Malta's 2030
National Energy and Climate Plan

December 2019

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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
ESD	Effort Sharing Decision
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
GDP	Gross domestic product
GHG	Greenhouse Gas
GJ	Giga Joule
GVA	Gross value added
GWh	Gigawatt hour
H&C	Heating and cooling
HPWH	Heat pump water heater
HVAC	High Voltage Alternating Current
HVO	Hydrotreated vegetable oil
ICE	Internal Combustion Engines
IMSC	Inter-Ministerial Steering Committee
IPPU	Industrial processes and product use
ktoe	kilotonnes of oil equivalent
kWh	Kilowatt hour
kWp	Kilowatt peak
LN	Legal Notice
LNG	Liquified Natural Gas
LULUCF	Land Use, Land use change and Forestry
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
MTGP	Melita TransGas Pipeline
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
SL	Subsidiary Legislation
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
WEM	'With Existing Measures' scenario
WPM	'With Planned Measures' scenario

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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 National Energy and Climate Plan (NECP) is presented at a time when globally, energy and climate issues are at the forefront of political and societal debate and the implications of climate change are ever so perceptible. At European level there is a clear drive towards climate neutrality by 2050. The new European Commission acknowledges that although Europe is currently on track to meet its 2030 emission reduction targets and goals enshrined in the Paris Agreement, reaching climate neutrality by 2050 will require more ambitious contributions of all sectors. In view of this increased ambition, the Commission is expected to present a proposal for the European Green deal which will include even more ambitious proposals in the area of Energy and Climate Change.

The Governance Regulation[1], which sets out the framework for the NECP, aims to ensure the achievement of the Union's 2030 long-term objectives and targets in line with the Union's international commitments under the Paris Agreement. A bottom-up approach is adopted, whereby Member States present their fair and ambitious efforts and contributions towards a decarbonised energy system and towards mitigating climate change. Whilst the Governance Regulation sets the basis for the development of this plan, this is complimented by a package of new EU legislation targeting energy efficiency, renewable energy, energy security and market design, appropriately referred to as the "Clean Energy for all Europeans Package".

Malta's National Energy and Climate Plan follows the scope of the Energy Union and covers its five dimensions: decarbonisation, energy efficiency, energy security, internal energy market, and research, innovation and competitiveness. The five dimensions are considered as being closely related and mutually reinforcing and are correspondingly treated as such within the plan. The underlying requirement of the plan's integrated and holistic nature was fully considered during the development of the NECP. In line with the iterative process outlined in the Governance Regulation, Malta's Draft NECP was submitted to the European Commission in December 2018 and updated during the course of 2019 whilst taking due account of the Recommendation[2] published by the European Commission on Malta's Draft NECP.

Malta's NECP follows the structure required by Annex I of the Governance Regulation. The Plan sets out Malta's national objectives and contributions for 2030 in the respective dimensions in Section 2 of the Plan and contains a description of the policies and measures that need to be implemented in order to reach these objectives in Section 3. 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. Projections under the 'With Existing Measures (WEM)' scenario are presented within Section 4, while the expected projected

[1] Regulation (EU) 2018/1999 of the European Parlaiment and of the Council on the Governance of the Energy Union and Climate Action.
[2] Commission recommendation of 18.6.2019. SWD(2019)268. Available online: https://ec.europa.eu/energy/sites/ener/files/documents/mt_rec_en.pdf

development of Malta's energy system and emissions under a 'With Planned Measures (WPM)' scenario are presented under the Impact Assessment section in 5.1. The impact assessment, which forms part of the analytical basis, further provides an overview of the impacts of the 'WPM' scenario on macroeconomic, health, employment, social and skills, and including an overview of the expected investment needs. Malta's NECP presents two main scenarios: a 'With Existing Measures' scenario and a 'With Planned Measures' scenario. While the former provides a snapshot of the current situation in Malta with implemented and adopted measures as of end of 2017 (with no impact post 2020), the latter scenario also consists of planned policies and measures which were adopted and implemented post-2017and portrays Malta's projected achievement once these measures are implemented.

The NECP serves as a strategic planning framework and policy document that will guide Malta's contribution to achieving the Energy Union's 2030 objectives and targets, whilst identifying those measures necessary for their achievement during 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. Whilst the Ministry responsible for finance and budget has been actively involved in the development of this plan, all financial estimates included in Malta's National Energy and Climate Plan are subject to review and endorsement on annual basis 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 significant net inwards migration.

The NECP provides a clear path for Malta to attain the overarching objectives of a sustainable, affordable and secure energy system which needs to follow a decarbonisation trajectory, whilst recognising the inherent challenges and opportunities brought about by national specificities such as spatial constraints, high population density, and a mild Mediterranean climate. This calls for specific solutions in each of the five dimensions, which may also depend on further technological and cost developments.

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

Malta's strategy under the Decarbonisation dimension strives to promote 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 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, a task which is progressively becoming ever more daunting given the growth in final energy consumption. Malta will extend its current support framework for RES to the period until 2030 and

launch new initiatives tailored to local specificities to ensure that technically and economically viable indigenous sources of renewable energy may be exploited.

Temperate climatic conditions and lack of energy-intensive industries mean that Malta has the second lowest final energy consumption per capita across all EU Member States. Nevertheless, 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 and number of suppliers and market players 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 cost efficient energy savings in the relative sectors whilst taking into account the effective potential. Malta will strive to continue decreasing the overall energy intensity of its economy and uphold its obligations under the Energy Efficiency Directive[3].

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 and suppliers and reduce energy import dependency primarily through the deployment of indigenous RES. Periodic contingency planning in the case of supply disruption for electricity, gas and oil sectors will be ensured, while energy security is also tackled within the context of the long-term objective of decarbonising the energy system, which will pose new challenges for Malta and thus will require new solutions. Malta considers the Gas Pipeline project with Italy as an important element to secure its energy supply and tap future opportunities such as the supply of biogas blended with natural gas and possibly also Hydrogen.

Malta's electricity grid is linked to the European grid via the 200MW Malta-Italy subsea interconnector, which ensures that Malta's interconnectivity shall remain well above the EU-wide target of 15%[4] throughout the whole projected period. 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[5] 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 duly protected.

Malta will endeavour to boost research, innovation and competitiveness, and a national R&I strategy driven by the smart specialization process is expected to be finalized by 2020. In order to foster research & innovation specifically in the area of energy and low-carbon technologies, it was determined that a sector-specific strategy for R&I in energy (and water) will be developed to fully take advantage of the value-added of such targeted investment. The National Strategy for Research and Innovation in Energy and Water (2021-2030) is expected to be finalized by Q1 2020. The Strategy's

[3] Directive (EU) 2018/2002 of the European Parliament and of the Council amending Directive 2012/27/EU on energy efficiency.

4 Calculated as electricity interconnection capacity (i.e capacity of the electricity interconnector with Italy) over the net installed capacity in Malta.

[5] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU

main aim is to contribute to Malta's transition to a low-impact and decarbonised economy in an effective, just and timely manner; strengthen competitiveness, growth and commercial attractiveness; and increase the level of domestic support for R&I in Malta.

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); Contributing to the EU -40% GHG emission reduction target; Fulfilling obligations of the Paris Agreement;	Management of Farm Slurries in the Maltese Islands; Waste Management Plan 2020-2030; Development of Waste-to-Energy Facility; Sustainable mobility measures;
	Renewable Energy	11.5% share of Renewable energy in gross final energy consumption in 2030; 14% RES share in the transport sector in line with Renewable Energy Directive;	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. - Financial support schemes for Solar PV; - Schemes to support solar water heaters and heat pump water heaters; - Biofuels substitution obligation;
Energy Efficiency		Energy intensity of 0.07 toe/thousand €$_{2005}$ in 2030. Reaching energy savings obligations under Article 7 of the Energy Efficiency Directive.	Energy savings obligations and incentives for all energy end-use sectors, through measures such as: - Electricity tariffs supporting energy efficiency; - Support schemes for services and industry; - Government leading by example; - Projects in primary water network and wastewater treatment plants

Energy Security	Continued diversification of energy sources and suppliers; Reduction of import dependency through the deployment of indigenous sources of RES, taking into account the specificities of Malta's energy system; Periodic contingency planning in the case of supply disruption for electricity, gas and oil sectors; Energy Security in the context of the long-term objective of decarbonization of the energy system and increased deployment of RES;	Delivery of gas pipeline ("MTGP") project; Critical infrastructure protection and cyber-security in the energy sector; Contingency planning (Gas Security of Supply, Risk Preparedness in the electricity sector, Oil Supply Disruption, Emergency stock holding obligations); Energy storage solutions and demand management
Internal energy market	Ensure competitive electricity prices for households, commercial and industrial sectors; Maintain the level of electricity interconnectivity well above the EU 15% target during the projected period until 2030;	Measures targeting an increase in the flexibility of the energy system and the protection of energy consumers. Delivery of gas pipeline ("MTGP") project;
Research & Innovation and competitiveness	Development of National Strategy for Research & Innovation in Energy and Water (2021-2030), which would: - Strengthen and support R&I that addresses national policy priorities and challenges and/or bolsters national competitiveness and growth in a variety of sectors; - Increase coordination and cooperation between the wide array of stakeholders in fields of energy and water;	Delivery of objectives of the National Strategy for R&I in Energy & Water, which may include[6]: - Establishment of Platform RINEW; - Enhanced financing of R&I projects within the priority areas identified; - Increased public-private partnerships in energy R&I; - Systematic collection of data for evidence-based evaluation;

[6] Subject to changes and updates following the public consultation on the Draft R&I Strategy expected to be finalized in January 2020.

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. Government's energy policy focuses on 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 underlying objectives guiding Malta's energy policy decisions in the last decade include:

- 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 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 the short term with a view to replace this option by a permanent multi-purpose gas pipeline with Sicily. 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 have resulted 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[7] over the

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

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, solar water heaters and heat pump water heaters (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 support the exploitation of viable indigenous sources of renewable energy.

Malta does not have a natural gas network (LNG is only made available to the power plant), although uses of natural gas in niche applications may start to develop if the Malta-Italy gas pipeline is pursued.

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.

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.

Other supporting documents amplify aspects of these policy frameworks and include measures designed to implement the various policies. The policies and measures described in the above-mentioned policy documents feature in the 'With Existing Measures' scenario.

National Energy Policy (2012)

The major policy areas and objectives 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 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 through 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 objective was to establish an electricity and gas interconnection with the European grids to provide the basis for integration with the EU internal energy market. 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 and protect 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 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 originally planned.

The National Renewable Energy Action Plan (2017)[8]

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.

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

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

- **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.

- **Well managed deployment of RES**: 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.

- **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)[9]

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 incentivize 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.

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

- **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)[10]

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 towards a better appreciation of our individual responsibility towards climate protection. 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 efficiency 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.
- **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)[11]

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 adaptation measures to reduce local greenhouse gas emissions. It identifies a number of key areas with potential for carbon emissions reduction 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:

[10]https://msdec.gov.mt/en/Document%20Repository/Malta%20Climate%20Change%20Adaptation%20Strategy/National%20Climate%20Change%20MITIGATION%20Strategy.pdf
[11] https://meae.gov.mt/en/Public_Consultations/MSDEC/Documents/MSDEC%20LCDS%20Vision.PDF

- 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), the '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 whilst its specified the maximum allowable glazing to wall ratio or the building services efficiency, no energy thresholds were included. 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. This policy document establishes targets for new nearly zero energy buildings, both for residential and other buildings, and examines possible barriers.

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*[12], 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.

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

iii. Key issues of cross-border relevance

Issues of cross-border relevance for Malta have to be viewed within the context of an island with no land borders and with effectively one neighbouring Member State. This has direct implications on Malta's energy system which is reflected in this plan, in particular under the Energy Security and Internal Energy Market dimensions.

Therefore, 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 and balancing.

The planned gas pipeline interconnection between Malta and Gela (Sicily, Italy) has reached the permitting stage and technical, financial and environmental studies are underway. The pipeline is scheduled for completion in 2025 provided it secures the necessary financing.

Cross-border cooperation in areas falling under the other dimensions, such as joint projects in renewables, cooperation and sharing of best-practices on measures targeting energy efficiency and possible joint projects in the area of research & innovation in low-carbon technologies are also considered.

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 was established to ensure that all national stakeholders contribute effectively towards the National Plan, as the development of the Plan required the coordination and contribution 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 providing relevant quantitative assessments and 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. The IMSC met another five times during 2019 in order to ensure the timely development and completion of the remaining sections required for the submission of Malta's Final Plan and to address issues such as the outcomes from the public consultation process and recommendations published by the European Commission on Malta's Draft Plan. There is a possibility that the IMSC structure or a similar one 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 Regulation falls primarily within the remit of the Directorate-General for Energy, the Ministry for Energy and Water Management is the lead 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 as key stakeholders responsible for the implementation of specific sections of national energy and climate policies falling and are also represented on the IMSC.

v. Technical assistance on the NECP

During the development of the Malta's Draft and Final Plans, Malta has benefitted from the use of technical support programmes provided by European Commission services. Malta participated in a European Commission's project in which Member States were provided assistance in developing national greenhouse gas projections[13]. The results and recommendations of this project fed into another Commission project through which technical assistance was provided to six Member States in their development of the Plan[14]. The scope of this project from DG CLIMA and DG ENERGY was to provide support to Member States in preparing aspects covering climate-related data gaps. Technical assistance was being provided in relation to expert peer-review of the models available at the Malta Resources Authority for the elaboration of projections of GHG emissions by sources and removals by sinks for the sectors Industrial Processes and Product Use (IPPU), Agriculture, Land Use, land-use Change and Forestry (LULUCF), and Waste.

Malta also benefitted from technical assistance through the Commission's Structural Reform Support Service (SRSS) contract. As part of the SRSS, the Ministry for Energy and Water Management benefited from the services of experts for a period of 12 months, who assisted with the development of energy models. The Ministry for Environment[15], Sustainable Development and Climate Change applied for Advisory Service concerning the Agricultural Sector.

Technical assistance was provided by E4SMA who focused primarily on the review of the analytical basis of Malta's NECP, supporting updating of the NECP modelling framework, development of the Impact Assessment section, as well as on the preparation of terms of reference for the Strategic Environmental Assessment. Support was provided on running the updated and enhanced modelling framework, in particular to conduct a scenario and sensitivity analysis. In relation to the Impact

[13] Service request No. 2016/03 under framework contract CLIMA.001/FRA/2015/0014
[14] CLIMA/C.2/SER/2017/0002
[15] "*Technical support for the development of the integrated NECP of Malta*" (SRSS/C2018/035)

Assessment, support was provided primarily on section 5.2 (macroeconomic, social, health impacts) and 5.3 (overview of investment needs).

The SRSS project "Technical support on the emission framework for the agriculture sector in Malta", the beneficiary of which was the Ministry for Environment, Sustainable Development, and Climate Change reviewed the existing and potentially new data providers to establish the most appropriate data streams on improving the agriculture inventory.

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 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 Draft NECP subsequently endorsed, in time for the Draft Plan's submission to the European Commission by the end of 2018.

Malta's Final NECP was approved by the Cabinet of Ministers on 3 December 2019, prior to its formal submission to the Commission in December 2019 in line with the requirements of the Governance Regulation.

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 were invited to provide feedback on Malta's NECP as part of the formal online public consultation process which took place at the beginning of 2019. This is further detailed in the section below.

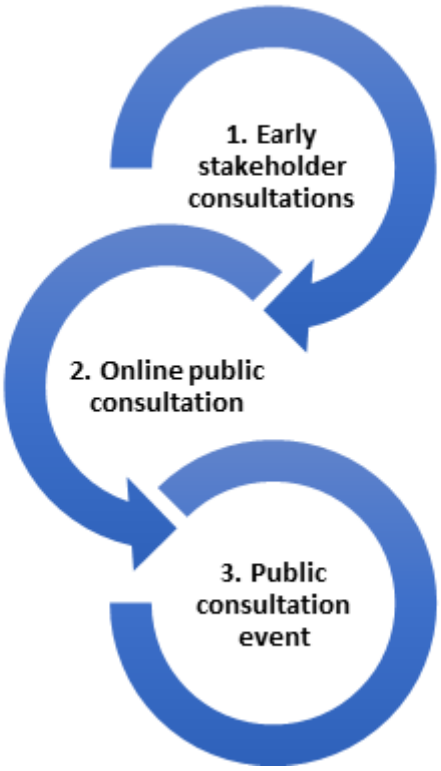
iii. Consultations with stakeholders, social partners, and engagement of civil society and the general public

The involvement of local authorities, social partners, civil society organisations, the business community, industry and other stakeholders as well as the general public is considered key under the Regulation on the Governance of the Energy Union. 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. The process of stakeholder engagement kicked-off early on in the preparatory stages of the draft NECP. The public consultation process was then carried out at the beginning of 2019 and is therefore fully reflected in Malta's Final NECP.

Stakeholder involvement and public consultations for Malta's NECP was carried out in three main stages:

- **Early stakeholder consultations** (during the drafting stage); and
- **Online public consultation** (after finalization of Draft NECP).
- **Public consultation session on Malta's Draft NECP**

Figure 1 - Public consultation process on the 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 and provide their views 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 NECP adopts a bottom-up approach and provides each Member State the opportunity to come up with ambitious, but realistic, national contributions to the Union's collective 2030 targets.

Individual meetings were held with the following entities which were considered as key stakeholders with respect 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 Arts, Science and Technology (MCAST)
- 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

In order to comply with Article 10 of the Governance Regulation, the second stage of the public consultation process for Malta's NECP was conducted in 2019 and taken into consideration in the Final version of the NECP.

The public consultation process was conducted early in 2019. The process followed the already established national procedure for online public consultations.[16] Using a platform administered by the Ministry for European Affairs and Equality, the general public, civil society organisations, trade unions, business organizations, government institutions and the general public are given the opportunity to participate in the online public consultation process. A notice of the consultation period was posted on the website of the Energy & Water Agency, the national entity leading the NECP process, on the Government's public consultation portal operated by the Ministry for European Affairs and Equality, as well as on the MEUSAC website (Malta-EU Steering and Action Committee). Publicity was given due consideration and open consultation notice advertisements were also posted in the major newspaper outlets.

Online public consultation took place during March and April 2019. Written feedback was received via the platform from 13 organisations and/or public citizens. The comments received through the online platform were subsequently analysed and discussed during subsequent meetings of the Inter-Ministerial Steering Committee. Each entity represented on the IMSC was requested to take due account of the comments received falling under its remit and requested to provide feedback on how these comments would be addressed in Malta's Final NECP.

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

Public consultation event on the Draft NECP (April 2019)

MEUSAC, together with the Ministry for Energy and Water Management (MEW) and the Ministry for the Environment, Sustainable Development and Climate Change (MESDC) organized a consultation session on the Draft NECP on 4 April 2019. The scope of the consultation session was for stakeholders to provide their views and feedback on the Plan in person. The event was initiated by the chairman of the IMSC tasked with the coordination of the development of the NECP who introduced the topic. All Ministries represented on the IMSC were present for the consultation session. The Energy & Water Agency then provided a presentation highlighting the legislative background, the process for the development of the Draft Plan as well as the main contents and objectives of the plan in the five respective dimensions of the Energy Union. Following the presentation, a discussion ensued and the floor was opened to all attendees for comments, questions and suggestions. The outcome of the public consultation event and the comments received were then also discussed post the event at IMSC level in conjunction with other written feedback received through the online public consultation process.

Other consultation processes

Apart from the general public consultation on the NECP, a separate public and stakeholder consultation was conducted within the processes of the Strategic Environmental Assessment (SEA) on the NECP and the Research & Innovation Strategy for Energy and Water being developed by the Energy & Water Agency.

Stakeholders were consulted throughout the process of the SEA in order to ensure their effective participation. All relevant parties were given the opportunity to provide their opinions on the environmental impacts of the measures proposed in the draft NECP. In order to conform with the national SEA regulation (S.L. 549.61) a statement of adoption and an outline of monitoring measures will be made public. The statement of adoption will include a summary of how environmental considerations have been integrated into the NECP, as well as how the environmental report and the results of the consultations have been taken into account. The statement will also include monitoring measures. It must be pointed out that the timeframes for the development and finalization of the SEA do not align with those of the NECP. At the time of finalization of the drafting of Malta's Final NECP, the SEA process was at scoping stage. It is expected that the SEA will be concluded during the course of 2020 and any major recommendations integrated in future NECP updates.

Additionally, the Energy & Water Agency is developing an R&I strategy for energy and water covering the period 2021-2030. The development of the strategy included a separate set of stakeholder consultations focused primarily on research institutes, academia, the national authority responsible for research & innovation and other stakeholders. This stakeholder consultation was concluded in October 2019 and will be reflected in more detail in the National R&I Strategy for Energy & Water which will be published in the course of 2020.

Summary of the Public's Views

Malta's Draft NECP, which was put up for stakeholder and public consultation received its fair share of comments, questions and requests for clarifications. As part of the online public consultation process, 13 organisations and/or citizens provided written feedback. The feedback received originated from the general public, the industry, academia, NGOs as well as national authorities and touched

upon various subjects linked to all five Energy Union dimensions and issues pertaining to the specificities of Malta. The section hereunder provides a summary of the views of various stakeholders and the general public on Malta's NECP. A more detailed description of the feedback received during the public consultation phase, as well as specific comments from the Ministries and entities responsible for the development of the NECP can be found in Annex I.

The public provided a number of **general and cross-sectoral comments**, for example that the NECP did not sufficiently build on top of previous and existing plans and strategies. The NECP is a holistic and integrated plan, which streamlines previous reporting obligations in the fields of energy and climate into one and introduces new reporting obligations in dimensions, such as the internal energy market, energy security and research & innovation and competitiveness. Comments addressing the lack of involvement of NGOs during the preparation of the Draft Plan had also been received.

In the area of **climate and GHG emission and reductions**, the public posed queries regarding Malta's level of progress towards its ESR target of -19% for 2030, as well as the Government's future intentions regarding the purchasing of allowances to meet this target. The Government was urged to address mitigation and adaptation to climate change in the plan and acknowledge the negative effects of climate change in Malta on the environment, health as well as on energy demand. The question of Malta not attaining it's ESR target and the purchasing of allowances to cover this gap was also discussed during the public consultation process. Some of the comments received raised the need for the application of the 'polluter-pays principle' to the services sector, which after transport, is the second highest consumer of energy.

Multiple comments, questions and suggestions were received in the area of **renewable energy**. The general public posed queries in relation to Malta's RES contribution and urged the setting of progressive targets for Malta in the area of renewable energy. Other questions were related to the absence of alternative sources of RES, such as wind, off-shore wind or solar PV in Malta's energy mix for the next decade. Malta's RES contribution reflects the Government's continued efforts to fully exploit indigenous RES sources within the present technical and geophysical limitations. The relevant circumstances affecting renewable energy deployment are described in section 2.1.2 of the NECP. The issue of joint RES projects and statistical transfers to attain Malta's RES target, as well as community incentives in the area of RES and communal solar PV farms were also topics discussed as part of the public consultation process.

In the area of **energy efficiency** some of the feedback received pointed out that Malta's Draft NECP lacks a serious approach in addressing energy efficiency on the demand side as well as the lack of effective incentives for energy savings or to curb energy consumption in the future. Concerns were raised that energy efficiency measures in the commercial sector are not sufficiently addressed and that the Draft Plan missed the opportunity for mobilizing new local markets to invest and propel energy efficiency. Feedback received pointed out that energy efficiency measures in the commercial sector are not sufficiently addressed.

The entities and citizens involved in the public consultation process also raised several issues with respect to the area of **buildings**, in particular that the area of energy performance of buildings is lightly considered in the Draft NECP. Several suggestions were highlighted, such as possible incentives to promote green rooftops, more stringent enforcement of energy efficiency measures in new buildings, as well as the integration of renewables in new and refurbished buildings in conjunction with the

allocation of more space on residential rooftops for the installation of solar water heaters. Some feedback touched upon how NZEB obligations beyond 2020 would be addressed in Malta's NECP while other queries were received in relation to Malta's Long-term Renovation Strategy, which is seen by the public as an opportunity to make the building sector more energy-positive. Increasing the financial attractiveness of the integration of RES in buildings from a developers' point of view was also discussed.

