%. This is the result of Malta's strive to build its competitiveness strengths to attract further business in this area, also through innovative approaches and disruptive technologies. On the other hand, there may be a reduced role for other service industries such as tourism and wholesale and retail as the country approaches its carrying capacity in terms of population and tourist visitors.

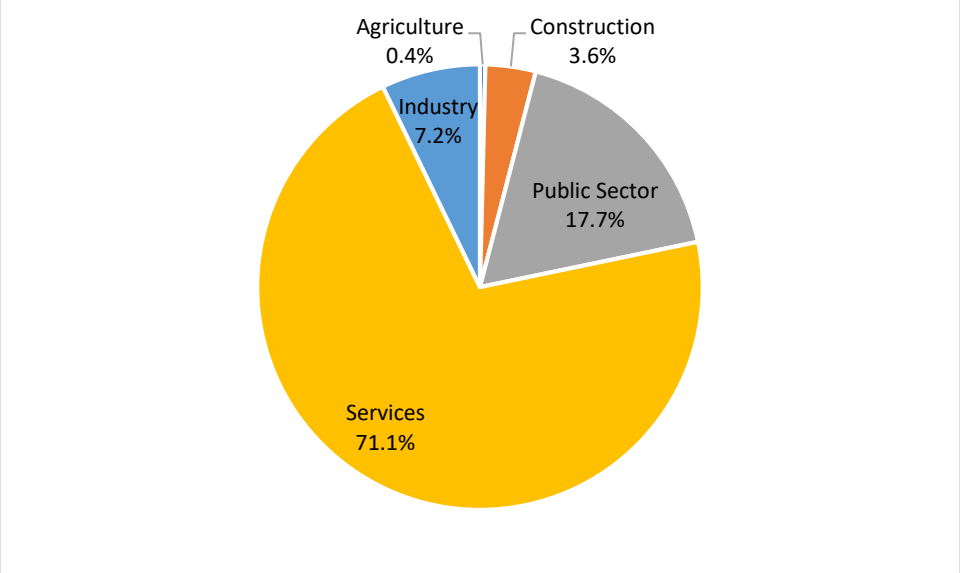
As at 2017, the wholesale and retail sector was the largest sector within the services sector, consisting of around 25% of the total services GVA, followed by gaming (16%), other business services (12%), administration services (12%), financial services (9%), and tourism (7%). In 2040, the composition of GVA depicts a different picture. The share of the wholesale and retail (16%), tourism (6%) and financial services (4%) will decline as opposed to sectors like administration services (32%), gaming (19%) and other business services (15%). The wholesale and tourism sectors are traditional sectors which are saturating unless Malta invests in specific niches. In order to sustain and even increase its competitiveness, Malta is seeking to attract innovative sectors like the video gaming and the blockchain technology industries, which require considerable use of administrative services.

As for the industry sector, this consists of approximately 9% of the total GVA as at 2017, and on average, it is expected to keep the share around 8% over the years. New opportunities are expected to arise within this sector, for instance the Medical Cannabis Industry which is estimated to be worth €0.3 billion by 2028. This shows that whilst some industries might be declining, new opportunities are arising which will help the industry sustain its contribution to GVA. A similar effect is expected in the

pharmaceutical industry as a result of continuous advancement in the healthcare sector. Should Malta manage to innovatively tap into these new industries, Malta's competitiveness will be strengthened, and a higher sectoral GVA is expected.

The share of public sector to GVA will remain, on average, around 17%, increasing by 0.7% by 2040 in comparison to 2017. As for the GVA associated with the public, agriculture, and construction sectors is expected to remain minimal. The agricultural share is expected to decline by 0.7% by 2040 while that of the construction sector will decline by 0.01%. The latter is the result of recent growth in the construction sector which will lead to a peak where the capacity for further growth saturates. As for the public sector, its contribution will remain stable over the years.

Figure 23 GVA distribution in 2040, %.



iii. Global energy trends, international fossil fuel prices, EU ETS carbon price

International fossil fuel prices used in modelling exercises for the development of the reference and policy scenarios of Malta's NECP are presented in Table 14 below. These projections have been provided and updated by the Commission. Similiarly, updated projections provided by the Commission on the EU ETS carbon price in constant 2016 prices is shown in Table 15.

Table 14 International fuel prices projections, EUR (2016)/GJ.

	2020	2025	2030	2035	2040
Oil	13.86	15.73	17.33	18.08	19.14
Gas	8.91	9.64	10.49	11.20	11.58
Coal	2.64	3.16	3.79	4.01	4.18

Table 15 EU ETS carbon price projections, EUR (2016)/tonnes of CO_2.

Year	2020	2025	2030	2035	2040
Carbon price (€'16/ t CO_2)	15.52	23.28	34.66	43.45	51.73

iv. Technology cost developments

Technology cost assumptions used in the development of Malta's reference and policy scenarios for the NECP are presented in this section.

Cost assumptions for small-scale residential solar photovoltaics - 3 kWp is currently the average size of residential PV systems - are based on the costs for small-scale rooftop solar PV set out in the ASSET (Advanced System Studies for Energy Transition) study on *Technology pathways in decarbonisation scenarios*, published in July 2018.[40] Overnight investment costs and annual fixed operation and maintenance costs reported in EUR/kW are presented in the third row of Table 16 for 2020, 2030, 2040 and 2050. In addition, a one-time €50 connection fee was included in the overnight capital costs. The cost of the inverter (EUR/kW), which is assumed to be replaced in year 11, was calculated based on historical data of inverter costs and projected based on trends in overnight costs outlined in Table 16. The technical lifetime of solar PV technology was assumed to be 20 years.

For non-residential PV systems, the overnight investment costs and fixed annual operation and maintenance costs for solar PV with a high potential were selected from the ASSET study. However, given the large variance between local (€ 1000 /kW in 2017) and projected EU capital costs (€ 700/kW in 2020), it was concluded that the ASSET study costs had to be complemented by other sources in order to accurately project the CAPEX of non-residential PV systems in Malta.

The ASSET study projected costs based on average prices of solar PV in Europe which have, in recent years, been driven down significantly following the introduction of auctions to support utility-scale PV systems and other renewable technologies around Europe. Given that the average size of non-residential PV system in Malta is 12 kWp, ASSET prices are not reflective of local costs.

Therefore, for non-residential PV systems, it was assumed that the ASSET costs did not adequately account for the Balance of Systems components. Thus, these were factored into the total PV system costs based on projections published by Fraunhofer ISE (2015) on behalf of Agora Energierwende[41]. These are outlined in Table 17. As the report uses 2014 as its base year, it is likely that the recent price evolution of PV systems, as a result of the increase in utility-scale PV, was not captured and therefore the costs are more reflective of small scale PV systems prevalent in Malta.

Table 16 Solar PV technology cost assumptions, EUR 2013/kW excluding taxes (Source: Technology pathways in decarbonisation scenarios, 2018).

	Investment costs (EUR/kW)				Fixed annual O&M costs (EUR/kW)				Lifetime
	2020	**2030**	**2040**	**2050**	**2020**	**2030**	**2040**	**2050**	**Years**
High potential	700	645	477	431	13	12.2	11.5	10.8	20

[40] https://ec.europa.eu/energy/sites/ener/files/documents/2018_06_27_technology_pathways_-_finalreportmain2.pdf

[41] Fraunhofer ISE (2015): Current and Future Cost of Photovoltaics. Long-term Scenarios for <arket Development, System Prices and LCOE of Utility-Scale PV Systems. Study on behalf of Agora Energiewende.

Small-scale rooftop	1435	930	745	610	24	17	15	13	20

Table 17 Cost reduction scenario, EUR 2014/kW excluding taxes (Source: Fraunhofer ISE, 2015).

	Cost reduction scenario (EUR (2014=100)/kWp)		
	2014	2050 (before efficiency effect)	2050 (incl. efficiency effect)
Installation	50	30-45	13-28
Mounting Structure	75	38-60	16-38
DC Cabling	50	30-45	20-32
Grid Connection	60	24-36	24-36
Infrastructure	40	28-36	16-26
Other BoS costs	60	39-56	29-46

The potential of floating offshore wind technology was assessed for the period 2021-2030. However, estimating the total installation costs for this innovative technology is difficult as available data is limited and only one such project has been implemented to date. Indeed, no cost assumptions were available from the ASSET study. In this regard, capital costs for floating offshore technology estimated by a study which explored the potential for floating offshore wind farms in the Mediterranean[42] were used as a base to calculate the total installation costs. These are presented in Table 18, taken from the study by Zountouridou et al. (2015).

It must be noted that there is a high degree of uncertainty associated with the deployment of new technologies. The world's first commercial windfarm using floating wind turbines, Hywind Scotland, was installed off the coast of Peterhead in Scotland in July 2017, 25m from the shore at a depth of 95-120m. The CAPEX for this project was €7.6 million per MW, thus significantly higher than that suggested in a review by Zountouridou et al. (2015) indicating the high costs associated with the deployment of new energy technologies.

Table 18 Low and high capital cost estimation, EUR/kW (Source: Zountouridou et al., 2015).

	Capital cost estimation (€/kW)	
	Low	**High**
Fixed-bottom technology	2600	4200
Floating technology	3200	4550

[42] Zountouridou, E.I., Kiokes, G.C., Chakalis, S., Georgilakis, P.S. and Hatziargyriou, N.D., 2015. Offshore floating wind parks in the deep waters of Mediterranean Sea. Renewable and Sustainable Energy Reviews, 51, pp.433-448.

4.2 DIMENSION DECARBONISATION

4.2.1 GHG emissions and removals

i. Trends in current GHG emissions and removals in the EU ETS, Effort Sharing Regulation and LULUCF sectors and different energy sectors

Malta's GHG emission trends, in terms of the overall profile of total national emissions over the time-series 1990 to 2016 (Figure 24 and Table 19) show an increase in total emissions up until 2012, followed by a rapid decrease over a period of just four years, with emissions in 2016 being even lower than the emissions in 1990.

Figure 24 Total Greenhouse Gas Emission trends from 1990-2016, Gg CO_2 eq.

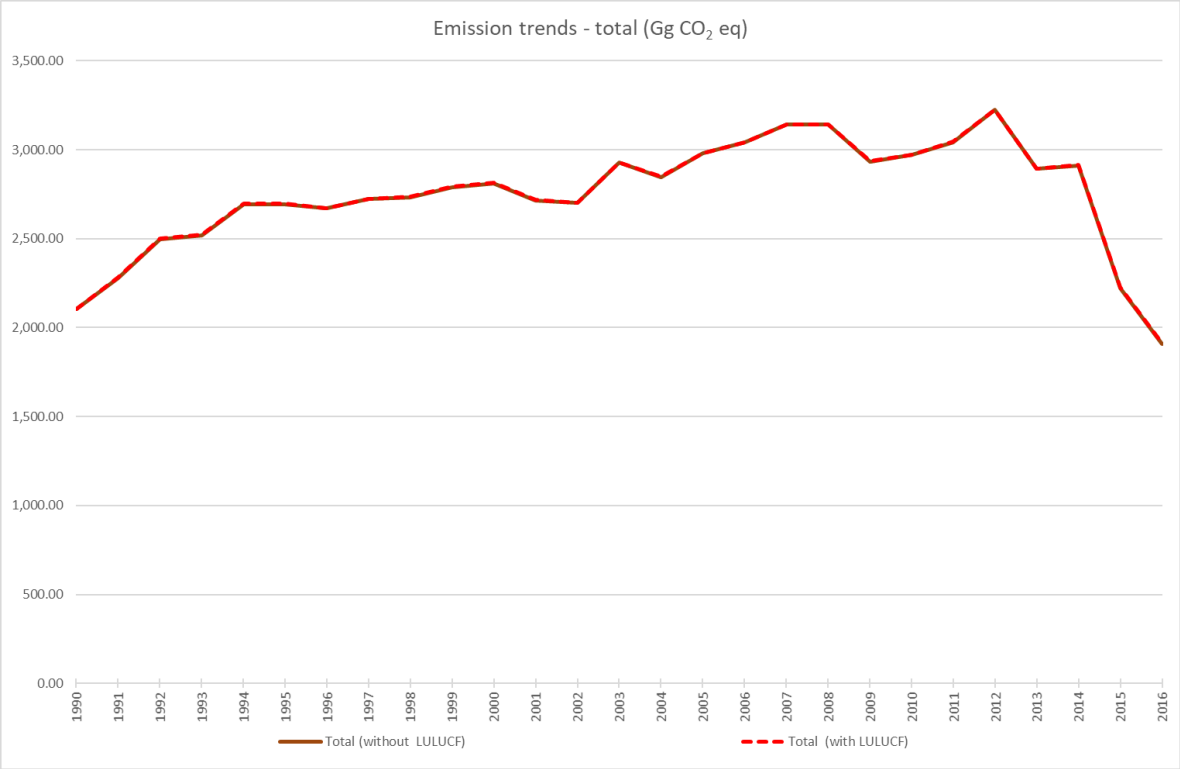


Table 19 Total GHG emissions, with and without LULUCF.

	Total emissions - without LULUCF	Total emissions - with LULUCF
	Gg CO_2 eq.	
1990	2102.06	2105.03
1991	2277.86	2282.61
1992	2496.40	2500.75
1993	2517.93	2521.20
1994	2692.53	2696.21
1995	2694.34	2697.41
1996	2668.89	2671.90
1997	2721.91	2724.84

1998	2731.73	2734.28
1999	2790.27	2792.19
2000	2810.52	2813.68
2001	2715.55	2717.65
2002	2700.36	2701.63
2003	2927.55	2928.94
2004	2844.79	2846.33
2005	2978.52	2980.22
2006	3037.61	3039.49
2007	3138.54	3140.55
2008	3138.54	3140.65
2009	2931.20	2933.45
2010	***2967.77***	***2696.77***
2011	3040.61	3042.84
2012	*3221.82*	*3224.29*
2013	2890.86	2893.56
2014	2908.66	2911.60
2015	2225.14	2228.32
2016	***1909.75***	***1913.16***

The peak of GHG emissions was recorded in 2012 during which such emissions were 53% higher than in 1990. In contrast the lowest emission levels were recorded in 2016, during which total national GHG emissions were around 9% lower than in 1990 (Figure 25). Between 2012 and 2016, there is a difference of more than 62% compared to 1990 emission levels. The 2016 total national emissions are almost 41% lower than 2012 emissions[43].

Year-to-year changes across the period are presented in Figure 26. Up until 2012, there are sixteen instances of positive year-to-year changes, that is, an increase in emissions is recorded from one year to the next, out of a possible twenty-two. Subsequent to 2012, there are three instances of year-to-year negative changes (i.e. emissions decrease for one year to the next), with only one instance of a year-to-year increase (2013 to 2014). The biggest year-to-year change is observed for 2014-2015, with total emissions in 2015 being more than 23% lower than the previous year. The trend in positive versus negative year-to year changes and the relative changes observed correlate with the overall trend for the whole period.

[43] Analysis of trends is based on total emissions with LULUCF. Net total emissions, i.e. total emission with LULUCF are higher than total emissions without LULUCF as the sector LULUCF reports net positive emissions.

Figure 25 Annual percentage change of total emissions compared to base year (1990), %.

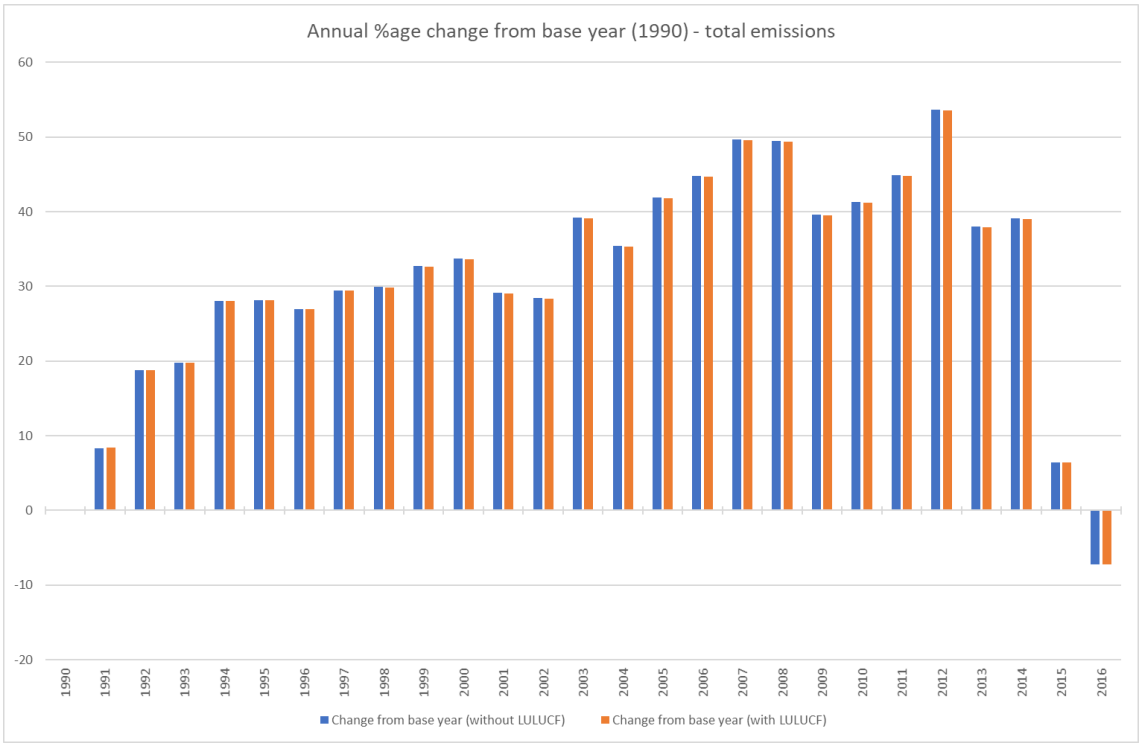
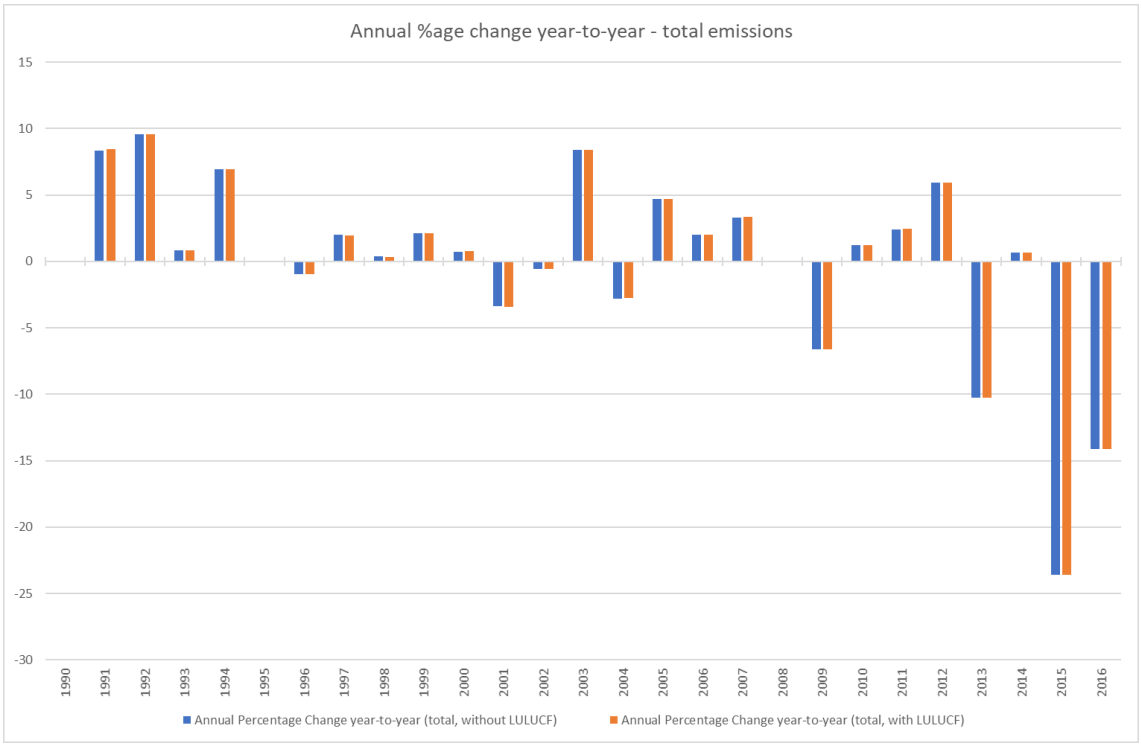


Figure 26 Annual percentage change in total emissions year-to-year, %.

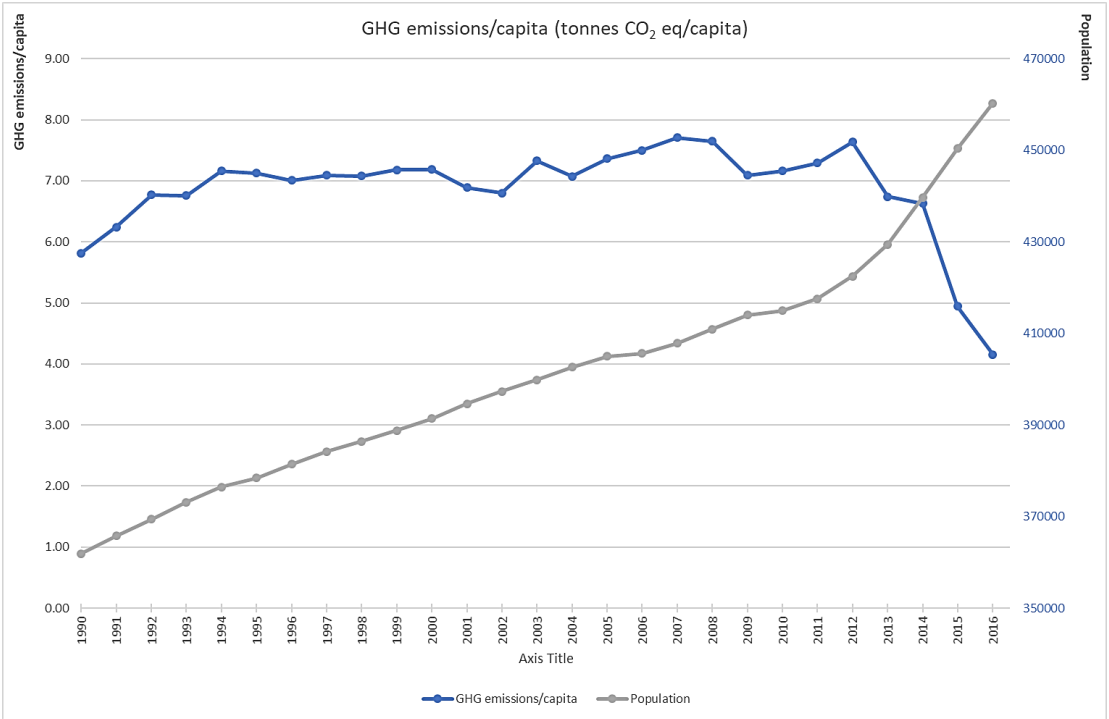


Trends in GHG emissions per Capita

Figure 27 describes the correlation between the trend in total national emissions and the trend in population of the Maltese Islands, in terms of GHG emissions per capita. Population has grown steadily over the years[44]. As observed for the trend in total emissions, GHG emissions per capita also show a general increasing trend from 1990 until 2012; this trend then reversed after 2012, with GHG emissions per capita increasing, even though population growth continued at a similar rate to previous years' growth. Emissions per capita reached their highest levels in 2007, at 7.7 tonnes CO_2 eq. per capita. The lowest rates of GHG emissions per capita are recorded for 2015 (4.9 tonnes CO2 eq. per capita) and 2016 (4.2 tonnes CO_2 eq. per capita).

One can infer, for the latter years, a certain decoupling between GHG emissions trends and population trends of the Maltese Islands, or, in other words, that population statistics alone cannot directly explain the changes in GHG emissions over the whole period under consideration. Indeed, one could consider that greater demand for major emitting activities in Malta, particularly energy (and therefore, energy generation) and mobility (i.e. road transport) as population grew, could explain the increasing emissions at least until 2012, as these activities have been the major contributors to overall emissions in absolute terms. However, targeted measures in these sectors could have a major impact on overall emissions, despite continued population growth, even more so if that one sector or category has a significant share of total national emissions. This is the case for the period after 2012, which saw substantial emission reductions due to major technical developments in the electricity generation sector; this has counteracted the increase that may have been expected with continued population growth.

Figure 27 Trend in emissions per capita compared to population growth trend, GHG emissions/capita.

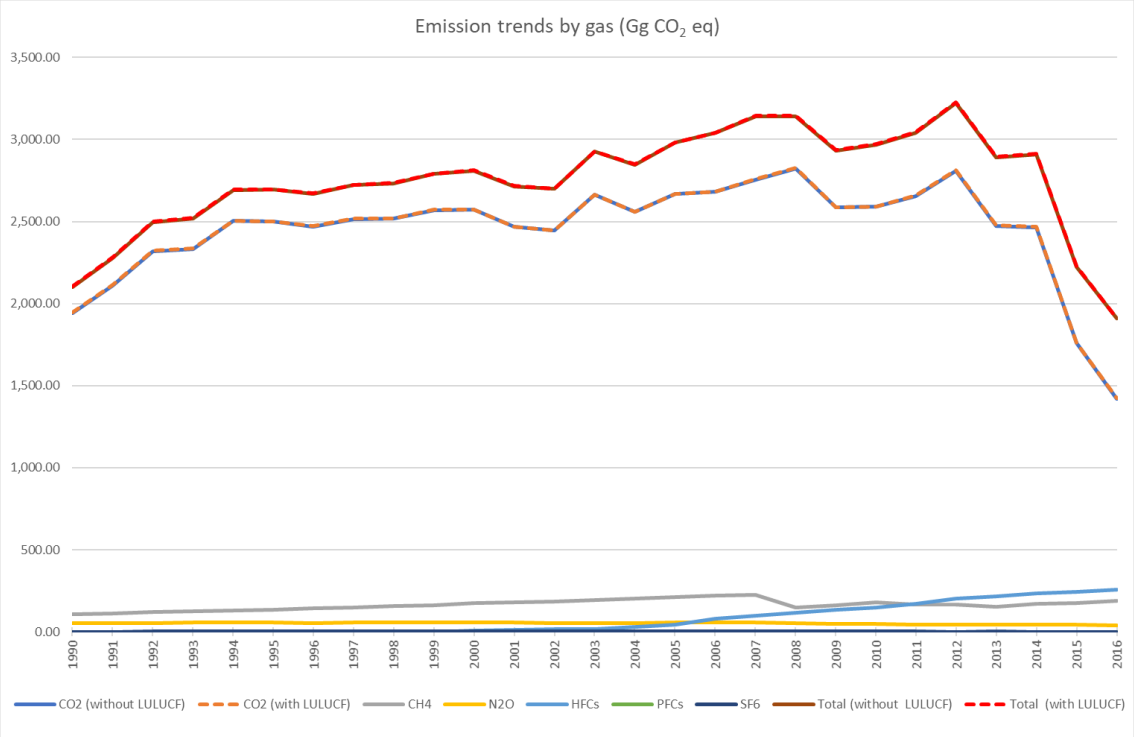


[44] Population data from NSO; population data as at end-of-year.