Some feedback was also received on the **internal energy market** and **security of supply** dimensions. Awareness was raised with regards to what was perceived as high security, high ecological, high technological and high governance risks associated to the gas pipeline project. Other citizens and entities raised queries with respect to future plans for a gas distribution network to serve domestic users after the commissioning of the pipeline. The importance of utility battery storage systems for security of supply reasons was also raised during the public consultation process, while other comments and queries received in this area were related to the energy poverty assessment, the necessity to put low-income households at the centre when designing policy, and the functionalities of installed smart meters with respect to providing useful energy consumption information to the consumer.

A relatively large number of comments were received in the area of **transport**, which plays an important role with respect to Malta reaching its targets in the areas of reducing GHG emissions, energy efficiency as well as renewable energy. Specific comments from participants in the public consultation process addressed the lack of alternative options for public transportation, showed support for a mass-transit system and asked about incentivizing and disincentivizing measures with respect to electric vehicles and ICE vehicles, respectively. Some comments pointed out the necessity to promote modal shift and reduce the population's reliance on passenger cars while others stressed the need to encourage the construction of additional walk-lanes and bicycle lanes in Malta. Additional queries were raised with respect to second-hand imports of vehicles, which do not contribute to either an increase in average vehicle efficiency or a reduction in fleet age.

iv. Consultations with other Member States

Malta fully appreciates the benefits which may reaped through engagement in regional cooperation and has consulted with relevant neighbouring Member States during the development of the NECP in line with Article 12(2) of the Governance Regulation. Due to Malta's geographical position at the edge of the European Union, but connected to the European electricity grid through Italy and in the process of strengthening this interconnection by the development of a gas pipeline between Malta and Sicily, the regional consultation process focused on discussions with Italy.

As part of the regional consultation process, a bilateral meeting was held on 11 September 2019 between key representatives from both Member States. During the meeting a number of different topics relevant to both Member States were discussed, including the possibility of finding common approaches towards similar challenges to meet 2030 EU targets, and how the two sides could cooperate more closely on a technical level. Given Malta's connection to the grid through Italy, a discussion on the expected developments of the electricity market in Italy and in particular in Sicily, as well progress on the Malta-Sicily gas pipeline project were also held.

v. Iterative process with the European Commission

Discussions for the preparation and coordination of Member States' Draft and Final NECPs were held within the framework of the Commission's Technical Working Group on NECPs with regular meetings being held to discuss best-practices and information relevant for the development of the Plan.

In line with the Governance Regulation, on 18 June 2019 the European Commission published an EU-wide assessment of Member States' Draft NECPs and issued Member State-specific recommendations, as well as accompanying documents with more detailed information on the Commission's assessment. The ten recommendations received by Malta focus primarily on additional domestic measures to achieve the ESR target, increasing the national ambition in the area of renewables, increasing ambition towards reaching energy efficiency targets and completing missing sections of the Plan, such as the Impact Assessment and the R&I dimension. The Recommendations issued to Malta also suggest providing more information on energy subsidies, analysing interactions with air quality policy, as well as making improvements to the overall detail of objectives and policies and measures included in the Plan. In line with Article 34 of the Governance Regulation, Member States have to indicate in the Final Plan how it has taken due account of the recommendation or otherwise provide a justification. The below table includes the list of recommendations and whether they have been addressed or otherwise.

Table 1 - Recommendations on Draft NECP issued to Malta and corresponding justifications

Recommendation[17]	**Section in which Recommendation has been addressed/ Justification in case this has not been addressed**
1. Plan additional domestic measures, in particular in the building and transport sectors, and quantify their expected impacts, in order to reduce the significant gap to its 2030 greenhouse gas target for sectors not covered by the EU emissions trading system of -19% compared to 2005. For reasons of cost-effectiveness some transfers of annual emission allocation from other Member States, as provided for by Regulation (EU) 2018/842 of the European Parliament and Council, could be justified.	Malta is bound to reduce its GHG emissions by 19% below its 2005 levels. Malta's limited mitigation potential, arising from our service-based economy have resultant high mitigation costs coupled with significant socio-economic considerations. Diseconomies of scale also hinder resorting to alternative technologies. These challenges have led us to seek the most flexible options available in line with the provisions under the Effort Sharing Regulation, given the limited geographical area, which restricts options for enhancement of land-based carbon sinks. Nonetheless, the NECP is a live document, which shall be updated with additional, new decarbonisation domestic polices, and measures which Government would decide to embark on, even following the finalisation of its national long-term decarbonisation strategy.

[17] Commission recommendation of 18.6.2019. SWD(2019)268. Available online: https://ec.europa.eu/energy/sites/ener/files/documents/mt_rec_en.pdf

2. Significantly increase the level of ambition for 2030 to a renewable energy share of at least 21 % as Malta's contribution to the Union's 2030 target for renewable energy, as indicated by the formula in Annex II under Regulation (EU) 2018/1999 and after due consideration of relevant circumstances and national constraints. Include an indicative trajectory in the final integrated national energy and climate plan that reaches all the reference points pursuant to Article 4(a)(2) of Regulation (EU) 2018/1999 in accordance with that share, in view of the need to increase the level of efforts for reaching this target collectively. Put forward detailed and quantified policies and measures that are in line with the obligations laid down in Directive 2018/2001 of the European Parliament and Council[9], to enable a timely and cost-effective achievement of this contribution. Increase the level of ambition in the heating and cooling sector to meet the indicative target included in Article 23 of Directive (EU) 2018/2001. Provide more detailed measures to meet the transport target in Article 25 of Directive (EU) 2018/2001. Provide more details on the enabling frameworks for renewable self-consumption and renewable energy communities, in line with Articles 21 and 22 of Directive (EU) 2018/2001.	The government's policy remains to support the deployment of effective indigenous renewable energy sources and cooperate at regional level where this can lead to benefits to all parties. This overarching policy will be pursued until 2030 with new initiatives launched and tailored to local specificities. Malta's relevant circumstances and national constraints affecting the deployment of renewable energy sources and hence Malta's contribution towards the Union's 2030 target, are described in Section 2.1.2. The indicative RES trajectory, including the three reference points in 2022, 2025 and 2027 are included in section 2.1.2 of the Plan. Additionally, detailed and quantified policies and measures are described in Section 3.1.2. In line with Article 23 of Directive (EU) 2018/2001, Malta shall endeavour to increase its share of renewable energy in the heating and cooling sector, as outlined in Section 2.2 v . For the scope of meeting the requirements of Article 25 of Directive (EU) 2018/2001, Malta intends to consider biofuels from feedstocks listed in Annex IX of the Directive as twice their energy content. Details on the enabling frameworks for renewable self-consumption is provided in Section 3.1.2.v of the Plan. The Government will continue to promote renewable self-consumption of electricity from Solar PV systems and ensure that no discriminatory charges apply. In view of the structure of Malta's electricity system, it is not foreseen that renewable energy communities will develop.
3. Substantially increase the ambition towards reducing final and primary energy consumption in 2030 in view of the need to increase the level of efforts to reach the Union's 2030 energy efficiency target. Propose more ambitious policies and measures that would deliver additional energy savings by 2030. Concrete additional	National circumstances affecting primary and final energy consumption and other barriers impede a more ambitious contribution to the Union's energy efficiency target. Steep increase in population and GDP, corresponding growing demand in the housing market, and the year on year growth in tourist arrivals, have made it

energy efficiency measures particularly in the building and transport sectors are needed in order to meet to be proposed for the 2021-2030 period.	difficult to restrain an increase in energy consumption. These national circumstances and barriers are described in more detail in Section 2.2 of the NECP. Policies and measures expected to deliver energy savings by 2030 are outlined in Section 3.2.
4. Specify the measures supporting the energy security objectives on diversification and reduction of energy dependency, including measures ensuring flexibility and possibly the increased role of demand response in the electricity sector.	The Energy Security and Internal Energy Market dimensions in Section 3 have been complemented with further details on measures supporting diversification, reducing energy dependency, contingency planning in the area of security of supply as well as measures intended to increase the flexibility of the energy system. Preventive and emergency measures under the Gas Security of Supply Regulations have also been outlined.
5. Further elaborate national objectives and funding targets in research, innovation and competitiveness, specifically related to the Energy Union, to be achieved between now and 2030, so that they are readily measurable and fit for purpose to support the implementation of targets in the other dimensions of the integrated national energy and climate plan. Underpin such objectives with specific and adequate policies and measures, including those to be developed in cooperation with other Member States, such as the Strategic Energy Technology Plan.	Malta is in the process of developing a Research & Innovation Strategy in the areas of energy and water management for 2021-2030. This strategy will identify key thematic areas for R&I over the coming decade, reflecting national policies and objectives for the energy and water sectors. This strategy will form the basis of the fifth dimension of Malta's NECP. National objectives related to R&I in energy are specified in Section 2.5, while policies and measures to reach these targets are highlighted in Section 3.5 of the Plan.
6. Further improve the level of detail of the objectives and policies and measures of the final integrated national energy and climate plan notably to set clear, measureable and forward-looking objectives for the internal market dimension and research, innovation and competitiveness dimensions; and illustrate to what extent the envisaged plans of petroleum exploration are in line with longer-term decarbonisation goals.	As outlined above, the level of detail of objectives and policies and measures in the dimension of **research & innovation and competitiveness** was strengthened by the development and inclusion of aspects of the National Strategy for R&I in Energy and Water for 2021 – 2030 in the NECP. National objectives for Malta in the **internal energy market dimension** reflect the specific nature of Malta's energy and electricity system, such as its size, having a sole supplier of electricity and the absence of a liquid wholesale market or electricity transmission system. The electricity interconnection level is expected to remain well above the Union 15% target throughout the whole projection period, reaching 24% in 2030.

	Objectives for transmission infrastructure and market integration are therefore confined by these realities. Nevertheless, objectives, policies and measures are described within the relevant dimension of the Plan. An ongoing Electricity Supply Study will provide more details on future energy system solutions. Apart from the increasing deployment of renewable energy sources, Malta has no indigenous energy sources that would provide a secure energy supply and is therefore dependent on imported fuels and electricity over the interconnector to meet its energy demand. Although the Government will continue to promote petroleum exploration opportunities, these should not be considered in contradiction to the long-term decarbonisation goals of the EU and its Member States, which stand at the forefront of the National Energy and Climate Plans.
7. Complement the mainly qualitative references to some of the projected investment needs, expenditures and funding sources, with further quantification in order to obtain a comprehensive assessment of overall investment needs to achieve the objectives, as well as information on the national and Union financial sources to be mobilised.	Section 5 (Impact Assessment) was not completed in time for the submission of Malta's Draft NECP. The Impact Assessment, including section 5.3 on an overview of investment needs and expenditures was conducted during the course of the preparation of Malta's Final NECP in 2019 and therefore features in the Final NECP. Section 5.3 includes an overview of the projected costs borne by the Government until 2030 as well as the expected costs borne by the citizens as a result of the implementation of Malta's planned Policies and measures.
8. List all energy subsidies, including in particular for fossil fuels, and actions undertaken as well as plans to phase them out.	Bearing in mind Malta's specificities, there are no plans to phase out any energy subsidies at this particular juncture, while remaining committed to, inter alia, encourage the adoption of technologies that can help reduce greenhouse gas emissions. More Information can be found in Sections 3.1.3.iv and 4.6.iv.
9. Complement the analysis of the interactions with air quality and air emissions policy, presenting and quantifying the impacts on air pollution for the various scenarios, providing	A quantification of the impacts of implementing the WPM scenario on air pollution is provided in Section 5.1.i. of the NECP. A link is made between

underpinning information, and considering synergies and trade-off effects.	the NECP and Malta's National Air Pollution Control Programme.
10. Integrate just and fair transition aspects better, notably by providing more details on social, employment and skills impacts of planned objectives, policies and measures.	An impact assessment conducted for the purpose of completing Section 5.2 focuses on several criteria, such as the economic impact, technical constraints, social acceptability, legal and regulatory barriers and quality of life with respect to the implementation of policies under the WPM scenario. This assessment shall ensure that policies and measures are well balanced and conductive of a just and fair transition.

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 insularity 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. Regional cooperation focuses 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. Regional cooperation is also considered within the area of contingency planning under the Energy Security dimension, such as the efforts made in the Gas Coordination Group. Malta is also open to future regional cooperation in the area of RES projects were these provides tangible benefits to all parties involved.

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

Aspects related to regional cooperation are considered in more detail within each individual dimension under Section 3. 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.

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

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 is bound to reduce its GHG emissions by 19% below its 2005 emissions pursuant to the Effort Sharing Regulation. Malta's limited mitigation potential, arising from our service-based economy, specifically in the transport and agricultural sectors as well as the legacy effect in solid waste disposal, have resultant high mitigation costs coupled with significant socio-economic considerations. A thriving economy, which albeit partially decoupled GDP from emissions, still has residual level-off coupling, which in turn drives up emissions. Diseconomies of scale also hinder resorting to alternative technologies. These challenges have led us to seek the most flexible options available in line with the provisions under the Effort Sharing Regulation (ESR), given the limited geographical area which restricts options for enhancement of land-based carbon sinks such as forests.

Malta remains committed to continue working towards mitigation action to meet its obligations and comply with the provisions as listed in the Effort Sharing Regulation. This, whilst acknowledging the geophysical realities including our climatic conditions, which lead us to not having 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).

Having said this, Malta's climate and energy policy features prominently in the political agenda as reflected through the recent major infrastructural investments in the energy sector. As a matter of fact, 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. Indeed, 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.

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 relation to this, the Maltese Government published a Vision Document, in 2017, highlighting its aspirations for socio-economic development in a low-carbon and climate resilient manner. 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.

ii. National commitments pursuant to LULUCF Regulation 2018/841

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 be noted 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

Relevant circumstances affecting renewable energy deployment (Article 5(1)(e))

Malta's potential for renewable energy deployment is mainly affected by physical and spatial limitations, technological advancement and resource potential, with resource availability and cost of land being the predominant barriers for further deployment.

The geology and topology of the island does not lend itself to the production of hydro (highest point: 253m above sea level) or geothermal energy (no significant thermal gradient), and wave energy production is still at the research stage. Fresh water and agricultural land are both scarce, thus biomass production is not an option. Wind was assessed thoroughly pre-2010[18], but as explained further below, conventional wind technology has been found to be largely incompatible with the local context. These relevant circumstances are expanded below and need to be taken into consideration whilst analysing Malta's national contribution in terms of its share of energy from renewable energy sources.

Solar PV

Solar energy is, so far, the predominant viable renewable energy source in Malta, and this led to efforts aimed at increasing the local RES-share to focus on the deployment of photovoltaic systems.

An assessment of Malta's technical potential for solar PV was conducted by the Energy & Water Agency in 2018. The results are similar (although slightly higher) to those estimated by the Joint Research Centre in 2019 using datasets from ENSPRESO, an open dataset for GIS-based energy models on renewable energy potentials, when the same assumptions were applied[19]. The technical potential assessment indicates that PV deployment post-2020 will be largely limited to suitable rooftops within the residential, commercial and industrial sectors, as well as a handful of ground-mounted systems.

Sites for ground-mounted systems, predominantly designated for installations above 1 MW, are relatively limited. The total area of the Maltese Islands (316km^2), coupled with a population density of over 1,500 persons per km^2 largely restricts the availability of green field sites, and therefore Government policy on solar farms was designed to take full advantage of brownfield sites such as car parks, disused quarries and landfills. For this purpose, the Planning Authority, in collaboration with the Ministry for Energy and Water Management, published the policy framework for the development of solar farms in 2017[20]. This provides guidance for the location of new solar farms and identifies environmentally-relevant specifications that need to be integrated into solar farm development. However, the relatively high land costs for such sites, driven by increasing land scarcity, together with significant grid connection costs is impacting the financial viability of solar farms. Disused quarries earmarked for solar farms are typically rented at rates in the region of 5€ per square metre per year. Areas (including rooftops) within industrial zones fetch much higher rental rates.

18 Strategy for Renewable Electrictiy Exploitation in Malta Volume 1: Renewable Energy Target and Volume 2: Policy Options Review, Mott McDonald (2005)

[19] https://ec.europa.eu/jrc/en/publication/enspreso-open-data-eu-28-wide-transparent-and-coherent-database-wind-solar-and-biomass-energy - assumptions similar to those taken by EWA are 85 MW/km2, excluding facades and natural areas (the latter being in line with Malta's Solar Farm Policy).

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

In the residential sector, uptake of solar PV has been positive and projections indicate that potential exists for additional installations. Dwellings with a rooftop suitable for PV installations include terraced, semi- and fully-detached houses, and, in some cases, maisonettes. Based on trends, it is assumed that apartments are not suitable to host PV installations due to limited available roof space[21] and issues relating to ownership; ownership of the rooftop of apartment blocks is often retained by the original developer in view of the potential for further development.

The majority of residential units currently under development in Malta are either apartments or, to a lesser extent, maisonettes[22], to maximize land utilization in view of the significant net inwards migration driven by strong economic growth as reflected by an increase in GDP of 6.6% in real terms in 2017. This trend is projected to be sustained over the next decade. 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 has a twofold effect: an increase in the depth of shadows cast on neighbouring buildings, and an increase in PV investor uncertainty, weary of possible overshadowing within the useful lifetime of the PV system. This trend therefore leads to an increase in the number of rooftops which are deemed unsuitable 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 using mature technologies due to significant restrictions in the local context, including technical, social and environmental constraints

Onshore Wind Farms

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 densely inhabited areas. Lack of possible environmental mitigation strategies to reduce impacts on protected bird colonies further contribute to the unfeasibility of onshore wind farms.

Offshore Wind Farms

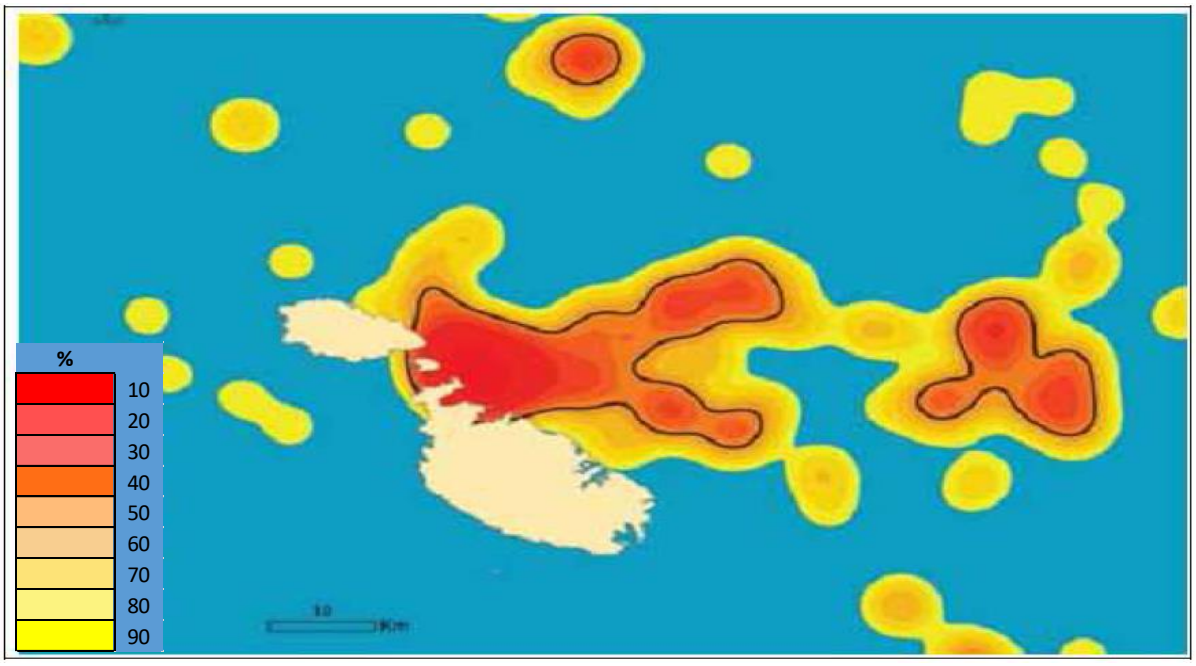
With regards to offshore wind turbines, the deep bathymetry of the Maltese marine area is a major drawback (Figure 3 - Bathymetric map of the Maltese Islands). In nearshore coastal areas and reefs with depths of less than 50m, constituting potential areas for the development of fixed-bottom wind farms, environmental and economic concerns remain significant. There are a number of competing uses for these zones, especially in view of Malta's reliance on tourism, maritime and shipping activities (Figure 4). Furthermore, a significant portion of the sea around Malta is a designated as a Special Protected Area and Special Area of Conservation. Indeed, assessments on the environmental impacts

[21] 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.

[22] 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.

of the now abandoned project to develop an offshore wind farm at Sikka l-Bajda[23] determined that adverse impacts on bird species, in particular the *Puffinus Yelkouan*, the marine environment, including potential adverse impact on the marine geology as location is characterised by submarine caves which could collapse, and marine life could not be effectively mitigated. The selected area is a rafting zone for the Puffinus Yelkouan which is an Annex I species under the Birds Directive and which also requires protection for its habitat[24]. Figure 2 highlights the inshore marine areas used by Puffinus Yelkouan as recorded from 31 GPS data loggers, extracted from Borg et al (2010). Malta hosts some 10% of the seabird's world population. This constituted one of the compelling reasons for the rejection of this project.

Figure 2 - Inshore marine areas used by Puffinus Yelkouan as recorded from 31 GPS data loggers, extracted from Borg et all (2010) Source: MEPA[25]



Potential offshore sites for Wind Farms were also assessed based on their technical potential by a study commissioned by the Malta Resources Authority in 2005 (Mott McDonald, 2005). All sites experience moderate to low wind speeds, with only the site at Sikka L-Bajda marginally exceeding 7m/s (7.16m/s at 80m) [26]. Wind speeds at the other sites vary between 6.41 and 6.66m/s (at 90m) and the corresponding projected capacity factor varied between 22% and 25%. These figures show that even the most promising site would still heavily underperform when compared to similar farms located in more favarouable areas such as North Sea where wind speeds are appreciably higher. This has significant implications on the level of attractiveness of such sites to potential investors.

[23] 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.

[24] As required by the Habitats Directive.

[25] Percentages shown in figure refer to moving speed of <10km/hr for birds tagged with a GPS logger from Rdum tal-Madonna, and they indicate feeding and rafting behaviour.

[26] 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.

In light of restrictions imposed by bathymetry, the intensity of commercial activity, the concentration of marine protected areas, and the wind resource itself, conventional offshore wind energy cannot be considered economically, socially or environmentally viable based on current technologies.

Floating Offshore

The potential for deep offshore wind energy via floating platforms remains in its infancy; this, combined with the associated high capital investment costs[27], 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 specific regions with high wind resource, over the short- to medium-term, the LCOE of a floating offshore wind farm installed in Maltese waters would still suffer from relatively low capacity factors and have to rely on significant financial support.

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[28,29]. Indeed, WindEurope[30] projected limited deployment of offshore wind technology in the Mediterranean until 2030 (Figure 5).

In light of the above, neither onshore nor offshore wind energy are included as a viable renewable technology option contributing to 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. In this regard, Malta shall seek to attract private investment in floating solar and/or wind which could benefit from support under the Innovation Fund, or if the technology would near full commercialization, seek funding under CEF.

27 Cost of floating wind estimated around €180-€200 per MWh (https://www.euractiv.com/section/energy/news/worlds-second-floating-wind-farm-sets-sail-for-portugal/) though this may be higher depending on grid connection costs.

[28] 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.

[29] 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.

[30] 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 3 - Bathymetric map of the Maltese Islands

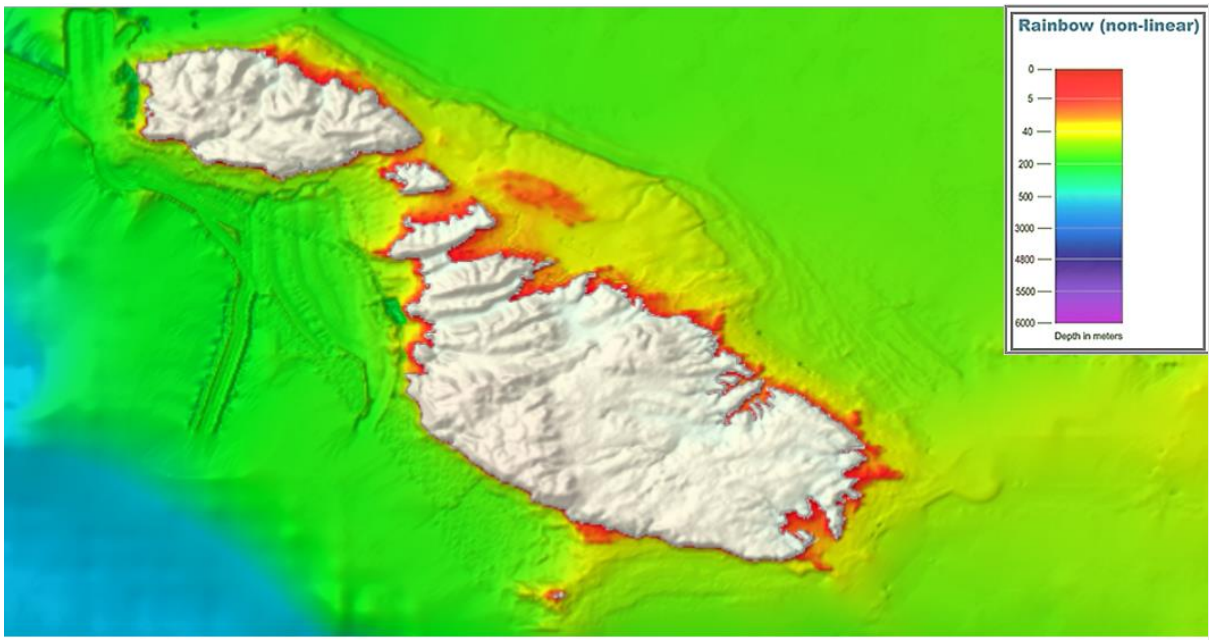


Figure 4 - Overview of major maritime activities in Maltese waters (Source: Strategic Plan for Environment and Development of Malta, 2015)

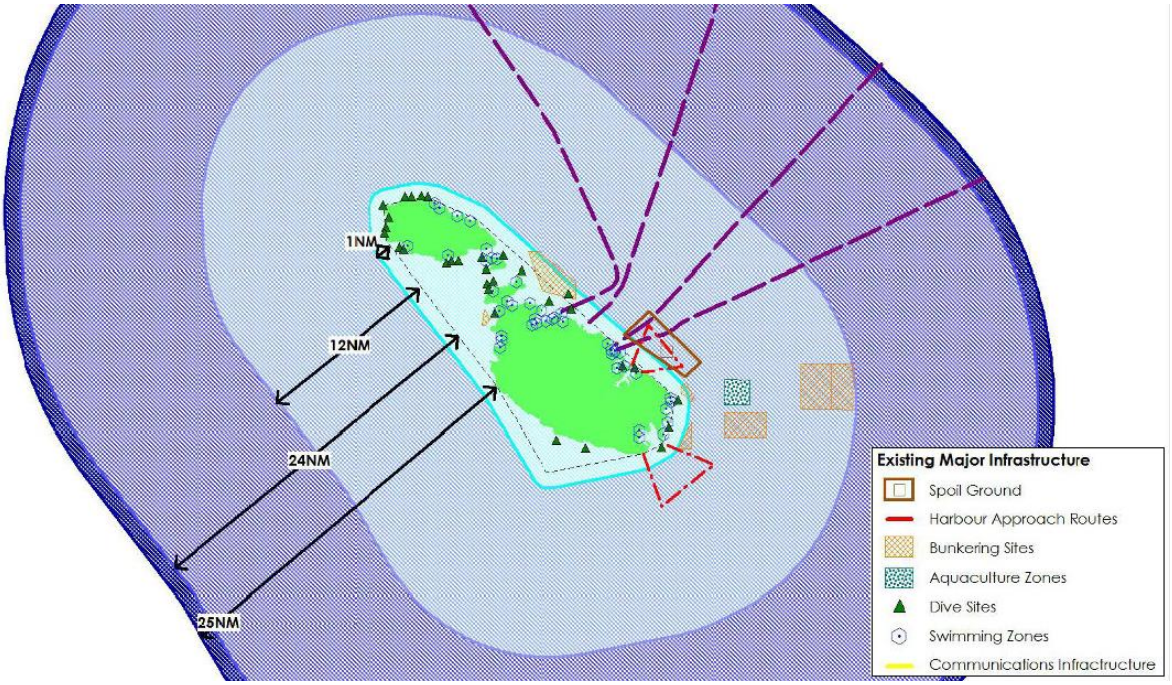
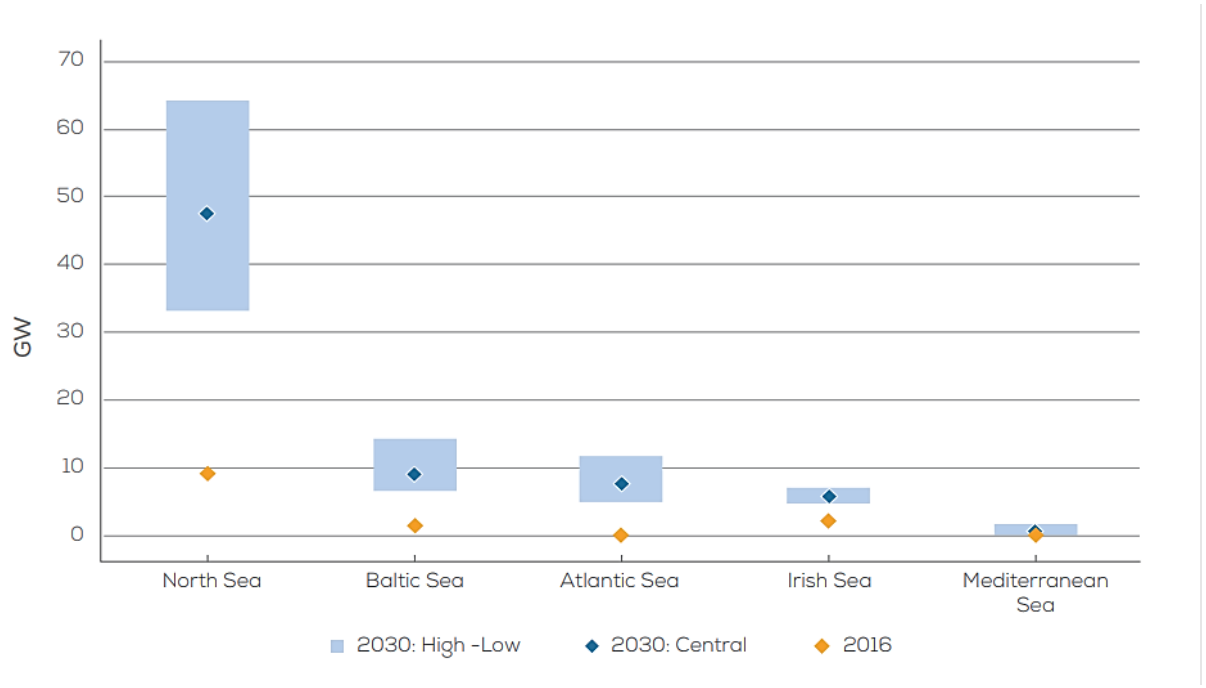


Figure 5 - WindEurope projections on 2016 and 2030 offshore wind installations per sea basin (Source: WindEurope, 2017)



Wave energy

As highlighted in Malta's NREAP[31] (2017) and a number of studies[32,33], wave technology in Malta faces several limitations in terms of technology, resources and potential sites. In view of the present state of technology readiness, reliability and affordability[34], wave energy is not expected to make any significant contribution towards Malta's RES 2030 share.

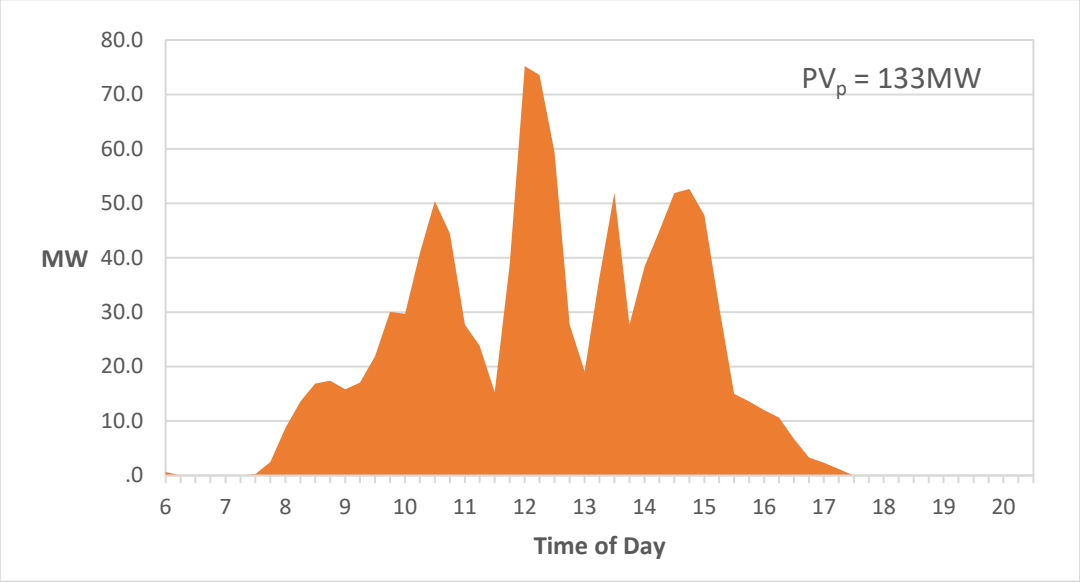
Grid Stability Considerations

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 41% of total RES consumption in 2020, increasing to 42% of the total RES share in 2030 under the 'With Planned Measures' scenario). The installations shall be concentrated within a very limited space (Malta's footprint), and generation is therefore highly susceptible to rapid fluctuations in output due to cloud coverage. A preliminary assessment shows that even with 133MWp of installed capacity, cloud cover can cause rapid variation in output of up to 60MW (Figure 6). These rapid fluctuations already pose a significant risk to grid stability, 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. Furthermore,

31 The Energy and Water Agency (2017). *The National Renewable Energy Action Plan 2015-2020* - Office of the Prime Minister, pp.120-123.
32 Scott Wilson Kirkpatrick and Co. Ltd (2003). *Malta Significant Wave Height Study*. Malta: Malta Maritime Authority.
33 Mott MacDonald (2005). *Strategy for Renewable Electricity Exploitation in Malta Volume 1: Renewable Electricity Target*. Malta: Malta Resource Authority.
34 Magagna, D., & Uihlein (2015). *Ocean Energy Development in Europe: current status and future perspectives*. International Journal of Marine Energy. 11. 84-104.

Malta's load and generation profile are very similar to that of Sicily; this means that excess RES generation in Malta would coincide with times of high RES generation in Sicily, reducing its effective market value. Currently, 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 Government to estimate the additional system costs involved to integrate further PV capacity. However, from the onset it is already clear that the available capacity (and hence balancing capability) of the interconnector is one of the main limiting factors.

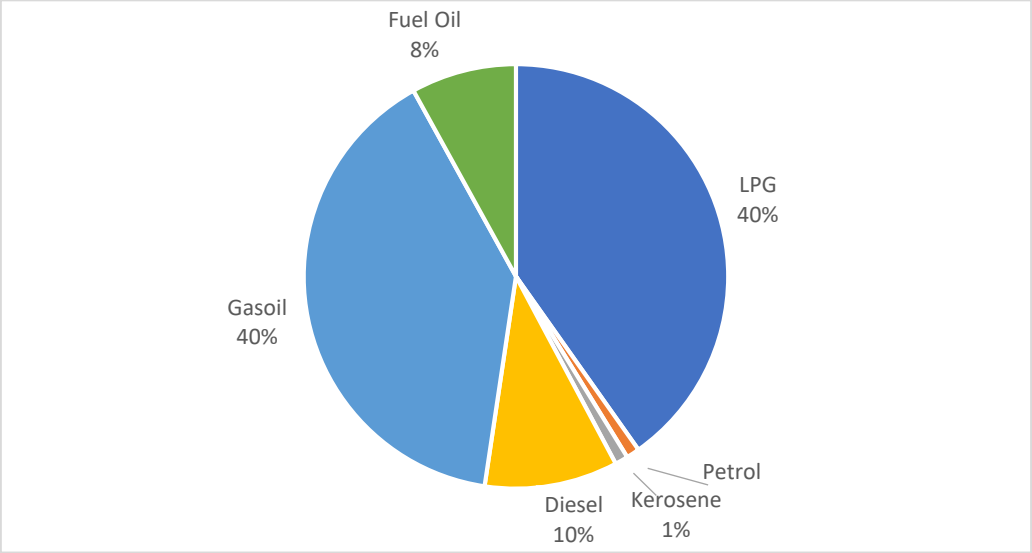
Figure 6 - The effect of cloud cover on electricity generation by 133 MWp of installed solar PV. Transients of circa 60MW are experienced within 60 minutes with the current level of installed capacity



Heating and Cooling

In 2017, 802 GWh of fossil fuels were consumed in Malta for heating and cooling, with the largest contributions coming from LPG and gasoil (Figure 7). More than half of the LPG share is attributed to households for cooking and spatial heating, with the rest being consumed in the services and industry sectors. Gasoil, fuel oil and diesel for heating and cooling is almost entirely consumed by the industry and services sectors for process heating. These fuels are used as alternatives to LPG in cases where the LPG storage requirements cannot be overcome due to space or safety restrictions.

Figure 7 - Fuels consumed for Heating and Cooling in 2017



Malta's projected renewable heating and cooling share depends on achieving the target deployment of solar and heat pump water heaters between 2021-2030. Also contributing to this are the air-to-air reversible heat pumps which are projected to increase without the need for any further policy intervention.

In 2015, a comprehensive assessment on the potential for the application of high efficiency cogeneration and efficient district heating and cooling in Malta was delivered to the Commission in accordance with Article 14(1) of Directive 2012/27/EU. This report determined that district heating and cooling systems are not technically viable or cost-effective solutions for Malta. This makes it more challenging to address the heating and cooling sectors. Furthermore, Malta's lack of potential for local cultivation of biomass and manufacturing of biofuels means that any fuel switch to biomass/biofuels would require imports of these products at significant additional costs.

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

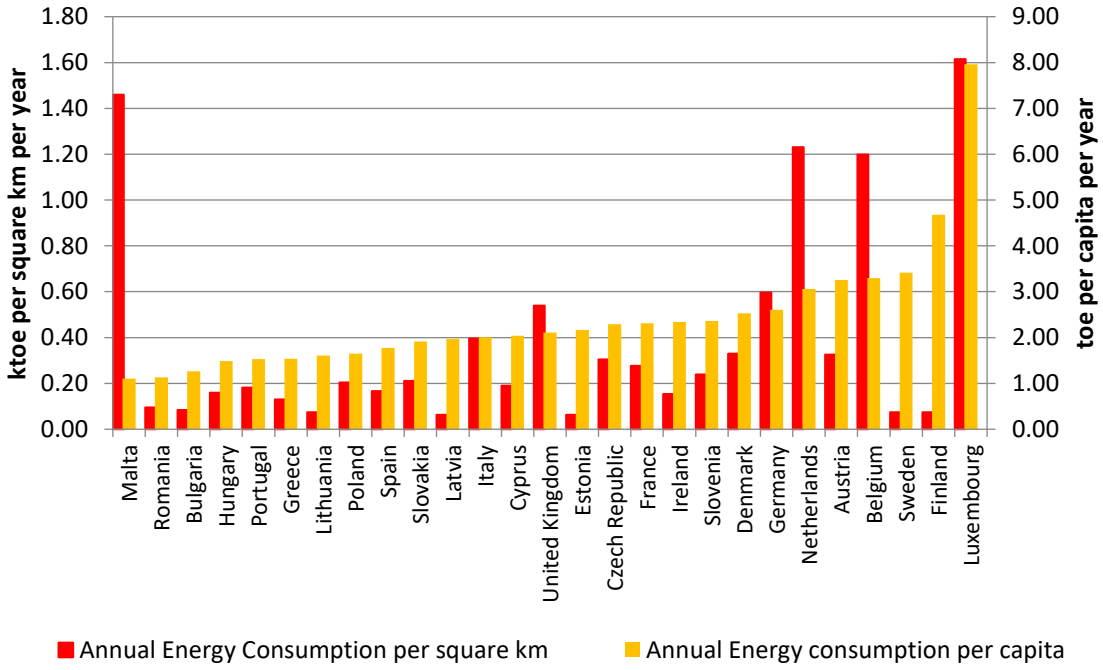
Meeting Malta's 2020 RES target

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 will meet this target mainly through indigenous sources, but also through biofuel imports and the use of statistical transfers in 2020. It is projected that Malta reaches a RES share of 9.3% by the end of 2020, and will therefore be seeking to make use of statistical transfers to cover the shortfall. This gap 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, tourist activity and economic growth. 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 (mainly solar) appears to be waning, possibly as a result of other investment opportunities at a

time of rapid economic growth. 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[35]. The total capacity offered in 2018 under the second call was 35MW but the total bids received amounted to less than 18MW.

Malta's efforts to meet its 2020 Renewable energy target and future RES objectives must also be framed within the context of having to rely on land intensive renewable energy sources such as PV. Figure 8 highlights how, albeit the final energy consumption per capita in Malta is the lowest amongst the EU-27, the energy consumption per square km is the second highest, marginally exceeded only by Luxembourg. It follows that for same percentage targets, the amount of RES which needs to be extracted per unit of area is much higher in the case of Malta. This is particularly relevant for land intensive renewables such as PV. Thus, for example to meet a 10% RES share in Greece would require around 0.015 ktoe/km^2/year whereas the same RES share for Malta would require almost ten times higher, 0.145 ktoe/km^2/year.

Figure 8 - Annual energy consumption per square km and per capita, 2012. Source: Eurostat.



Overview of Malta's 2030 RES contribution

Taking full account of all the relevant circumstances affecting the deployment of renewable energy described in the introduction to this section, Malta's contribution to the 2030 Union target in terms of the share of energy from renewable energy in gross final consumption is shown in Table 2. Malta's RES share, and thus its contribution to the Union's 2030 target is expected to amount to **11.5%** in 2030. Malta's RES contribution in the three reference years, 2022, 2025 and 2027 is expected to reach 10.3%, 11.0% and 11.6%, respectively. The contribution excludes RES ambient cooling captured by air-

[35] 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.

to-air heat pumps, as the Commission has not yet established a methodology for calculating renewable energy for cooling, as required by Directive EU 2018/2001 by December 2021[36].

It must be noted that under the 'With Planned Measures' scenario, Malta expects to make use of statistical transfers or other types of cooperation mechanisms in 2021 to maintain the minimum 2020 RES share of 10% post-2020. Table 2 also indicates the three reference points in 2022, 2025 and 2027 as required by the Governance Regulation. While in 2022 it is expected that Malta will need statistical transfers to meet the indicative trajectory - reflecting 18% of the total increase in the share of energy from RES between the 2020 target and Malta's contribution in 2030 - in 2025 and 2027 Malta's actual RES trajectory is expected to be higher than the 43% and 65% indicative trajectory reference points. It is to be noted that Malta's RES contribution is projected to be slightly higher in 2027 compared to the following three years due to expected commissioning of the Malta-Gozo tunnel; this would significantly decrease the consumption of gasoil by the ferries and consequently affect the gross final consumption of energy, which is expected to increase at a relatively slower pace in 2027.

Table 2 - Malta's RES contribution between 2021-2030, %

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Malta's RES contribution	**10.0%**	**10.3%**	**10.5%**	**10.9%**	**11.0%**	**11.2%**	**11.6%**	**11.5%**	**11.5%**	**11.5%**
Indicative trajectory increase (as per Article 4(2) of Reg. 2018/1999)		18%			43%		65%			
Reflected in %-share		*10.3%*			*10.7%*		*11.0%*			
Actual RES trajectory	9.7%	10.1%	10.5%	10.9%	11.0%	11.2%	11.6%	11.5%	11.5%	11.5%

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, heating & cooling and transport are provided in Figure 9. Malta's RES share in all three sectors are expected to increase in the projected period until 2030 as a result of the implementation of policies and measures outlined in Section 3 of the NECP.

[36] Malta's contribution to the Energy Union's renewable target will be updated to include ambient cooling in line with the Commission methodology, once published.

Figure 9 - Estimated trajectories for sectoral share of RES under WPM scenario, 2021-2030

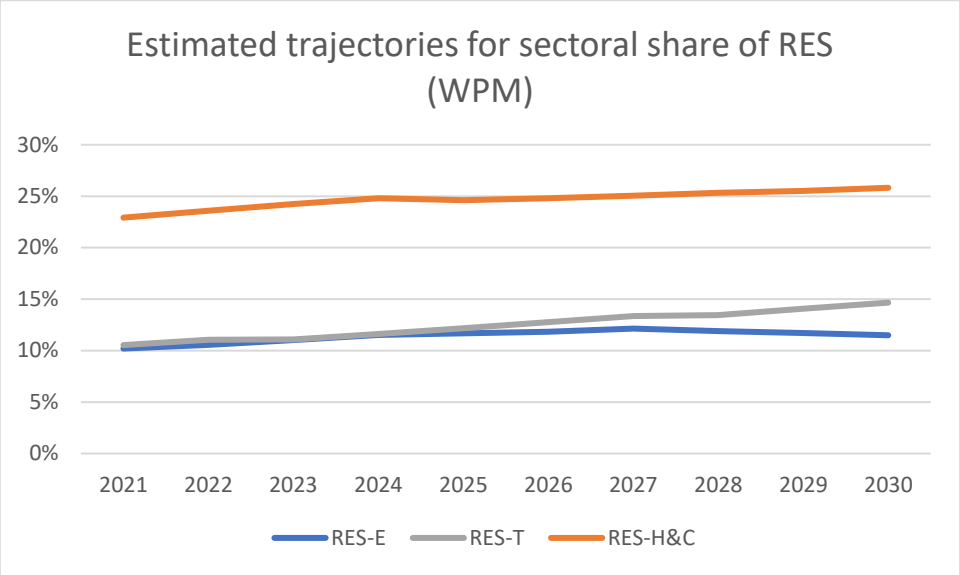


Table 3 - Estimated trajectories for sectoral share of RES (WPM), 2021-2030

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RES-E	10%	11%	11%	12%	12%	12%	12%	12%	12%	11%
RES-T	11%	11%	11%	12%	12%	13%	13%	13%	14%	15%
RES-H&C	23%	24%	24%	25%	25%	25%	25%	25%	26%	26%

According to Article 23(1) of the recast of Directive 2019/28/EC on the promotion of renewable sources, Member States are obliged to take action to increase the share of renewable heating and cooling by an indicative 1.3 percentage points annually between 2020 and 2030 (calculated as an annual average for 2021- 2025 and 2025-2030). Since Malta does not have a district heating and cooling system that allows for the use of waste heat, this 1.3% indicative target is limited to an indicative 1.1% instead.