General discussion of emission trends by gas

Carbon dioxide (CO_2) emissions contribute the biggest share of total national emissions with the trend mirroring that of total national emissions changes (Figure 28 and Table 21). Between 1990 and 2003 CO_2 accounted for more than 90% of total national GHG emissions. In contrast, between 2015 and 2016, CO_2 accounted for less than 80% of total emissions (Figure 29). Compared to base year, net CO_2 emissions were 26.9% lower in 2016. For the same year, CH_4 emissions were 79.6% higher than 1990 levels while N_2O emissions were 21.1% lower. No emissions occurred in 1990 for HFCs or were estimated for PFCs, while SF_6 emissions in 2016 were 338% higher than 1990 emissions.

Figure 28 Greenhouse gas emission trends by gas between 1990 – 2016, Gg CO_2 eq.



Note on Table 20: Values denoted as '0.00' indicate that emissions have been estimated but the value is of an order of magnitude that cannot be represented at two decimal places. Always refer to CRF tables for exact emissions data.

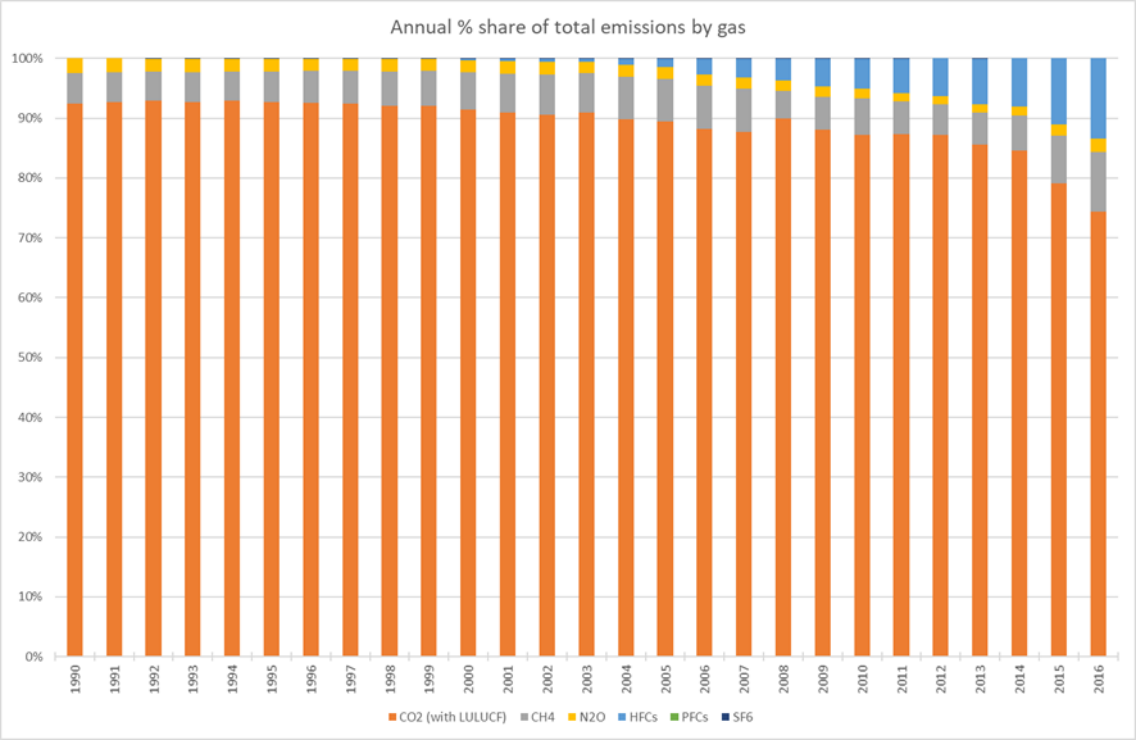
Table 20 Greenhouse gas emission trends by gas between 1990-2016.

	CO_2 (excl. LULUCF)	CO_2 (incl. LULUCF)	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total (excl. LULUCF)	Total (incl. LULUCF)
	Gg CO2 eq.									
1990	1943.32	1946.28	105.92	52.81	NO, NE, NA	NO, NA	0.01	NO	**2102.06**	**2105.03**
1991	2110.58	2115.33	113.24	54.04	NO, NE, NA	NO, NA	0.01	NO	**2277.86**	**2282.61**

1992	2319.45	2323.81	120.18	55.33	NO, NE, NA	NO, NA	1.43	NO	**2496.40**	**2500.75**
1993	2333.91	2337.19	126.45	56.13	NO, NE, NA	NO, NA	1.43	NO	**2517.93**	**2521.20**
1994	2502.53	2506.21	131.61	56.96	0.00	NO, NA	1.43	NO	**2692.53**	**2696.21**
1995	2498.30	2501.37	135.91	58.69	0.00	NO, NA	1.44	NO	**2694.34**	**2697.41**
1996	2469.97	2472.97	142.45	55.03	0.00	NO, NA	1.45	NO	**2668.89**	**2671.90**
1997	2515.05	2517.98	149.32	56.09	0.00	NO, NA	1.45	NO	**2721.91**	**2724.84**
1998	2516.05	2518.60	155.92	58.28	0.01	NO, NA	1.47	NO	**2731.73**	**2734.28**
1999	2570.29	2572.21	162.72	55.79	0.01	NO, NA	1.47	NO	**2790.27**	**2792.19**
2000	2570.87	2574.02	173.53	57.96	6.70	NO, NA	1.47	NO	**2810.52**	**2813.68**
2001	2468.11	2470.22	178.36	56.32	11.26	NO, NA	1.49	NO	**2715.55**	**2717.65**
2002	2443.92	2445.18	184.73	55.24	14.99	NO, NA	1.50	NO	**2700.36**	**2701.63**
2003	2662.36	2663.74	191.69	54.98	16.45	NO, NA	2.06	NO	**2927.55**	**2928.94**
2004	2557.28	2558.81	201.19	55.31	29.48	NO, NA	1.54	NO	**2844.79**	**2846.33**
2005	2666.02	2667.73	212.95	56.20	41.78	NO, NA	1.56	NO	**2978.52**	**2980.22**
2006	2679.44	2681.32	220.71	57.02	78.86	NO, NA	1.57	NO	**3037.61**	**3039.49**
2007	2756.05	2758.06	226.88	57.29	96.74	0.00	1.58	NO	**3138.54**	**3140.55**
2008	2823.74	2825.85	146.48	54.19	112.37	0.00	1.75	NO	**3138.54**	**3140.65**
2009	2584.32	2586.57	161.51	50.74	133.13	0.00	1.50	NO	**2931.20**	**2933.45**
2010	2590.22	2592.22	179.72	50.64	145.49	0.00	1.69	NO	**2967.77**	**2696.77**
2011	2655.27	2657.50	167.53	44.19	169.02	0.00	4.59	NO	**3040.61**	**3042.84**
2012	2810.52	2812.99	165.55	44.28	201.03	0.00	0.45	NO	**3221.82**	**3224.29**
2013	2473.93	2476.64	154.95	42.98	216.32	0.00	2.68	NO	**2890.86**	**2893.56**
2014	2463.00	2465.94	171.21	43.10	230.77	0.00	0.58	NO	**2908.66**	**2911.60**
2015	1757.75	1760.93	178.36	42.47	246.37	0.00	0.19	NO	**2225.14**	**2228.32**
2016	1420.28	1423.69	191.06	41.83	256.55	0.00	0.05	NO	**1909.75**	**1913.16**

The trend in relative share of each gas in total GHG emissions (Figure 29) is worth noting. The share of CO_2 is decreasing, a trend that becomes especially evident in the second half of the time-series. This is due to two main factors: (i) the trend in CO_2 absolute emissions, especially the decrease maintained over recent years; and (ii) an increase in emissions of HFCs.

Figure 29 Percentage share by gas of total GHG emissions between 1990-2016, %.



Carbon dioxide emissions and removals

As shown in Figure 30, the majority of CO_2 emissions reported by Malta are generated by the energy sector (2016 share: 99.7% of total national CO_2 emissions), with very small amounts estimated for sectors IPPU (0.03%), LULUCF (0.24%) and waste (0.05%). Within the energy sector, the category Energy Industries had a share of 40.7% of total national CO_2 emissions while transport had a share of 44.1%, in 2016 (Figure 30).

Figure 30 CO_2 emission trends by sector between 1990-2016, Gg CO_2 eq.

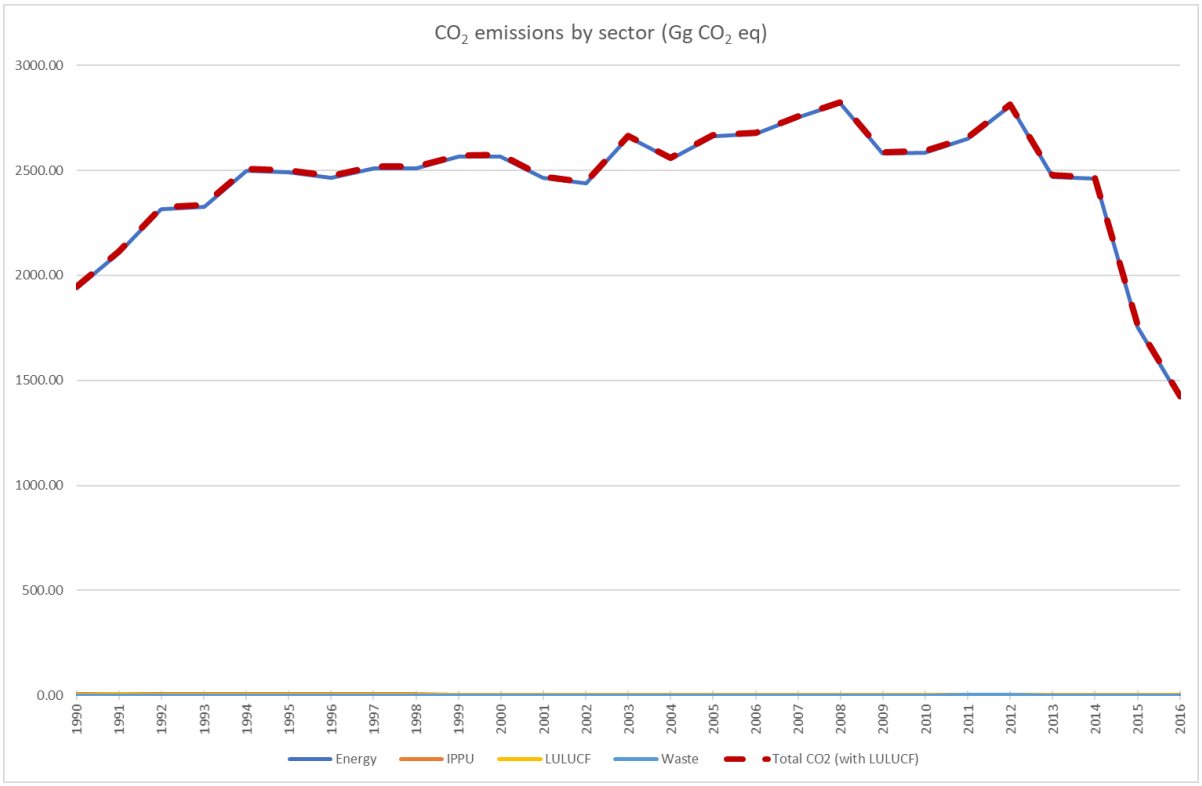
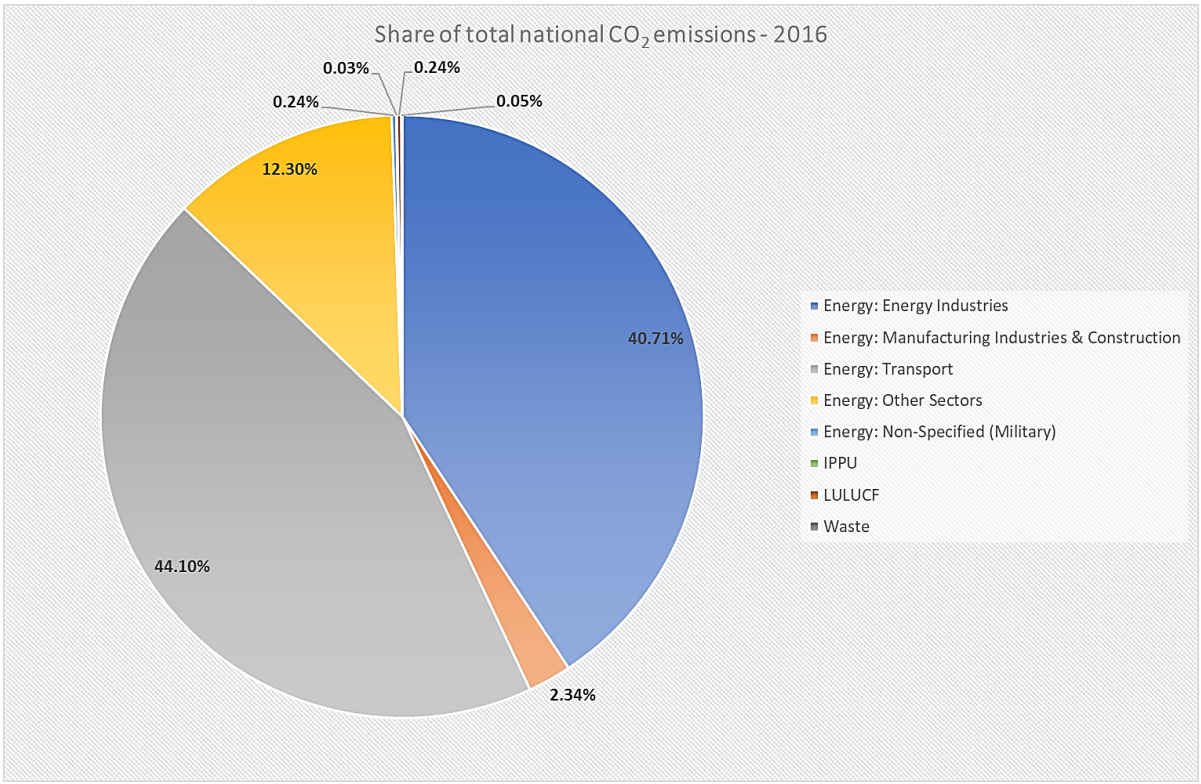


Figure 31 Share of sector/category in total CO_2 emissions for 2016, %.



Methane emissions

The waste and agriculture sectors are two main contributors to total national CH_4 emissions (Figure 32), with the share from the waste sector showing an increase over time. In 2016, emissions from the waste sector accounted for 80% of total national CH_4 emissions, followed by 18.5% for agriculture (Figure 33).

Figure 32 CH4 emission trend by sector between 1990-2016, Gg CO_2 eq.

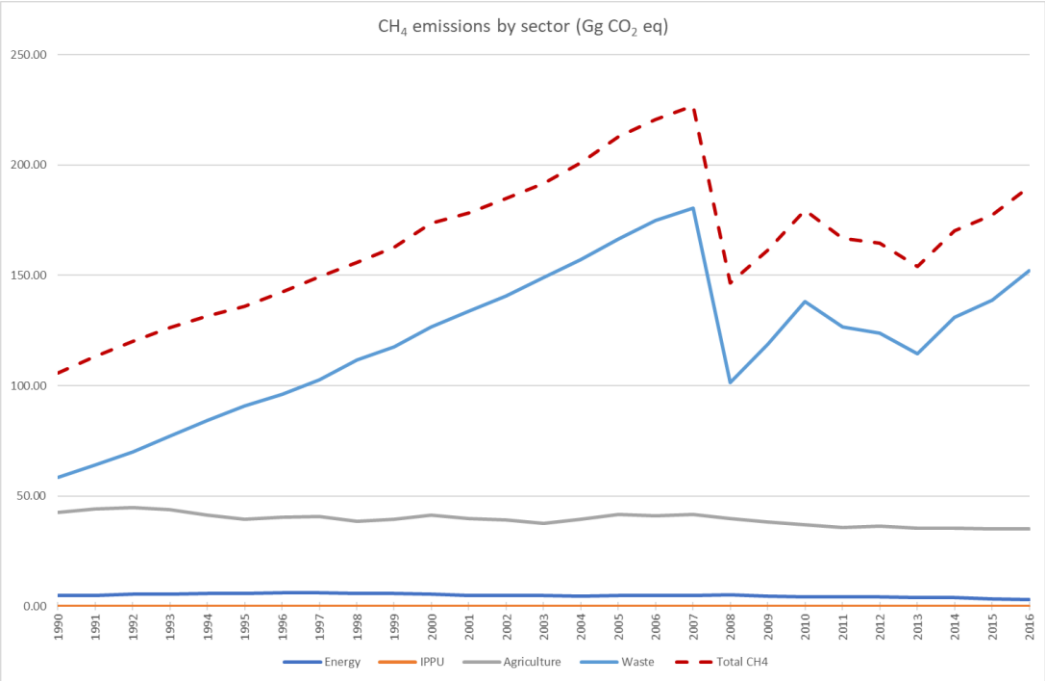
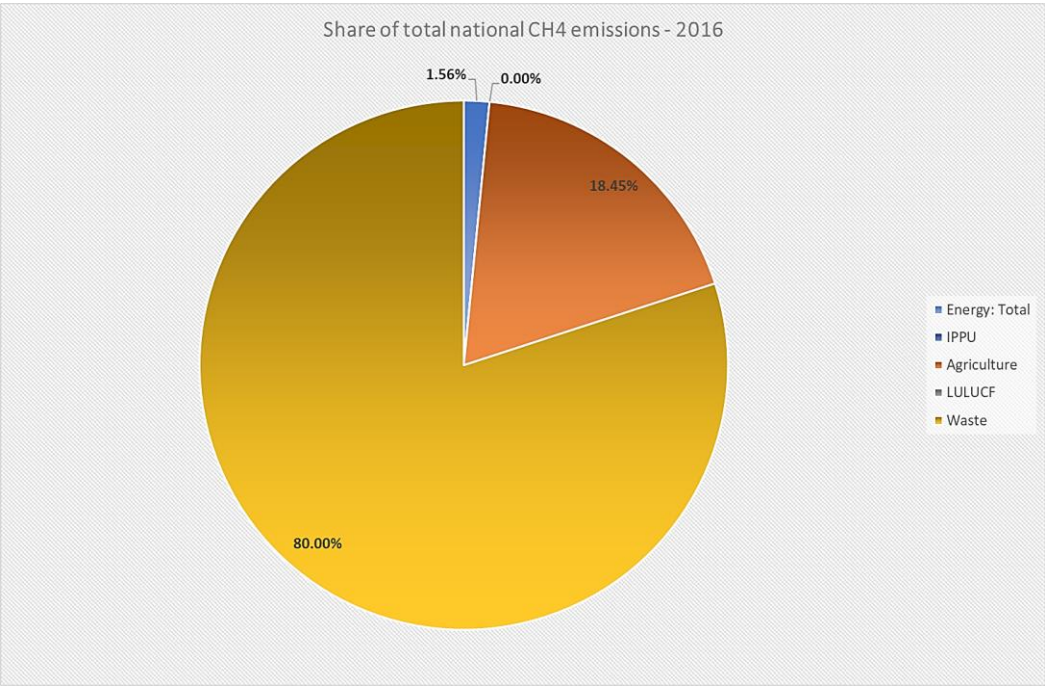


Figure 33 Share of sector in total national CH4 emissions in 2016, %.



Nitrous oxide emissions

Total national N_2O emissions are dominated by emissions of this GHG from agriculture sector, with lesser contributions by sectors Waste and Energy and an even smaller contribution of sector IPPU (Figure 34). The share of agriculture in total national N_2O emissions in 2016 was 71.4%, with Waste and Energy accounting for almost 24% of total national N_2O emissions between them (Figure 35).

Figure 34 N_2O emission trends by gas as total and by sector, Gg CO_2 eq.

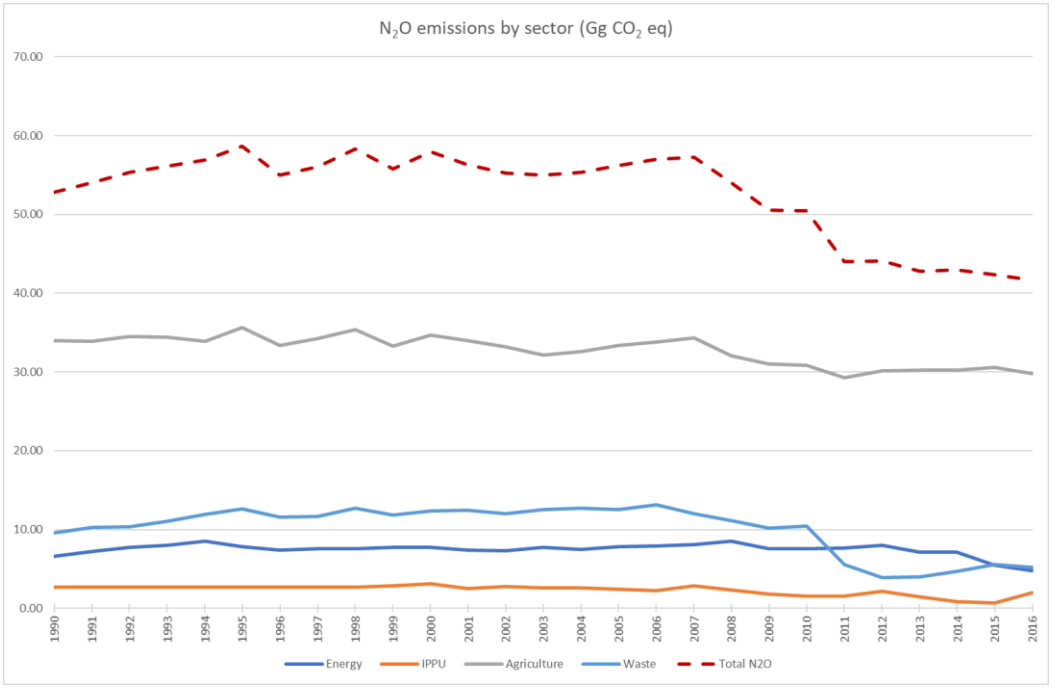
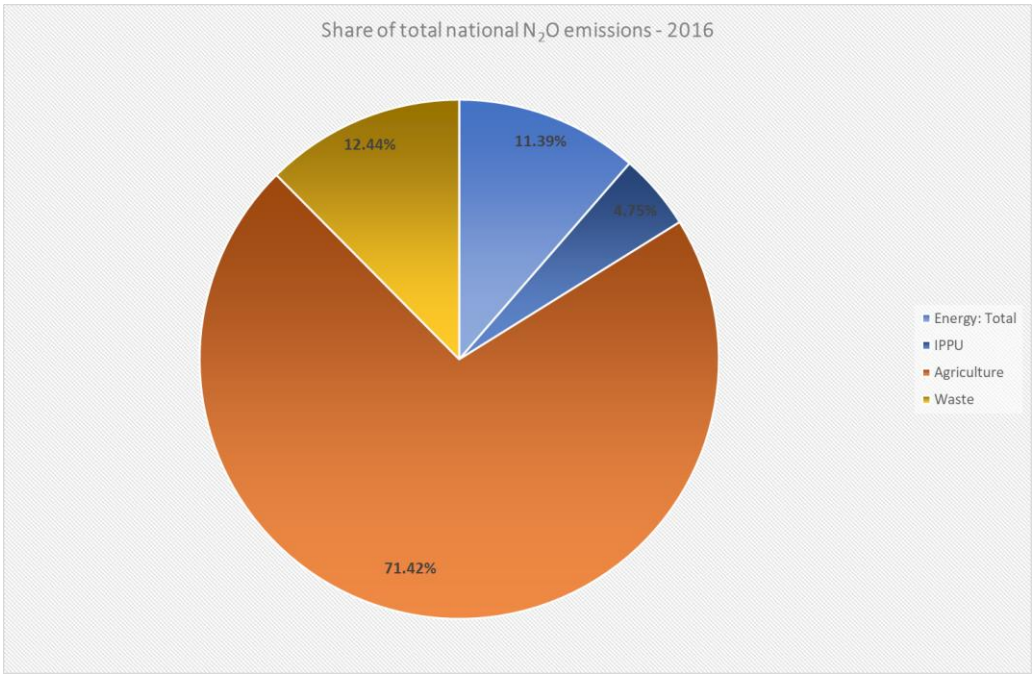


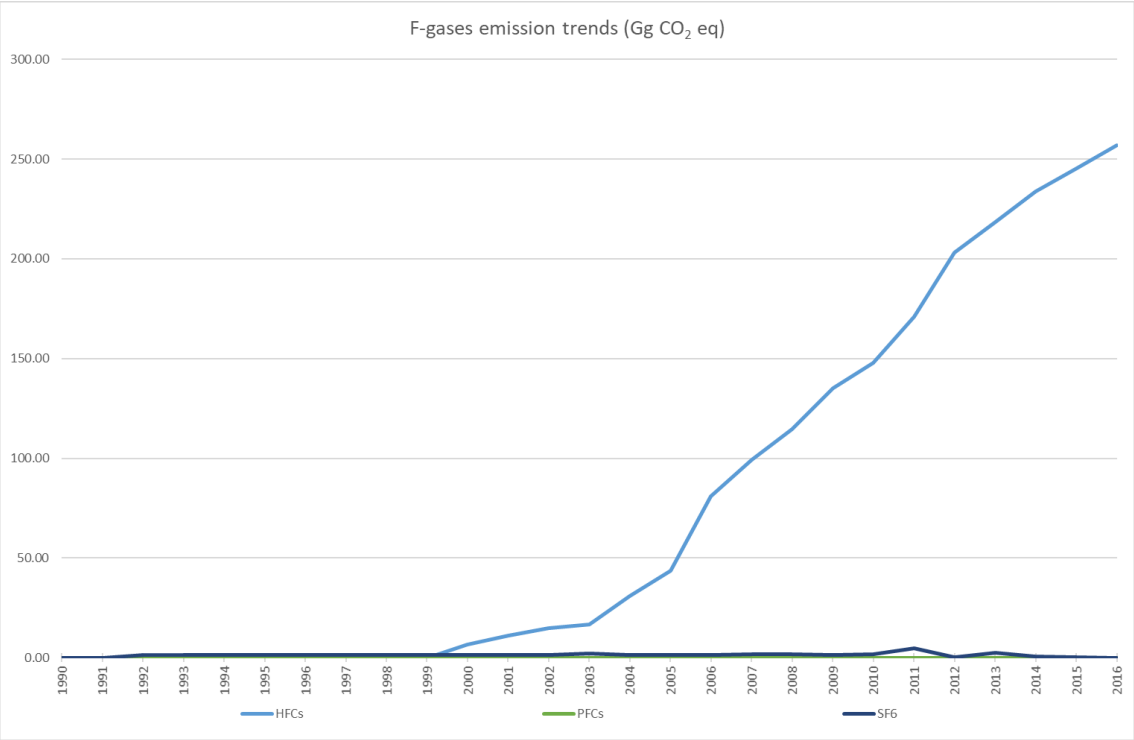
Figure 35 Share of total national N_2O emissions in 2016, %.