The share of renewable heating and cooling is expected to reach a share of 22.06% by 2020 and rising to 25.71% by 2030. In order to reach the indicative 1.1% target, Malta must endeavour to increase this RES share to a minimum of 33.06% by 2030. In energy terms, this denotes a minimum increase of an additional 130 GWh to be reached over a period of 10 years, which is almost double that projected for 2020.

As indicated in the introductory part of Section 2.1.2, the opportunities for Malta to reach the 1.1% target are highly challenging:

- the unavailability of a natural gas distribution system on the Maltese territory, excludes the option to blend biogas;
- no sources of indigenious biomass;
- the possibilities of replacing/blending LPG with bioLPG (mainly used for cooking/industrial processes) are rather limited due to limited availability and significant additional costs to both

households and industry. We consider that the 40% share of LPG is largely unaddressable over the short to medium term;

- a share of 28% biodiesel blend would be required to meet the 1.1% target by 2030. The additional cost to industry/services would amount to circa €70 million. Given that all biofuels would need to be be imported, incurringly additional shipping costs (and associated carbon footprint), such a measure would not provide any tangible economic benefits to Malta.

However, despite it being an inherently challenging target to reach, Malta plans to make use of the recast comprehensive assessment referred to in Section 2.1.2 in 2020, to further assess cost-effective opportunities that could contribute towards an increase in the renewable heating and cooling share by 2030.

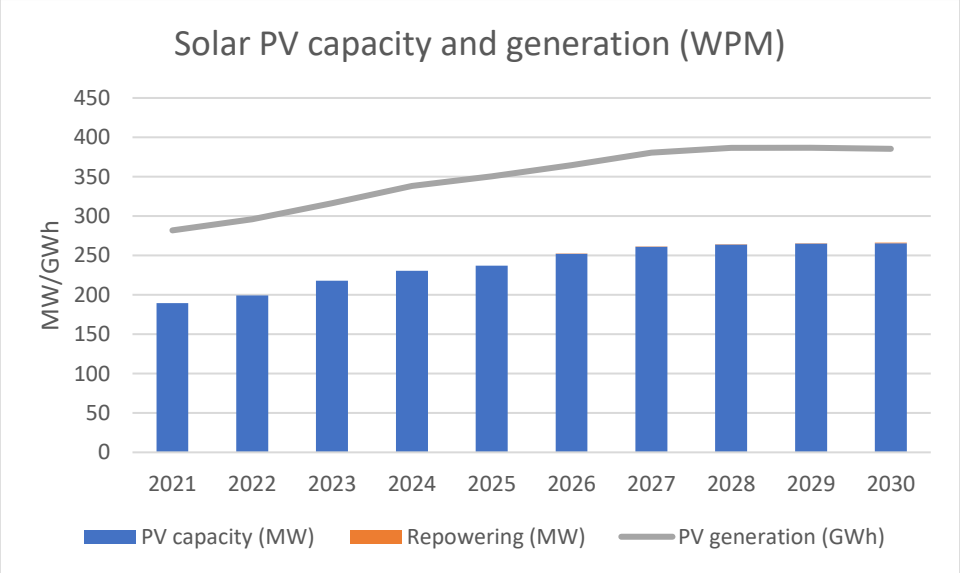
iii. Estimated trajectories by renewable energy technology including expected total gross final energy consumption per technology and sector and total planned installed capacity per technology and sector

RES-Electricity

RES-E trajectory is composed of RES generation from Solar PV and waste-to-energy CHP plants (Figure 11). Figure 10 illustrates the projected capacity of solar PV from 2021-2030, based on the Government's commitment to encourage higher penetration of solar PV through financial support schemes and other measures which facilitate uptake. Under the WPM scenario, solar PV is expected to reach 266 MWp by 2030. This implies a total footprint of approximately 3.2 – 3.7km^2. Both rooftop and brownfield sites will continue to be given priority for installations. Some repowering is projected to begin as from 2026. However, this is to a very small extent prior to 2030 as installations of solar PV predominantly took place from 2010 onwards.

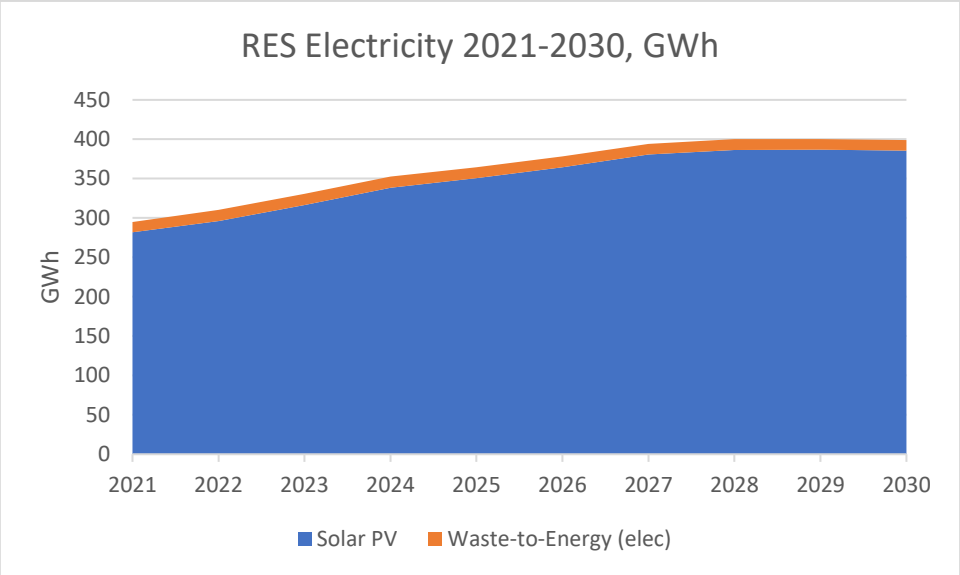
Solar PV technology is projected to contribute to 42% of Malta's RES contribution in 2030, being the largest contributing RES technology in Malta.

Figure 10 - Solar PV capacity and generation under the WPM scenario, 2021-2030



Electricity generation from waste-to-energy plants is expected to contribute a relatively small share to the RES-E trajectory as shown in Figure 11.

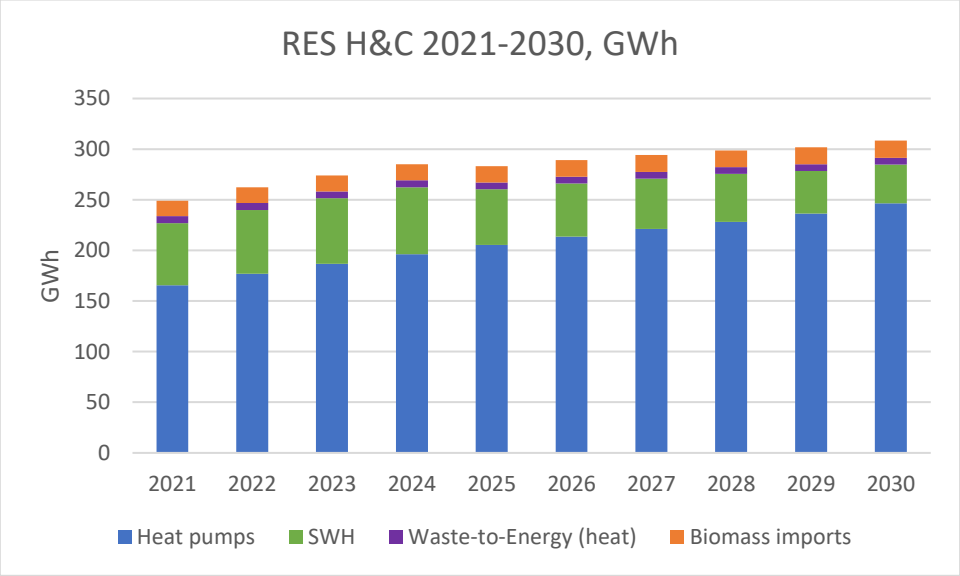
Figure 11 - RES Electricity trajectory between 2021-2030, GWh



RES-Heating and Cooling

Renewable energy in the heating and cooling sector is projected to contribute to 33% of Malta's RES contribution in 2030 under the WPM scenario. Figure 12 shows the relative contribution by each H&C technology towards this share. The Government is planning to implement measures targeting solar water heaters, heat pump water heaters and waste-to-energy plants with the aim of increasing Malta's RES Heating & Cooling share. Air-to-air heat pumps are not deemed to need policy intervention.

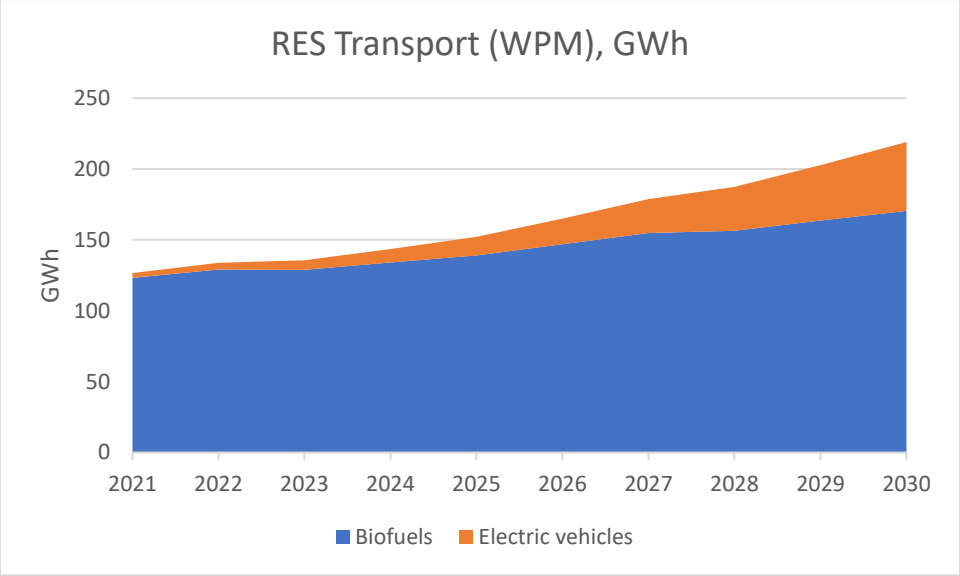
Figure 12 - RES Heating and cooling under WPM scenario 2021-2030, GWh



RES-Transport

The RES-T share (Figure 13) is expected to be predominantly met by an increase in biofuel consumption, achieved 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. Under the WPM scenario, the stock of electric and plug-in-hybrid electric vehicles is currently projected to increase from just above 1,000 in 2020 to almost 26,000 by 2030, comprising 6% of the projected total fleet. This shift is mainly driven by Regulation (EU) 2018/1832 and Regulation (EU) 2019/318 which impose stricter CO_2 emissions standards on manufacturers of road vehicles post-2020. It must be noted that there is no rail system in Malta, which further exposes Malta's reliance on road transport.

Figure 13 - RES trajectory in transport under WPM scenario 2021-2030, GWh



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

The Maltese Government is committed make a decision by early 2020 to establish a cut-off date for the importation and registration of Internal Combustion Engine (ICE) passenger vehicles in Malta. To comply with this, a holistic strategy will be developed which will identify measures and necessary initiatives to support such a transition. This would inevitably have a significant impact on Malta's future energy system, including Malta's share of renewable energy in the transport sector, all of which would be reflected in future NECP updates and reporting cycles.

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 between 2021-2030 (Figure 14), largely due to an increasing percentage of biofuels in road transport fuels. Production of bioenergy from waste treatment facilities, both electricity and heat, and the use of biomass for space heating in the residential sector are expected to remain largely stable in the projected period. The projected consumption of biofuels, split by type, is shown in Figure 15. Biofuels are expected to continue increasing throughout the projected period mainly due to the continued blending of road diesel with HVO, FAME (to a lesser extent), and advanced biofuels in line with the Renewables Directive. Advanced biofuels are expected to contribute to 25% of the total consumption of biofuels by 2030.

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 low heating demand, targeting increased efficiency in heating and cooling is deemed more appropriate than promoting the importation of biomass. Imported biomass in Malta primarily includes wood pellets, fuel wood in logs or briquettes, sawdust and wood charcoal, all of which is assumed to be consumed by the residential sector for heating purposes. In 2018, 49% of biomass imports originated from EU countries while 51% was imported from non-EU countries. Under the WPM scenario, imports of biomass are expected to remain largely stable and to follow current trends.

Figure 14 - Estimated trajectory for bioenergy under the WPM scenario 2021-2030, GWh

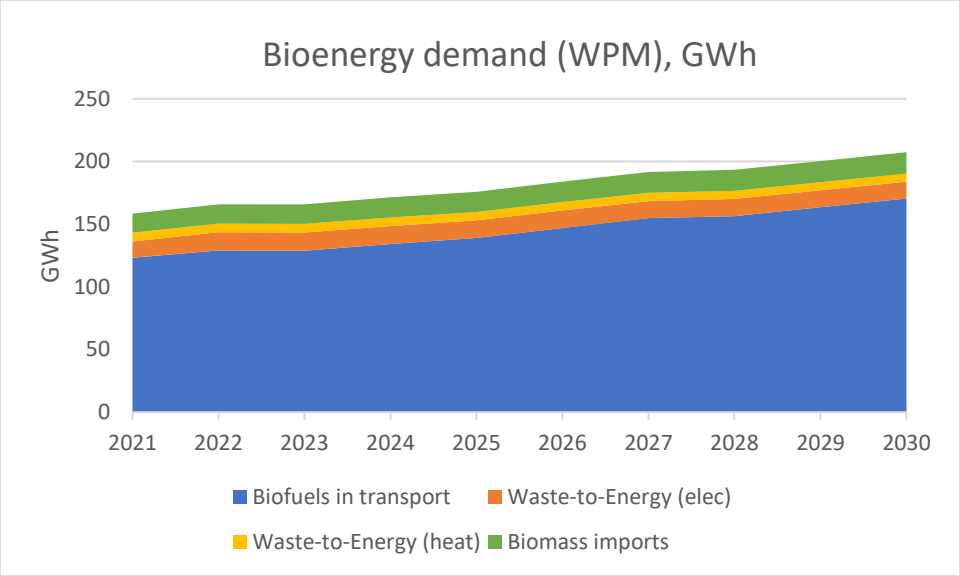
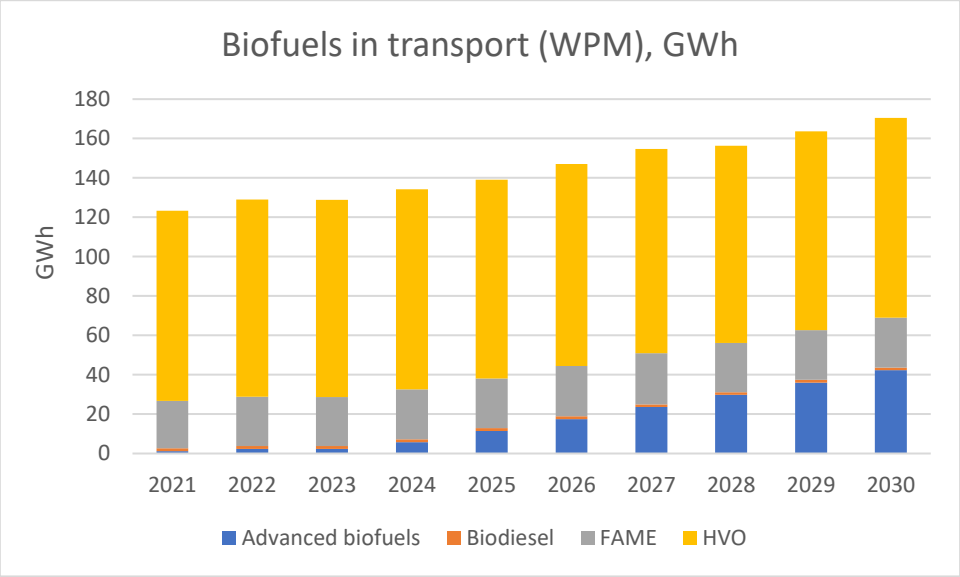


Figure 15 - Projections of biofuels under WPM scenario, 2021-2030, GWh



2.2 DIMENSION ENERGY EFFICIENCY

Relevant circumstances affecting primary and final energy consumption

Article 6 of the Governance Regulation sets out the contribution-setting process for Member States in the area of energy efficiency. In their contribution, Member States may take into account national circumstances affecting their primary and final energy consumption, including the remaining cost-effective energy-saving potential, evolution of GDP, as well as changes in energy imports and the energy mix. The section hereunder describes and highlights Malta's national circumstances affecting primary and final energy consumption as well as the main barriers impeding a more ambitious contribution of Malta to the Union's energy efficiency target.

The diversification of energy sources and supply sources achieved in recent years constitutes an important milestone for Malta. 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 natural gas, electricity imports and renewables. The increased efficiency of the new gas-fired generation plant, commissioned in 2017, significantly reduced primary energy demand in Malta. Nonetheless, increasing population, and corresponding demand in the housing market, and the growth of tourism have intensified pressure on land and scarce natural potable water resources. Steep population and GDP growths in recent years have indeed made it difficult to restrain an increase in energy consumption. From 2010 to 2018, the average annual growth rate of Malta's population has amounted to 1.8%, which represents the second largest annual increase in the EU after Luxembourg and is nearly ten times the EU28 average of 0.2%[37] National population projections used for the development of Malta's NECP, which are based on data published by the National Statistics Office (NSO) and the Ageing population report with adjustments for net immigration and natural increase in population, show that Malta's population should increase from almost 500,000 in 2020 to 554,882 by 2030. In July 2019, Eurostat published an update of demographic projections with Malta's figures significantly revised over the medium to long- term. While in the projections used for the NECP Malta's population would have reached 573,531 by 2040, under Eurostat's projections Malta's population reaches 661,550. While Maltese authorities are cautious about the Eurostat methodology[38] it is evident that increases in population would inevitably affect Malta's future energy demand.

Table 4 – National NECP Population projections, thousands

	2020	2030	2040
Population	496,790	554,822	573,531

In terms of GDP growth, projections are based on the assumption that the current trend of high annual economic growth peaked in 2017 at 6.6% and will start to slow down and stabilize in the future, although maintaining a relatively strong level of 3.5% by 2030. Based on national projections, it is

[37] Based on Eurostat data on population on 1 January [demo_pjan], updated 6.6.19

[38] Eurostat projections are underpinned by an upward revision in the net-migration assumption as the Eurostat projection methodology assumes that all migrant workers settle and retire in Malta. On the other hand, local studies establish that foreign workers only stay in Malta for a temporary period, with an average length of stay of foreign workers of 3.5 years.

expected that the outcome of GDP and population projections leads to an increase in GDP per capita from over 20,000 EUR in 2017 to almost 30,000 EUR by 2030. Although there is an element of decoupling between energy and GDP, increasing energy demand in absolute terms is expected to continue post-2020.

Malta has the second lowest final energy consumption per capita across all EU Member States, only slightly above half of the EU average. This is a result of different factors including climatic conditions and lack of energy-intensive industry. Heating requirements in Malta are on the lower end of the scale when compared to other Member States, whereas cooling is provided by heat pump technology, which in itself is already deemed as being one of the most efficient technologies. However, this also means that interventions would need to be performed higher up in the marginal cost curve and are often not viable financially. On the other hand, the changing landscape, whereby a higher share of the population is living in apartments as opposed to single unit buildings, and higher expectations with regards to thermal comfort, means that an increasing number of households are resorting to air conditioners to achieve the desired comfort level rather than relying on natural ventilation. Furthermore, the shift from single unit buildings to apartments also implies that the most effective options to reduce the carbon footprint of households i.e. the installation of photovoltaic panels and solar water heaters, are not always a possible option.

A similar situation exists in government owned and occupied buildings. A case study commissioned by the Government of Malta to evaluate possible options to renovate a number of typical government office blocks highlighted that given the low energy intensiveness of activities in the selected buildings, the return on investment for the majority of the renovation options is quite low. Consequently, in some cases the payback period may exceed the expected building or improvement duration.

Malta's share of final energy consumption in the transport sector is at around 55%, which is indeed much higher than the EU average. It must be pointed out, however, that by virtue of its geographic isolation, 40% of the final energy consumption in the transport sector is attributed to aviation. This is a result of both a higher number of tourist arrivals, which has increased from 1.4 million in 2012 to 2.6 million in 2018 (a staggering 80% growth), but also the lack of real alternatives for Maltese citizens to travel abroad, there being no fixed link to mainland Europe. The same can be said for consumption by the road transport sector which, albeit several initiatives to promote alternative means of transport, remains heavily dependent on private cars as the principal means of transportation. So far studies have shown that there is insufficient activity to support a mass transit system. However, the Government shall continue to monitor demographic changes and developments in transport demand whilst assessing the future viability of such a solution from an environmental and financial sustainability perspective. The highly built Maltese landscape (over 33% is developed) limits options for exclusive bus lanes or lanes dedicated to other means of transport. The electrification of the transport sector in Malta is expected to follow trends across Europe and uptake largely depends on affordability and availability of vehicles. The Government plans to continue supporting and incentivizing the electrification of the transport sector through grants and specific measures. The Government also intends to establish a cut-off date for the importation and registration of Internal Combustion Engine (ICE) passenger vehicles in Malta. A decision will be taken on this by early 2020.

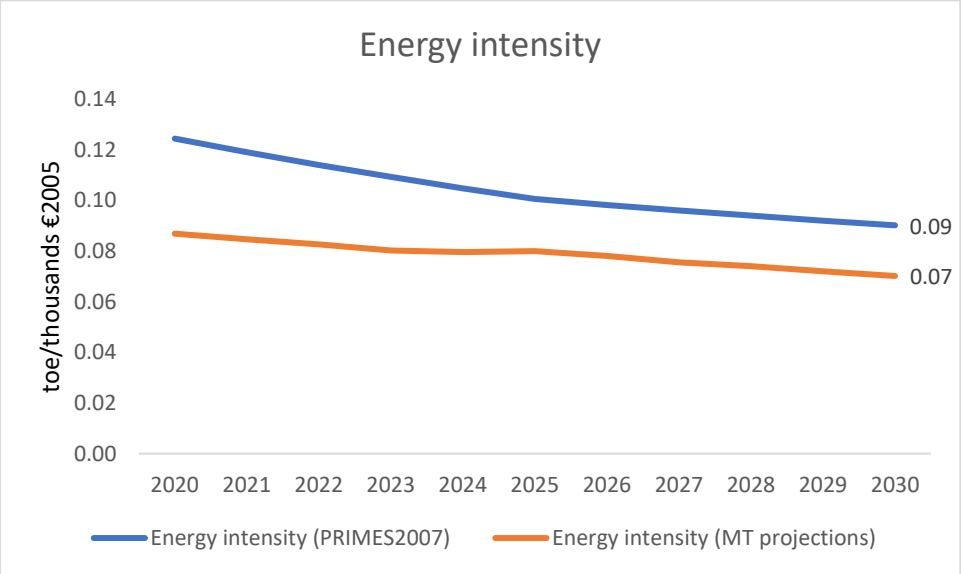
Malta's share of final energy consumption in industry is also significantly lower than the EU average and as an open, service-based economy, Malta is characterised by low energy intensity. In 2017, Malta's energy intensity (calculated as gross inland consumption divided by GDP) amounted to 0.09 ktoe/thousand €. In comparison to other Member States in 2016 and 2017, Malta's energy intensity was third lowest in the EU behind Denmark and Ireland. Heavy consumers of energy in the industrial and services sectors are targeted through regulations and voluntary agreements encouraging the adoption of energy efficient technologies.

The factors mentioned above along with the specific characteristics of Malta's energy system and market, such as its small nature, the existence of a single electricity supplier, and the absence of natural gas networks and district heating and cooling networks substantially limit the range of measures available to meet energy savings obligations under the Energy Efficiency Directive. Notwithstanding this, Malta is doing its share to increase energy efficiency in the various end-use sectors and will continue to implement energy efficiency policies and measures in line with the EU's energy acquis. The Government is also committed to continue leading by example and as described in the following sections will be implementing a number of measures to promote energy efficiency.

i. Indicative national Energy Efficiency contribution to achieving Union target

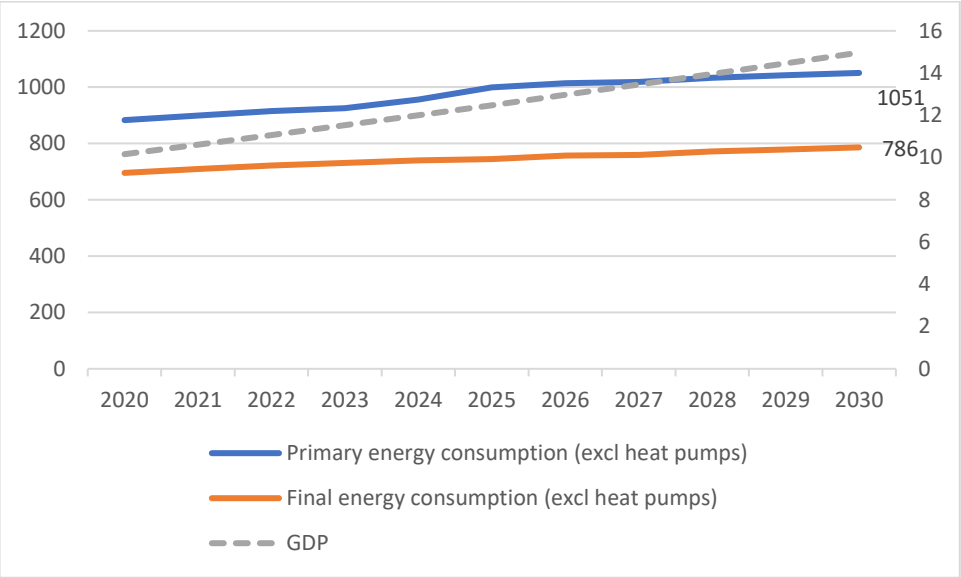
The EU's 2030 energy efficiency target of 32.5% is measured with reference to the projections performed by PRIMES in 2007. Malta's indicative energy efficiency contribution to the 2030 target is an energy intensity level of 0.07 toe/thousand $€_{2005}$ as compared to a level of 0.15 toe/thousand $€_{2005}$ 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 16).

Figure 16 - 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 1,051 ktoe and 786 ktoe respectively (Figure 17).

Figure 17 - Projected primary and final energy consumption levels in absolute terms, ktoe.



Energy intensity is being defined as the ratio between primary energy consumption and gross domestic product at 2005 constant prices. In projecting primary energy consumption, it is assumed that: (i) renewable electricity and electricity from waste-to-energy plants is dispatched first, followed by a mix of conventional plants running on natural gas and electricity imported over the interconnector: and (ii) the share of distribution losses is constant for the period 2021-2030, based on the average ratio of losses in recent years. The share of electricity imported over the interconnector is projected to vary between 10 and 20%. This is relevant as a change in this share would have a corresponding impact on the projected primary energy consumption in view of the way Eurostat accounts for the efficiency attributed to the interconnector.

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

As outlined above, 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 number and size of fuel suppliers which substantially limits the range of measures available to the policy maker 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 2017 stood at 6.6%, 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 3.7% increase in 2017. The growth in population, employment and economic activity resulted in a 7% increase in total final energy consumption. The steep increase in population

and GDP in such a relatively short time span has made it difficult to restrain energy consumption, which maintained an upwards trend during 2018 and 2019. Figures for final energy consumption are provided in Table 5.

Table 5 - Final energy consumption, ktoe.

Year	Final Energy Consumption[39] [ktoe]
2016	583
2017	624
2018	661

The provisional average final energy consumption for the period 2016-2018 amounts to 622.7 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 82.2 ktoe of cumulative energy savings by end 2030.

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. In line with this obligation, 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 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 is not available.

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

Malta does not have other national objectives in areas such as energy efficiency in transport and heating & cooling. Measures and actions undertaken by Malta, including in these sectors, are described under Section 3.2 of the Plan.

[39] Data is based on the latest national energy balance figures which will be reflected in future Eurostat updates. The data provided for 2018 is still provisional.

2.3 DIMENSION ENERGY SECURITY

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

The Energy Security dimension needs to be looked at within the unique context of a geographically isolated island Member State with a high import dependency due to the lack of domestic energy sources, with the exception of renewables the deployment of which is in itself largely constrained by physical limitations and resource potential. The specific characteristics of Malta's energy system and market, such as its small nature, the existence of a single electricity supplier, the absence of natural gas pipeline interconnection are all factors which affect Malta's security of supply.

The projected growth in energy demand until 2040 under the 'With Planned Measures' scenario will require more energy, which in turn will require higher deployment of RES, more reliance on electricity imports over the interconnector and possibly additional conventional local generation capacity[40]. It will also require a more flexible energy system which amongst others incorporates storage and takes advantage of opportunities for demand side management. The Energy and Water Agency commissioned a study which will assess how Malta can ensure a secure power system whilst remain aligned with its international commitments on decarbonisation.

Malta's National Energy Policy (2012) underlined 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 sources, procurement sources, exporting country and supplier. Since the adoption of the National Energy Policy, in line with the objectives mentioned therein, Malta's energy system has undergone multiple changes, such as the commissioning of a 200MWelectricity interconnector with Sicily in 2015 and the restructuring of the local power generation capacity to run on natural gas (LNG) while decommissioning inefficient units fired by heavy fuel oil and the old Marsa Power Station. This has significantly reduced the carbon footprint of the electricity generation mix, which is now based primarily on natural gas, electricity imported via the interconnector and the increasing share of electricity produced by photovoltaic installations, while also maintaining standby gasoil generation capacity (including dual fired diesel engines) available as back-up in the event of an emergency, a feature contributing to Malta's security of supply.

The objectives set out in the 2012 policy remain, to a large extent, still valid today and even post-2020, whilst the measures necessary to achieve these objectives have to be adapted to new realities and developments within the global energy market, the EU's internal energy market as well as local developments, such as the expected substantial increase in population, increased demand in the labour market and growth of tourism and energy demand. Energy security must also be tackled in conjunction with the long-term objectives of decarbonisation of the energy system and the economy as a whole.

Malta's high-level objectives in the area of energy security as set out in the NECP can be summarized into the following:

- Continued diversification of energy sources and suppliers;

[40] The energy modelling framework used to project Malta's WEM and WPM scenarios for the purpose of the NECP did not consider peak energy demand situations caused by extreme weather conditions, etc but focused on a 'normal' day.

- Reduction of import dependency through the deployment of indigenous sources of renewable energy whilst taking into account the specificities of Malta's energy system;
- Increasing the flexibility of the national energy system, including through the roll-out of cost-effective, innovative solutions such as storage;
- Periodic contingency planning in the case of supply disruption for the electricity, gas and oil sectors;
- Energy security in the context of the long-term objective of decarbonisation of the energy system and increased deployment of RES;

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

Natural gas, which is used as fuel in the power generation sector is currently imported in the form of LNG. There are currently no gas pipeline interconnections, however a Final Investment Decision on the construction of the Melita Trans Gas Pipeline project (MTGP) between Malta and Sicily is expected to be taken by 2020 subject to financing. LNG is imported via marine carriers and held in a Floating Storage Unit (FSU) supplying LNG to a regasification plant and to Delimara 3[41] and Delimara 4[42] power plants. LNG is procured on the international market, which provides flexibility in terms of sources of origin. In 2017 and 2018 LNG was delivered from 8 different countries of origin.

A physical connection to the European gas network would result in a more reliable, secure and energy efficient form of transport of natural gas as it will replace the LNG supply chain, which has both a limit in its technical capacity and its susceptibility to adverse weather conditions. MTGP is being designed with bi-directional flow capability, and hence may provide for future reverse flow from Malta to Italy (European gas grid) in case of emergency gas disruption situations. This would facilitate the formulation and implementation of preventive, emergency and solidarity action plans at both national and EU regional levels as required by the Security of Gas Supply Regulation. The gas pipeline project is described in more detail in Section 3.3.i.

iii. National objectives with regard to reducing energy import dependency from third countries

As mentioned above, given Malta's unique geographical location tied with the absence of domestic energy sources (with the exception of indigenous renewable sources) and the specificities of Malta's energy system, make it extremely challenging to reduce energy import dependency in general, including from third countries. In view of this, Malta's objectives with regard to reducing import dependency are interlinked with national objectives focusing on the continued deployment of domestic renewable energy sources and the over-arching long-term goal of decarbonizing the energy system. Should the Melita TransGas Pipeline come into operation, Malta would strengthen its interdependency with other EU Member States by being connected to the Trans-European Natural Gas network. This would eliminate Malta's current reliance on transportation routes of LNG from third countries.

[41] Delimara 3 (D3): 8 gas-fired turbines with a maximum rated capacity of 152 MW. 4 of the 8 engines are dual fuel and can also run on gas-oil, supporting security of supply.
[42] Delimara 4 (D4): 205 MW gas-fired high-efficiency combined cycle gas turbine (CCGT) commissioned in 2017.

To strengthen the diversification of energy supply and reduce energy import dependency, Malta's objective in the area of renewable energy is to fully exploit all cost-effective indigenous renewable energy sources whilst also contributing to the long-term goal of decarbonisation of the energy system. Nevertheless, given the limited options for cost-effective indigenous sources due to reasons explained in the decarbonisation dimension, Malta's reliance on energy imports persists and is expected to remain high in the projected period.

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

Increased flexibility of the national energy system will be tackled by the Government and energy system operators through multiple actions:

- Increased deployment of domestic renewable energy sources and their safe integration in the energy system;
- The Government will continue to assess innovative, viable and cost-effective solutions tailored to the specificities of Malta's energy system, such as the deployment of energy storage solutions, which would incorporate aspects related to increased RES generation;
- The Government will continue to assess solutions for ensuring system stability with respect to grid integration constraints inherent in small and peripheral electricity systems;

The ongoing study commissioned by the Government will assess the economic and technical viability of flexibility solutions for the power system for the upcoming decade and beyond.

2.4 DIMENSION INTERNAL ENERGY MARKET

2.4.1 Electricity interconnectivity

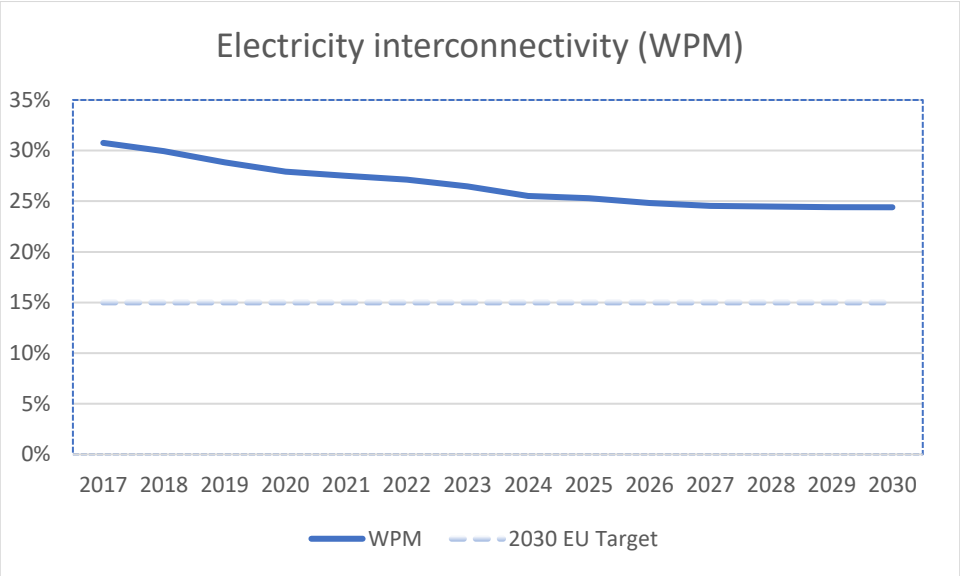
i. The level of electricity interconnectivity aimed for in 2030

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.

Malta's electricity interconnectivity level is projected to be at 24% by 2030 under the WPM scenario, remaining well above the EU 15% interconnectivity target. The Government is currently undertaking an assessment to determine which infrastructure requirements are required in the medium-term (until 2035) to ensure the desired level of generation adequacy is maintained. In the area of electricity

interconnectivity, Malta's objective until 2030 in the area of interconnectivity is therefore to remain above the 15% EU target.

Figure 18 - Electricity interconnectivity level under WPM scenario



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**

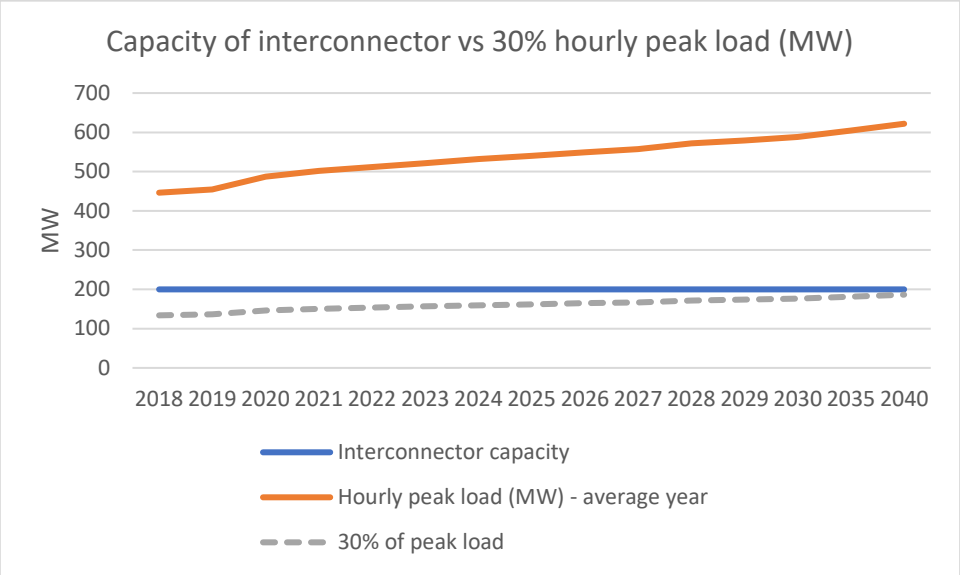
Enemalta is obliged to dispatch electricity from local generation plants and/or from the interconnector based on their order of economic merit. Any imbalances between the volumes determined on the day-ahead market and actual electricity flows over the interconnector are settled at the prices calculated 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 Load**

The nominal transmission capacity of the interconnector is 200 MW. Based on projections of national peak load under the WPM scenario, it is expected that the capacity of the interconnector shall remain

above the indicative threshold of 30% of peak load[43] throughout the projected period until 2040 (Figure 19). Nevertheless, moving towards 2040 the nominal transmission capacity of the interconnector will be just sufficient to satisfy this 30% threshold. This is being taken into account in the assessment currently being conducted by the Government, and the best level of interconnectivity will be reviewed once this is concluded.

Figure 19 - Nominal transmission capacity of interconnector vs 30% of peak load (WPM), 2018-2040



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 installed renewable electricity generation capacity between 2021-2030 under the WPM scenario, as shown in Figure 20. However, in the context of Malta's electricity system, the 30% threshold has limited relevance. RES electricity in Malta is almost exclusively generated from photovoltaic systems with no storage capability and significant intermittency caused by highly variable and localized cloud cover.

[43] The projection of peak load does not take into account potential (and likely) variations from the climatic average, that is, the impact of temperatures on peak loads.

Figure 20 - Nominal transmission capacity of interconnector and installed RES generation capacity, 2018-2030

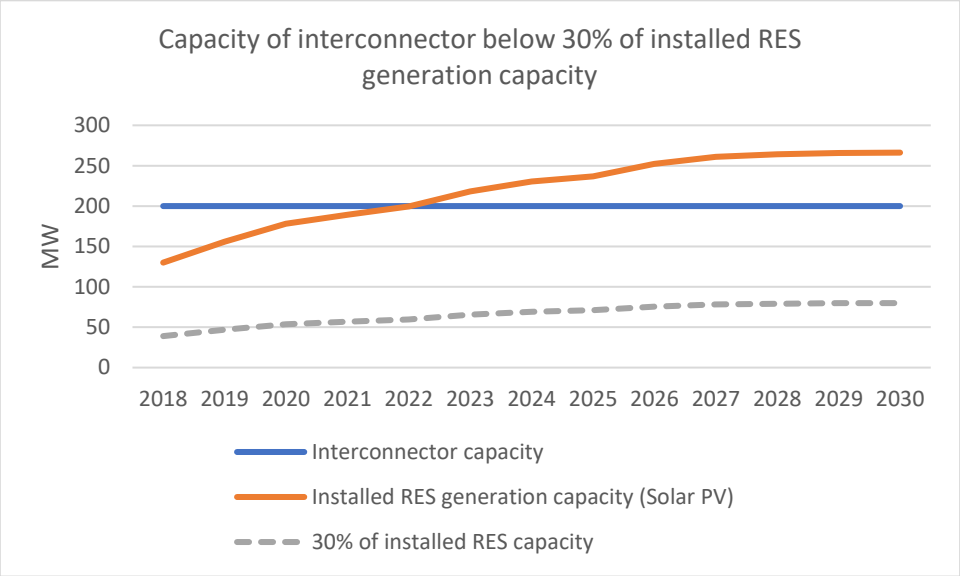


Figure 21 – Solar PV generation during a typical day in April with intermittent cloud cover (MW)

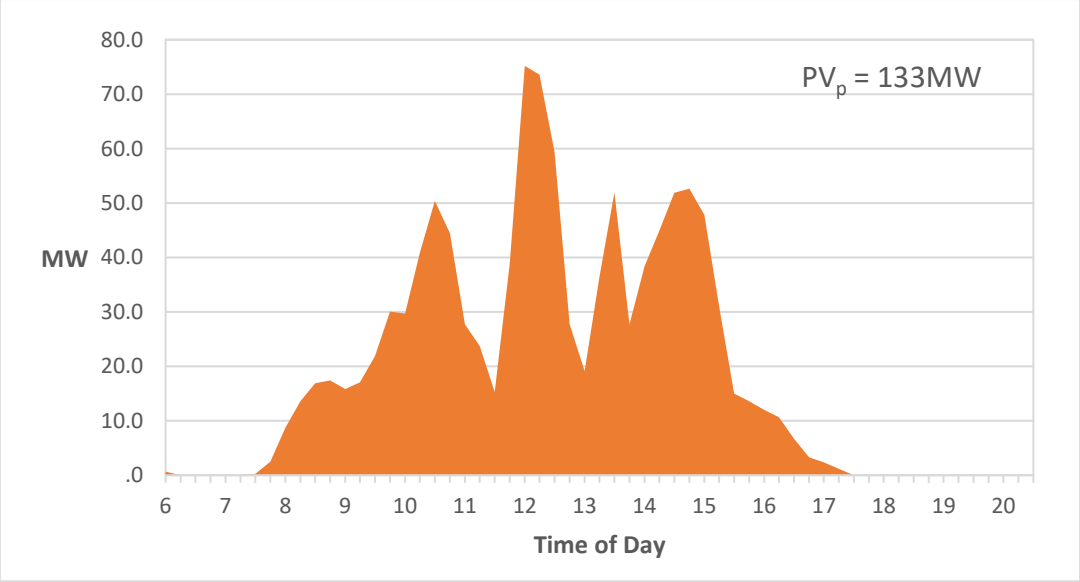


Figure 21 shows how, with an installed PV capacity of 133MWp, transients of circa 60MW are experienced within 60 minutes. As the installed renewable electricity generation capacity grows to a projected 266MWp by 2030, these transients are expected to increase proportionally. In view of the relatively small size of the Maltese grid, such transients are significant and consequential, resulting in interconnector imbalances requiring rapid load shifting, as well as frequent start-up and shutdown of the conventional generating plants. In practice this means that the interconnector capacity needs to handle the full extent of the imbalances, at least until conventional power plants can be ramped up, if spare capacity is available. This scenario also has significant implications for the DSO which is responsible for balancing the Maltese electricity system, which could be partially mitigated if the Italian electricity intraday wholesale market (with reference to the Sicilian bidding zone) would allow bids closer to gate closure time. The study commissioned by the Ministry responsible for Energy shall

identify options to optimize system costs whilst increasing its flexibility to absorb further renewable energy sources.

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 66 of Directive EU/2019/944 from the requirements of Article 43 (Unbundling of transmission systems operators), Article 35 (Unbundling of DSO), Article 6 (Third party access), and until 5th July 2027, from Article 4 (Free Choice of Supplier).

Natural Gas Transmission Infrastructure Projects

The proposed Malta-Italy Natural Gas Pipeline (MTGP) (Project of Common Interest 5.19) is described in Section 3.3.i. under the Energy Security dimension.

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. 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 the Government.

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 Directive (EU) 2019/944. 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 significant cost to ensure the desired level of generation adequacy as recognised by EU Commission's decision SA.45779 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[44]; and
- Ensure that appropriate distribution systems and market-related operational measures are taken in order to minimise the curtailment of electricity produced from RES.

iii. 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 99.6% of its consumers with smart meters and has adopted a tariff system that favours the prudent use of energy. Objectives and actions concerning renewable self-generation are discussed in section 3.1.2.vi. The expected increased share of renewable self-consumption by consumers with an installed PV system would provide additional benefits in the form of reduced stress on the electricity grid, in particular during peak hours in the summer months.

Additionally, a second generation of smart meters are being installed which will allow the consumer to be more aware of his energy consumption. This will be done through the consumer energy

[44] This shall be aligned with Article 12 to Regulation (EU) 2019/943.

management system where in-house display systems, smart phones and other devices will provide the consumer with real-time information on their consumption. Through this readily accessible information, the consumer has the opportunity to better understand his consumption patterns, resulting in increased energy conservation.

iv. 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.

Support for additional PV capacity shall also be aligned with the exigencies of a stable grid and shall consider options which facilitate the integration of battery storage. This promises to provide several benefits, including mitigation of overvoltage on the LV network, peak shaving, increased self-consumption and demand management. However, this depends significantly on the availability of storage solutions at an appropriate price point, such that any Government intervention can yield the desired results.

v. 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 3.4.4.i. 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 section 3.4.4. The assessment concluded that Malta does not have a significant number of households under energy poverty and therefore national objectives in this area have not been set. Nevertheless, as described in 3.4.4. Malta will continue to assess potential measures focusing on the alleviation of energy poverty and vulnerable groups of consumers.

2.5 DIMENSION RESEARCH, INNOVATION AND COMPETITIVENESS

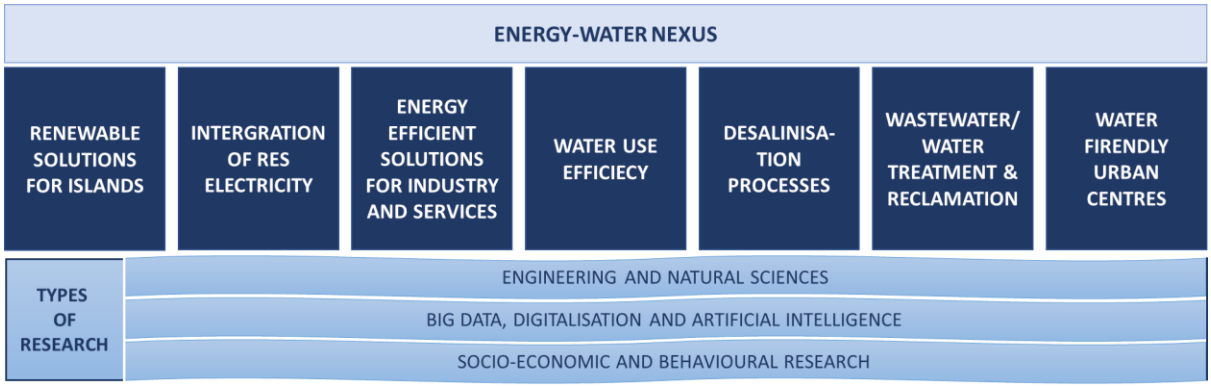
i. National objectives and funding targets for public and private research and innovation relating to the Energy Union

Malta's objectives for R&I relating to the Energy Union are defined in the Draft National Strategy for R&I in Energy and Water 2021-2030[45]. This is the first sectoral-specific Strategy which relates to energy and low-carbon technologies. During the upcoming ten-year period, Malta will seek to support and bolster R&I initiatives relating to the dimensions of Energy Union, specifically those which address national policy priorities and challenges, and those which contribute to national competitiveness and economic growth. This Strategy also seeks to strengthen and increase coordination and cooperation on R&I projects between the public sector, research institutions and business enterprises.