Emissions of fluorinated gases

Since 1999, among the Fluorinated (F-) gases, the predominance of HFCs is very evident, and estimations of emissions of this group of gases show a consistent increase up to the present (Figure 36). All emissions of these gases fall within the sector IPPU. It is worth noting that emissions of HFCs in 2016 accounted for around 99% of total IPPU emissions.

Figure 36 F-Gases emission trends by gas: HFCs, PFCs, SF, totals by gas in Gg CO_2 eq.



Description and interpretation of emission trends by category

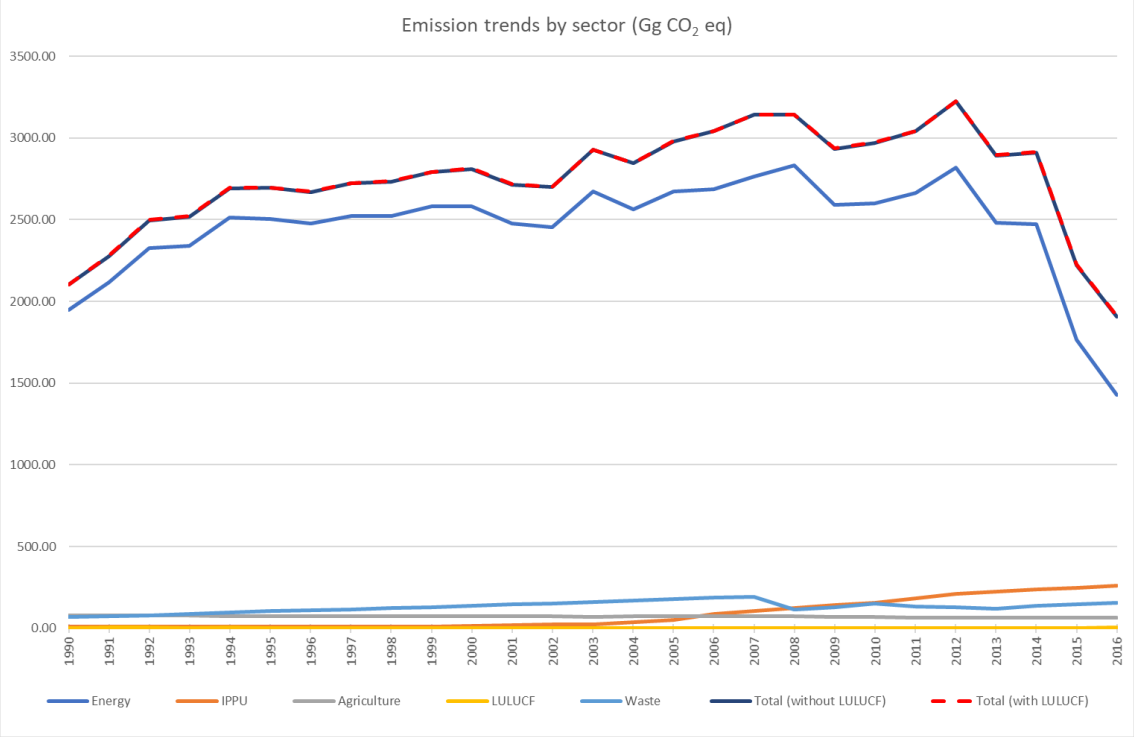
Table 21 gives an overview of emissions by sector for the whole time-series presented in this submission. The trends by sector are represented in Figure 37.

Table 21 GHG emission trends by sector, 1990 - 2016

	Energy	IPPU	Agriculture	LULUCF	Waste	Total excl. LULUCF	Total incl. LULUCF
	Gg CO2 eq.						
1990	1949.12	7.93	76.52	2.96	68.49	**2102.06**	**2105.03**
1991	2116.90	8.16	78.03	4.75	74.77	**2277.86**	**2282.61**
1992	2327.21	9.17	79.22	4.36	80.79	**2496.40**	**2500.75**
1993	2341.96	9.20	78.35	3.27	88.40	**2517.93**	**2521.20**
1994	2511.06	9.50	75.26	3.68	96.71	**2692.53**	**2696.21**
1995	2506.22	9.47	74.93	3.07	103.73	**2694.34**	**2697.41**
1996	2477.86	9.25	73.60	3.00	108.91	**2668.89**	**2671.90**

1997	2522.90	9.46	74.85	2.93	114.70	**2721.91**	**2724.84**
1998	2524.32	8.88	73.79	2.55	124.74	**2731.73**	**2734.28**
1999	2579.40	8.35	72.81	1.92	129.71	**2790.27**	**2792.19**
2000	2579.94	15.20	76.05	3.15	139.35	**2810.52**	**2813.68**
2001	2476.12	19.22	73.66	2.11	146.54	**2715.55**	**2717.65**
2002	2451.70	23.13	72.36	1.26	153.18	**2700.36**	**2701.63**
2003	2670.94	24.84	69.87	1.39	161.90	**2927.55**	**2928.94**
2004	2565.48	37.11	72.00	1.54	170.20	**2844.79**	**2846.33**
2005	2674.70	49.48	75.07	1.71	179.27	**2978.52**	**2980.22**
2006	2687.52	86.89	74.88	1.88	188.31	**3037.61**	**3039.49**
2007	2765.22	104.59	75.95	2.01	192.78	**3138.54**	**3140.55**
2008	2833.44	120.03	71.88	2.11	113.19	**3138.54**	**3140.65**
2009	2591.89	140.35	69.07	2.25	129.89	**2931.20**	**2933.45**
2010	2598.06	152.17	67.94	2.00	149.59	**2967.77**	**2696.77**
2011	2662.55	179.02	64.80	2.23	134.23	**3040.61**	**3042.84**
2012	2818.90	206.76	66.43	2.47	129.73	**3221.82**	**3224.29**
2013	2481.11	223.85	65.76	2.71	120.14	**2890.86**	**2893.56**
2014	2470.13	235.45	65.54	2.94	137.54	**2908.66**	**2911.60**
2015	1765.44	247.77	65.84	3.18	146.10	**2225.14**	**2228.32**
2016	1426.85	259.04	64.86	3.41	159.00	**1909.75**	**1913.16**

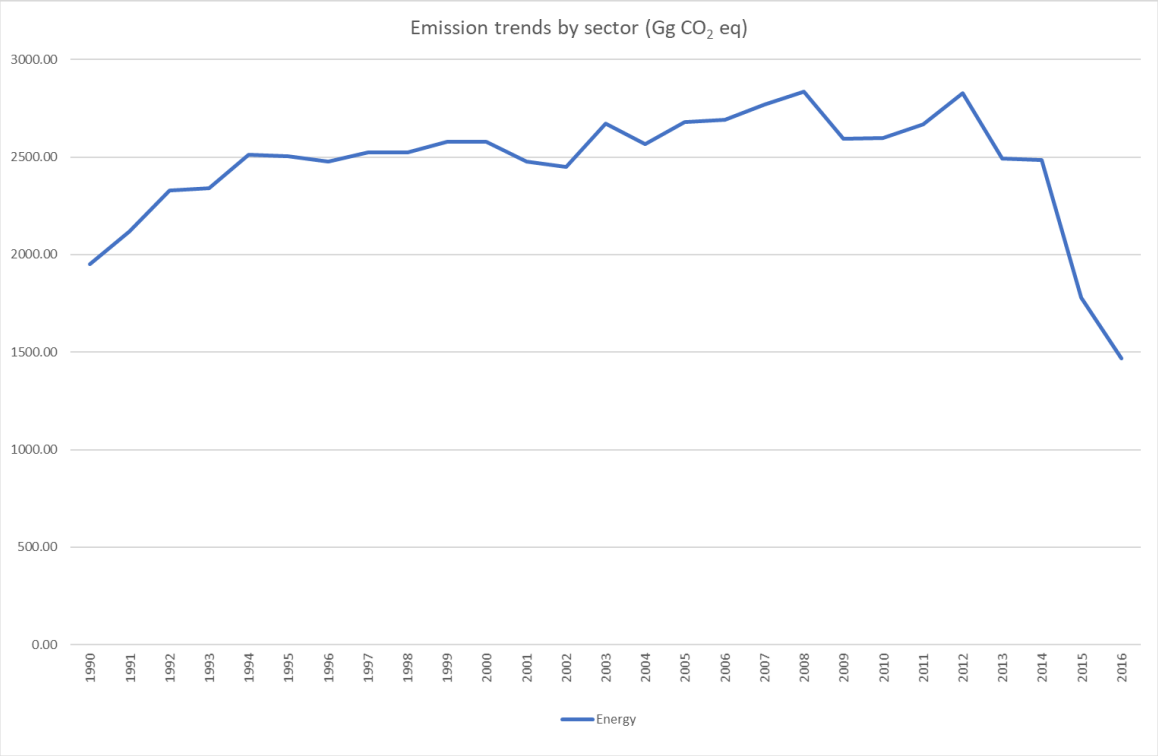
Figure 37 Emission trends by sector, Gg CO_2 eq.



Energy sector emissions

The trend profile for the energy sector can be distinguished by two sub-trends (Figure 38), namely a continued increase up to 2012, and a subsequent rapid decrease until 2016. The first sub-trend reflects increased demand for energy, primarily in electricity generation and transport. This is followed by substantial and relatively quick efficiency gains in emission terms and in electricity generation over the last four years.

Figure 38 Emission trends in the energy sector between 1990-2016, Gg CO_2 eq.



The strong influence of the energy sector on national GHG emissions in Malta has already been noted above. This can be further demonstrated when one compares the relative year-to-year change in energy emissions and the change from 1990 emissions when compared to the same assessment for total national GHG emissions.

As already noted, the majority of emissions in this sector can be attributed to CO_2 (Figure 41), with methane and nitrous oxide emissions together accounting for just above 0.5% of the total energy GHG emissions in 2016. This state of play hasn't changed in any substantive manner from 1990.

Figure 39 Annual percentage change in Energy sector emissions year to year between 1990-2016, %.

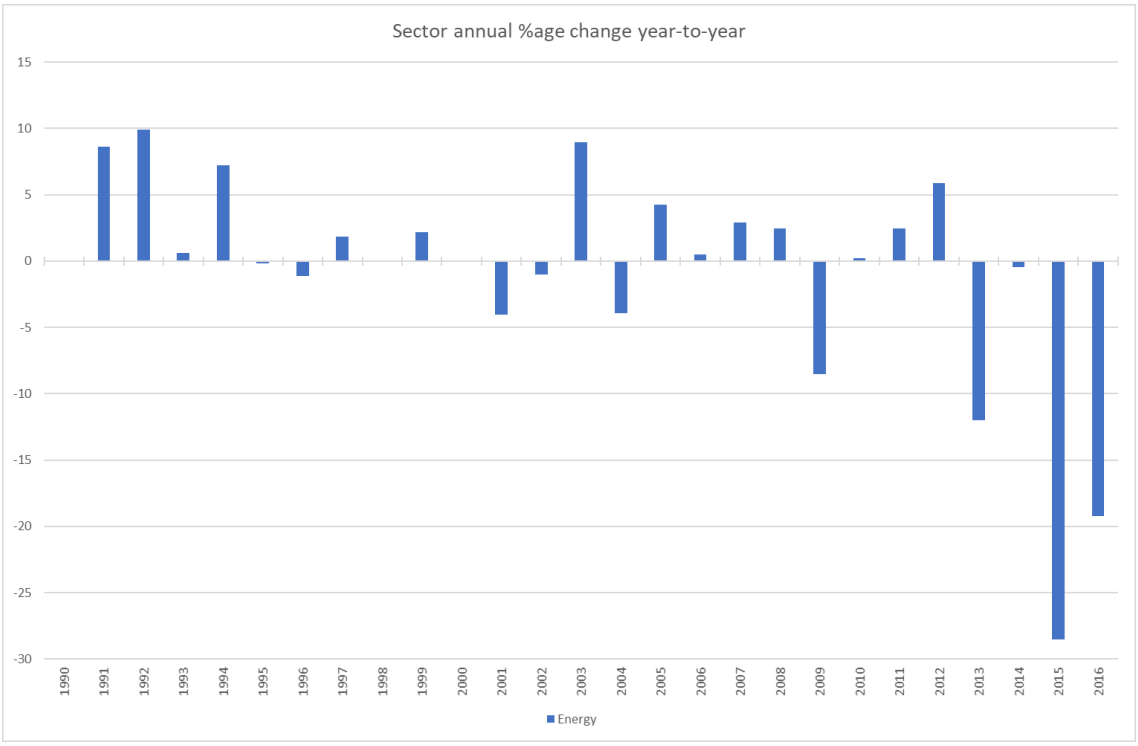


Figure 40 Annual percentage change in energy sector emissions between 1990-2016 compared to base year (1990), %.

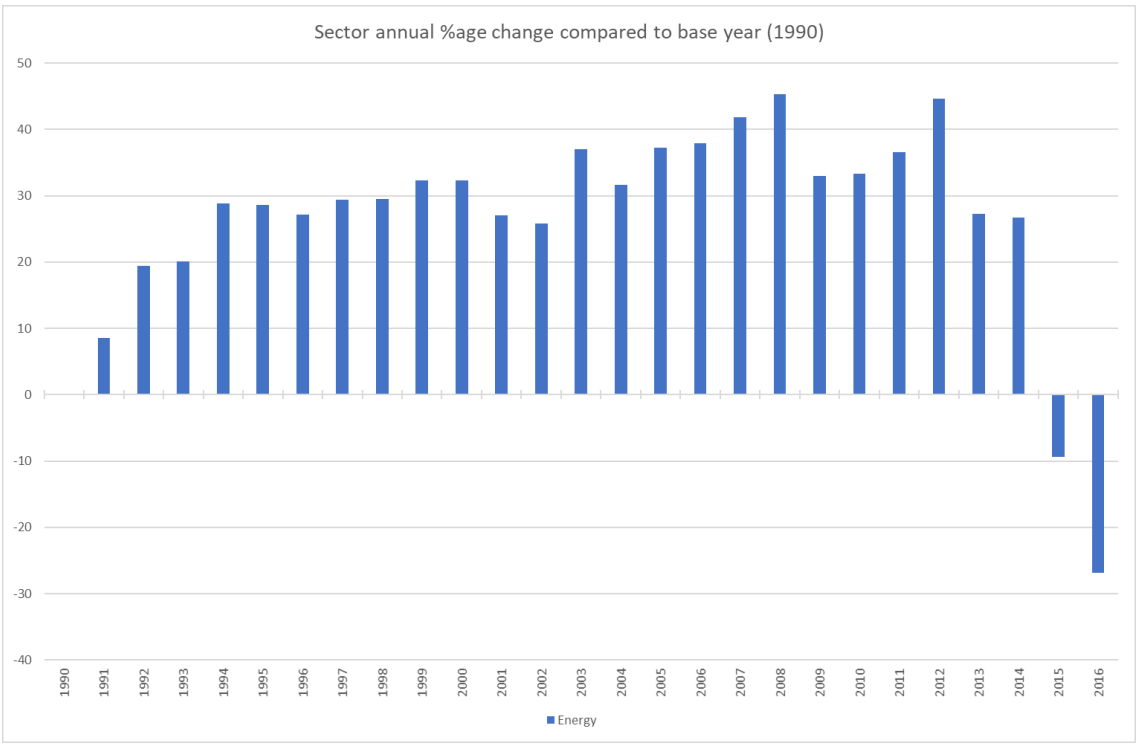
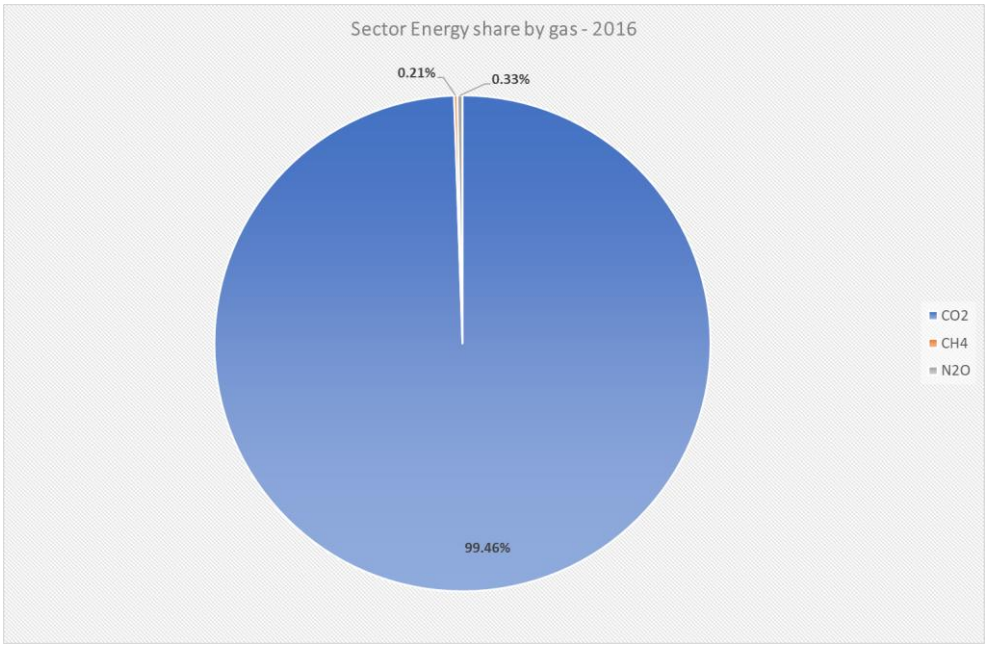


Figure 41 Share by gas in total energy sector emissions in 2016, %.



IPPU sector emissions

The overall profile of IPPU emissions over the 1990-2016 period shows a consistent increase since the turn of the millennium (Figure 42). The major contributor to HFC emissions are activities under category 2F1 Refrigeration and Air-Conditioning, which on its own had a share greater than 97% in 2016 of total IPPU GHG emissions.

Figure 42 Emission trend in IPPU sector between 1990-2016, Gg CO_2 eq.

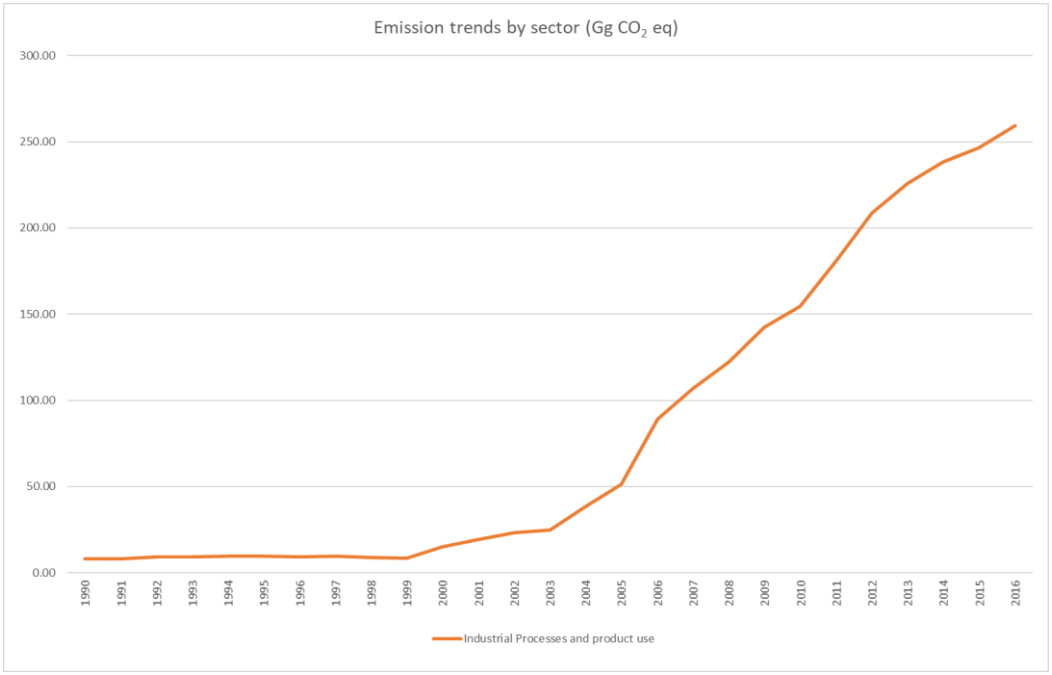
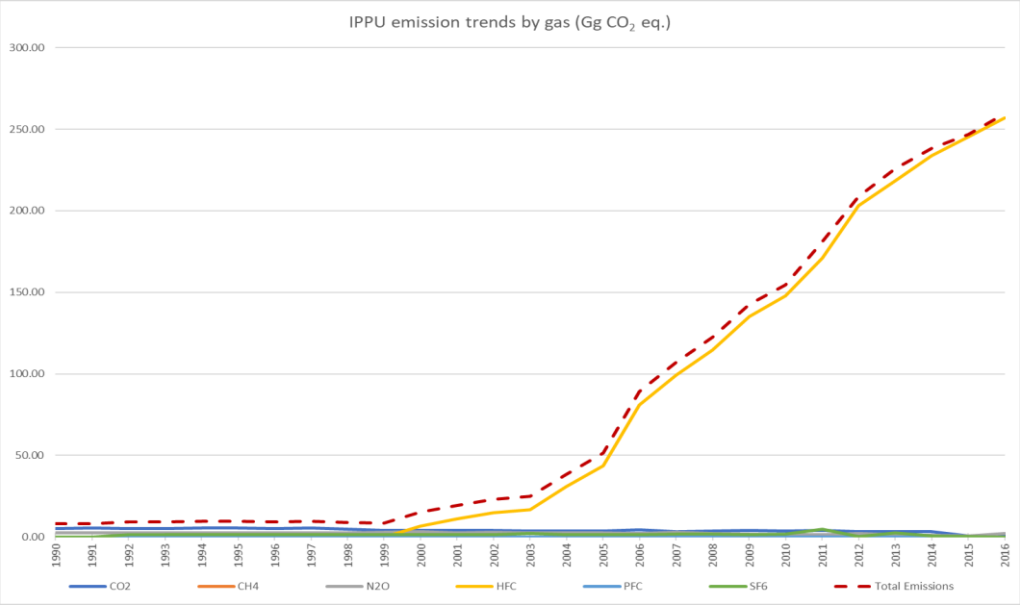


Figure 43 Emissions trends by gas within IPPU sector between 1990-2016, Gg CO_2 eq.



Agriculture Sector emissions

In general, emissions from the agricultural sector have seen a decrease in emissions over the 1990-2016 period (Figure 44), with emissions in 2016 being 15.2% lower than 1990 emission levels. The overall share of this sector in total national emissions has not fluctuated much during the period, starting at 3.6% in 1990 and being at 3.4% in 2016.

Figure 44 Emission trends in agriculture sector between 1990-2016, Gg CO_2 eq.

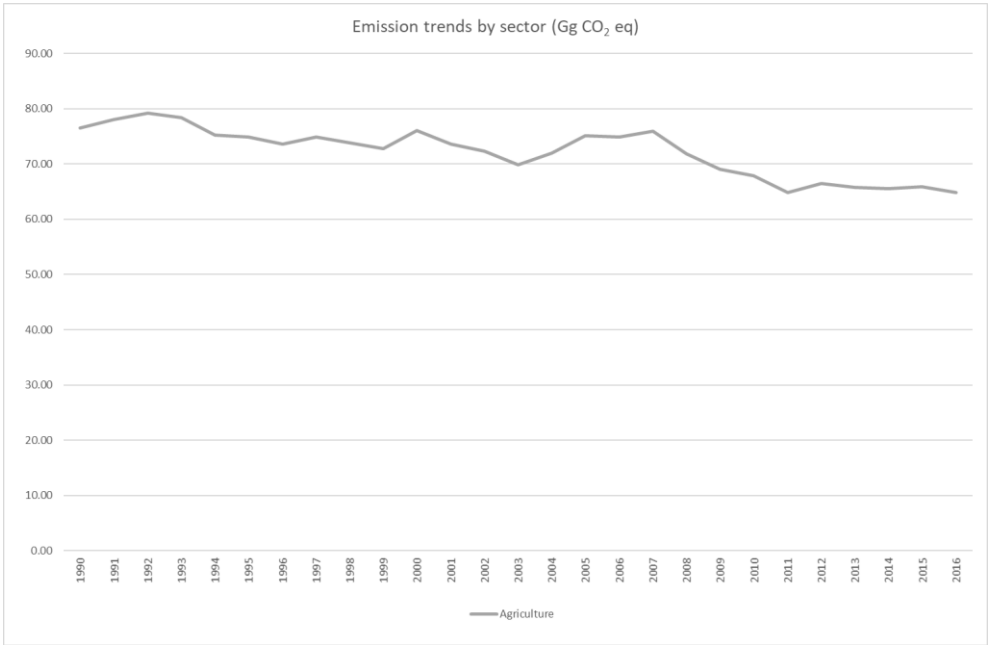
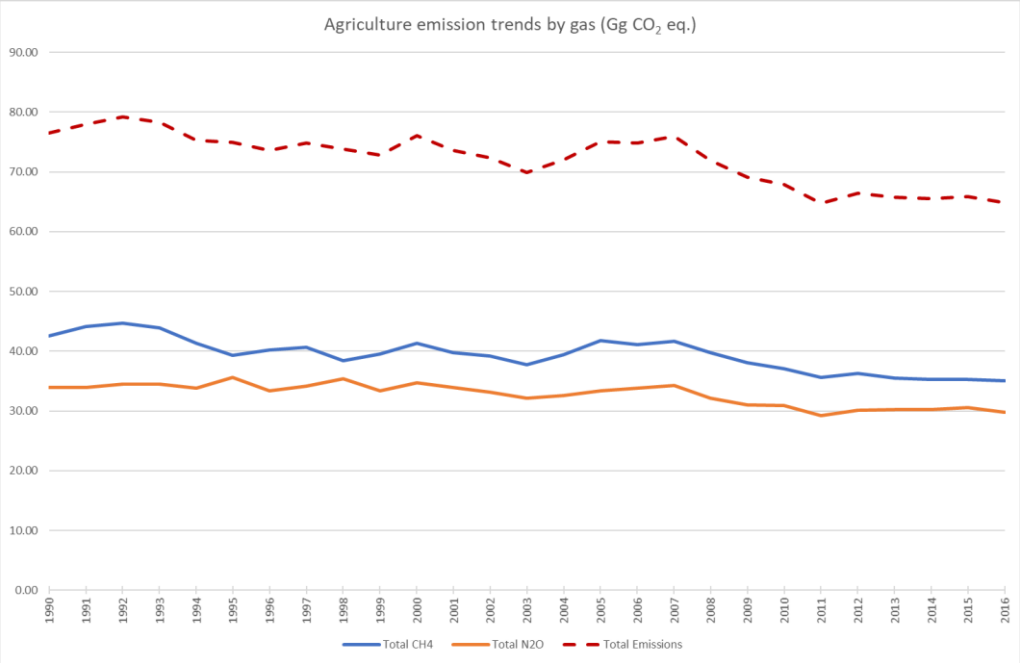
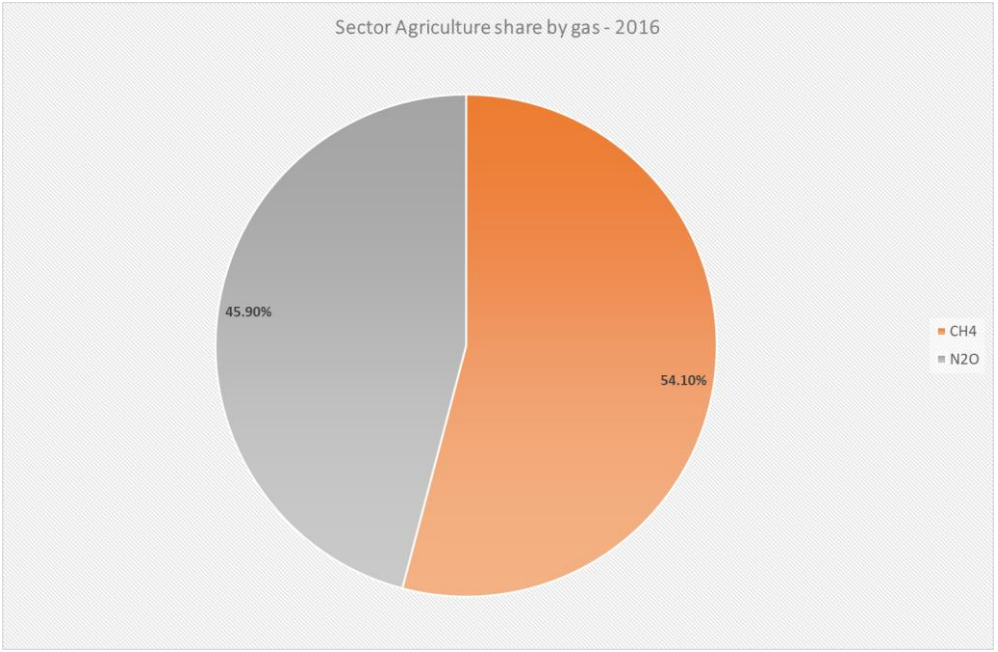


Figure 45 Emission trends by gas within the agriculture sector between 1990-2016, Gg CO_2 eq.



In the agriculture sector, it is worth noting a more balanced sharing of total sector emissions between the two gases, as opposed to the situation in other sectors (Energy and IPPU), where one GHG has a dominant position as the major contributor to sectoral total emissions. In this sector, both methane and nitrous oxide are important contributors, with only a relatively small difference in their respective share, a situation that has been maintained over the course of the period 1990-2016, with methane emissions being always somewhat higher (CH_4: 54.1% and N_2O: 45.9% in 2016).

Figure 46 Share by gas in total agriculture emissions in 2016, %.

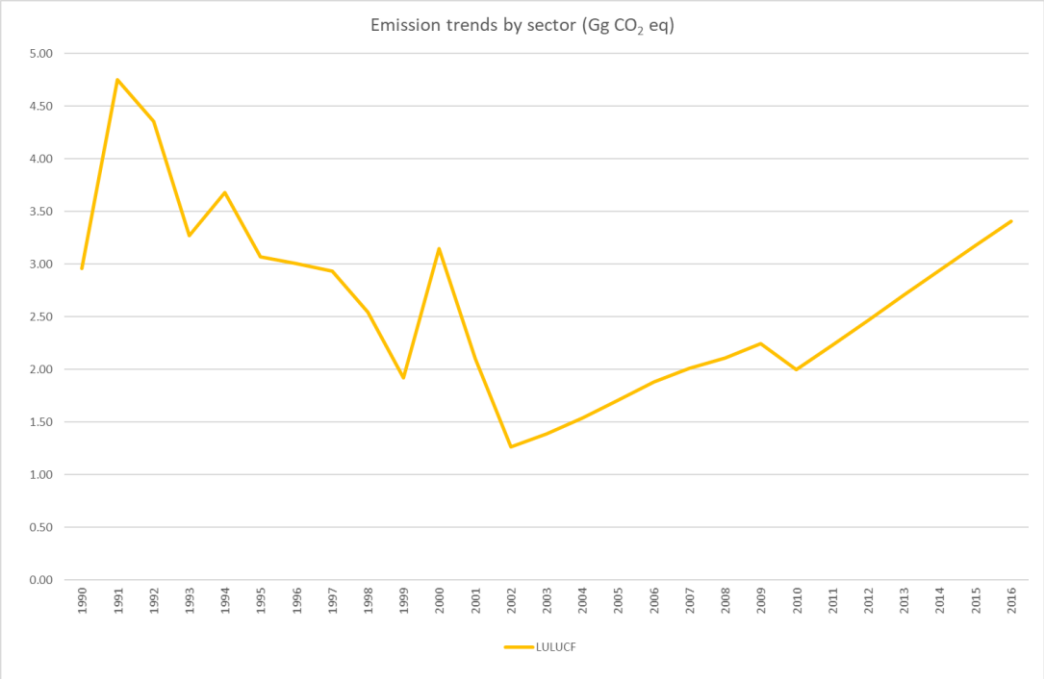


The category with the highest share of estimated emissions in this sector is 3A Enteric Fermentation, followed by 3D Agricultural Soils and 3B Manure Management.

LULUCF sector emissions and removals

The LULUCF sector consistently shows the lowest share of total national GHG emissions throughout the time-series (0.1% in 1990; 0.2% in 2016). Variations in year-to-year emission estimates seem relatively large (Figure 47); however, this should be seen in the context of a sector with very small levels of emissions and year-to-year relative differences can appear to be more significant than they are in absolute terms. Only CO_2 emissions are reported for this sector.

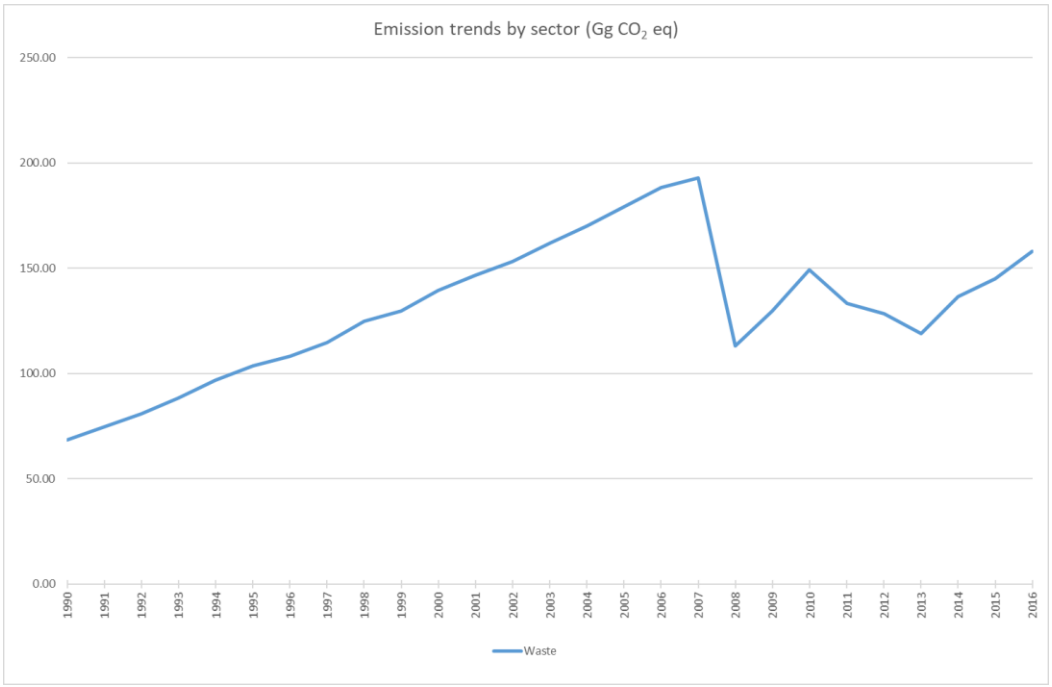
Figure 47 Emission trends in LULUCF sector between 1990-2016, Gg CO_2 eq.



Waste sector emissions

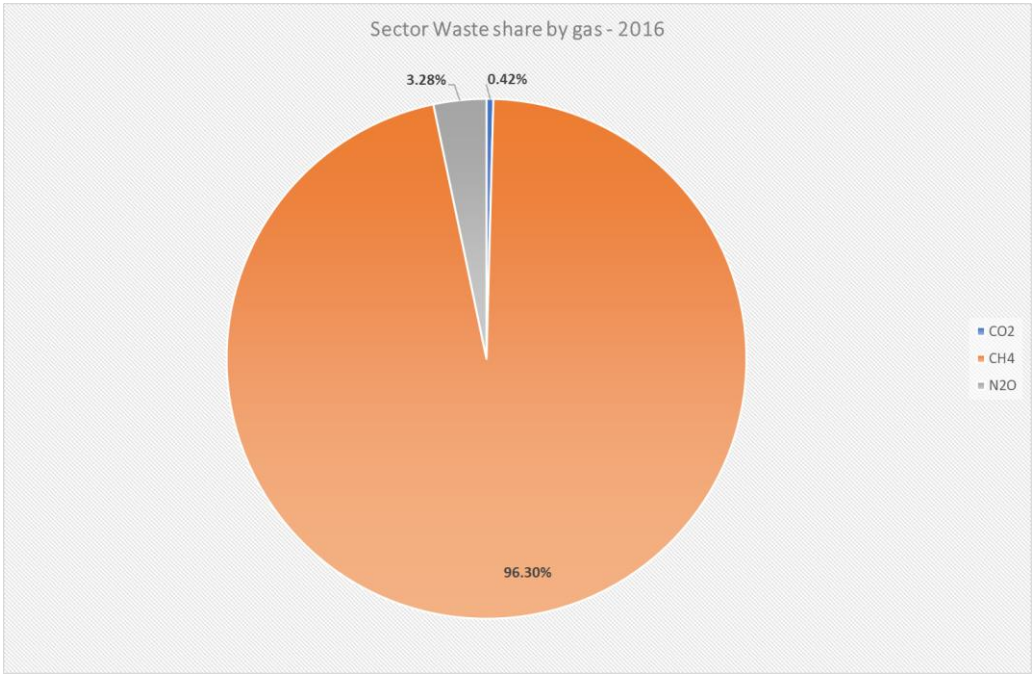
Before being overtaken by IPPU sector in the later years of the first decade of the millennium, for a long period of time, the waste sector was the second highest contributor to national GHG emissions after energy generation. Over that same period, sectoral emissions from waste showed a consistent increase. In later years, estimated emissions vary substantially, though the general trend is that emissions since 2008 have always been less than the peak reached in 2007.

Figure 48 Emission trends in waste sector between 1990-2016, Gg CO_2 eq.



The distribution of waste sector emissions between gases sees the predominance of CH_4 as the GHG with the largest share of sector emissions, surpassing the contributions of N_2O and CO_2. Emissions from solid waste management account for the largest share of emissions in this sector.

Figure 49 Share by gas in total waste sector emissions in 2016, %



ii. Projections of sectorial developments with existing national and EU policies and measures at least until 2040

The projections reflect the results of a modelling tool developed for the assessment of policies and measures and the generation of projections, further explained in later sections. These modelled scenarios are based on specific assumptions regarding framework conditions, including demographic and economic activity, technological trends, energy costs/prices and similarly relevant variables described in Section 4.1. The policies and measures, and combinations thereof, that have been implemented, or will be implemented, at different points in time are modelled as exogeneous variables. The model is sub-divided into a number of sector-specific sub-models having different levels of complexity.

The historic data feeding into the sectoral models to estimate GHG emissions projections is the same as that reported for submission in 2018, i.e. latest historic year of 2016. The following presents the reference scenario. which takes into account currently implemented and adopted policies and measures as at end 2017.

Agriculture Projections

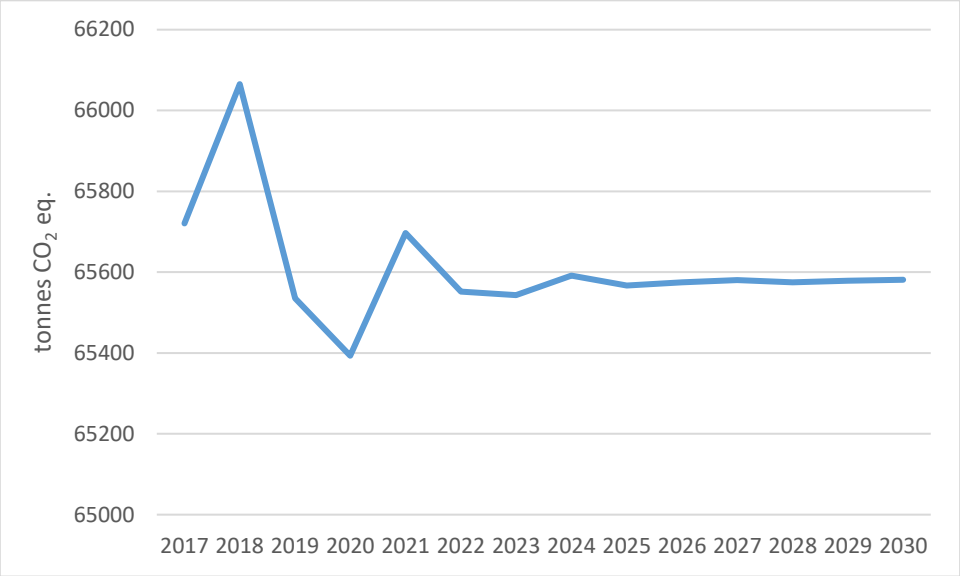
The Agriculture sector accounts for a very small share of national GHG emissions (3%). CH_4 is the main GHG emitted by the agricultural sector, from enteric fermentation and manure management. Very small amounts of N_2O are also emitted from manure management and fertiliser use.

Various policies and measures have been implemented in this sector which should also reduce the GHG emissions profile of the local agricultural sector (Figure 50). Addressing Malta's obligations under the EU legislation, particularly the Nitrates Directive (91/676/EC)[45], N_2O emissions from the use of fertiliser is expected to decrease over time as improved cultivation practices are adopted, principally through the application of the Code of Good Agricultural Practice[46] and the Nitrates Action Programme. Furthermore, Malta benefited from the European Agricultural Fund for Rural Development, a financial instrument under the reform of the Common Agricultural Policy with the aim of strengthening the EU's rural development policy and simplifying its implementation.

The categories within this sector which are applicable to Malta are Enteric Fermentation, Manure Management, Agricultural Soils and Indirect Emissions.

[45] Directive 91/676/EC on the protection of waters against pollution caused by nitrates from agricultural sources.
[46] The Maltese Code of Good Agricultural Practice for the Maltese Islands. Agricultural Services and Rural Development Division, 2003.

Figure 50 Projected agricultural emissions under the reference scenario from 2017-2030, tonnes CO_2 eq.



Rural Development Programme 2007-2013 (2009)[47]

The European Agricultural Fund for Rural Development (EAFRD) Regulation[48] lays down the general rules governing community support for rural development financed by the EAFRD. The aim of the EAFRD is to contribute to the promotion of sustainable rural development throughout the European Union in a complementary manner to other Community market and income support policies. Its objective is to provide support for rural development that shall contribute to:

- Improving the competitiveness of agriculture and forestry through restructuring, development and innovation;
- Improving the environment and the countryside by supporting land management and;
- Improving the quality of life in rural areas and encouraging diversification of economic activity.

Malta published the Rural Development Programme (RDP) for 2007-2013 which outlines the strategic plan for which EAFRD will be utilised and which comprises a series of priorities and measures agreed upon between Malta and the European Commission.

Modernisation of Agricultural Holdings

This measure was intended to facilitate Maltese farmers to take up investments in production techniques that enable them to meet new market conditions and demands in the face of the inherent structural weakness of the Maltese agricultural market due to the extremely limited real capital expenditure. Through this measure farmers were supported to modernise agricultural holdings so as

[47] https://secure2.gov.mt/mrra-ma/rdpm_20072013?l=1

[48] Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD)

to improve not only their economic performance but also the environmental, occupational safety, hygiene and animal welfare status of their holdings.

This measure is further divided into three sub-measures:

- General modernisation and improvements in the performance of agricultural holdings (sub-measure 1);
- Environmental investments (sub-measure 2);
- On-farm investments in order to comply with newly introduced Community standards (sub-measure 3).

The third sub-measure dealt with on-farm investments in order to comply with EU standards. Support was granted to achieve compliance with the provisions of the Malta Action Programme regarding the storage capacity for manure and slurry. Through this sub-measure investment for 3196 m^3 of cesspits and 1924 m^3 of manure clamps was availed of. In the case of the Nitrates Directive, the actions eligible for support included the installation of waste storage, management and treatment structures necessary in order to meet the requirements of the Nitrates Action Plan as specified in the Code of Good Agricultural Practice for the Maltese Islands.

A list of relevant investments which were made on the farms is shown in Table 22.

Table 22 List of investments related to farms

Type of expenditure	No. of projects
Cesspit	10
Manure clamp	16
Manure separator	3
Energy saving equipment / machinery	32
Solar water heater	20
Fertigation system	1
Water reservoirs	74
Wind turbines	7
Thermal insulation	7

Rural Development Programme (RDP) 2014-2020 (2014)[49]

Malta has recently submitted the new Rural Development Programme (RDP) for 2014-2020 to the European Commission. The RDP focuses on three main cross-cutting objectives namely the environment, climate and innovation. The draft programme focuses and prioritises climate change mitigation and adaptation by introducing various measures. The RDP identified five main themes:

- Theme 1: Water, wastes and energy - improving sustainable use and generating renewable energy;

[49] https://secure2.gov.mt/mrra-ma/con_doc?l=1

- Theme 2: Maltese quality produce - improving quality, traceability, strategic marketing, adding value, branding and promotion;
- Theme 3: Sustainable livestock - improving resource efficiency, competitiveness and productivity, and welfare;
- Theme 4: Landscape and environment - managing habitats and features; and
- Theme 5: Wider rural economy and quality of life - developing rural tourism, rural skills and promoting social inclusion.

Measures related to climate change were aligned under Theme 1, 3 and 4. Some of the measures include:

- knowledge transfer and information actions;
- advisory services;
- farm management and farm relief services;
- investment in physical assets; Cooperation;
- farm and business development;
- quality schemes for agricultural products, and foodstuffs;
- organic farming; and
- investments improving the resilience and environmental value of forest ecosystems.

Some of the sub-measures under the above mentioned main measures, for instance the promotion of food chain organisation and risk management in agriculture will contribute indirectly to mitigating emissions of GHGs through reduction of fossil fuel used in transport, since this in turn will reduce the need for imports. The measures related to advisory services and training, under Themes 1, 3 and 4 will have beneficial effects through mitigation of emissions, and through making Maltese agriculture more adaptable and resilient to climate change. Training in water management for example will result in reduced water consumption, and possibly some return to dry land farming and other traditional practices. Improved knowledge of nutrient budgeting and management will lead to reduced fertiliser applications, better use of organic waste, which indirectly result in reductions in CO_2 emissions from reduced chemical fertiliser use. Improved soil management as a result of training and skills development will result in reduced energy consumption and decreases in CO_2 emissions from soil. Protection of biodiversity and landscape will have positive benefits for soil carbon storage and CO_2 absorption, and more effective use of Maltese forage will reduce the carbon footprint of Maltese agriculture by reducing its reliance on imports and transportation. Advisory services will also help to support the applicants to RDP schemes understand the impacts of their activities on climate change, and seek to minimise those effects where possible as well as to adapt to climate change.

Nitrates Action Programme (2011)[50]

One of the most challenging environmental implications of livestock farming is the generation of manure and its management to prevent pollution of water bodies, coastal waters, air and soil

[50] www.agric.gov.mt/file.aspx?f=1224

resources. The Nitrates Action Programme aims to reduce pollution of ground and surface water by nitrates. Some of the measures identified in the Action Programme regarding manure management relate to the type and capacity of on-farm storage of manure and slurry. It requires that manure is stored in leak-proof, covered storage clamps connected to cesspits, which should be leak-proof and covered. Additionally, cesspits must have sufficient capacity to collect all urine and washing for at least a period of 15 days. Solid manure must be stored in covered clamps from 15 October to 15 March, thus it must be ensured that livestock farms have a structure that provides sufficient storage capacity throughout this period. Farmers are also obliged to keep records of slurry and manure transport/disposal.

This Action Programme requires users of organic and/or inorganic fertilisers to register with the competent authority responsible for nitrates. This provides better control on the use of such fertilisers. Furthermore, farmers utilising fertilisers are required to attend a course on the use of fertilisers. The Nitrates Action Programme requires that administrative controls are put in place to verify farmers' submissions of records regarding slurry and manure transports, disposal, quantities and their final destination. Proper records of organic fertiliser and livestock manure purchase are being maintained to verify compliance with periods when land application of nitrogen fertiliser is prohibited; to identify risk farmers or/and land users; to conduct inspections; to suggest remedial action in order to enforce measures laid out in the action program on an individual farm basis; and to propose the administration of fines and legal actions.

The implementation and monitoring of the Nitrates Action Programme in Malta during the present reporting period was inter-alia effected through, and supported by, the Rural Development Programme and cross-compliance checks forming part of the implementation of that programme. All farmers and livestock breeders are eligible to apply for funding under the RDP. Several key measures in the RDP directly targeted the measures included in the Nitrates Action Programme.

An informal Inter-Ministerial Committee has been established with the purpose of discussing discharges of farmyard waste into the sewerage network. Following a number of meetings, an inception report has been drafted and a stock taking exercise has been undertaken to give a clear overview of the situation. The inception report provides recommendations on a road map to be considered including a recommendation for the establishment of an Inter-Ministerial Steering Action Committee (IMSAC) that would encompass all entities concerned to propose follow up action necessary to address the problem of management and treatment of livestock waste. The IMSAC held its first meeting during the first quarter 2015. One of the first issues being tackled by the IMSAC is the updating of the current Agricultural Waste Management Plan which was drawn up in 2005 and amended in 2008.

Another project was undertaken in which livestock farms were mapped through a specific GIS model indicating type, size and spatial distribution of farms. The outcome of this project should provide solid groundwork for the IMSAC to be in a position to ensure that an effective system is established for the management of livestock waste.

InfoNitrates LIFE+ Project

The InfoNitrates LIFE+ project (LIFE 10 INF/MT/000092) focused on the delivery of an extensive information and communication campaign for the proper use and management of nitrates in agriculture and livestock breeding in the Maltese Islands. The principle objectives of InfoNitrates LIFE+ project were to train and educate the farming community on the Nitrates Action Plan (NAP). This national action plan was drawn up according to the Nitrates Directive.

A post-project action plan was set up by the InfoNitrates managing team and the Directorate of Agriculture, so as to build on the results achieved through the InfoNitrates educational campaign. The project was completed on 30th June 2014, in time for the Nitrates Action Unit (NAU) to take over in the implementation of the NAP with the farming community. This unit was set up purposely by the Directorate of Agriculture to control and monitor farmers and livestock breeders in ensuring that the application, transport and storage of fertilisers is done in compliance with all the provisions laid down in the Nitrates Directive, and more specifically, the transposed national legislation (Legal Notice 321 of 2011 and Nitrates Action Plan for Malta).

During their visits to farmers, who were trained through the InfoNitrates project, the NAU personnel are already accessing fertiliser plans being applied on certain parcels. After being exposed to the application of a fertiliser plan, farmers are in a position to comprehend its dynamics and provide suggestions for technical improvements. Moreover, the NAU bridge the training gap left after the completion of the InfoNitrates campaign by referring farmers to the Farm Advisory Services Consortium (FASC). The latter has been set up for the purpose of providing advice to farmers and livestock breeders in respect to cross compliance and the application of fertiliser plans.

Nitrates database

Legal Notice 321 of 2011 established the setting up of a Nitrates Database, in which all the parcels not registered on the Integrated Administration and Control System (IACS) are now being registered in this database. The Directorate of Agriculture, being the Competent Authority, has established a centralised system in ensuring that the Nitrates Database could be compiled in its entirety. In this regard a Front Office in which farmers are requested to register their entire holdings has been set up. To date there have been 4,182 holdings that have been registered, covering a total of 17,033 parcels and an area of 2,869 hectares. Throughout the registration process, farmers are briefed on their obligations through the legal provisions of the Nitrates Registry, such as the provision of their information to registered Farm Advisory Service entities.