The Strategy places the research and the innovation aspects of R&I on equal footing, both considered to play an important role in contributing to the realisation of national ambitions relating to decarbonisation and industrial competitiveness. In the same vein, multidisciplinary research is emphasised and encouraged by the Strategy, which foresees support of R&I initatives from engineering and natural sciences, to digitalisation and artificial intelligence, and socio-economic and behavioural research. Within this multidisciplinary framework, a number of priority areas for R&I during the period 2021-2030 are identified (Figure 22). Those relating specifically to dimensions under the Energy Union include the following: (i) renewable solutions for islands; (ii) integration of RES electricity; and (iii) energy efficient solutions for industry and services. Note that these are the priority areas included in the *Draft* Strategy, selected based consultations with experts and early engagement with stakeholders. These are subject to updates/modifications based on the feedback received through the public consultation process which is expected to start in November 2019.

[45] At the time of writing of the Final NECP, the Draft National Strategy for R&I in Energy and Water 2021-2030 is about to be published for public consultation, with a view to its finalisation by the beginning of 2020.

Figure 22 - Priority areas for R&I activities defined in the Draft National Strategy for Research and Innovation in Energy and Water (2021-2030), subject to amendments following the upcoming public consultation process.



As noted in a report by the JRC Policy Support Facility (2019) on its peer-review of the Maltese research and innovation system, it is difficult to acquire a clear picture of the present R&I landscape in Malta and this naturally extends to R&I in field of energy and low-carbon technologies. As a result, a 'baseline' for R&I in this field has not yet been established, without which concrete targets cannot be set out. During the first implementation period under the National Strategy for R&I in Energy and Water, it is planned that a framework for systematic data collection on R&I in energy and water will be developed and a comprehensive baseline formed. Based on this, quantified 2030 objectives for R&I in energy and water could be established.

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 specific national objectives with regard to competitiveness. That being said, the National Strategy for Research and Innovation in Energy and Water (2021-2030) prioritises support for research activities which contribute towards the competitiveness of domestic business enterprises. Such home-grown products may also have the potential for scaling up and replication, thus multiplying the inherent added-value of such research and enhancing its potential contribution to increasing industrial competitiveness.

3 POLICIES AND MEASURES

3.1 DIMENSION DECARBONISATION

3.1.1 GHG emissions and removals

The final National Energy and Climate Plan (NECP) has been drafted whilst the long-term decarbonisation strategy for Malta is under development. Since the timelines of the two strategic documents were not running in parallel, additional policies and measures to those outlined in this section of the NECP could be included in the decarbonisation strategy. These would ultimately feature in a subsequent revision of the NECP. This is in line with the possibility of updating the NECPs to reflect new policies and measures which Governments decide to embark on, acknowledging the need to further reduce climate emissions, and the socio-economic impact of such policies and measures.

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

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 are being implemented as agricultural practices, which reduce the GHG emissions profile of the local agricultural sector. Addressing Malta's obligations under the EU legislation, particularly the Nitrates Directive (91/676/EC)[46], 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[47] 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. Beyond this, manure management is set to improve through the enactment of the below measure, which requires both an investment in new infrastructure and a change in current operations.

Manure Management – Dewatering of Slurries

The Governance of Agricultural & Bio-resources Agency has identified a way forward for the management of slurries, which cannot be applied to soil, considering the local context and the prevalent agricultural practices, adhering to circular economy principles retaining value resources in the process. The policy direction is to dewater the slurries and separately treat the liquid fraction from the solid parts of the dewatered manure. The main emission reduction, once this measure is implemented will be through the stabilisation of the organic content in the dry part and attained through the different treatment technologies applied to the separate fractions produced. Additionally,

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

this will allow that the current practice of having slurries discharged in the wastewater network to be discontinued, thus relieving wastewater management plants from the additional organic burden, and unnecessary maintenance costs. The emission reductions to be brought about by this measure are modelled in the WPM scenario.

Land Use, Land Use Change and Forestry

As illustrated in an earlier section, Malta is obliged to comply by the commonly referred to as the no-debit rule in line with the provisions of the Regulation on the inclusion of GHG emissions and removals from land use, land use change and forestry. Hence, Malta seeks to enhance removals or reduce emissions in the LULUCF sector. In view of this, afforestation projects have been undertaken in recent years, which had an effect on the area covered by permanent vegetation, particularly trees. However, the CO_2 removals as a result of such policy actions, have not been estimated, given that the scale of projects and the scale of removals would be very limited.

To date, such afforestation projects were focused on areas which also served as recreational spaces or were designated with conservation statuses, these included 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 also 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.

Another policy measure to incentivise tree planting was the 34U campaign, 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.

The policy direction in the years to come is to further augment such afforestation projects to enhance the sequestration potential to its maximum potential, whilst in parallel also focus on the better management of Natura 2000 sites to increase areas suitable for such purpose without negatively impinging on the conservation designations of these sites. All this whilst improving the data management of these activities to register progress in the calculation and reporting mechanisms pursuant to this Regulation.

Waste Management

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

The national Waste Management Plan for the Maltese Islands, covering the period from 2014-2020 has provided the strategic policy direction in this sector to shift waste management practices up the waste hierarchy, hence transitioning further from waste disposal in engineered landfills, which generate GHG emissions, to recovery, recycling, reuse or prevention, which have a lower environmental and carbon footprint. This is being further bolstered with additional policies as illustrated below, which have been modelled under the WPM scenario.

Waste Management Plan 2021-2030

Policies and measures charted out in the current Waste Management Plan 2014-2020 shall be further reinforced in the next Waste Management Plan which shall cover the time horizon between 2021-2030. The ultimate objective remains invariably the efficient use of resources to maximise the inherent value of waste in accordance with the circular economy principles. In doing so, we strive to generate less waste by increasing the lifespan of products and/or retaining resources in a closed loop through further reuse, or recycling, before ultimately recovering energy once products reach end-of-life. It will also endeavour to attain the ambitious waste targets agreed to recently, hence increasing recycling of municipal solid waste (MSW) to 60% by 2030 [and 65% by 2035] and reduce landfilling of MSW to 10% by 2035.

The new plan shall propose specific policies and measures, to build upon the progress registered in implementing those emanating from the current plan, the impacts of which are partly registered in the "With Existing Measures" scenario, whilst others are included in the "With Planned Measures" scenario, depending on the date of implementation.

Waste diversion from landfilling to more sustainable management alternatives shall 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.

This shall be notably achieved by consolidating further: (i) the separate collection of organic waste from households, which was rolled out on a national scale in October 2018. This shall in future be extended to include commercial establishments through regulatory and fiscal measures, hence capturing larger amounts of this biodegradable fraction which contributes significantly to GHG emissions when compared to other waste streams. (ii) the design and commissioning of new end-of-pipe infrastructural solutions to treat separately collected organic waste from which biogas is generated as a by-product; and (iii) focusing awareness campaigns on better quality recycling, together with increasing the enforcement capacity, as the success of waste management strategies and the subsequent reduction of GHG emissions generated in this sector, hinge upon the behavioural patterns of society at large, as waste separation at source is key to sustainable management of waste.

Recovering Energy from Waste

To further reduce landfilling of non-otherwise treatable or recyclable fractions, a decision to design, build and commission a waste-to-energy (WtE) facility was taken to treat the remaining estimated 40% of MSW.

It has been identified that the development of a WtE facility in Malta to complement the existing waste management infrastructure is a necessity to attain targets, established in various EU directives and transposed in both the current and upcoming Waste Management Plans for the Maltese Islands, which will see us through to 2030. Moving grate technology will be resorted to, with a thermal input between 30 and 43MW. The preferred location has been identified as that adjacent to existing engineered landfills and other waste management facility within the Maghtab complex.

The project will be based on proven technologies for WtE plant, including proven technology for flue gas cleaning. This means that the plant will be technically similar to many other WtE plants in Europe, with lower emissions generated in comparison to landfill activities. It is estimated that the WtE plant will be in operation in 2024.

ii. Regional cooperation in this area

Malta was one of the countries that had acknowledged the need to establish mechanisms to strengthen regional cooperation to address common climate change challenges through the promotion of better knowledge, sharing of information and best practices on adaptation and mitigation. This was done back in 2014 through the signing of the Declaration on Environment and Climate Change under the Union for the Mediterranean (UfM).

The provisions set under the Effort Sharing Regulation to allow Member States to seek flexible options in their compliance to the respective national targets is in itself an example of regional cooperation in order to contribute towards the European Union's collective target of 40% reduction of its GHG emissions by 2030 compared to 1990 levels. In view of Malta's limited mitigation potential, and resultant high mitigation costs coupled with significant socio-economic considerations such flexible options were resorted to, through the engagement of bilateral agreements with other Member States, which achieved emissions reductions in excess of their assigned national target.

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

Implementation of policies and measures which will lead to emissions reductions invariably require a financing plan, particularly those which involve heavy capital investment. Such financing plans are currently being drawn up and the tapping into EU funding mechanisms for specific infrastructural solutions particularly in the waste management sector are being considered such as structural and investment funds.

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 renewable energy sources and support the private sector in similar endeavours, taking into account all relevant circumstances affecting the deployment of renewable energy. Malta's potential for RES deployment is mainly affected by physical and spatial limitations, technological advancement and resource potential, with the availability and cost of land being the predominant restrictions for further deployment. In this regard, policies and measures will predominantly focus on solar PV, renewable

water heating technologies and biofuels. The shift towards a higher share of renewable heating and cooling[48]) from heat pump technology is not driven by a specific measure but indirectly benefits from advantageous 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. An assessment of Malta's technical potential for solar PV conducted by the Energy & Water Agency 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 capacity of solar PV.

Support for solar PV is regulated through Subsidiary Legislation 545.27 and 545.31 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, 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. 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.

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. 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 below 60A/phase or 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[49].

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 (MIP), which manages state-owned industrial premises, is promoting the use of roofs in industrial zones for the installation of PV systems. A Strategy focusing on the integration of renewable energy was launched by MIP in December 2018. This includes mapped scenarios for increased penetration of solar PV on tenants' rooftops. One-to-

[48] Renewable energy from cooling from air-to-air heat pumps is not included within Malta's RES share. As per Directive (EU) 2018/2001, the European Commission is required to establish a methodology for calculating renewable energy for cooling by December 2021.

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

one discussions and surveys with tenants are also being conducted with the aim of identifying potential barriers and encouraging the installation of RES. Future collaboration between MIP and relevant Government entities is envisaged with a view to also encourage tenants to make improvements in energy efficiency and further integrate renewables.

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 also in view of development trends which highlight the prioritisation of multi-apartment dwellings and high-rise buildings, that is, buildings with an increasing height to floor (roof) ratio. Discussions with key stakeholders may identify ways in which to better incorporate renewable technologies, thus increasing local renewable capacity and the energy performance of the building.

In order to further encourage the use of renewable sources of energy, the Government launched a scheme for voluntary organisations where eligible applicants will be offered a completely free PV system to be used on their premises. Depending on the size of the premise/building, organisations can choose to either install a 12 module PV system or a 24 module PV system. The scheme will be made available twice, with the first round of applications received in October 2019 and the second call will be open in March 2020.

Battery storage

As of 2020, a pilot scheme supporting the integration of battery storage with PV systems will be launched. Early adopters of solar PVs whose feed-in-tariff has expired will be eligible to receive a 25% grant (capped at €1,000) against the purchase of a battery system for the storage of renewable energy and therefore increase the share of self-consumption. A preliminary study was conducted in 2019 to assess the feasibility of such a measure; the pilot project will feed into this continuing assessment. It is likely that a large-scale roll-out of battery storage systems for households, PV-integrated or stand-alone, would require a significantly higher level of support or lower cost of storage than at present. In this regards Malta shall be seeking EU funds (including Cohesion funds) to bridge the gap.

Waste-to-energy plants

Organic waste is expected to continue being treated through anaerobic digestion plants. Projections of renewable electricity and/or heat generated by waste-to-energy plants from biodegradable waste content are based on projections of waste generation and are projected to remain largely constant throughout the projected period under the WPM scenario, as outlined in Section 2.1.2. In reality, it is expected that the treatment of the bio-organic fraction of waste can slightly increase in the future to reflect an increase in population. The Government is carrying out studies to assess the potential of increasing capacity of treatment of organic waste.

A new waste-to-energy thermal treatment plant is expected to be commissioned in 2024. 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 Malta's RES share in the NECP 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 pump water heaters, air-to-air heat pumps and biomass imports.

Renewable Water Heating Technologies

Given the high solar intensity prevalent in Malta, solar water heaters (SWH) are considered a viable source of RES. The effectiveness of an ongoing grant scheme supporting the purchase of SWH by households, has dwindled in recent years, with consumer preference shifting towards PV systems, especially when technologies compete for limited roof space. In 2018, the Government increased the maximum support level for SWHs from €400 to €700, capped at 50% of the eligible cost. The support scheme for Heat Pump Water Heaters (HPWH), which was launched in 2017, was extended and increased in 2018 to also provide a grant of 50% of eligible costs up to €700.

Post-2020, the existing financial support and incentives being offered will be revised with the aim of overcoming recently observed barriers. The Government aims to provide support for the installation of 800 renewable water heating technologies, namely solar water heaters and heat pump water heaters, each year from 2021-2030. 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/HPWH before purchasing the unit, removing potential downtime of a household's water heating unit. 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 800 units each year from 2021-2030 under this scheme will reach approximately €1,100,000 annually. As the capital cost of SWHs/HPWHs is assumed to remain high compared to conventional electric 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 parallel to the revamping of these schemes, the Government plans to initiate an educational and awareness raising campaign to entice households to invest in such technologies by highlighting the benefits of SWHs/HPWHs. It must be noted, however, that current trends which prioritise the development of high rises and multi-apartment buildings limit the technical potential of SWHs.

Air-to-Air Heat Pumps

Reversible air-to-air 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 air-to-air 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.

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[50] with the aim of meeting the target of a 10% share of RES in

[50] Subsidiary Legislation 545.17

transport in 2020 as per Article 3(4) of Directive 2009/28/EC. In line with Article 25 of Directive (EU) 2018/2001, the Government intends to extend the current substitution obligation framework until 2030, by gradually increasing the obligation of biofuel blending on importers of petrol and diesel from 10% in 2020 to 14% in 2030, by energy content, as a share of renewable energy supplied for final consumption in the road transport sector. The obligation will additionally require importers of petrol and diesel to increase the share of advanced biofuels from 0.1% in 2020 to 3.5% in 2030, with the share in 2022 and 2025 being 0.2% and 1% respectively. For the scope of meeting the requirements of Article 25 of Directive (EU) 2018/2001, Malta intends to consider biofuels from feedstocks listed in Annex IX of the Directive; these may be considered as twice their energy content for calculating the share of biofuels for transport.

Local importers and wholesalers of petrol and diesel will likely meet their post-2020 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[51].

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.

Malta has introduced an obligation on fuel importers to blend 0.1% share of advanced biofuel in their mix in 2020. This is in spite of the fact that advanced biofuels tend to be available in relatively small volumes globally[52,53] and their price projections demonstrate a sustained substantially higher cost over conventional biofuels and mineral fuels[54,55].

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[56] 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 has been assumed for projection purposes 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

[51] Neste Corporation (2016). Neste Renewable Diesel Handbook. Available at: https://www.neste.com/sites/default/files/attachments/neste_renewable_diesel_handbook.pdf
[52] ECOFYS (2017). Crude Tall Oil Low ILUC Risk Assessment: Comparing Global Supply and Demand.
[53] 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.
[54] DG Mobility and Transport, Sub Group on Advanced Biofuels (2018). Building up the Future: Cost of Biofuel.
[55] 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
[56] DG Agriculture and Rural Development & the Joint Research Centre. EU Agricultural Outlook: For the Agricultural Markets and Income 2017-2030.

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 CIF costs tend to be higher than for larger markets.

The energy regulator, REWS, will continue to ensure that all biofuels placed on the market fulfil the necessary sustainable criteria.

Electric vehicles

When projecting the local stock of electric vehicles and plug-in-hybrid electric vehicles under the WPM scenario, the impact of the relevant EU fleet CO_2 Regulations for the period post-2020 was taken into account. Although these standards will apply to vehicle manufacturers, the fleet of brand-new vehicles purchased in Malta tends to reflect that available on the EU market and therefore an assumption was made that the CO_2 fleet averages would also apply to Malta. It is assumed that vehicle manufacturers will increase the proportion of electric vehicles in their fleet to meet these standards. As a result of these Regulations which are supplemented by a national scrappage scheme, the stock of electric and plug-in-hybrid electric vehicles is expected to increase from just above 1,000 in 2020 to almost 26,000 by 2030 under the WPM scenario. Policies and measures addressing the electrification of transport are outlined in Section 3.1.3.iii focusing on low-emission mobility.

ii. Specific measures for regional cooperation

Development of indigenous renewable capacities will continue to be prioritised. However, given Malta's limited technical capacity for mature renewable technologies, as well as a sustained increase in demand, Malta envisages the need to acquire renewable energy credits to meet the 2020 RES share target of 10%, maintain this minimum target in 2021 and also meet its first reference point on the indicative trajectory in 2022. This plan foresees the option for Malta to avail itself of cooperation mechanisms to meet its renewable energy contributions as long as any higher commitments are subject to equitable sharing of costs and benefits.

In this context, Malta is willing to cooperate with Italy and explore the possibility of entering into joint RES projects as long as these yield benefits for both Member States. The possibility of tapping into EU funds such as the Innovation fund and CEF will also be considered, as well as coordinating with other Mediterranean countries on such projects.

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 Directive (EU) 2018/2001, the Government plans to extend existing support schemes, in the form of EU/national capital grant incentives and operating aid for the promotion of electricity from RES,[57] beyond 2020 in order to increase penetration of RES, with a focus on solar PV and renewable water heating technologies.

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

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

2030, indicating that few consumers would invest without financial support. This is the same for the commercial systems for which, based on current projections, the LCOE will not reach grid parity until the end of the projected period; this is largely on account of the associated high costs for land/rooftop rent and/or grid connections. 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.

It is being estimated that, on average, an additional estimated €8.4 million annually will be required to finance grants and feed-in tariffs supporting the installation of new PV systems and SWHs/HPWHs post-2020. An additional €12.2 million annually, on average, will be required throughout the period for continued support of existing PV systems. 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 Directive (EU) 2018/2001, 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 the periodic progress reports.

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

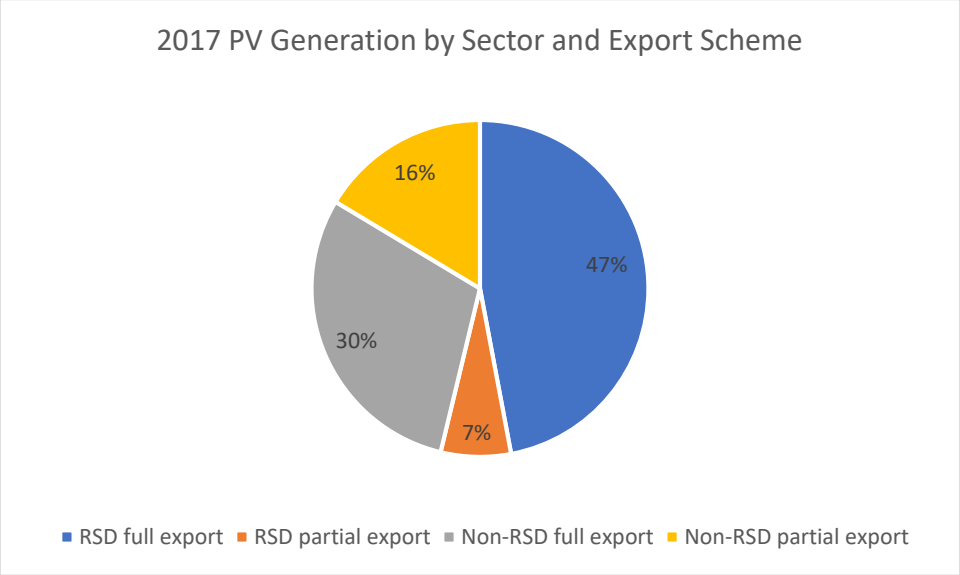
On a national level, discussions are ongoing on how best to implement the requirements of Article 16 and 17 of Directive (EU) 2018/2001. Following its transposition, Malta will implement the necessary regulatory and administrative changes required by the Directive.

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 legislation, 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. The option for self-consumption is not applicable for PV installations owned by third parties, with full export to the grid being the only option.

In 2017, systems on partial export generated 23% of total electricity from solar PV (Figure 23). Additionally, the proportion of electricity generated by these systems that was effectively consumed on-site in 2017 was 59%.

Figure 23 - Electricity production in 2017 from PV systems on full vs partial export by sector (residential (RSD) vs. non-residential (Non-RSD)), %



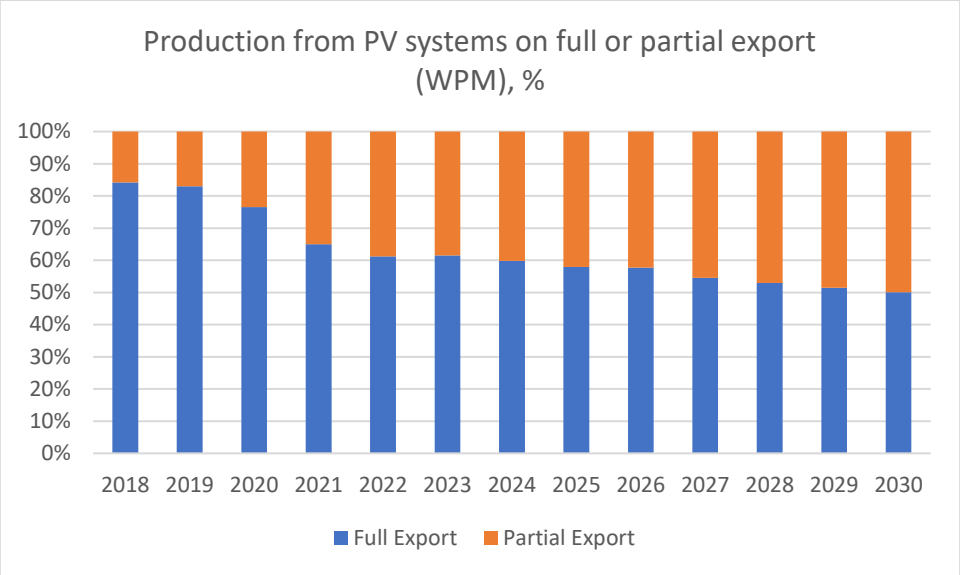
Since the introduction of support schemes in the form of feed-in tariffs, Malta's regulatory framework supported self-consumption and ensured that there would be no legal or technical barriers to renewable self-consumption. Systems which prioritise self-consumption face no additional charges when selling 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 (in real time) 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) of Directive (EU) 2018/2001, Malta

will be conducting an assessment to explore any potential unidentified barriers to renewable self-consumption.

It is expected that under the 'With Planned Measures' scenario, Malta will reach a Solar PV capacity of 266 MW by 2030, thus fulfilling its currently estimated technical potential. As explained in sections above, the Government intends to reach this capacity by extending its current framework of RES support schemes post-2020 for both residential and non-residential systems, including in the form of feed-in-tariffs (FITs)/ feed-in premiums. As the support period for several PV systems come to an end, it is expected that most of these will switch to a "self-consumption" billing option. Thus, consumers opting for this option are expected to increase, reaching circa 50% of installed PV systems by 2030 (Figure 24). This shift is also expected to drive demand management (to minimize electricity exported to the grid), which may be beneficial to the grid operator if well managed to reduce demand peaks.

Figure 24 - Production from PV systems on full or partial export under WPM scenario, 2018-2030, %



In view of the structure of the Maltese electricity system with one electricity supply market (Enemalta is designated as an exclusive supplier in Malta), it is not foreseen that renewable energy communities will develop in the short term. The specific nature of Malta's electricity system is fully recognized in Directive (EU) 2019/944 on common rules for the internal market for electricity in which Malta is granted derogations on third-party access, choice of supplier, and provisions related to unbundling.

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

Malta does not have any district heating and cooling networks. 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'[58], 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

[58] 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

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

As explained in previous sections, biomass is imported to Malta in rather small volumes and used for heating purposes by the residential and to a small extent the industrial and services sectors. It is foreseen that biomass imports in the future will remain stable and no specific measures are foreseen to promote the use of energy from biomass.

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

The competent authority responsible for the overall implementation and administration of the EU ETS in Malta is the Malta Resources Authority. In Malta, EU ETS covers the power generation and the aviation sectors. Legal Notice 434/2013 transposes Directive 2003/87/EC into local legislation in relation to stationary installations, while Legal Notice 403/2012 transposes the Directive insofar as it relates to aviation activities.

Operators of an installation performing an activity falling under Annex I of the Directive are required to apply for a GHG emissions permit. The allocation of allowances to stationary installations in the power generation sector is carried out in accordance with harmonized EU-wide rules, which involves both auctioning and free allocation on the basis of agreed benchmarks. Electricity generation plants in Malta falling within the scope of the EU ETS Directive are not eligible to any free allowances and are required to acquire allowances through auctioning and/or purchases on the emissions trading market. As regards the allocation for Phase IV (2021-2025), electricity generation plants were not eligible for any free allowances. Operators of installations in Malta are also obliged by law to submit to the competent authority monitoring plans describing how emissions will be monitored and reported.

Directive 2003/87/EC as amended by Directive 2008/101/EC included aviation activities in the scheme for GHG emission allowance trading. The Directive provides for an EU Member State to be responsible for administering each aircraft operator in the EU ETS. Allocation of allowances to aircraft operators is partly free on the basis of benchmarking and partly through auctioning. Three aircraft operators administered by Malta were granted free allocations for the years 2017 – 2023. Aircraft operators are also obliged to have an approved monitoring plan for annual emissions as well as for tonne-kilometer data.

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 final 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.

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 was introduced in October 2018. Although the effect of these measures on emissions has yet to be assessed, it is estimated that this measure has led to a reduction of circa 6,300 car trips. 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.

When compared to the WEM scenario, emissions under the WPM scenario are expected to decrease as a result of a number of infrastructure projects on the TEN-T network that will alleviate congestion and lead to an overall increase in the average speed of vehicles (and thus, lower fuel consumption compared to the WEM), such as:

- TEN-T Kappara (completed in 2017): expected CO_2 emission reduction of 1,700 tonnes per year;
- TEN-T Marsa-Hamrun By Pass Phase I (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 5,243 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.[59] The vehicles used are all electric.

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

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

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 2020. 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 now being analysed. 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)[60]

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

Bearing in mind Malta's specificities, there are no plans to phase out any energy subsidies at this particular juncture, while remaining committed to, inter alia, encourage the adoption of technologies that can help reduce greenhouse gas emissions.

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

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:

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

Figure 25 shows the final energy consumption per capita across all EU Member States. Malta has the second lowest final energy consumption per capita which is slightly more than half of the EU average.

Figure 25 - Final energy consumption per capita in 2017, GJ/capita (Source: Eurostat)

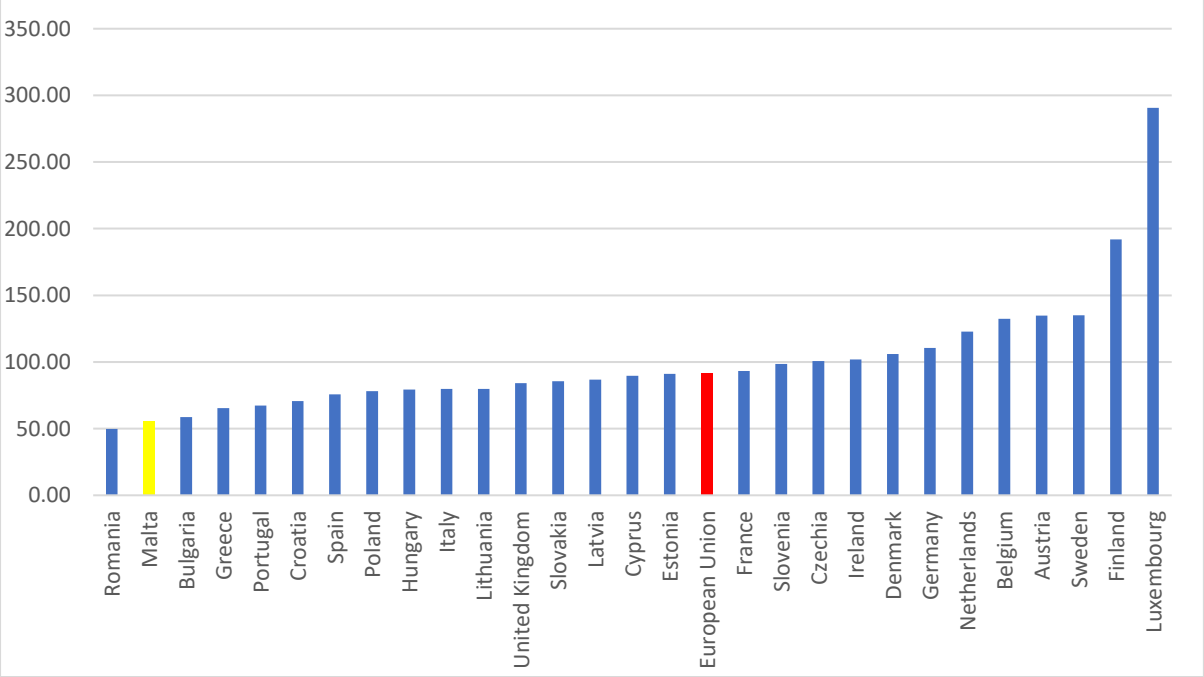


Figure 26 shows the sectoral consumption for the European Union for the year 2016 whilst Figure 27 shows the sectoral consumption for Malta for the same year. It can be highlighted that Malta's share of final energy consumption in transport is much higher than the EU average. This is mainly because:

- 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 climate, implying a lower heating demand i.e. heating percentage share of the final energy demand.

Figure 26 - Final energy consumption by sector in the EU in 2016, % (Source: Eurostat)

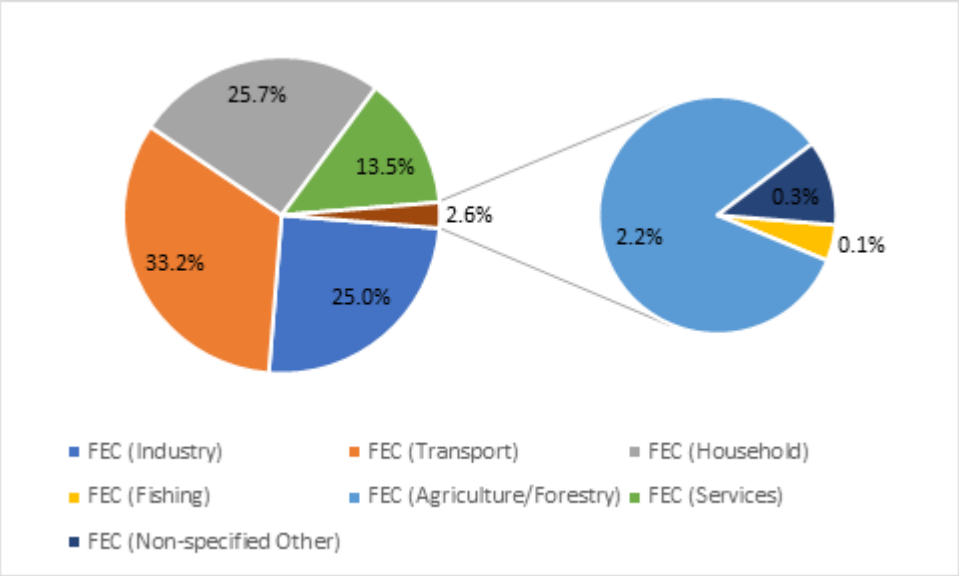
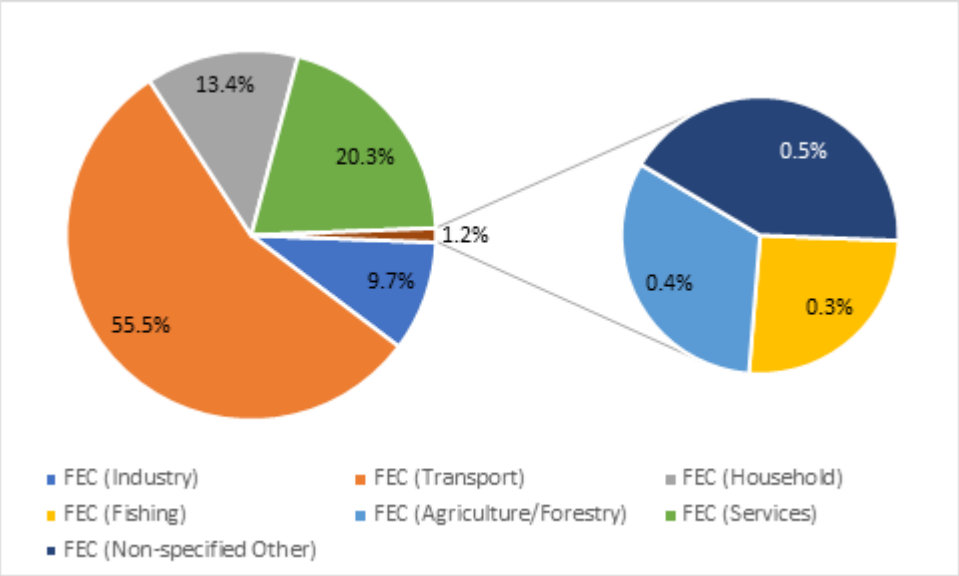


Figure 27 - Final energy consumption in Malta by sector in 2016, %



Transport

The transport sector is responsible for over half of the final energy consumption. Malta will be addressing energy efficiency in transport, through the measures identified in the 2025 Transport Malta Master plan as outlined in Section 3.1.3 iii on policies and measures to achieve low-emission mobility (including electrification of transport). Furthermore, the transport scrappage scheme, also included in the aforementioned section, will incentivise owners to scrap old less efficient vehicles and replace them by new vehicles thus reducing the number of old motor vehicles on the road.

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.

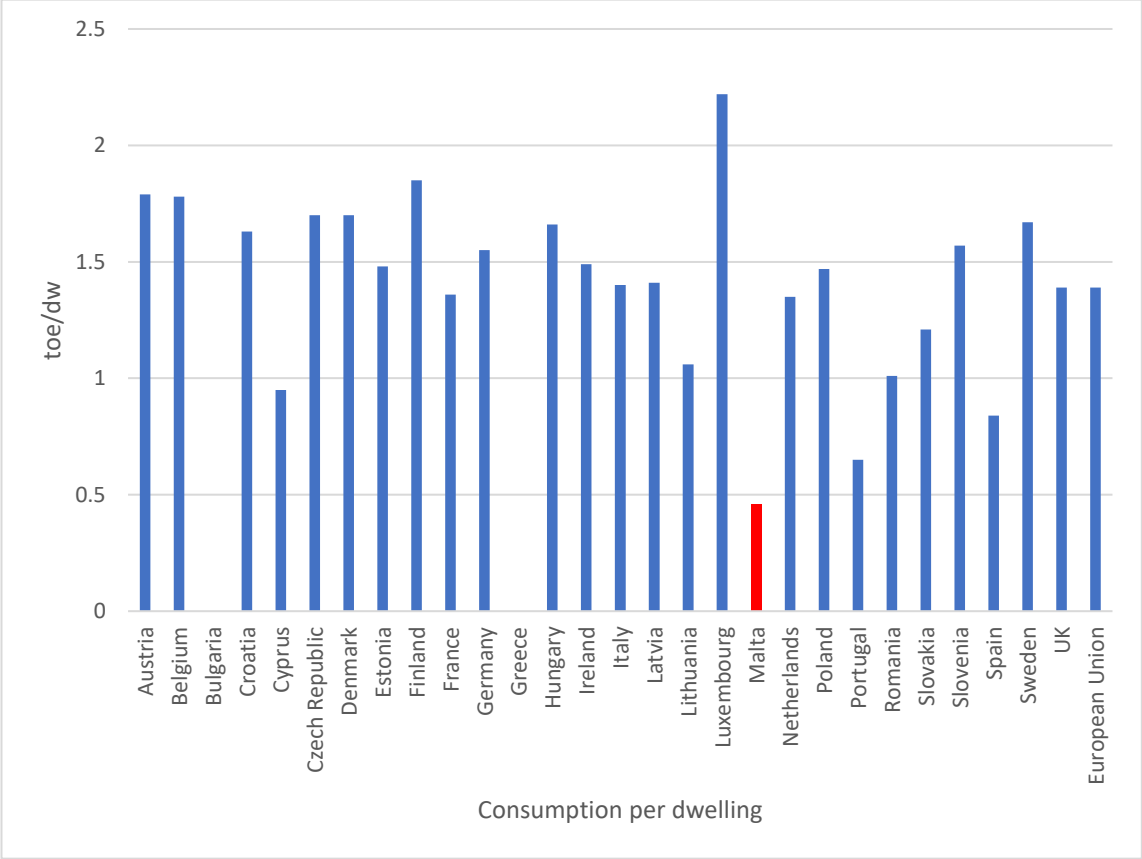
In contrast, Malta's share of final energy consumption by the services sector in 2017 was higher than the EU average reflecting the local service-based economy. Nonetheless, whilst the gross value added (GVA) of the services sectors increased by 9% its energy consumption increased by 4%.

Malta plans to address energy savings in these sectors by setting up a scheme in order to promote and address energy efficiency investment. Enterprises will be encouraged to undertake energy efficiency projects which shall be supported by investment aid. 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 until 2030.

Households

As per Figure 28, Malta's average consumption per dwelling is well below the EU average and is the lowest among all EU Member States.

Figure 28 - Average consumption per dwelling (adjusted to EU climate) in 2016, toe/dw (Source: Odyssee-Mure)



Furthermore, as shown in Table 6, Malta has a considerably different consumption profile. While the European Union as a whole 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 use of distributed alternative efficient cooling heat-pump technology. Furthermore, the installation of air conditioners employing heat pump technology does not require incentives and policy intervention for its

deployment. This is confirmed by the significant growth in the number of installations which is projected to continue to grow under both the 'With Existing Measures' and 'With Planned Measures' scenarios of the NECP. 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 any direct government policy. 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, benefit from utilization of ambient energy 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, air to water heat pumps and photovoltaic panels for own consumption. As these schemes are cross-sectoral and contribute to Malta's renewable energy target, they are described in more detail under Section 3.1.2 of the Plan.

Table 6 - Share of final energy consumption in the 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.

Furthermore, post-2020, electricity tariffs shall continue to incorporate a built-in mechanisms which promotes end-use savings. This includes a "rising block tariff" and an eco-reduction mechanism. These mechanisms incentivize end-users to reduce consumption below an established threshold and deter high consumption by applying higher tariffs as consumption increases.

Energy and Water Nexus

The biggest challenge in the Maltese water sector is the scarcity of natural freshwater. Malta has the lowest freshwater availability per capita in the EU. Even if these natural water resources are used sustainably, they are still not enough to meet national demand and therefore the production of alternative (non- conventional) water resources is a necessity. In view of this, Malta has developed a water management framework based on the conjunctive use of water demand management and water supply augmentation measures.

At present, the provision of water services accounts for 6% of the total national electricity demand. This is mainly used for water production, particularly due to the use of sea-water desalination plants which account for around 60% of the total production of potable water. Malta is well aware of the interdependency between energy and water and that the provision of the two has to be considered in a holistic and economic manner if sustainability is to be achieved. In this regard, 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 €38.6 million.

Water Demand Management (water efficiency) also leads to energy savings as it results in lower volumes of water moving in the urban water cycle. At national/regional level, distribution network leakage identification and control is the most effective measure to optimise the effective use of water. Leakage management in Malta resulted in a reduction of around 40% of municipal water demand over a 15-year period.

Demand management measures are also important at the level of the user. Domestic water consumption in Malta stands at around 17 million m^3 pa which amounts to an average daily consumption per person of around 115 litres. Well aware of this, the Energy and Water Agency has embarked on a nation-wide campaign to help raise awareness on the optimised and efficient use of water resources to facilitate a cultural shift in people's behaviour towards water conservation. Various communication methods are being used in order to reach the wide population including developing a campaign Branding Identity; advertising on conventional media; education through non-conventional media sources; organization of large events amongst others.

The Agency also carries out household visits (particularly in vulnerable households) where technical personnel are tasked with helping residents understanding energy and water usage and provide tailored energy conservation tips. Such households are also provided with water saving kits which provide all the necessary information on water conservation (also as part of the aforementioned campaign).

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. In line with these obligations, 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[61]

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, long payback periods associated with most measures, 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 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.

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

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.iii 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 strive towards a decarbonised economy. There are also a number of additional measures which are expected to contribute but are not listed under Article 7 measures due to them being difficult to quantify. These mainly target efficient transportation and include free public transport for youths and the elderly (over 75 years), support for bicycles and pedelec bicycles whereby a grant is given on the purchase of either of the two equivalent to a full refund of the VAT and additional sea transport routes around the island to increase connectivity.

Electricity Generation

By 2017, Malta had closed its inefficient power generation units and was exclusively using natural gas for electricity generation[62] 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 co-funded under the CEF. The plan is to obtain the permits and apply for EU co-funding for works by 2020 and, following a publication of an Engineering Procurement and Construction tender, proceed with construction for a target commissioning date of 2025. 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 and local legislation. It must be noted that Enemalta has installed 99.6% of its consumers with smart meters and has adopted a tariff system that favours prudent energy use and energy efficiency, with 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

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

shall be a prerequisite for access to support schemes mentioned in section 3.2.iii. 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.

In 2019, the Malta Business Bureau[63], launched a business cluster on energy efficiency which brings together experts, suppliers, and clients in order to facilitate knowledge transfer, exchange of best practice and help identify solutions to challenges businesses encounter on energy efficiency projects. Challenges could include sourcing specific technical expertise, financing of larger projects, and administrative and bureaucratic hurdles. Government is set to provide support in line with State Aid rules, in order that set ups such as Energy Clusters take shape.

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 build on lessons learnt from previous cycles so as to ensure that future Energy Audits performed by non-SMEs attain a higher quality. To take the audits a step further,

[63] The Malta Business Bureau represents the Malta Chamber of Commerce, Enterprise and Industry and the Malta Hotels and Restaurants Association (MHRA) in Brussels and Malta. It does so by liaising directly with the European institutions, the Maltese Permanent Representation and with umbrella organisations such as BusinessEurope, EUROCHAMBRES and HOTREC on all policy and funding issues affecting Maltese business interests.

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 and energy poor households. Energy efficiency schemes and grants will specifically address vulnerable households including the elderly 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 €200,000 to support a scheme for vulnerable and energy poor households under which old appliances are replaced by new efficient units.

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 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.

The Energy and Water Agency will also be undertaking initiatives to help raise awareness amongst the public on behavioural changes which can help save energy. These include studies as well as educational and social media campaigns in order to increase energy efficiency in households.

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. 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 funds. National authorities responsible for implementing specific energy efficiency measures and carrying out specific projects are responsible for their financing. Nevertheless, the use of EU funds is and will continue to be used as a complementary financing tool to national funds for energy efficiency measures.

The current Operational Programme I '*Fostering a competitive and sustainable economy to meet our challenges'* for the 2014-2020 period, aims to enable the shift towards a more low-carbon and environmentally-friendly society. 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.

For the next programming period 2021 – 2030, Malta shall seek to secure funding to continue to support the deployment and integration of RES and energy efficiency-measures in households, industry and services, and Voluntary Organisations. As explained earlier, several EE measures are not deemed as financially viable which leads to a significant funding gap. A similar situation exists for small scale RES such as Solar Water Heaters (SWH) and Heat Pump Water Heaters (HPWH). The uptake of the former has dwindled over the past years, and the latter technology has yet to take off. Furthermore, thousands of solar water heaters are expected to reach their end of life in the next 5 years. In order to meet the renewable energy contribution as well energy efficiency targets under article 7, it is estimate that around 800 households would need to be supported to purchase either a SWH or a HPWP each year until 2030. Government support would need to be leveraged by EU funding if this figure is to be achieved. The budget for this measure is estimated at 14 million Euros. Malta is also banking on EU Funds to support Energy Efficiency actions by Voluntary organisations, industry and services sectors. The total budget for the aforementioned is set at 5 million euros and 17.5 million euros respectively.

The conclusions of an ex-ante assessment carried out by the EIB on behalf of the Managing Authority in connection with the design of a financial instrument to support EE and RES 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 and Directive (EU) 2019/944.

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 implicit in the way measures are selected and policies adopted, and would therefore not feature as an explicit measure to be identified under each of the five dimensions of Malta's NECP.

There are, however, other factors that need to be equally considered when applying the "Energy First" principle in energy planning, policy and investment decisions which need to give due importance to security of supply and cost-efficiency. 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

Melita TransGas Pipeline

Malta is working actively on the development and implementation of the Melita TransGas Pipeline ("MTGP") from Delimara (Malta) to Gela (Italy), that would end its isolation by connecting the island to the trans-European Natural Gas Network. This would allow the transportation of gas from the Italian gas network necessary to meet Malta's gas demand for power generation and provide the basis for the development of an inland gas distribution market.

MTGP Project has been selected as a Project of Common Interest (PCI 5.19) under the priority corridor "North South gas interconnections in Western Europe" in the first, second and third PCI lists. It poses a means to fulfil EU strategic energy policy goals on energy solidarity between Member States, the formation of an Internal Energy Market, diversification of sources, reduced dependency on a single

supply source and improved energy security. Indeed, the conclusions of the European Council of February 2011, and reiterated in October 2014 stated that "No EU Member State should remain isolated from the European gas and electricity networks after 2015 or see its energy security jeopardized by lack of the appropriate connections", corroborating the urgency of MTGP implementation.

In August 2018, Melita TransGas Company Limited ('MTG') was established as a public undertaking to succeed the obligations of the Ministry for Energy and Water Management (as the previous Project Promoter of PCI 5.19) for the implementation, construction and commissioning of the MTGP. The company would also be entrusted with the operation of the transmission infrastructure and has taken the role of the prospective Transmission System Operator.

The Maltese Government fully supports the implementation of the MTGP, including it in all the plans and programmes aiming to ensure diversification of gas supply sources and increase security of supply by connecting Malta to European gas networks.