IPPU Projections

Implementation of the F-gases Regulations

Regulation (EC) No. 842/2006[51] on certain fluorinated greenhouse gases addresses emission control through the requirement of minimum qualifications for personnel who make use of such substances. This requirement has been implemented through the establishment of sector specific subsidiary regulations which have been published locally as follows:

- Minimum qualification course required by Article 12(3) of implementing Regulation (EC) No. 303/2008[52] and Article 4(2) of implementing Regulation (EC) No. 307/2008[53] (Fixed air conditioning and refrigeration equipment, and vehicle air conditioning);
- Minimum qualification course required by Article 7(1) of implementing Regulation (EC) No. 305/2008[54] (High voltage switchgear);
- Minimum qualifications course required by Article 12(3) of implementing Regulation (EC) No. 304/2008[55] (Fire protection equipment).

Requirements of Regulation (EC) No. 842/2006 have been further implemented through the publication of the Certain Fluorinated Greenhouse Gases Regulations (LN93/10).

[51] Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases.

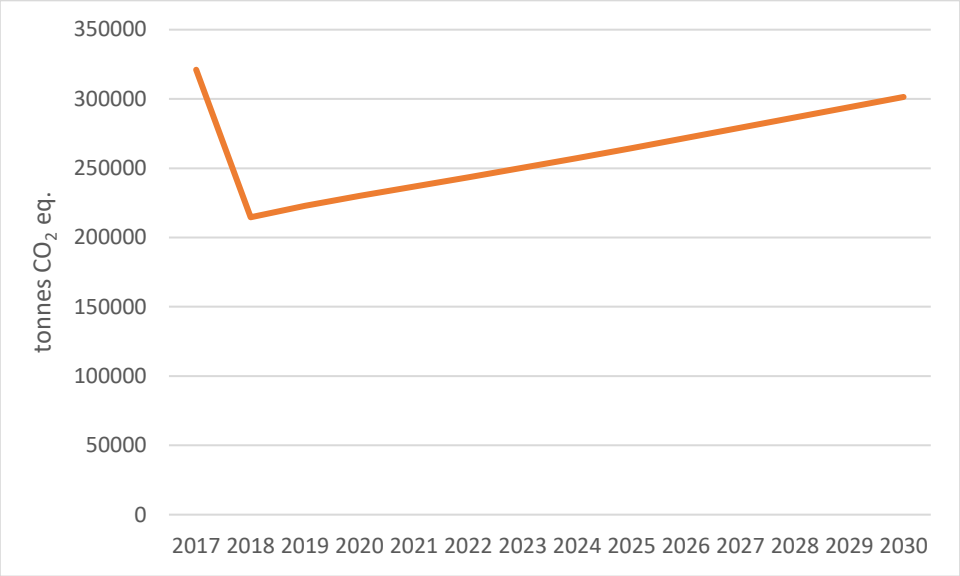
[52] Commission Regulation (EC) No 303/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of companies and personnel as regards stationary refrigeration, air conditioning and heat pump equipment containing certain fluorinated greenhouse gases.

[53] Commission Regulation (EC) No 307/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, minimum requirements for training programmes and the conditions for mutual recognition of training attestations for personnel as regards air-conditioning systems in certain motor vehicles containing certain fluorinated greenhouse gases.

[54] Commission Regulation (EC) No 305/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of personnel recovering certain fluorinated greenhouse gases from high-voltage switchgear.

[55] Commission Regulation (EC) No 304/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of companies and personnel as regards stationary fire protection systems and fire extinguishers containing certain fluorinated greenhouse gases.

Figure 51 IPPU emissions under the reference scenario from 2017-2030, tonnes CO2 eq.



LULUCF Projections

The Regulation on the inclusion of GHG emissions and removals from land use, land use change and forestry (LULUCF) into the 2030 climate and energy framework (Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of GHG emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU) requires Malta to ensure that GHG emissions from land use, land use change or forestry are offset by at least an equivalent removal of CO_2 from the atmosphere, the so-called 'no debit' rule, in the period 2021 to 2030. Accounting under the LULUCF Regulation is split over two compliance periods, 2021 to 2025 and 2026 to 2030, with Malta being required to show that over each of these compliance periods, it is abiding, at least, by the no debit rule. If this cannot be achieved by actions in the sector, the Regulation also provides for flexibility mechanisms by which Malta can close any gaps that it may have in respect of the no debit rule: the use of annual emission allowances allocated to Malta under the Effort Sharing Regulation or buying net removals from other Member States who have successfully increased their rate of net removals beyond their respective commitment. This Regulation should incentivise Malta to enhance removals or reduce emissions in the LULUCF sector.

In view of the high population density of the islands and the limited land availability, and to a certain extent the local climatic conditions (such as limited rainfall), the potential for further reduction of CO_2 emissions through carbon sequestration in vegetation is envisaged to be minimal. The woodland areas of the Maltese Islands total about 200 hectares. Native forest is all but extinct, cut down by early colonisers for wood and to clear the land for agriculture and building. These residual woodland areas are now protected by legislation.

It is to note that at present Malta is reporting net emissions for the LULUCF sector. Efforts are ongoing, through capacity building support being provided by the European Commission on the

implementation of the LULUCF Regulation, to revise the methodology for the determination of emissions and, or, removals, from Malta's LULUCF activities, which may in future result in a recalculation of Malta's LULUCF sector showing a net removal rate. This would however reflect a methodological change; policies and measures in the LULUCF sector will still remain a requirement for Malta to ensure that at least, compliance with the no debit rule can be maintained.

In recent years afforestation projects have been undertaken and have had an effect on the area covered by permanent vegetation, particularly trees; however, the CO_2 removals have not been estimated, given that data availability is sparse (this needs to be updated as it will not be the case as regards to the NFAP as CO2 will be calculated).

Afforestation Projects

Several afforestation projects are undertaken by a number of entities. These include Foresta 2000 in Mellieħa, Buskett woodland, Salina National Park, Ta' Qali National Park, Xrobb l-Għaġin Park; rehabilitation of Magħtab closed landfill and various other projects in conjunction with Local Councils, schools and other entities.

The Ministry for Gozo conducts various ecological restoration projects. As from 2010 over 6,103 trees and over 60,714 shrubs/climbers/perennials were planted through the Simbiotic EU Project in places such as Chambray Grove, Three Hills Garden, Il-Qortin ta' Isopu and Nadur.

34U Campaign

The current 34U campaign is being maintained by the Park, Afforestation and Countryside Restoration (PARKS) Department within the Ministry for Sustainable Development, the Environment and Climate Change. The objectives of the 34U are the planting of indigenous trees, forestation, increase the surface area with permanent vegetation and recreating tracts of Mediterranean woodland, to encourage biodiversity in Malta.

Natura 2000 Management Plan

Measures within the Natura 2000 Management Plans contain several actions to increase the habitat coverage of Annex I habitats and to conserve the existing habitats in a good status. These may indirectly apply as through the expected results the land use would mitigate against CO_2 emissions and indirectly ensure that the habitats' footprint is not otherwise used by a CO_2-generating activity.

For the LULUCF sector, the policy scenario projections will be provided in the final report, since extensive work conducted on the FRL should be ready by the end of this year.

Waste Projections

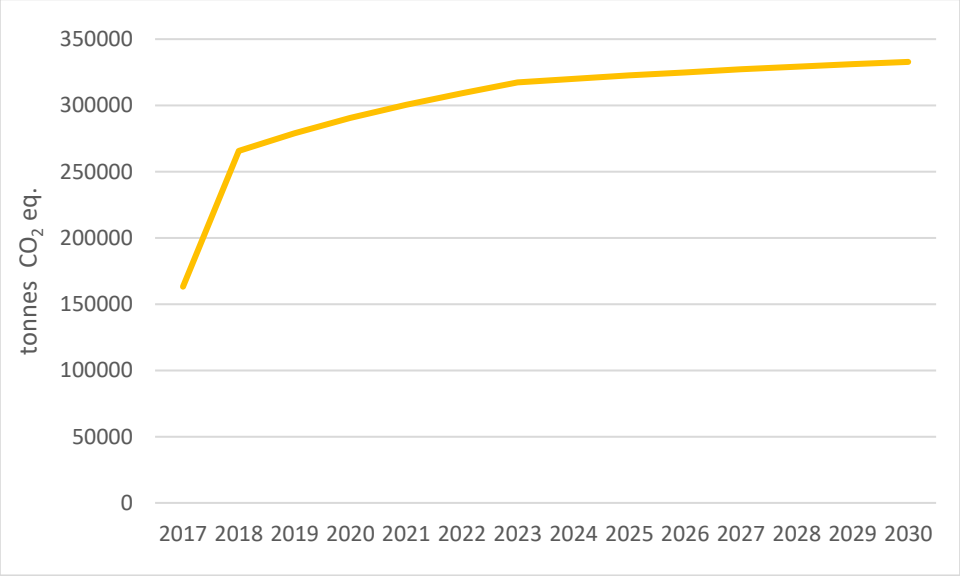
The overall share of GHG emissions from the waste sector is equivalent to <5% of the gross national emissions. The main gas emitted is methane, mainly from disposal of solid waste to land as is the largest contributor of GHGs

Until early 2004, solid waste was deposited in unmanaged landfills. One of three landfills (Wied Fulija) was closed in 1996, and the other two landfills, Magħtab (in Malta) and Qortin (in Gozo) were closed in 2004. For the period 2004 - 2007, municipal solid waste was disposed of in a managed landfill at Ta' Żwejra, and subsequently in the Għallis managed landfill which started operating in the beginning of 2007. These landfills are operated by WasteServ Malta Ltd., a company set up by the Government of Malta in 2002 to organise, manage and operate national waste management systems.

Malta's waste water handling infrastructure consists of two main networks that collect both domestic and industrial waste water as well as some storm water runoff. The sewerage system has been upgraded with the building of three new sewage treatment plants, which process started in 2006 and ended in 2011. Two of the plants came into operation in 2008, while the third became fully operational in 2011.

A number of measures have been previously implemented and are included under the Reference scenario, with projected trajectory in Figure 52.

Figure 52 Projected waste emissions under the reference scenario from2017-2030, tonnes CO2 eq.



Reduction of Emissions from Open and Closed Landfill sites

- **Aerial emissions Works at Magħtab and Qortin Landfills**

Although closed since 2004, the Magħtab and Qortin landfills are still sources of GHG emissions due to the waste present in the landfills that slowly decays underground for years after closure. In 2008, landfill gas extraction infrastructure was installed to treat odour and noxious gas emissions from these

closed sites in a regenerative thermal oxidiser. The works also involved re-contouring works of the landform to improve stability of the waste mass, control emissions and to rehabilitate the sites for eventual alternative uses. Landfill gas extraction is expected to continue until 2028.

On the basis of emissions data from the Magħtab and Qortin sites and using first order decay methodology to estimate the rate of methane generation from the waste deposited at these site, the net GHG savings from the treatment of methane (which constitutes a small percentage of emissions from these site) have been estimated. The net savings take into account the savings from the combustion of methane generated by the landfills and the CO2 emissions from combustion process.

- **Gas Management at Żwejra and Għallis Non-hazardous Landfill**

Following the closure of the unmanaged landfills in Malta, solid waste deposition commenced at the engineered landfill at Ta' Żwejra, serving as an interim managed landfill until the larger landfill at Għallis was prepared. The latter started operating in the beginning of 2007.

The management of landfill gas is a condition of the IPPC permit for both facilities, pursuant to the requirement under the Landfill Directive for the management and utilisation, where possible, of landfill gas. Hence, following closure of the specific cells within the site, capping of the waste mass and extraction of gases will be carried out and the extracted gases flared or possibly combusted for energy generation, subject to available budget. It should be noted that emissions from post treatment of the flared/combusted emissions that may be eventually required have not been considered in the estimates.

- **Sant' Antnin Mechanical and Biological Treatment Plant**

Over the years, the quantity of waste being deposited in landfills has gradually decreased due to improved recycling practices and diverting of degradable waste to the Sant' Antnin Composting plant, in operation since 1993.

Since 2012 the upgraded Sant' Antnin Plant with the aim of improving the technology used and the environmental performance of the plant, to manage waste more efficiently and produce compost while facilitating the recovery of green energy.

To this end, the new Sant' Antnin Waste Treatment Plant includes a biological treatment plant for the production of biogas through the anaerobic digestion of biodegradable municipal solid waste. The biogas produced is to be used for the generation of electricity by combustion in a Combined Heat and Power (CHP) plant, and any excess electricity will be fed to the grid.

The biological treatment plant was inaugurated in 2010. All CO2 emissions from this plant are considered to be of biogenic origin.

- **Establishment of new Mechanical Biological Treatment Plants in the North of Malta**

WasteServ Malta Ltd is planning to reduce, to the extent possible, the amount of waste being deposited in landfills in Malta, and to utilise waste through energy from waste projects. Bio digestion

was highlighted as being an ideal solution. A plant treating municipal solid waste (MSW) and animal manure was constructed in the north of Malta in 2015.

Wastewater Management

- **Operation of Urban Waste Water Treatment Plants**

The three waste water treatment plants were constructed under the Government's Infrastructure Programme for the upgrading of the national waste water infrastructure. These plants are currently struggling with compliance to the Urban Waste Water Treatment Directive due to the ingress of farmyard waste discharges on an unprecedented level.

- **Wastewater Sludge treatment**

The Malta South Urban Waste Water Treatment Plant (Malta South UWWTP) is the largest of the three waste water plants constructed under the Government's Infrastructure Programme for the upgrading of the national waste water infrastructure and for achieving compliance with the requirements of the Urban Waste Water Treatment Directive.

The Malta South UWWTP features anaerobic sludge digestion facilities with biogas production and reducing the plant's energy demand on the national grid. Biogas produced is combusted in a CHP plant for energy recovery: the electricity output meets a share of the plant's own operating demand, whereas the waste heat is used up in heating up and maintaining the sludge digesters at 37°C.

ESR Sector Projections

Figure 53 Projection of sector emissions under the reference scenario from 2017-2030 (without LULUCF input), tonnes CO_2 eq.

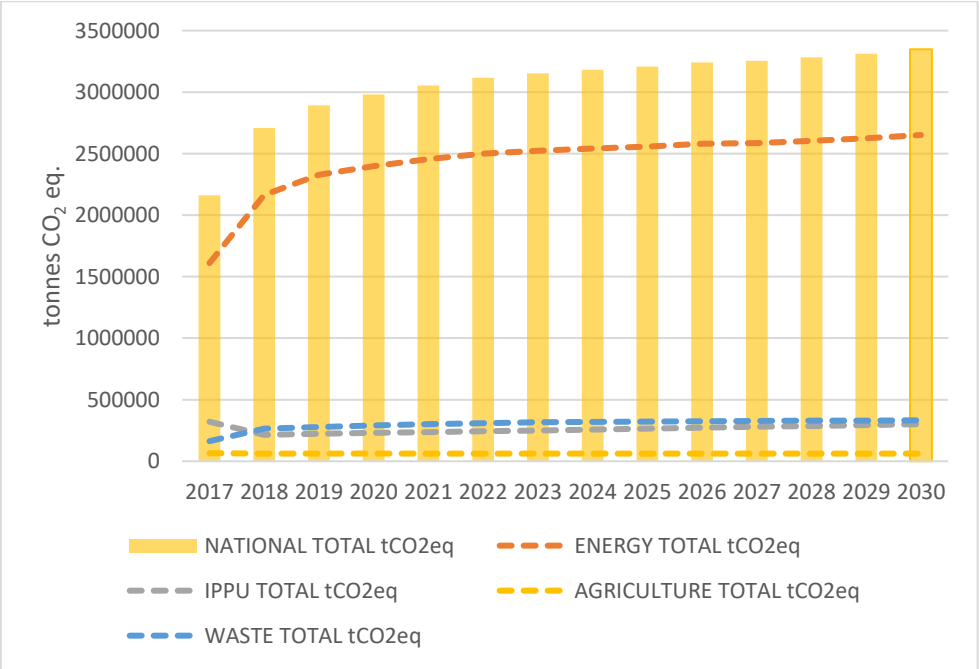
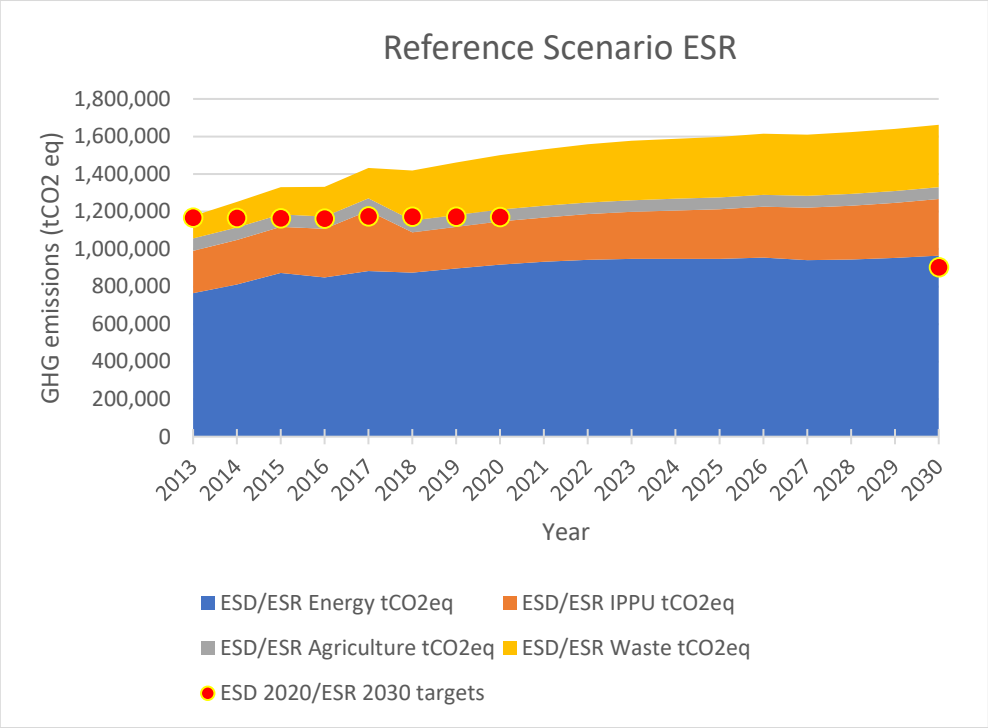


Figure 54 Projections of ESR total emissions by sector under the reference scenario from 2017-2030, tonnes CO_2 eq.



4.2.2 Renewable energy

i. Current share of renewable energy in gross final energy consumption and in different sectors (H&C, electricity, transport) as well as per technology in sectors

Table 23 below shows the share of renewable energy in total gross final energy consumption, as well as in the sectors of heating and cooling, electricity and transport. As of 2017, the share of renewable energy in relation to gross final energy consumption is estimated to have reached 7%, increasing from 6.2% reached in the previous year. As shown in table, the highest relative share of renewable energy was achieved in the heating and cooling sector.

Table 23 Share of renewable energy in gross final energy consumption, total and per sector 2010 - 2017

%	2010	2011	2012	2013	2014	2015	2016	2017*
Heating and cooling	7.5%	11.4%	13.4%	15.4%	15.2%	15.1%	16.8%	19.2%
Electricity	0.0%	0.5%	1.1%	1.6%	3.3%	4.3%	5.7%	6.6%
Transport	0.6%	2.2%	3.5%	3.6%	4.8%	5.7%	5.8%	7.6%
Overall RES share	**1.1%**	**1.8%**	**2.8%**	**3.7%**	**4.7%**	**5.3%**	**6.2%**	**7.0%**

* Data for 2017 is provisional

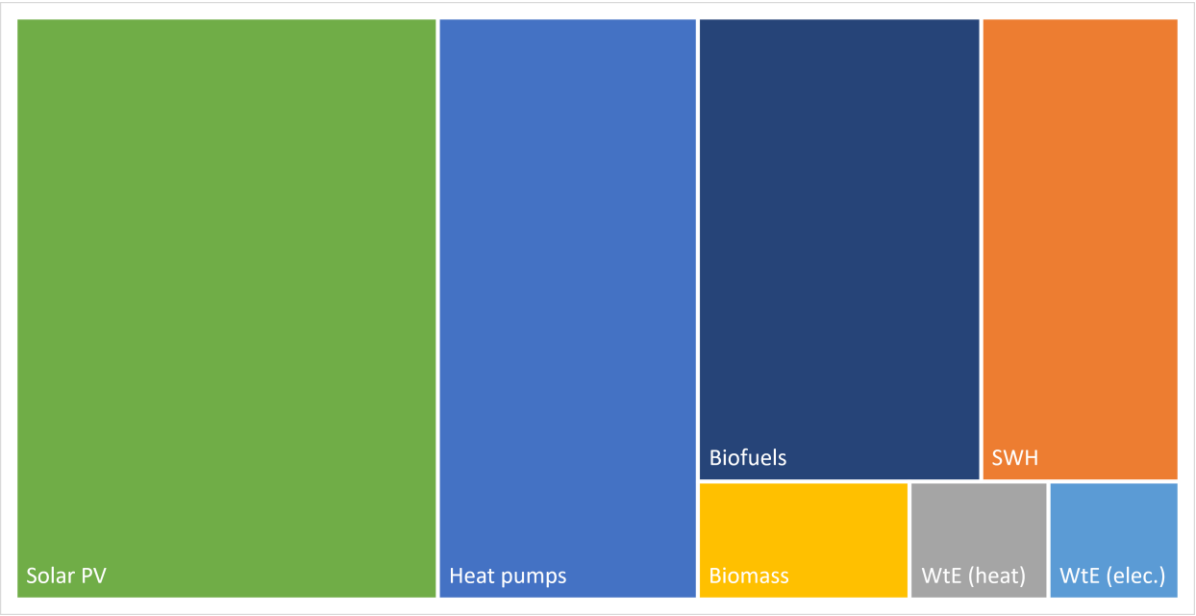
Total final energy consumption of RES in Malta in 2017 amounted to 431 GWh. This portrays a substantial annual increase from the 370 GWh registered in 2016, which can be attributed primarily

to the continued deployment of solar PVs and greater use of biofuels on the Maltese market. This is to be compared to a mere 6 GWh of RES consumption registered in 2005, when only a handful of solar water heating systems were practically the only RES technology in Malta.

Government's policy is to fully exploit all reasonable potential indigenous sources of RES in order to achieve Malta's 2020 RES target of 10% share in gross final consumption of energy. PV technology was demonstrated to be the most robust and fastest-growing of all technologies, owing much to the characteristics of Malta in relation to solar intensity but also to the successful history of public and Government initiatives to promote the technology to its maximum reasonable potential. Yield of PV systems in Malta is among the highest in Europe. There was a sharp increase in the uptake of PV between 2010 and 2017, with the total cumulative installed capacity at the end of 2017 standing at just over 112 MWp. Successful PV deployment has happened largely due to national incentives offered through various schemes, including ERDF co-financed grants and attractive feed-in-tariffs.

Figure 55 below provides a visualisation of the share of renewables in final energy consumption by technology in 2017. Currently, the largest contribution of renewable energy is provided by solar PVs, contributing to around 36% of renewable energy in 2017, followed by heat pumps with 22%, the use of biofuels in the transport sector at 21% and solar water heaters, contributing with 13.6%. While there has been a continued increase in the use of heat pumps for heating and cooling, and biofuels used in the transport sector, the installation of new solar water heaters in recent years has slowed down.

Figure 55 Share of RES technologies in consumption in 2017.

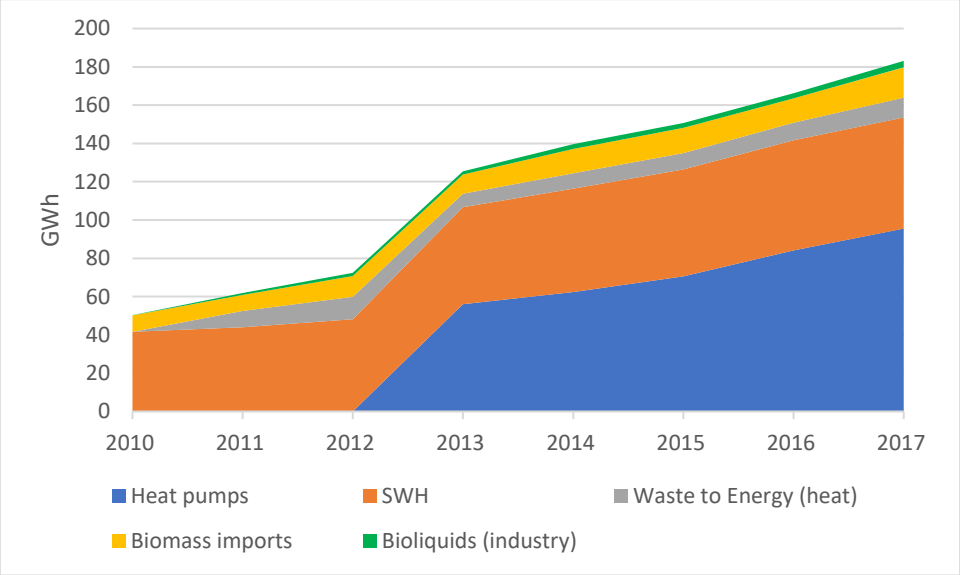


Share of RES in the heating and cooling sector

Malta does not have any district heating networks as past studies indicated and confirmed that district heating networks would not be cost-effective given the type of climate and capital costs, thus making such an investment economically unfeasible. In 2017, the consumption of RES in the heating and cooling sector is estimated to have reached 183 GWh, which represents an increase from 166 GWh in the previous year. In comparison, the consumption of RES in H&C in 2010 only accounted for 52 GWh. Renewable energy share in the heating and cooling sector can be attributed primarily to the use of heat pumps and solar water heaters, with biomass imports, heat produced from Waste-to-Energy plants and bioliquids used for spatial heating and industrial processes in the industrial sector accounting for the balance.

Figure 56 below shows the development of renewable energy consumption in the heating and cooling sector between 2010 and 2017. The figure provides a visualisation of the continued increase of RES technology penetration in the heating and cooling sector, driven by heat pumps and solar water heaters.

Figure 56 Renewable energy consumption in the heating and cooling sector between 2010-2017, GWh.



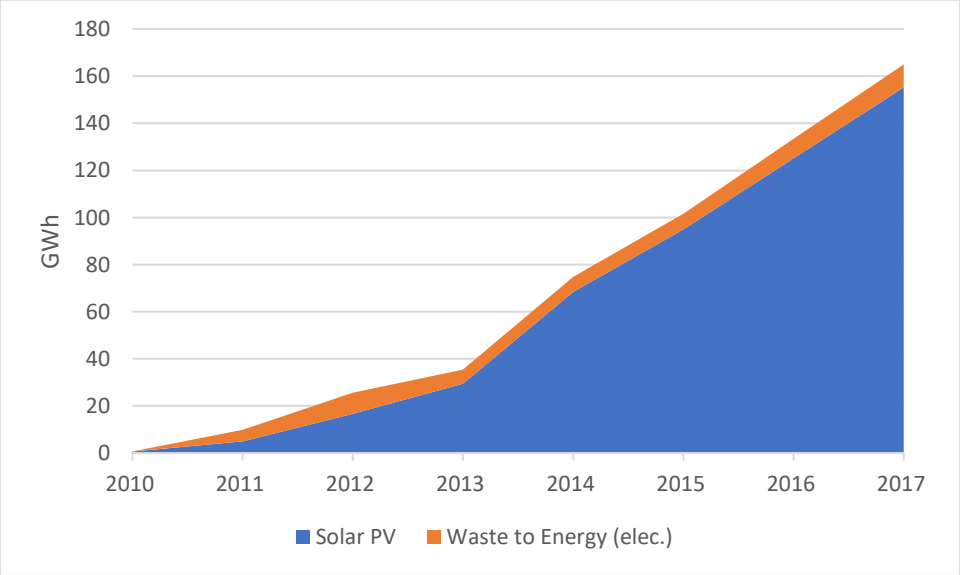
Due to its typical warm Mediterranean climate, the major application for heat pumps in Malta has traditionally been for ambient cooling. This has resulted in buildings being fitted with reversible air-to-air units. However, also in response to lower electricity tariffs, the utilisation of heat pumps technology for heating purposes increased, and often replaces the use of either LPG heaters or electric filament heaters. In 2017, there were almost 300,000 air conditioners employing heat pump technology (split-units) installed in Malta, with 204,500 of these installed within the residential sector. Their utilisation in SMEs and large enterprises for both ambient heating and cooling has also been on the rise.

Solar Water Heaters (SWH) are favoured by the high solar intensity prevalent in Malta and they eliminate a good percentage of energy consumption otherwise going for water heating in the residential and to a lesser extent the commercial sector. However, their use is limited in summer when ambient temperature is high and hot water demand is low even though their yield is at its maximum. Since 2005, a number of grant schemes have been provided to promote the use of solar water heaters for households, increasing RES-H generation by an average of 3.8 GWh/year. Nevertheless, a downward trend in recent years is evident, as the number of SWH installations including the number of grant requests fell well below the peak reached in 2009. This negative trend can be attributed mainly to the consumer shift towards PV systems, developments in the construction and renovation of buildings linked with limited roof accessibility and saturation of the SWH domestic market at current levels of support.

Biomass imports comprised primarily of wood charcoal, fuel wood and wood pellets, which are used for heating purposes by the approximately 12,000 households that have a wood or pellet burning stove or fireplace, as well as a small number of establishments in the services sector and industry. Generation of renewable energy from waste treatment in the form of heat made a contribution of slightly over 10 GWh in 2017. This contribution is attributed to the combined heating and power (CHP) and Regenerative Thermal Oxidiser (RTO) facilities at the Sant Antnin Solid Waste Treatment Plan (SAWTP), an RTO at the Maghtab Environmental Complex and the Malta North Mechanical and Biological treatment plant. Waste management in Malta is driven by Malta's Waste Management Plan, adopted in 2014, which focuses on increased prevention, re-use, recycling and recovery and minimisation of disposal and considers energy recovery as an effective measure to process residual waste and reduce land-filling.

Share of RES in the electricity sector

Figure 57 Renewable energy consumption in the electricity sector between 2010-2017, GWh.

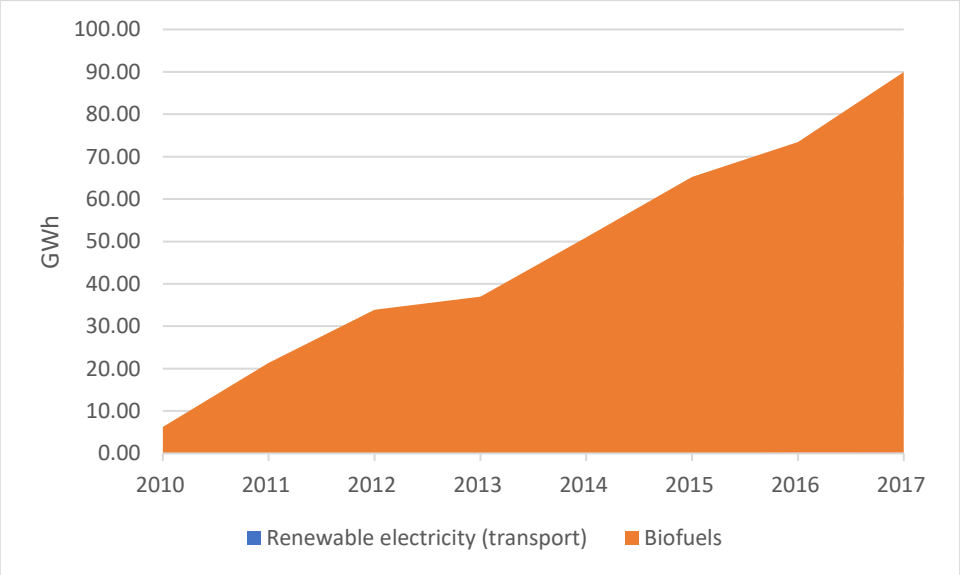


The share of electricity production from renewable energy in relation to total electricity consumption was 6.6% in in 2017, an increase from 5.6% from the previous year. Renewable electricity generation in 2017 amounted to 165 GWh. Apart from electricity generation from PV systems, the other contributor towards renewable electricity are the electrical output from CHP plants treating waste and sewage, managed by Wasteserv and Water Services Corporation respectively. In 2017, waste-to-energy plants generated 9.74 GWh of electricity. The contribution of microwind is deemed to be negligible. The development of renewable energy consumption in the electricity sector from 2010 to 2017 can be seen in Figure 57.

Share of RES in transport sector

In 2017, 8.2% of the transport sector's energy consumption was attributed to RES. Malta's push to decrease the sector's dependency on fossil fuels has been given great importance, with focus placed primarily on achieving the separate 10% RES-T target in 2020. The lack of a mass transport system or rail largely limits the electrification options to the replacement of ICE vehicles by EVs. RES consumption in the transport sector in 2017 reached 89.6 GWh, which constitutes a significant increase from the 6.2 GWh in 2010.

Figure 58 Renewable energy consumption in the transport sector between 2010-2017, GWh.



As shown in Figure 58, RES in the transport sector is almost exclusively the result of the use of biofuels, with renewable electricity in transport having a minimal role. The dominant biofuel used in Malta is biodiesel, in particular FAME and Hydro-treated Vegetable Oil (HVO). Malta requires that biofuels placed on the market fulfill the necessary sustainability criteria and comply with EU directives and local legislation. In order to achieve an increasing penetration of biofuels in the transport sector, Legal Notice 68/2011 was published in 2011. This introduced a 'substitution obligation' for biofuels, by

which importers and wholesalers of automotive fuels are obliged to place on the market a minimum biofuel content as a percentage of the total energy content of fossil diesel and petrol.

In 2018, fuel suppliers are obliged to blend conventional automotive fuels with at least 8.5% biofuels by energy content. The percentage is expected to reach 10% by 2020, thus enabling Malta to reach its RES target in transport. To supplement diesel blending, the use of HVO has been introduced by importers since 2015. As of 2017, 48.8 GWh of HVO was consumed by road transport, which accounts for more than half of the renewable energy consumption of the transport sector.

As mentioned above and seen in Figure 58 the contribution of renewable electricity in the transport sector is only marginal. In 2017, there were 332 registered electric vehicles in Malta, ranging from passenger vehicles, motorcycles and quads to electric light and heavy-duty vehicles. Another 861 vehicles were registered as hybrid. The main benefit of electric vehicles lies in achieving zero tailpipe emissions, although the effective reduction in GHG emissions largely depends on the energy mix and efficiency of generation infrastructure. However, these figures are negligible when compared to the total number of 364,274 passenger, light duty and heavy-duty vehicles registered in Malta as of end of 2017. The low uptake of electric vehicles can be attributed to the relatively high capital cost compared to internal combustion engines, notwithstanding Government incentives to promote the purchase of electric vehicles, which include a grant of 6,000 EUR available to individuals, enterprises, as well as NGOs when purchasing an electric vehicle.

ii. Indicative projections of development with existing policies for the year 2030 with an outlook to the year 2040

Current policies and measures on the promotion and support of renewable energy extend until 2020, in line with the 2017 National Renewable Energy Action Plan. Table 24 and Table 25 illustrate the overall RES share in Malta's projected gross final energy consumption until 2040 under the reference scenarios, in which national measures targeting the continued RES uptake do not extend post-2020. Similar to the two policies scenarios provided in section 2.1.2, Reference Scenario 2 includes the cooling share from heat pumps over and the above the RES shares included in Reference Scenario 1.

Table 24 RES under reference scenario 1

%	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
RES-E	8.0	7.9	7.6	7.3	7.0	6.8	6.7	6.6	6.6	**6.6**	8.3	8.9
RES-H&C	21.0	21.3	21.8	21.8	22.3	22.4	22.2	21.9	21.5	**21.0**	20.2	21.9
RES-T (actual share)	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5	**0.5**	1.5	4.8
Overall RES share	7.0	7.1	7.1	7.0	7.0	7.0	7.1	7.1	7.2	**7.2**	8.4	9.9

Table 25 RES under Reference scenario 2

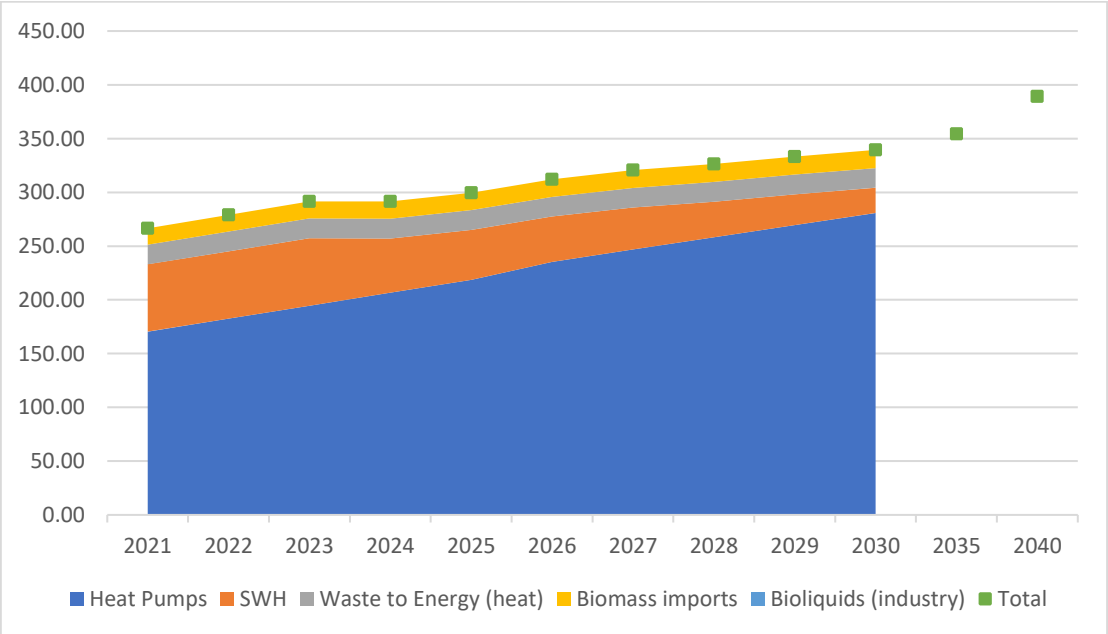
%	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
RES-E	8.0	7.9	7.6	7.3	7.0	6.9	6.7	6.6	6.6	**6.6**	8.3	8.9
RES-H&C	30.2	30.9	31.8	32.2	33.1	33.6	33.6	33.4	33.1	**32.6**	32.2	34.5
RES-T (actual share)	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5	**0.5**	1.5	4.8
Overall RES share	9.1	9.3	9.4	9.4	9.5	9.6	9.8	9.9	10.0	**10.1**	11.4	13.1

Under the reference scenario, the overall share of RES in gross final energy consumption is projected to increase even in the absence of supporting policies and measures post-2020, albeit at a slower rate than in the period 2011-2021. However, this growth shall be matched by an increase in gross final energy consumption which is expected to grow from 6,214 GWh in 2017 to 8,721 GWh in 2030 under reference scenario 1. Therefore, the growth in renewable energy generation shall only be sufficient to maintain an overall RES share relatively stable ain the region of 7.0-7.2% between 2021-2030.

Share of RES in Heating and Cooling

The largest increase in RES will occur in the heating and cooling sector, with consumption increasing from 183 GWh in 2017 to 340GWh in 2030 under reference scenario 1, as can be observed in Figure 59.

Figure 59 RES consumption in H&C projections under Reference scenario 1, GWh.



Heat pump technology is projected to have the most significant contribution. The affordability of this technology combined with the continual rise in expectations of thermal comfort ensures sustained growth also reflecting demographic changes. For instance, the number of heat pumps imported in 2016 and 2017 was above average due to increased activity in the construction sector in response to a significant influx of inwards migration. Split-unit heat pumps in the residential sector are expected to increase from 204,500 at the end of 2017 to 403,000 in 2030 and 527,000 in 2040. In the non-residential sector, installation of new heat-pumps is also expected to increase in line with the country's economic activity. The construction of new or modernisation of office spaces, hotels, and other commercial spaces will create a continued demand for the importation of air conditioning systems employing heat pump technology. In both cases, it is also assumed that units will be replaced once they reach their end-of-life. As it is difficult to gather information on the efficiency of new units, a conservative approach is being taken assuming a minimum level of SPF ($SCOP_{net}$).

As for RES consumption from centralized air conditioning units, Malta is in the processes of analysing the consumption of renewable heat from VRF systems for integration into the final NECP. The projections for heat pumps include a share of reversible centralised units; this is based on a preliminary assessment, which will be further studied in 2019 and is therefore subject to revision for inclusion in the final plan.

By contrast, solar water heaters (SWH) are unlikely to be installed if grant schemes to promote uptake are not maintained due to their high capital cost (compared to alternatives such as electric boilers) and long payback period. Indeed, in recent years, Malta has observed a downward trend in new SWH installations despite the availability and promotion of grants. In the reference scenario, it is assumed that there will be no installations of new SWH post-2020, and consumption of RES-H from SWH follows a steady decline from 2025 onwards, as units reach their end-of-life and are not replaced. An assumption of 20 years was made for the technical lifetime of SWH in Malta.

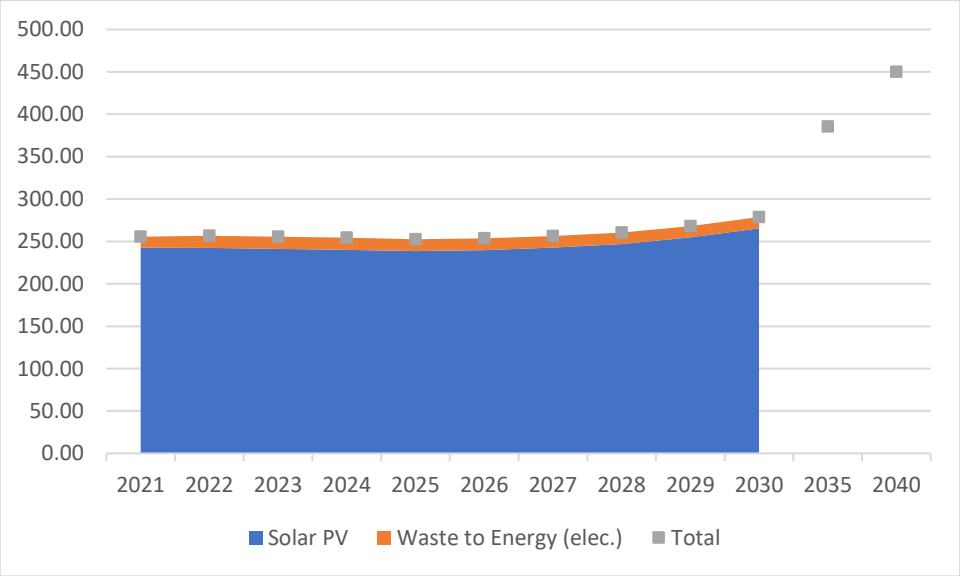
Biomass imports, used for space heating by a small number of households, is not projected to increase significantly; capital costs for such infrastructure is relatively high, and heating by LPG heaters and heat-pumps is likely to remain the preferred mode of space heating. Bioliquid use in industry in the period 2011-2017 was rather low and is projected to be negligible in the post-2020 period. The existing substitution obligation on fuel suppliers will expire at the end of 2020 and it is assumed that suppliers will not continue to import bioliquids should biofuel obligations in the transport sector no longer apply.

Generation of renewable energy in the form of heat from waste treatment is projected to remain largely constant. It is assumed that waste treatment plants reaching their end-of-life will be replaced by those of a similar capacity.

Share of RES in Electricity

As illustrated in Figure 60, under existing policies and measures the generation of RES-E is projected to remain largely stable over the 10-year period following 2020 at an average of 260 GWh annually, only increasing slightly to 279 GWh in 2030.

Figure 60 RES consumption in electricity projections under Reference scenario 1, GWh.



Based on Malta's Waste Management Plan, the generation of electricity from waste-to-energy plants is expected to remain largely stable. However, this will continue to constitute only a small percentage of RES-E in Malta.

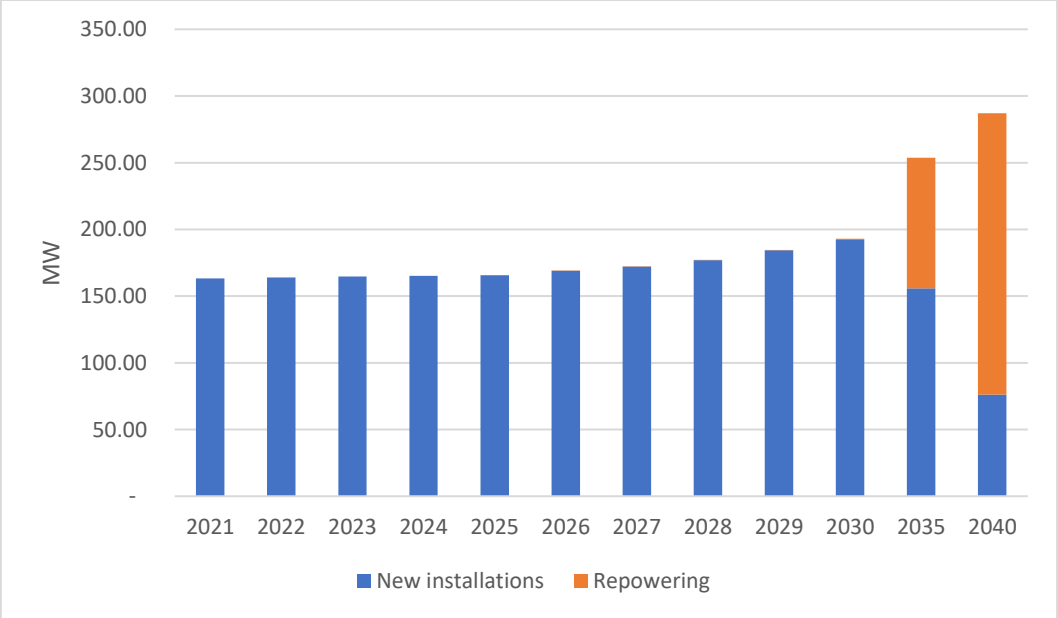
As indicated in the previous section, the penetration of solar PV has been significant, with a history of successful public and Government initiatives to promote uptake which, under the reference scenario, are set to continue until but not extend beyond 2020. From 2021 onwards, uptake would therefore depend on the feasibility of PV systems based on the price gap between electricity prices and LCOE, which is sensitive to the respective hurdle rates in the residential and non-residential sector.

Based on the projected costs for residential rooftop solar PV installations, it is expected that uptake in the residential sector of solar PV will be negligible in the 10-year period post-2020 as the LCOE of such systems will be higher than the proxy for the market price. In the absence of feed-in-tariffs or grant schemes, it is assumed that residential systems will become feasible post-2030, following which an estimated 9.5MW capacity will be added over a 5 to 7 year period, in addition to approximately 23.5MW from repowering between 2031-2040. No repowering is expected to occur before 2030 as no systems will have reached their end-of-life.

By contrast, the installation of PV systems in the non-residential sector is projected to continue post-2020 even in the absence of incentives to promote uptake, albeit at a much lower rate. Industrial-sized PV installations are projected to be feasible based on market revenues from 2020 onwards, with the LCOE of such systems projected to reach grid parity around 2025.

In 2017, 31% of non-residential systems were installed primarily for the purposes of self-consumption. Therefore, it is assumed that mid-range consumers in the non-residential sector, seeking to reduce costs of energy use, would continue to install industrial-sized systems post-2020 primarily for self-consumption, creating an annual additional capacity of between 0.4-0.9MWp. From 2025 onwards, the declining costs of PV systems together with a slight increase in electricity prices are projected to render PV systems a financially attractive investment for most entities in the non-residential sector, both as small-scale rooftop systems and solar farms. As a result, the pace of installation of new installations will increase. Also, those systems reaching their end-of-life (the first systems in 2025) will be replaced with a similar or higher capacity, given the financial feasibility of such an endeavour. Following this trajectory, the non-residential sector in Malta is projected to fulfil its technical potential by the period 2035-2040 (approximately 175 MWp). A summary of projected uptake under the reference scenario is illustrated in Figure 61.

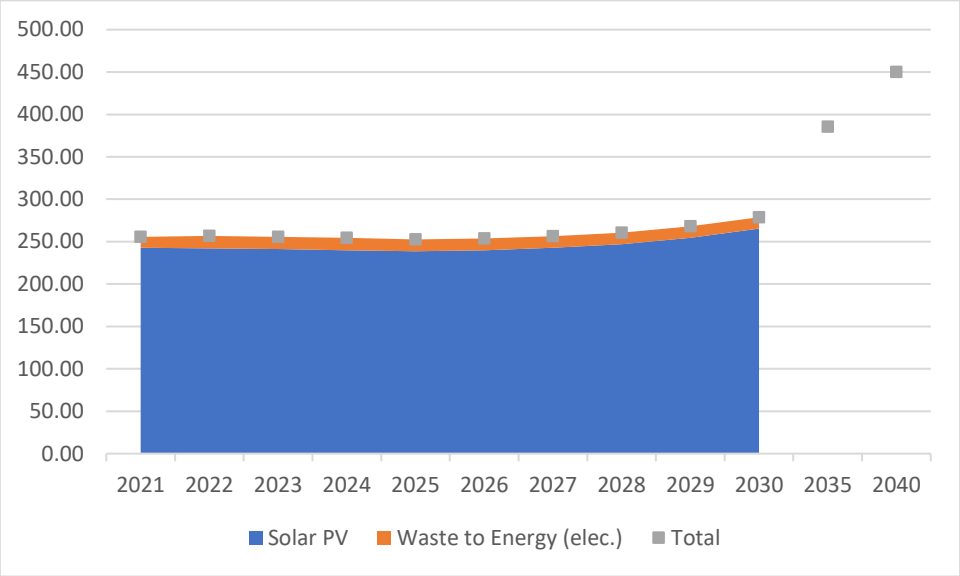
Figure 61 Increase in PV capacity as a result of new installations and repowering between 2021-2040, MW.



Share of RES in Transport

As illustrated in Figure 62, the transport sector is dependent on policies and measures to achieve the sectoral RES-T target. Current policies and measures for biofuels, which constitute the most significant portion of renewable energy in transport, do not extend beyond 2020 which, under the reference scenario, results in a decline from 118.5 GWh in 2020 to 0.9 GWh in 2021.

Figure 62 RES consumption in transport projections under Reference scenario, GWh.



As the current substitution obligation on fuel suppliers does not extend beyond 2020, in the reference scenario it is assumed that suppliers will no longer continue to import biofuels which are generally more expensive than their fossil counterpart per unit of energy content. Therefore, contribution of biofuels in transport from 2020 onwards is expected to be nil under the reference scenario. National strategies and action plans in the transport sector are committed to encourage the uptake of electric vehicles in Malta.

4.3 DIMENSION ENERGY EFFICIENCY

i. Current primary and final energy consumption in the economy and per sector

Malta's total primary and final energy consumption by sector from 2013 until 2017 is presented in Table 26. Figures provided are in line with the methodology applied by Eurostat for reporting to date. However, Table 27 considers ambient heat captured by heat pumps, mainly given that it is envisaged that the methodology will change as from 2017 data year reporting.

Table 26 Total primary energy consumption and final energy consumption by sector from 2013-2017, ktoe (excluding heat pumps).

	2013	2014	2015	2016	2017*
Total primary energy consumption	**869**	**876**	**756**	**716**	**816**
Total final energy consumption	**525**	**546**	**575**	**586**	**620**
Transport	*288*	*299*	*314*	*323*	*349*
Industry	*53*	*55*	*56*	*56*	*57*
Services	*105*	*112*	*119*	*118*	*122*
Residential	*73*	*74*	*79*	*78*	*85*
Agriculture, forestry, fishing	*4*	*4*	*4*	*4*	*4*

*estimate

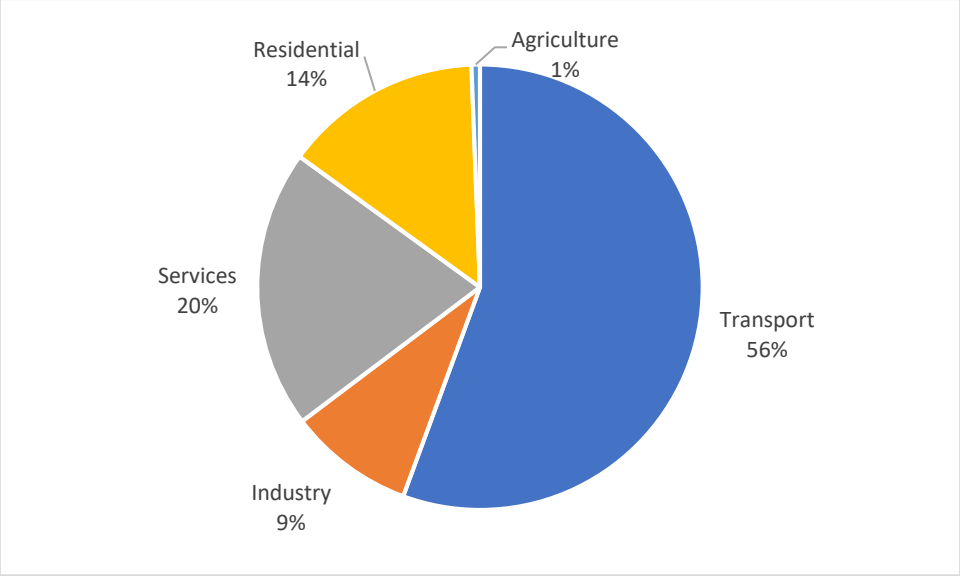
Table 27 Total primary energy consumption and final energy consumption by sector from 2013-2017, ktoe (including heat pumps).

	2013	2014	2015	2016	2017*
Total primary energy consumption	**874**	**882**	**762**	**723**	**824**
Total final energy consumption	**531**	**552**	**581**	**593**	**628**
Transport	*288*	*299*	*314*	*323*	*349*
Industry	*53*	*55*	*56*	*56*	*57*
Services	*106*	*113*	*121*	*120*	*125*
Residential	*77*	*78*	*83*	*83*	*90*
Agriculture, forestry, fishing	*4*	*4*	*4*	*4*	*4*

*estimate

The distribution of final energy consumption by sector in 2017 (excluding heat pumps) is shown in Figure 60. The transport sector contributes to more than half of total consumption, followed by the services and residential sectors as the other predominant consumers of energy.

Figure 63 Final energy consumption by sector in 2017, %.



ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling

The residential and services sectors make up 87% of the total estimated heating and cooling demand. Local climatic conditions impose a much higher summer cooling demand than the winter heating requirements. Malta has no public district heating and cooling network. This cooling demand is currently being addressed through very efficient air-to-air heat pumps, which are widely used in both households and commercial buildings. These heat pumps are also being used in reverse mode for spatial heating purposes. In recent years, with the increase of construction of high-end high-rise buildings, integrated solutions have also been set up to achieve more cost-effective heating and

cooling. However, the main consumer of fuel-based spatial heating technologies is the hotel sector. As an effort to incentivise the uptake of high efficient CHP units, in 2016 the government released a scheme whereby enterprises are eligible for aid through tax credits. To date, the uptake was nil, mainly due to the regulatory barriers related to storage of fuel (mainly LPG) and the limited space available for on-site storage facilities.

The Comprehensive Assessment of the Maltese heating and cooling demand commissioned in 2015, titled '*An Energy Roadmap- Towards Achieving Decarbonization for the Maltese Islands – Analysis for a Cost-Effective and Efficient Heating and Cooling'*[56], carried out in accordance with the provisions of Article 14(1) of the Energy Efficiency Directive – 2012/27/EU, sought to identify the potential of technically and economically feasible applications of high efficiency cogeneration and efficient district heating and cooling.

In view of the current installed stock of heating and cooling technologies, which is already very efficient, and the low share of heating demand, it is envisaged that the role of heating and cooling networks and CHP technology in the next decade is only marginal. This is further accentuated by the fact that Malta has practically no available indigenous resources of biomass or biogas, and currently there is no natural gas distribution network to render the fuel supply cheaper than the present options.

This is reflected in the conclusions of the study which shows that the final energy consumption for heating and cooling purposes is relatively low compared to what is needed to create favourable conditions for enhancing CHP and district heating. Despite the increase in final energy consumption for heating and cooling foreseen for 2020 and 2030 in the services and industry sectors, the final heating demand is likely to remain too low to make such technologies feasible. This is even more evident for micro-cogeneration that rely on a stronger demand.

iii. Projections considering existing energy efficiency policies, measures and programmes for primary and final energy consumption for each sector at least until 2040

As indicated in section 4.3 (i), Malta is providing two sets of projections – one excluding heat pumps (Figure 64), and the other including heat pumps (Figure 65) - in view of upcoming changes in Eurostat reporting methodologies.

[56] Figure estimated based on 2013 data. Source: An Energy Roadmap- Towards Achieving Decarbonization for the Maltese Islands – Analysis for a Cost-Effective and Efficient Heating and Cooling

Figure 64 Projections for energy consumption under the reference scenario, ktoe (excluding heat pumps).

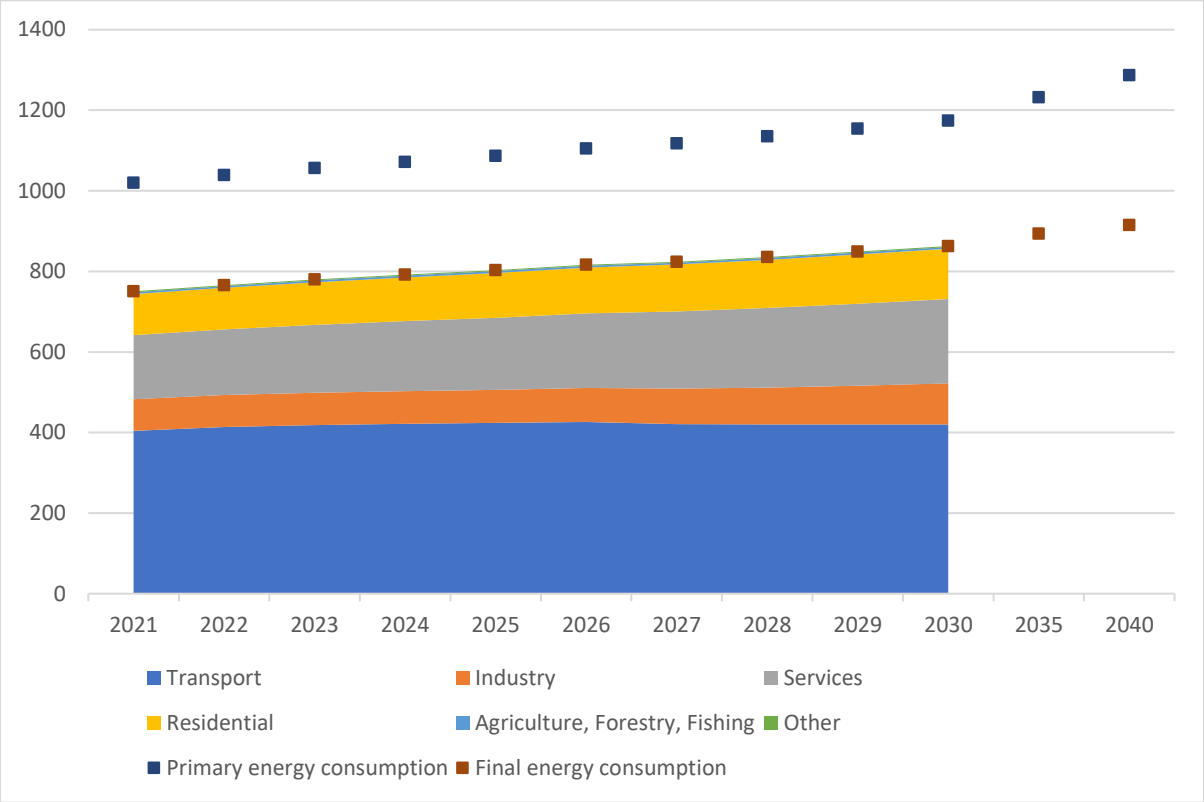
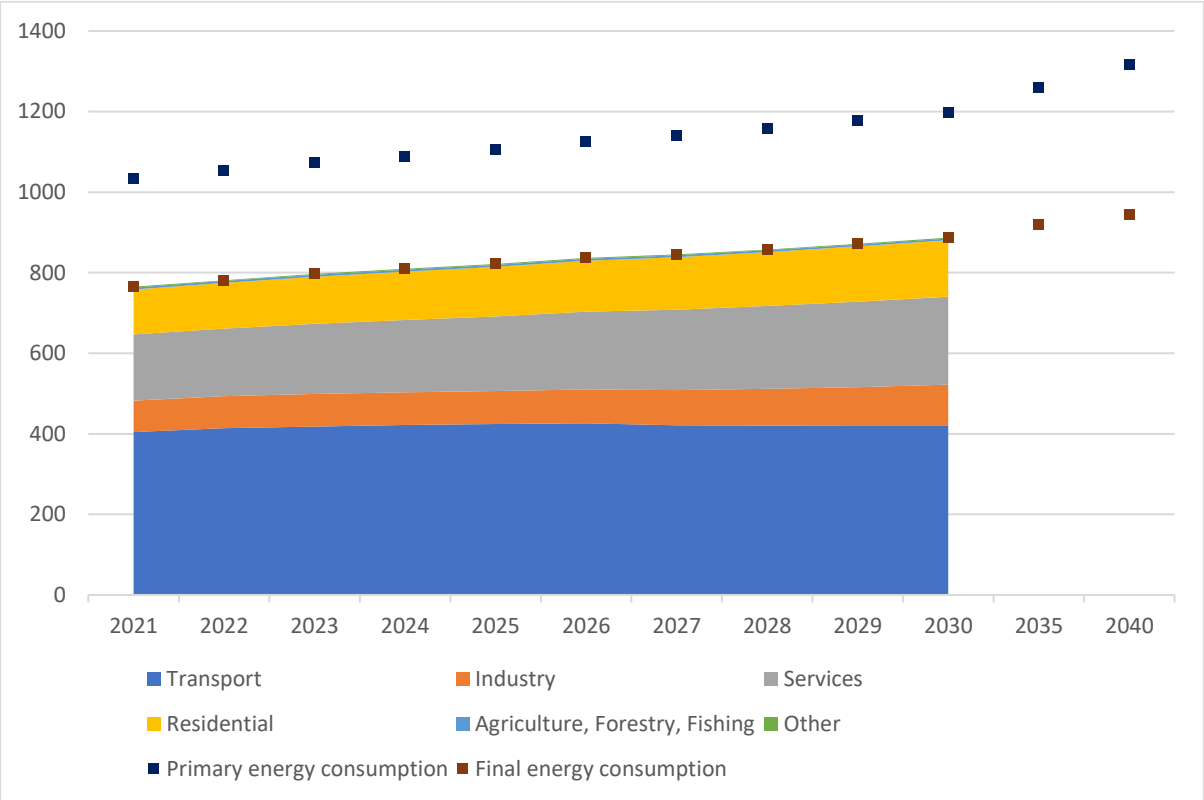


Figure 65 Projections for energy consumption under the reference scenario, ktoe (including heat pumps).



iv. Cost-optimal levels of minimum energy performance requirements resulting from national calculations according to Article 5 of EPBD

In 2015, a new document "Technical Document F – Minimum Energy Performance requirements for Buildings in Malta" was issued, updating the existing minimum energy performance requirements, and listing the overall energy thresholds for residential buildings and offices. The document is divided into two parts.

The first part of the document specifies the minimum energy performance requirements for buildings in Malta and the Overall Energy Performance Requirements for new Dwellings (Table 28) and the Overall Energy Performance Requirement for new non-Dwellings (Table 29), specifically for offices. Part 2 of Technical Document F focuses on the minimum requirements for building services in Malta.

Table 28 Overall energy performance requirement for new dwellings, kWh/m² per annum.

Building category	Flatted dwellings	Terraced houses	Semi-detached housing	Fully-detached housing	Indicative mean Energy requirement
Primary energy demand (kWh/m² annum)	140	90	55	55	85

Table 29 Overall energy performance requirement for new non-dwellings (offices), kWh/m² per annum.

Building category	Buildings used exclusively as offices	Buildings with offices occupying >50% of useful floor area
Primary Energy Demand (kWh/m² annum)	290	350

4.4 DIMENSION ENERGY SECURITY

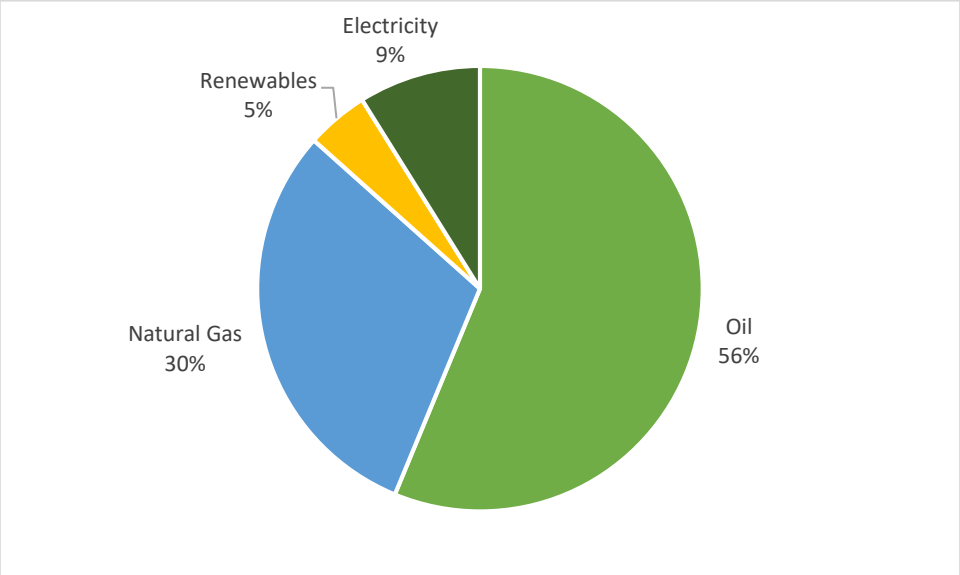
i. Current energy mix, domestic energy resources, import dependency, including relevant risks

The diversification of energy sources and suppliers achieved over the last years constitutes an important milestone for Malta, a country which lacks indigenous energy sources aside from renewable energy (which itself faces certain technical limitations). In 2015, the Maltese national grid was connected to the European energy network through a 200MW Malta-Italy HVAC cable; this was an important technological development which ended Malta's isolation from the European energy network, and provided increased security of supply and flexibility of electricity services.

The energy mix of primary products as a share in gross inland consumption in 2017, as shown in Figure 66, portrays the effects of diversification and the recent reforms of Malta's energy system. The high dependency on oil and petroleum products decreased from 79% in 2016 to 56% in 2017, whereby the share of natural gas now amounts to 30% of the energy mix. The share of renewable energy is also

increasing on an annual basis. The share of electricity imported over the interconnector in the energy mix in 2017 was 9%. In 2017, net import dependency[57] in Malta reached 95.8%.

Figure 66 Estimated energy mix as share in gross inland consumption, including electricity imported over the interconnector in 2017, %.

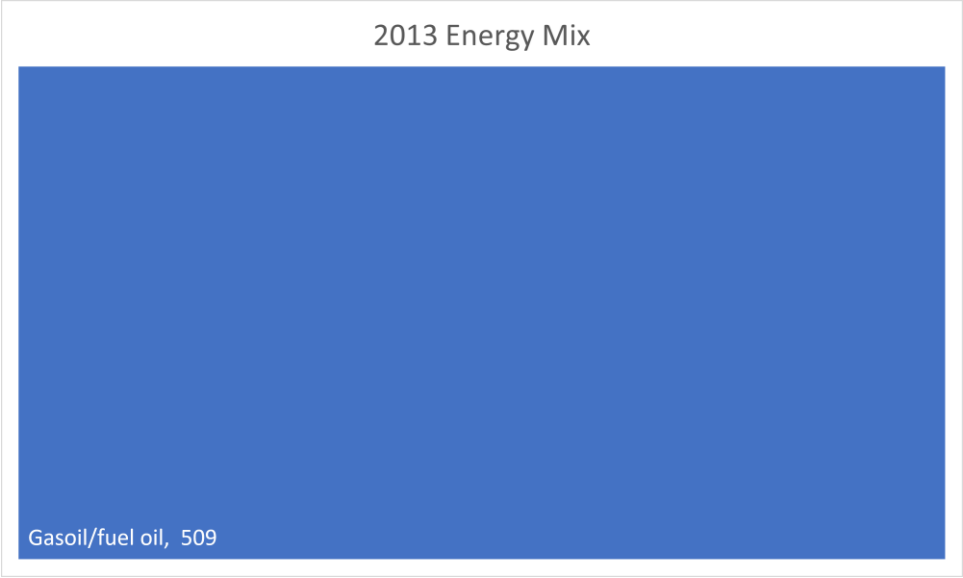


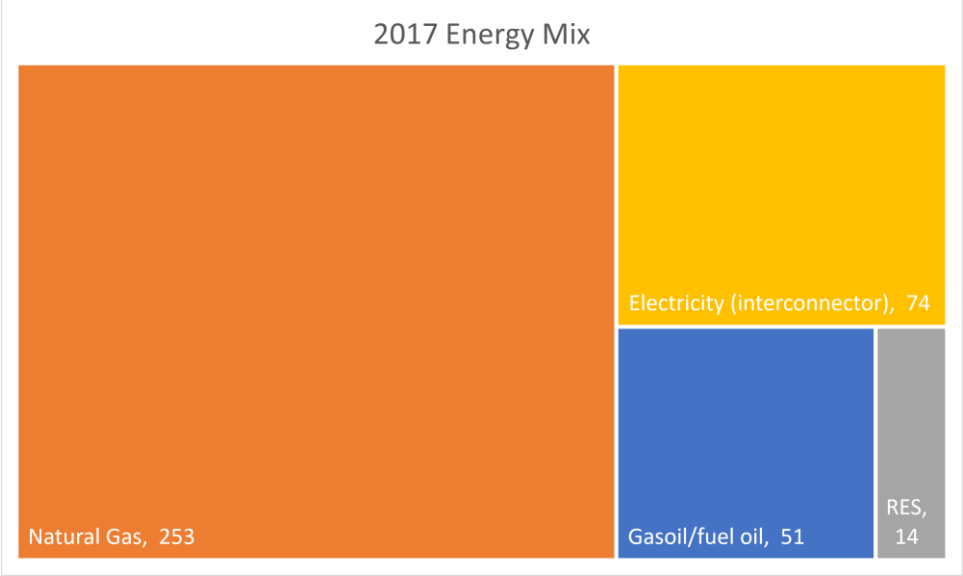
Energy mix for Electricity Generation

Over the past five years, Malta has transformed its energy mix used for electricity generation from one based on heavy fuel oil and gasoil, to a more sustainable energy mix based on gas, gasoil, renewables, and electricity imports (Figure 67). Following significant investments in a new generation plant and the conversion of an existing plant, natural gas replaced heavy fuel oil as the main fuel for electricity generation. In 2017, LNG constituted almost 65% of local energy mix for electricity generation, with electricity imported over the interconnector and gasoil/fuel oil covering the remaining portion at 19% and 13% respectively. The increased efficiency of the new generation plant also significantly reduced primary energy demand in Malta.

[57] This indicator measures the level of total net imports as a proportion of total gross inland consumption and the energy consumption of maritime bunkers. Net import dependency, as defined in Eurostat, may reach values of above 100% in cases of increasing stock levels.

Figure 67 Energy mix for electricity generation between in 2013 and 2017, ktoe.





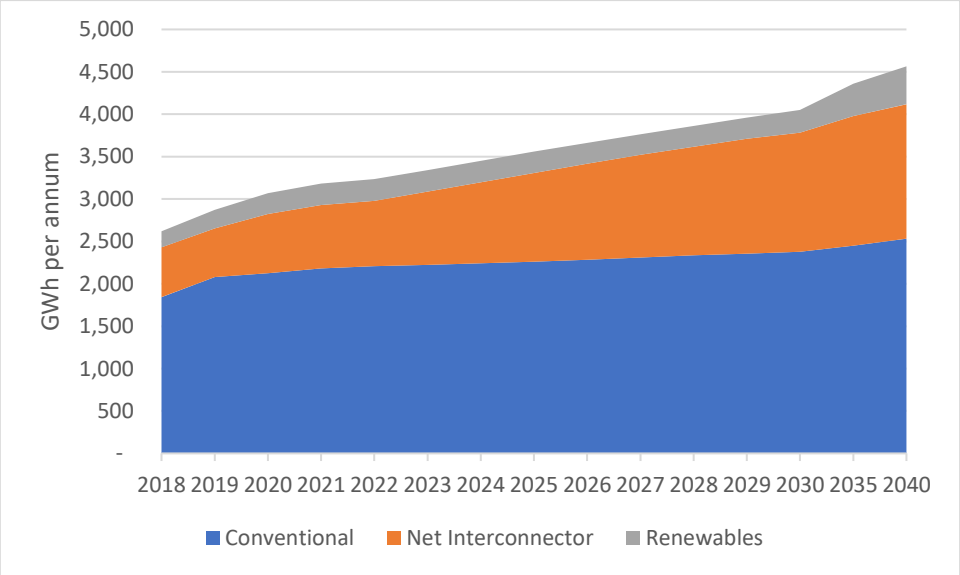
LNG is currently imported via marine carriers and held in a floating storage unit which supplies gas to the new power plant as well as the existing plant. The establishment of the LNG facility further diversified the sources of supply, as it provides access to an unlimited number of sources of LNG. Alternative third countries tapped for LNG imports in 2017 included the USA, Equatorial Guinea, Egypt and Point Fortin in Trinidad and Tobago. Foreseen potential suppliers include Algeria, Libya, the Russian Federation, Norway and Azerbaijan.

ii. Projections of development with existing PAMs at least until 2040

In the coming years, the energy mix for electricity generation shall be maintained and consolidated. Once the planned Malta-Sicily gas pipeline project is complete, natural gas will be supplied through

the European gas grid and is expected to largely replace the present LNG supply. For the short to medium term gasoil shall continue to be a secondary source of energy, used during instances of emergency by a backup power plant and four dual-fuel diesel engines. At present, there are no plans for a second interconnector[58], thus the reference scenario maintains present levels of interconnection capacity. Figure 68 outlines projected electricity generation by source until 2030, with a view to 2040, distinguishing between local generation from conventional fuels and renewable sources, and that imported through the interconnector.

Figure 68 Electricity generation by source under the reference scenario between 2018 - 2040, GWh/annum.



4.5 DIMENSION INTERNAL ENERGY MARKET

4.5.1 Electricity interconnectivity

i. Current interconnection level and main interconnectors

At the end of 2017, Malta had an interconnection level of 29%, well above the 2030 interconnection target of 15%. Import interconnection capacity amounted to 200MW, while Malta's net nominal generation capacity in 2017 was 683.7MW. Malta aligned its methodology for the calculation of the current interconnection level with the European Commission's approach as included in the country factsheets of the Third State of the Energy Union report, whereby the interconnection level is calculated as a ratio between import interconnection capacity and net generation capacity.

The details of 200MW HVAC interconnector are outlined in Table 30.

[58] This is subject to the outcomes of the in-depth study on power generation commissioned by Enemalta for the period 2019-2040.

Table 30 Malta-Sicily Electricity interconnector details.

Characteristics	Details
Starting point	Substation in Sicily – Ragusa
Landing point in Sicily	Marina di Ragusa
On-shore route (Sicily Marina di Ragusa to Ragusa)	18.992km
Off-shore route	98.735
Landing point Malta	Qalet Marku
End point Malta	Maghtab substation
On-shore route Malta	Included in the offshore route length
Average depth	110m
Voltage rating	220 kV AC
Nominal capacity	200MW
Total length of interconnector	117.727 km

ii. Projections of interconnector expansion requirements (including for the year 2030)

As indicated in the section above, Malta's electricity interconnection level is well above the 15% EU interconnection target for 2030 required by the Governance regulation. Currently, there are no plans for a second interconnector, although this is subject to the outcome of the in-depth study on power generation covering the period 2019-2040 commissioned by Enemalta.

4.5.2 Energy transmission infrastructure

i. Key characteristics of the existing transmission infrastructure for electricity and gas

As described in Section 2.4.2 related to national objectives and targets in the area of energy transmission infrastructure, in Malta there is no electricity transmission system. Details on the planned gas pipeline project are described in detail under the Energy Security dimension.

ii. Projections of network expansion requirements at least until 2040

The local distribution grid network has three voltage levels, i.e. 132kV, 33kV, and 11kV. Reinforcement of the 11kV network is a continuous process following increase in demand. The seasonal peak load on the 33kV Distribution Centres (DC's) is monitored and measured against respective DC installed transformer capacity, so that the necessary expansions (installation of additional transformers, or erection of new DC's) are affected before the N-1 threshold is reached. Reinforcement of the 33kV network is affected to sustain these DC expansions. With regards to the 132kV network, while this network presently caters for N-1 requirements, Enemalta is planning for reinforcement of the 132kV network in view of future normal demand increase as well as planned large-scale infrastructural investments which will entail a substantial stepped increase in localised demand. Enemalta is also

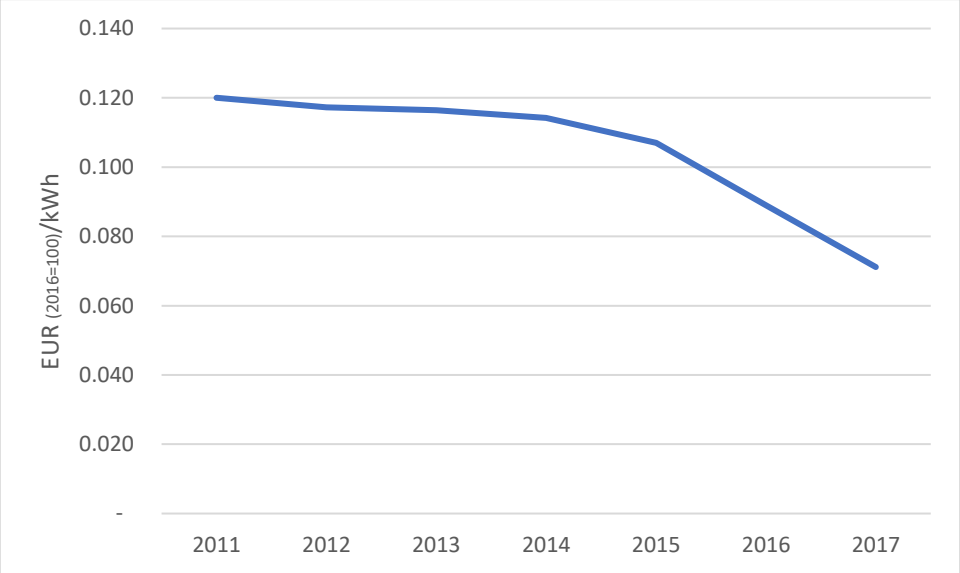
studying the reinforcement of the 132kV network required for Malta's grid to be self-sufficient in the eventuality of long-term unavailability of the Malta-Sicily Interconnector.

4.5.3 Electricity and gas markets, energy prices

i. Current situation of electricity and gas markets, including energy prices

As noted in previous sections, there are no wholesale electricity or gas markets in Malta. Enemalta performs the functions of a DSO and constitutes the sole electricity supplier to final consumers. Wholesale electricity prices are reported by REWS as the proxy for the market price[59], that is, as the average cost of meeting the demand forecast through local generation and, as of 2015, electricity imported over the interconnector excluding generation from RES. Following recent significant investments in the energy infrastructure, the proxy for the market price has followed a steady decline since 2011 (Figure 69) from €0.12/kWh in 2011 to €0.071/kWh in 2017.

Figure 69 Trends in the proxy for the market price from 2011-2017, EUR (2016)/kWh.



ii. Projections of development with existing policies and measures until at least 2040 (including for the year 2030)

The present gas hedging agreement extends until 2021. From 2022 onwards, Malta's gas (LNG) prices are expected to reflect international market prices; ultimately, this affects national electricity prices as generation costs in Malta (and to some extent Sicily) are determined by the price of natural gas. In

[59] As there is no liquid wholesale market in Malta, the proxy for the market price is used to establish a reference price for electricity generation. This is published on an annual basis under Subsidiary Legislation 545.27 entitled "Feed-in Tariffs Scheme (Electricity Generated from Solar Photovoltaic Installations) Regulations."

projecting this impact on local energy prices, the same assumptions employed by the European Commission for international gas prices were adopted. Following the completion of the Malta-Gela pipeline (planned completion date in 2024), Malta will be connected to the Trans-European Gas Network and subject to the same wholesale gas prices. The EU ETS carbon prices projected by the European Commission were incorporated into future wholesale electricity prices based on the efficiency of local generation plants.

Figure 70 illustrates the projected trends in electricity and gas prices. Malta's electricity prices, in nominal terms, will remain relatively stable until 2021 as a result of gas hedging agreements; this appears as a slight decrease in Figure 70 where values are in euro 2016 constant prices. From 2022 onwards, electricity prices will be subject to changes in international gas prices and rising EU ETS carbon prices, and are projected to increase. The increase which can be observed between 2021 and 2022 is a result of alignment of electricity prices with evolving gas prices, once the current hedging agreements expire. The effect of the growing EU ETS carbon price becomes more prominent post-2025 and 2030, when a substantial increase in carbon prices is expected (Table 31).

Based on current projections of gas and EU ETS prices, wholesale electricity costs are projected increase from €0.078/kWh in 2022 to €0.096/kWh in 2030 (euro 2016 constant).

Figure 70 Projected wholesale electricity and gas prices from 2017-2040, EUR (2016)/kWh.

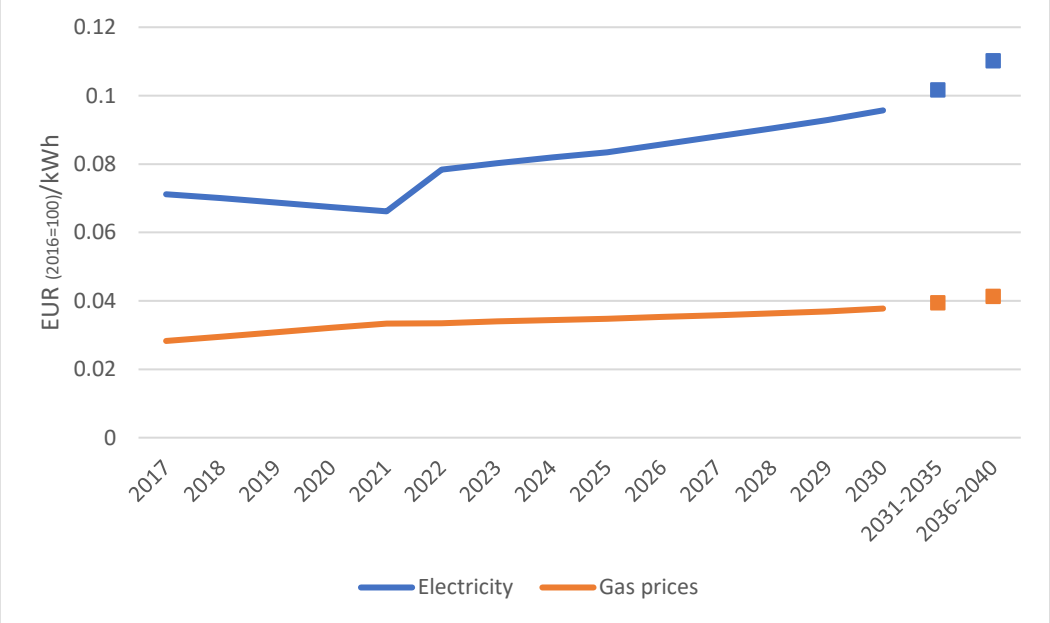


Table 31 Projected EU ETS carbon prices according to EU Reference Scenario 2016

	2015	2020	2025	2030	2035	2040
EU ETS carbon prices (€'13/ t of CO2)	7.5	15.0	22.5	33.5	42.0	50.0
EU ETS carbon prices (€'16/ t of CO2)	7.8	15.5	23.3	34.7	43.5	51.7

4.5.4 Energy poverty assessment

Malta's commitment to reduce poverty and social exclusion is manifestly reflected in the National Strategic Policy for Poverty Reduction and for Social Inclusion 2014-2024, which acknowledges that poverty is multidimensional and thus comes in many forms. To establish a better understanding of poverty, this strategic policy document sets out to present the key indicators of poverty, namely, absolute poverty and relative poverty. One way of measuring the latter is through the material deprivation rate (MDR) which is defined as the number of persons living in households who are not able to afford at least three out of nine deprivation items which include "mortgage or rent, utility bills, hire purchase instalments or other loan payments" and "keeping their home adequately warm in winter". These two parameters are also actually defined as primary indicators for energy poverty by the Energy Poverty Observatory.

For the purposes of Malta's National Energy and Climate Plan which requires an assessment of energy poverty as distinct from the overarching concept of poverty, the former is defined as "*whether a household can afford the necessary energy services to meet its basic daily living requirements*." The inability of households to keep their homes adequately warm is the indicator being used to assess the level of energy poverty in Malta.

Figure 71 Percentage of households unable to keep their home adequately warm in Malta compared to the EU average, % (Source: Eurostat).

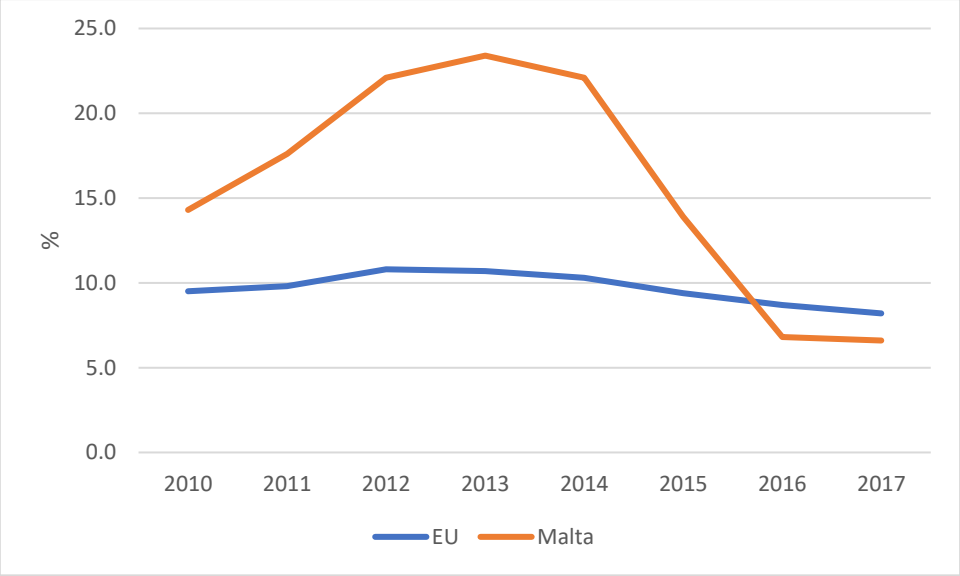


Figure 71 illustrates the great strides made in Malta in recent years with regards to the percentage of households unable to keep their homes adequately warm in winter. This has fallen from its peak of 23.4% in 2013, to 6.6% in 2017, and has been lower than the EU average for the last two consecutive years. This significant decrease is a result of of national policies and measures being implemented by the Maltese Government (outlined below) and complemented by the recent substantial reduction in energy bills following the massive investments in energy infrastructure.

- The Energy Benefit scheme administered by the Department of Social Security within the Ministry for the Family, Children's Rights and Social Solidarity, under which vulnerable households receive a direct reduction in their utility bills, besides an overall change in Malta's national energy policy which also resulted in significant reductions in electricity and water tariffs for both citizens and businesses.
- The Eco-reduction scheme under which households that consume either: (i) less than 2 000 electricity units per year in a single household; or (ii) less than 1,750 electricity units per person in a two or more-person household, receive a direct rebate on 15-25% of their electricity bills. This policy incentivises efficiency and lower consumption, while also having a positive effect on the bills of low-income households who fall within the consumption limit.
- The provision of professional advice, free-of-charge, by the Energy and Water Agency to vulnerable and low-income households on energy efficient appliances and behaviour.
- Financial schemes aimed at reducing energy and water consumption in low-income households through the replacement of old and inefficient appliances, the result of collaboration between the Energy and Water Agency and the LEAP centres within the Foundation for Social Welfare Services.
- In previous years, a number of projects were carried out to improve the energy efficiency of low-income households through financial schemes, consumer awareness and education programmes. Post-implementation monitoring of results was also carried out.

4.6 DIMENSION RESEARCH, INNOVATION AND COMPETITIVENESS

i. Current situation of the low-carbon-technologies sector and its position on the global market

R&I on low-carbon technologies within National Policy

The National Energy Policy published in 2012 designated RES as the focus of the public sector's research efforts in energy, reflecting the absence of other indigenous energy resources, as well as the current early stage of development of Malta's R&I sector. The policy directs R&I to Malta's strengths – technologies relevant for solar and marine resources. Other general actions tied to the Energy Policy relate to state financing, promotion of and participation in the EU Research Framework Programme (FP), adaptation of technologies to the local market, especially in the case of RES and the promotion of private investment in R&I in RES micro generation.

Malta's 2017 NREAP expands on this policy focus and aims to encourage R&I in the development and commercialisation of RES technology, with particular focus on solar and wave energy, including the potential exploitation of marine-based RES. The NREAP notes that the University of Malta, through the Institute for Sustainable Energy, was already investing in this line of research.

Under the National Integrated Maritime Policy, energy is identified as one of the four main maritime pillars, including a specific emphasis on renewable energy. In particular, the policy notes that the Maltese Government will continue to promote the research into the exploration of blue renewable energy opportunities and encourage further collaboration between research and academic institutions including in the implementation of pilot projects.

Funding for National Research and Innovation

FUSION Programme

FUSION[60] is managed by the Malta Council for Science and Technology (MCST) and supported through Malta Government funds, and will run until 2020. The main objectives of FUSION are to raise the level and profile of locally funded research, to ingrain R&I at the heart of the Maltese economy, to spur knowledge-driven and value-added growth and to sustain improvements in the quality of life. FUSION also provides a forum in which public and private enterprises invest in more innovative and eco-efficient products and services.

FUSION is composed of two programmes, designed to offer the necessary mentoring and financial support to researchers and industry. The Commercialisation Voucher Programme (CVP) aims to improve the development and commercialisation potential of innovative research ideas. While the programme does not contribute directly to Malta's R&I expenditure target, it seeks to ensure that the commercialisation potential of proposed innovative solutions is taken into account in the preparatory stages of the project, including the protection of potential intellectual property. The Technology Development Programme (TDP) aims to support the actual development of innovative projects proposed by public and industrial entities. TDP provides state financing in the form of grants for research, development and innovation in science and technology.

The budget of the FUSION programme is set at a minimum of €2.2 million per year from 2018-2020, with the possibility that this increases by € 400,000 per year depending on the uptake. No changes in expenditure in areas related to low-carbon technologies are expected, unless additional measures are implemented to increase interest in a specific area.

A thematic area of competitive strength included under the Smart Specialisation Strategy of Malta's 2020 R&I Strategy is resource-efficient buildings. This sector was identified with the goal of exploring innovative solutions for improved resource efficiency in new and existing buildings, including through demonstration projects and optimisation. Innovation in resource-efficient buildings would also transform the sector by increasing value-added, and hence green jobs and growth.

As of October 2018, CVP awarded projects under the Resource-Efficient Buildings Smart Specialization area have been allocated total funding worth more than €200,000. Under the TDP programme, out of four project applications in the Resource-efficient buildings area, two projects worth almost €400,000 were funded. Since 2014, an additional eight projects which included an energy conservation aspect

[60] http://mcst.gov.mt/ri-programmes/fusion/

were funded under the TDP programme. Total funds allocated for these projects amounted to €1.37 million.

Horizon 2020

Maltese authorities are involved as coordinators and/or partners in numerous Horizon 2020 projects under the areas of secure, clean and efficient energy as well as climate action, environment, resource efficiency and raw materials. The total budget of these projects amounts to €108 million, and approximately €2.67 million has been allocated to Maltese beneficiaries.

Malta also participates in the EU's Framework Programme for Research and Technological Development (FP). Malta obtained over €17 million funding from FP7 (2007 – 2013). As part of the Framework Programme, Maltese entities have been involved in projects related to the areas of environment (including climate change) and energy amounting to a total of €44 million, with Maltese beneficiaries being allocated more than €1.1 million.

Malta is represented in all the H2020 Programme Committee Meetings where research topics are lobbied by national experts so as to include relevant calls in all the H2020 Work Programmes.

Maritime Proof of Concept Award

Malta Marittima, a Government agency established in 2016, seeks to bring together industry and government stakeholders to promote the continued and enhanced development of the marine and maritime industries in Malta. Malta Marittima itself is also mandated to develop a targeted and cross-cutting research programme, aimed at realising the high growth potential of the blue economy.

In 2017, Malta Marittima, together with the University of Malta, launched the Maritime Proof of Concept. The annual €100,000 fund aims to aid and financially support researchers and entrepreneurs in moving towards commercialisation of their maritime-related technology. Among the projects awarded, the FLASC project aims to develop a hydro-pneumatic energy storage system that integrates into an offshore floating platform to reduce problems related to RES intermittency.

National Research and Innovation Projects

Malta seeks to contribute to the European SET Plan actions through the implementation of specific projects, primarily in the following areas:

- Sustain technological leadership by developing highly performant renewable technologies and their integration in the EU's energy system;
- Reduce the cost of key technologies;
- Increase the resilience, security and smartness of the energy system;
- Become competitive in the global battery sector to drive e-mobility forward; and
- Specific projects related to these actions are described in more detail hereunder.

Solar Research Lab at the Institute for Sustainable Energy (ISE)[61]

The Solar Research Lab project (ERDF 335) involved the development of a state-of-the-art Solar Research Lab at the Institute of Sustainable Energy campus in Marsaxlokk. The lab consists of research capacities which are not present in most companies, universities or research institutes across Europe. Project costs amounted to €3.25 million. The lab was designed with a primary focus of conducting highly specialized research on materials used for solar cells, including on the detection of material flaws. The lab is expected to attract interest from other companies and academic institutions conducting research in this area.

The most prominent ongoing project is the Solaqua 2 project which focuses on floating photovoltaics, a follow-up to the Solaqua project funded in 2012 which proved the viability of floating PV systems in terms of survivability and cost. The outcome of the Solaqua project was the establishment of the first prototype system launched in open sea. Solaqua 2, a one-year project funded by the TAKEOFF Seed Fund resulted in the design of a prototype through extensive modelling. The main aim of the project was to design and develop the ideal platform in terms of ruggedness and cost. Solaqua 2.1 was announced in November 2018 and intends to test the Solaqua 2 prototype in wave tanks and basins.

Other ongoing research in the Lab includes the following projects:

- *SiForce project* – aims to study the effect of defects in the silicon materials on the efficiency of solar cells.
- *MedSolar project* **–** aims to design PV panels that cater for the specificities of Maltese and Mediterranean roofs. The project will launch an application for funding for the development and testing of prototype panels.
- *TiNSEL (Transparent Nanometric Structures for Efficient PV Layers) project* **–** aims to develop efficient thin film PV cells.
- *Shallow-ground Geothermal Heat Pump for Space Heating and Cooling of Buildings project* - focuses on studying the viability of shallow geothermal energy for heating and cooling of buildings.
- '*Evaluation of the Flow Phenomena in Maltese Complex Terrain' project* – consists of an ongoing wind study using the LIDAR at the Solar Research Lab.

ISE also assumes the role of a partner in international projects such as ZEROCO2 and FLASC, the former an Interreg Europe project focusing on the promotion of near zero CO_2 emission buildings due to energy use, expected to run until March 2020.

Maximising Energy from Deep Offshore Wind Turbines (project number: KD01TSX)[62]

[61]https://investinginyourfuture.gov.mt/project/environment-climate-change-and-renewable-energy-sources/solar-research-lab-55181316

[62] https://www.um.edu.mt/knowledgetransfer/technology/offshorewindenergy

The design is an interface that takes an unpredictable and variable input from an offshore wind turbine and converts it into an output that is smooth and predictable. To date, the former constitutes a significant issue with offshore wind turbines connected to conventional electrical grids. The project seeks to make use of existing infrastructure, the floating platform and an anchoring system to maximise benefits from offshore renewable energy installations. This improves the feasibility of wind energy, with the added benefit of heat exchange using cold deep-sea water. The system can also be adapted to wave, tidal and floating PV installations. A patent application for the design has been submitted and the project is seeking commercial interest to construct and demonstrate a full-scale prototype.

Blue Ocean Energy project[63] – feasibility assessments and identification of best sites for wave energy extraction

The Blue Ocean Energy project, run by the University of Malta, was designed to provide an understanding of the sea wave conditions around Malta and estimate the wave energy resource, thus providing the baseline information to potential projects for feasibility assessments and the identification of the best sites for energy extraction. The study also delved into the most productive machine suitable for local waves and identified the challenges that are needed to be overcome by any promising technology. These challenges were addressed in the Draft Strategic Roadmap of October 2015 prepared by the Ocean Energy Forum created in 2014.

Electrical Energy and Efficiency Laboratory for the University of Malta (ERDF077)

The project's objective was to support Malta's efforts of expanding its human capital base in science, engineering and technology and contributing towards a growing and knowledge-based, competitive economy through the provision of tertiary education (undergraduate and postgraduate), as well as advanced RTDI activities in collaboration with industry and international research institutions and also promote the area of energy efficiency and renewable energy. The project seeks to garner collaborative research with industry, public authorities and other local and foreign research institutions.

ii. Current level of public and, if available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

Current Level of Public and Private Research and Innovation Spending on Low-Carbon Technologies

In 2016, total expenditure on R&I in Malta amounted to €58.7 million, or 0.58% of GDP. The private sector contributed to 62% of the total R&I expenditure, whereas the public sector, constituting of the Government and higher education, contributed a combined total of 38%.

[63] https://www.um.edu.mt/library/oar/handle/123456789/23442

In 2016, 9.7% of the total public expenditure, amounting to €2.17 million, was earmarked to projects in fields relating to Energy Union dimensions. These were identified as projects having socio-economic objectives corresponding to Energy and Environment (as defined by the Frascati Manual, 2015[64]). Private sector expenditure within this field amounted to a combined total of €1.03 million for the year 2016. Table 32 and Table 33 provide an overview of the aforementioned expenditure for the public and private sector respectively.

Table 32 Public sector R&I expenditure by relevant fields of socio-economic objective, EUR (Source: NSO).

R&I Expenditure in Euros in the Public Sector related to the Energy Union			
	2014	**2015**	**2016**
Environment	2,524,362	1,034,181	2,122,278
Energy	91,497	22,138	49,116
Total	2,615,859	1,056,319	2,171,394

Table 33 Private sector R&I expenditure by relevant fields of socio-economic objective, EUR (Source: NSO).

R&I Expenditure in Euros in the Private Sector related to the Energy Union			
	2014	**2015**	**2016**
Environment	617,338	749,643	887,671
Energy	628,683	187,360	137,500
Total	1,246,021	937,003	1,025,171

Current Number of Patents

According to Eurostat data for Patent applications to the European Patent Office (EPO), latest estimated figures for 2016 reported a total number of 6.65 registered patent applications.

Current Number of Researchers

In 2016, 1,470 researchers in Malta were engaged in R&I. The highest number of researchers were registered with the Public sector, amounting to 60%, mainly attributed to the Higher Education sector specifically. The total number of researchers between 2014 – 2016, as reported by NSO, is shown in Table 34.

Table 34 Total number of researchers between 2014-2016, (Source: Eurostat tsc00003 & NSO).

Current Number of Researchers	2014	2015	2016
Public Sector	876	897	886
Private Sector	473	515	584
Total	1,349	1,412	1,470

[64] http://www.oecd.org/publications/frascati-manual-2015-9789264239012-en.htm

Out of the total number of researchers, on average 54% were engaged in fields relating to the Energy Union dimensions (i.e Natural Sciences, Engineering and Technology and Agricultural sciences) in 2016. The trend of the 2014-2016 dataset (Table 35) shows a growing number of researchers within the relevant fields.

Table 35 Number of researchers by relevant fields of science between 2014-2016, (Source: NSO).

Total Number of Researchers Per Field of Study			
FIELD OF STUDY	**2014**	**2015**	**2016**
Natural Sciences	332	355	340
Engineering & Technology	369	367	431
Medical & Health Sciences	207	214	231
Agricultural Sciences	24	35	26
Social Sciences	257	267	281
Humanities & The Arts	151	168	161
Not Classified	9	6	0
Total of relevant fields of science	725	757	797
Total of all fields of science	1349	1412	1470

iii. Breakdown of current price elements that make up three main price components (energy, network, taxes/levies)

Electricity price elements that make up the three main price components are published by Eurostat for both households and non-household consumers. To note that until 2013, apart from a number of small renewable energy generators, electricity generation, distribution and supply were provided by a single vertically integrated operator, Enemalta plc. The regulated electricity prices reflected the overall costs incurred by these operations as well as a reasonable rate of return. The tariffs adopted a rising block structure to incentivise energy efficiency whilst ensuring that industry which have a significant consumption by virtue of their operations would remain competitive on the international market[65].

However, with the privatization of the Delimara 3 149MW plant, the construction of Delimara 4, a 205MW plant by a private operator, and the shutting down of both Marsa and the Delimara 1 power plant, almost all of the conventional power generation is now no longer operated by Enemalta. Enemalta maintains its exclusive electricity distribution and supply functions.

The network-associated price component has for the past 10 years been estimated at €0.0220 per kWh whereas the energy and supply component vary depending on the tariff band and published prices. A 5% VAT applies, which is the only significant applicable levy/tax element (Malta applies the minimum levels of taxation applicable to electricity in line with Council Directive 2003/96/EC. This

[65] The present tariff structure is available at: https://www.enemalta.com.mt/services/tariffs-billing-and-payments/

varies between 0.5 and 1.0 Euro/MWh). Table 36 lists the main price components as applicable to different tariff bands for the non-household sector.

Table 36 Main price components by tariff bands in non-household sector in 2017, EUR nominal (Source: Eurostat).

	ALL BANDS (IA-IF)	BAND 1A <20 MWh	BAND 1B 20 MWh - 499 MWh	BAND 1C 500 MWh - 1 999 MWh	BAND 1D 2 000 MWh - 19 999 MWh	BAND 1E 20 000 MWh - 69 999 MWh	BAND 1F 70 000 MWh - 149 999 MWh
Energy and Supply	0.1202	0.1738	0.1301	0.1138	0.0981	0.0795	0.0747
Network Costs	0.0220	0.0220	0.0220	0.0220	0.0220	0.0220	0.0220
VAT (taxes/levies)	0.0071	0.0098	0.0076	0.0068	0.0060	0.0051	0.0048
Total	0.1493	0.2056	0.1597	0.1426	0.1261	0.1066	0.1015

For the household sector, the average energy and supply component during 2017 stood at €0.1291/kWh whereas the network costs were estimated at €0.0220/kWh, and the taxes, fees and levies at €0.0076/kWh. It must be noted that the electricity tariff in Malta does not include any renewable taxes, capacity taxes, environmental taxes or nuclear taxes. Costs associated with security of supply are internalized whereas support for renewable energy is financed through central government budget.

iv. Description of energy subsidies, including for fossil fuels

This will be included in the final plan to be submitted in December 2019.

5 IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

This section, along with the inclusion of the outcome of the Strategic Environmental Assessment process will be integrated into Malta's Final NECP.

5.1 IMPACTS OF PLANNED PAMS DESCRIBED IN SECTION 3 ON ENERGY SYSTEM AND GHG EMISSIONS AND REMOVALS

i. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant of emissions of air pollutants in accordance with Directive 2016/2284/EU under the planned PAMs at least until ten years after the period covered by the plan

To be included in final NECP.

ii. Assessment of policy interactions at least until the last year covered by the plan

To be included in final NECP.

iii. Assessment of interactions between existing and planned national PAMs and Union climate and energy policy measures

To be included in final NECP.

5.2 MACROECONOMIC AND, TO THE EXTENT FEASIBLE, THE HEALTH, ENVIRONMENTAL, EMPLOYMENT AND EDUCATION, SKILLS AND SOCIAL IMPACTS OF THE PLANNED POLICIES AND MEASURES

To be included in final NECP.

5.3 OVERVIEW OF INVESTMENT NEEDS

i. Existing investment flows and forward investment assumptions

To be included in final NECP.

ii. Sector or market risk factors or barriers in the national or regional context

To be included in final NECP.

iii. Analysis of additional public finance support or resources to fill identified gaps identified under (ii)

To be included in final NECP.

5.4 IMPACTS OF PLANNED PAMS ON OTHER MEMBER STATES AND REGIONAL COOPERATION

i. Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

To be included in final NECP.

ii. Impacts on energy prices, utilities and energy market integration

To be included in final NECP.

iii. Where relevant, impacts on regional cooperation

To be included in final NECP.