As portrayed in Figure 103, the peak demand and electricity generation demand are projected to continue to increase. Whilst the Electricity Supply Study is expected to present optimal solutions to meet the expected growth in electricity demand, the range of solutions are limited within the context of the present configuration:

- The LNG facility at Delimara (tender issued in 2013) was sized in such a way as to ensure that together with the installed power generation, interconnection capacity and projected growth in PV installations, the electricity system would be able to meet peak load and demand whilst ensuring the desired level of system adequacy. However, the latest national electricity demand projections, developed for the purpose of this NECP, indicate a much steeper growth in demand (peak demand reached 510MW in 2019[64]), which is expected to be sustained in the short to medium term. This requires urgent solutions, to be in place to maintain the present level of security of supply. The size and operational limitations of the LNG facility impinge on the range of possible options;

- The present LNG facility also has inherent limitations such as the inability to provide natural gas to the power plants during specific (bad) weather conditions, which could lead to a situation where supply to consumers would need to be curtailed should this occur during periods of high demand;

- The main purpose of the LNG facility was to enable the country to switch from heavy fuel oil to natural gas in the shortest possible time, but was always intended as a short term solution in view of the pipeline project. This is also reflected in contractual arrangements between Enemalta and the suppliers of LNG which provides for a gas-exit clause after 10 years of operation to coincide with the projected commissioning of the pipeline;

- The LNG facility is designed to service exclusively the power sector. The LNG supplier and operator of the LNG facility is not allowed to supply other clients with gas in view of its

[64] https://www.enemalta.com.mt/news/high-electricity-demand-registered/

obligations under the assigned SGEI (to ensure the desired level of security of supply) and in line with Malta's notification and subsequent Commission Decision SA.45779. This restricts the development of an inland market for natural gas. It is expected that the commissioning of a natural gas pipeline, which would be subject to the rules of 3rd Energy package, would provide a good basis for the development of an internal market for natural gas.

The Government of Malta therefore considers the pipeline as an essential element for the development of its electricity system necessary to provide the desired flexibility, reliability and level of security of supply with regards to future solutions which are deemed critical to meet additional demand.

Moreover, in view of the climate change policies at the EU level, the implementation of the pipeline will eliminate the GHG emissions from the current liquefaction, shipping and regasification activities necessary for the LNG supply.

The development of the pipeline shall also take full account of Malta's commitment to decarbonise its economy and will ensure that at the design stage features are included which do not preclude its use to carry green fuels such as biogas and hydrogen should the distribution of these products over the European gas grid becomes mainstream in the future. Such a development would greatly contribute towards Malta's future efforts to increase its renewable energy share given the limited effective RES resources and clear trend towards electrification.

The project envisages a gas pipeline interconnection between Gela (Sicily-Italy) and Delimara (Malta) currently designed as a 22 inches (560mm) diameter, 159km length and with a bi-directional flow capacity of 2 Bcm/y at standard conditions.

MTGP has been repeatedly included in the national Ten-Year Network Development Plan (TYNDP) of the Italian TSO (SNAM Rete Gas) confirming that it "is ready to implement the necessary measures to facilitate the connection to the national network, when the progress of the project will prefigure an effective commitment to its realization".

At European level, MTGP (ENTSOG Project Code: TRA-N-031) has constantly been submitted and included in the Union-wide TYNDP of 2013, 2015, 2017 and 2018 elaborated by ENTSOG pursuant to the Regulation (EC) No 715/2009.

MTGP has already benefitted from the 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 up to the end of 2020:

- the Pre-feasibility study and Cost-Benefit Analysis, completed in April 2015, determined that the project is feasible and identified the most economical project technical configuration;

- the Basic Design 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), and enabled the start of the permitting procedures in both Malta and Italy;

- in 2018 activities related to the environmental studies, a preliminary marine route survey and the front-end engineering design were commenced.

- a cross-border cost allocation decision was issued jointly by the Maltese and Italian National Regulatory Authorities on the 4th of June 2019 which states that Malta should bear 100% of the costs of the MTGP project and as such, no monetary transfer is needed between Italy and Malta.

The project promotor is seeking financing avenues including the possibility of bringing onboard a strategic partner. A Final Investment Decision, is expected to be taken by the end of 2020. This will be followed by the publishing and award of an engineering, procurement and construction (EPC) contract. Table 7 provides an overview of the preliminary project implementation plan.

Table 7 – Gas pipeline project implementation plan

Timeline	Description
November 2017	Start of pre-application permitting procedures in Malta and Italy
2018	Start of preliminary marine route survey (PMRS), Front-End Engineering Design, and EIA studies
2019	Cross Border Cost Allocation Decision issued jointly by Maltese and Italian NRAs
2020	Submission of Full Permit Application Files to Maltese and Italian Competent Authorities
2021	Publishing of Tender for EPC Contract
2022	EPC Contract Award
2025	Construction & commissioning completed

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. Each designated critical and emergency organisation is required to identify Security Liaison Officers (SLOs) and Emergency Liaison Officers (ELOs), which act as the points of contact for security related issues between the owner or operator of the critical infrastructure (CI) and the CIP Unit. The CIP Unit's responsibility is to assess whether each designated CI possesses an Operator Security Plan (OSP) and has in place equivalent security, technical, communication and organisational measures.

Under LN 434/2011, every owner or operator of a designated critical infrastructure 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.

Cyber-security in the energy sector

Directive (EU) 2016/1148 of the European Parliament and of the Council concerning measures for a high common level of security of network and information systems across the Union is transposed into national legislation through the **Measures for High Common Level of Security of Network and Information Systems Order**[65] (Legal Notice 216 of 2018). The order establishes the Critical Information Infrastructure Protection Unit (CIIP unit) within the Critical Infrastructure Protection Directorate, responsible for monitoring the application of the Order, which includes the establishment of criteria for the identification and designation of essential services within Malta as well as identifying the designated operators of essential services in Malta. The CIIP unit is also tasked with encouraging the use of European or internationally accepted standards and specifications relevant to the security of network and information systems. Electricity, oil and gas undertakings are included as operators of essential services in the energy sector.

The requirements and tasks of Computer Security Incident Response Teams (CSIRTs) within designated operators are also spelled out in the legislation. CSIRTMalta, the national CSRIT Unit within the CIIP Unit, supports critical infrastructures (CIs), Critical Information Infrastructures (CIIs) and other sensitive infrastructures in Malta on how to protect their information infrastructure assets and systems from cyber threats and incidents. CSIRTMalta also promotes the sharing of unclassified information which is useful against cyber-attacks and provides alerts and warnings to its constituents and internal autonomous CSIRTs.

A number of measures are currently being prepared by the Critical Infrastructure Protection Directorate to enhance the cyber security across multiple sectors, including energy. This includes the following:

(i) Identified Operators of Essential Services are encouraged to establish their own Computer Security Incident Response Team (CSIRT) under the local transposition of the NIS Directive (L.N. 216 of 2018).

[65] Measures for High Common Level of Security of Network and Information Systems Order (Legal Notice 216 of 2018):http://justiceservices.gov.mt/DownloadDocument.aspx?app=lp&itemid=29161&l=1

(ii) CSIRTs within Operators of Essential Services (OES) are encouraged to take part in CSIRTMalta constituent program and uptake a number of recommended measures such as access to the Malware Information Sharing Platform (MISP) and take part in regular training workshops.

(iii) CSIRTMalta managed to successfully apply to an EU funds program and acquired 1.2 million EUR in funds to assist OES's CSIRTs in purchasing equipment and necessary training such as MISP training and TAP devices.

Cyber-security risks were also considered within the existing contingency planning, such as the Risk Assessment and Preventive Action Plan and Emergency Plan under the Gas Security of Supply Regulation. The Critical Infrastructure Protection Directorate (CIPD) was consulted during the development of these plans to ensure that gas facilities are classified with respect to designated essential services, that the appropriate cyber-security measures are in place which enable the manual override of electricity and gas facilities in the event of a cyber-attack.

Gas Security of Supply

The Security of Gas Supply 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 multiple tasks, which includes the development of a gas security of supply national Risk Assessment, a Preventive Action Plan and an Emergency Plan. The Ministry for Energy and Water Management, as the designated Competent Authority for Malta, delegated these tasks to the Energy & Water Agency. In line with Annex I of the same regulation, Malta forms part of four risk groups, which are also required to prepare a Risk Assessment and the regional chapters for the preventive and emergency action plans:

- 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 Libyan and Algerian risk groups have completed the common risk assessment and the relevant document has already been submitted to the Commission.

Malta's **National Risk Assessment** in line with Article 7(3) of the Regulation was completed and submitted to the European Commission in December 2018. The Risk Assessment considered the loss of the gas facility at Delimara on a day of peak demand with a likelihood of occurring once in 20 years. As the only use of natural gas in Malta is for electricity generation, the Risk Assessment considered how the loss of the LNG facility would impact the supply of electricity. Since meeting electricity demand is more sensitive to within-day peaks as compared to gas, Malta's Risk Assessment also considered within-day peak periods. The Risk Assessment identified that should the single largest

piece of gas infrastructure be lost, Malta would be unable to meet all gas demand should this coincide with an exceptionally high energy demand day. The "N-1" principle identified that at a daily level, peak demand can be met by relying on all other sources of electricity, such as gas-oil-fired generation units, the electricity interconnector and indigenous PV generation. However, the Risk Assessment also demonstrated that whilst solar PV contributes in aggregate and in daylight hours, peak electricity demand in afternoons and evenings cannot be completely met without gas for electricity production. The Risk Assessment also highlighted the strategic national importance of the Delimara site and the need to ensure its security and resilience against natural hazards and man-made threats. Multiple risk scenarios were identified and adapted to gas security of supply.

Article 8(2) of the Regulation requires that Member States develop a **Preventive Action Plan** containing the measures needed to remove and mitigate the risks identified in the Risk Assessment and an **Emergency Plan** outlining the measures to be taken to remove or mitigate the impact of a disruption of gas supply.

The Preventive Plan established a list of preventive measures in place, or to be adopted, to address the risks tied to a disruption of gas supply, as well as the measures and obligations of relevant stakeholders which contribute to the prevention of a gas disruption of supply. The list of preventive measures includes physical security arrangements, periodic technical and engineering inspections and monitoring, national security measures, legal, statutory and operational obligations, as well as measures promoting the use of RES, energy efficiency measures, measures promoting the diversification of sources of energy supply, as well as measures available at regional level identified within the relevant Risk Groups. Malta does not have household gas customers, SMEs or essential services that are connected to a gas distribution network or gas district heating network. Nevertheless, customers are vulnerable if the supply of gas is restricted or stopped through the reduced availability of electricity. To minimise the impact from a gas supply disruption, Malta will maintain a formalized procedure for prioritising electricity supply to these groups of vulnerable customers.

The Emergency Plan defined three main crisis levels related to a disruption of gas supply: early warning, alert and emergency, and outlined the roles and responsibilities of specific actors, such as the competent authority (MEW), natural gas undertakings, the electricity distribution system operator, the national regulatory authority, the Civil Protection Department and other stakeholders per each crisis level. The Plan also identified the measures and actions to be taken to mitigate the impact of a disruption of gas supply on the electricity sector and the mechanisms and provisions in place to ensure the appropriate coordination and exchange of information between the main actors in the gas and electricity sectors. Apart from the escalation process, going from one crisis level all the way to an emergency situation, the Plan also outlines the measures and responsibilities for the process of de-escalating an emergency situation back to business-as-usual.

The Preventive Plan and Emergency Plan are being submitted to the European Commission by the end of 2019 and will be made public thereafter. The risk assessment, preventive action plan and emergency plans shall also be updated every four years. This periodic reporting cycle allows Member States to assess the risks leading to a potential gas supply disruption and identify the necessary preventive measures and emergency measures on a regular basis. The Melita Trans Gas Pipeline would have a significant impact on Malta's energy security and would introduce new risks and require the implementation of new preventive and emergency measures. This would be reflected in future

updates of the plans under the Gas Security of Supply Regulation should the pipeline come into operation.

Risk Preparedness in the Electricity 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, the Competent Authority and Enemalta, are obliged to comply with Regulation (EU) 2019/941 on risk-preparedness in the electricity sector repealing Directive 2005/89/EC. The Regulation sets out a common framework of rules on how to prevent, prepare for and manage electricity crises whilst ensuring that measures are taken in a coordinated and effective manner, including solidarity measures between Member States. As per the Regulation, Member States are required to ensure that all relevant risks relating to the security of electricity supply are assessed, identify electricity crisis scenarios and subsequently establish Risk-Preparedness Plans, which consist of national and regional measures to prevent, prepare for and mitigate electricity crisis. This Risk-Preparedness Plan will be developed in line with the Regulation.

Taking cognizance of the obligations arising out of the now repealed Directive 2005/89/EC, 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 which lead to a breach of 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 amended by Commission Implementing Directive (EU) 2018/1581, 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 and amended by Legal Notice 156 of 2019. 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.

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 for Energy and Water Management. 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.

Emergency stock holding obligations

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, with the balance being held locally as either physical stock or tickets. 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.

Petroleum Exploration Activities

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.

Although the Government will continue to promote petroleum exploration opportunities, these should not be seen in contradiction to the long-term decarbonisation goals of the Union and its Member States, which are at the forefront of the Energy Union Governance framework and the NECP. The Government's commitment remains to support the deployment of viable and effective indigenous renewable energy sources, whilst already having moved to a more sustainable energy mix based on natural gas and the electricity interconnector. The role of gas-based generation will be important to sustain energy demand in the medium-term on the road to decarbonisation of the energy system in the long-term.

Energy Storage solutions

The Government is closely monitoring the development of the energy storage market considered essential for further deployment of photovoltaic capacity and for optimization of the power system by providing for demand management and peak demand shaving. This may postpone the requirement for new power generation facilities. In this regard, the Government will be assessing cost-effective,

technically viable options to increase the flexibility of Malta's power system whilst ensuring the desired level of security of supply and further integration of low carbon technologies.

It's important to note that the range of storage solutions which could be successfully implemented in Malta is also limited. For instance, the predominant large-scale energy storage solutions, such as pumped-storage hydropower are not available in the Maltese context. As per projections under the 'With Planned Measures' scenario, the capacity of solar photovoltaics is expected to increase from 112 MW in 2017 to 266 MW by 2030.

Policies and measures to promote the deployment of renewable sources of energy, including solar PV generation, are described in more detail under the Decarbonisation dimension.

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. There is only one supplier of electricity in Malta and therefore the onus to meet the energy demand, including peak demand is on Enemalta plc. as the DSO. Enemalta maintains a gasoil-powered back-up generation plant having a total nominal capacity of 180 MW which is used in case of an emergency and which provides black start capability.

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.

Regional cooperation is expected to be most prevalent with respect to the implementation of the MTGP pipeline. 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.

As regards 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.

Regional cooperation is also an important element under the Security of Gas Supply Regulation. As mentioned above, Malta forms part of the active Libyan and Algerian Risk Groups. The Common Risk Assessments for Algeria and Libya confirmed that Malta is not at significant risk from disruption to gas supply from either country. The only source of natural gas in Malta is imported LNG. To date, LNG used in Malta has not been sourced from Algeria or Libya. The Regional N-1 analysis demonstrated that the technical capacity of remaining gas infrastructure within these Risk Groups is adequate to meet maximum gas demand in the event of a disruption to the single largest piece of infrastructure. The Regional chapters of the Preventive Plan and the Emergency Plan also identify various mechanisms developed for cooperation between Member States, such as the exchange of relevant information between Competent Authorities, risk groups, and the Gas Coordination Group organized by the European Commission.

Should the MTGP pipeline become operational, the risk to Malta in the context of these risk groups will change and the risk to gas security of supply will be reassessed accordingly. The gas pipeline would also open up a new range of regional measures and cooperation mechanisms for the prevention and mitigation of a disruption of gas supply, including solidarity arrangements between neighbouring and interconnected Member States and interconnection agreements between adjacent TSOs.

Under the new Risk-Preparedness Regulation in the electricity sector, Member States are required to act and cooperate in a spirit of solidarity in order to prevent or manage electricity crises. Regional and bilateral measures have to be agreed upon by Member States for the purpose of protecting public safety and personal security and outlined in their Risk-Preparedness Plans. Malta's national Risk-Preparedness Plan will be developed in the coming future and will take into account solidarity mechanisms, in particular through the electricity interconnector with Italy.

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 sought to develop the Malta-Italy gas pipeline. Funding was also sought 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. Apart from funding mechanisms falling under the Multiannual Financial Framework, Malta will continue to seek to tap direct EU funding opportunities.

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. 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 Electricity Supply Study commissioned by the Government for the period 2019-2035. 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, while taking into account the additional transmission costs.

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, financial support measures, 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 which would also include aggregation, demand response and storage subject to technical requirements.

Public Service Obligations

The electricity distribution system covering Malta remains under the responsibility of one distribution system operator which forms part of a vertically integrated company, Enemalta plc. Enemalta is the only undertaking which is licensed to carry out all the three activities of generation, distribution and supply.

ElectroGas Malta Ltd (EGM) owns and operates the combined cycle gas turbine (CCGT) at D4 running on natural gas. The licence to generate electricity from this plant was issued by the Regulator (REWS) to ElectroGas Malta Ltd in 2017. The CCGT plant was constructed as part of a single electricity and natural gas supply project, the scope of which was to enhance the security of supply of electricity, replace inefficient generation plants and switch to natural gas as the main source of local power generation. The project and underlying agreements were subject to an assessment by the European Commission under the Services of General Economic Interest (SGEI) framework which led to the *State Aid Decision SA 45779 (2016/NN) – Malta Delimara Gas and Power Energy Project*. In its Decision, the European Commission recognised the importance of the project for the security of electricity supply in Malta. The Commission concluded that ElectroGas Malta Ltd has been entrusted with a Public Service Obligation (PSO) to make available electricity and gas to Enemalta when dispatched and nominated by Enemalta, and this entrustment constitutes a SGEI in terms of Article 106 of the Treaty on the Functioning of the EU ("TFEU").

The project involves the following contractual structure:

I. **Security of Supply Agreement (SSA)** – agreement between the Government of Malta, Enemalta and EGM to ensure that, should any circumstances arise which is capable of leading to the termination of the other contractual agreements, or in the event that Enemalta is unable to continue procuring electricity and/or gas from EGM, the Government will be able to assume Enemalta's obligations under the relevant supply arrangements.

II. **18-year Power Purchase Agreement (PPA)** – supplying up to 215 MW of energy every hour from D4 CCGT. The PPA is an agreement between EGM and Enemalta, whereby EGM agrees to make available electrical energy to Enemalta, and to supply electrical energy when dispatched by Enemalta. In turn, Enemalta agrees to pay for availability of D4 and the electrical output delivered by EGM to electricity distribution network.

III. **18-year Gas Supply Agreement (GSA)** – providing the volume of gas required to meet demand to both D3 and D4. The GSA is an agreement between EGM and Enemalta, whereby EGM agrees to make gas available to Enemalta, and to supply gas to D3 when nominated by Enemalta. In turn, Enemalta agrees to pay for the availability of the LNG facility and the gas delivered by EGM to D3. The GSA agreement will expire on the same date as other transaction agreements, subject to early termination at the option of Enemalta, known as the "GSA Exit" clause, which is designed to safeguard the envisaged future gas interconnector with Sicily.

As part of the agreements, EGM also agrees to procure LNG on a fixed and indexed price basis for consumption as gas in D4 and delivery as gas in D3, and to procure and maintain the FSU for the term.
In 2014, by virtue of a public service agreement and pursuant to Recital 5 and Article 3(2) of Directive 2009/72/EC ("Electricity Directive"), the Government of Malta entrusted Enemalta plc. with the public service obligation (PSO) to provide and maintain a reliable source of supply of electricity in Malta. By contracting with EGM for the supply of gas and electricity to Enemalta, the latter delegated part of its PSOs to EGM in compliance with Article 3(5) of the 1977 Enemalta Act.

As regards the existence of a genuine and clearly defined SGEI, the measures are indispensable to ensure security of supply, which is an objective which justifies PSOs. In particular, the measures guarantee system reliability and adequate generation capacity at all times, as per the N-1 requirements. As regards the amount of compensation for the SGEI, D4 and the Gas facilities will be entirely dedicated for the attainment of the PSO. Payments under the Transaction Agreements constitute the compensation for the provision of the PSO. The PSO has been set up with the aim of ensuring security of supply and contributing to environmental protection and energy affordability.

The European Commission noted that the PSO complied with Article 3(2) of the Electricity Directive based on the following conclusions:

- They are justified in the general economic interest as they aim to ensure security of supply, which is specifically recognized in the Directive as a legitimate objective for imposing PSOs in the electricity sector;
- They are proportionate since the use of a CCGT plant sourced by a local gas terminal, was found to be the best available option in the context of Malta to ensure security of supply;
- They are clearly defined, transparent, non-discriminatory and verifiable;

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 relying on the interconnector to provide balancing services and to a lesser extent on local conventional facilities. 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 the Government mentioned previously.

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

The legal framework has up to now provided priority dispatch for RES but this shall be aligned with Regulation (EU) 2019/943 on the internal market for electricity. Enemalta is obliged to dispatch electricity based on their order of economic merit, irrespective of whether this is from local generation plants, from the interconnector or from storage.

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.[66] 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.

[66] 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. Policies and measures to achieve the objectives set out in 2.4.4

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 29 - Percentage of households unable to keep their home adequately warm in Malta compared to EU average, % (Source: Eurostat)

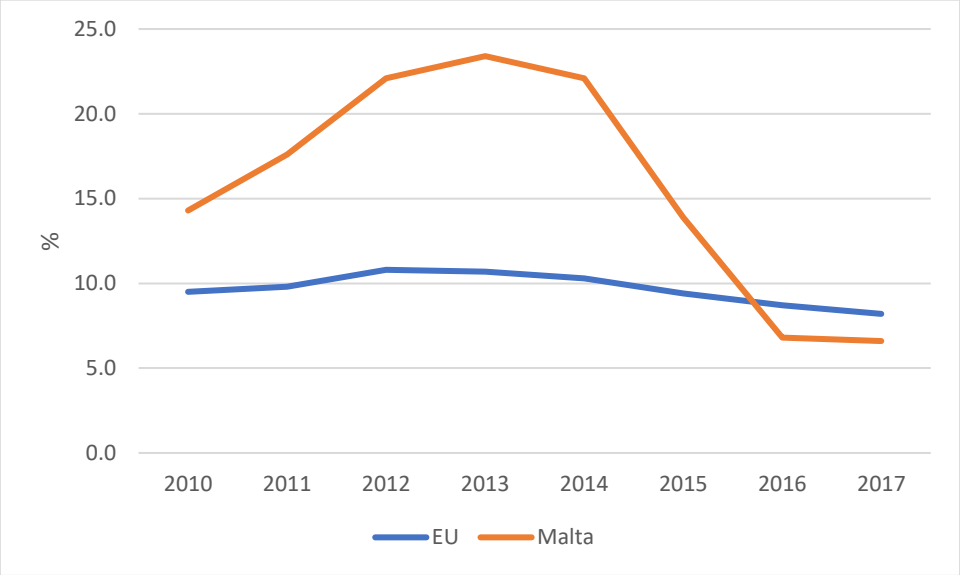


Figure 29 illustrates the great strides made in Malta in recent years with regards to the percentage of households unable to keep their homes adequately warm in winter. This has fallen from its peak of 23.4% in 2013, to 6.6% in 2017, and has been lower than the EU average for the last two consecutive years. This significant decrease is a result of national policies and measures being implemented by the Maltese Government (outlined below) and complemented by the recent substantial reduction in energy bills following the significant 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/vulnerable 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 line with the requirements of the revised Energy Efficiency Directive, the Governance Regulation and the Electricity Market Directive, efforts in addressing vulnerable and energy poor households will

be continued through policies developed in conjunction with the Ministry responsible for Social Services.

The energy efficiency schemes and grants addressing this sector of society will continue and will be adapted to increase their effectiveness. In recent years, Malta allocated an annual budget of approximately €200,000 to support schemes for vulnerable households under which old appliances are replaced by new, more efficient units. Furthermore, plans are being developed to also extend these schemes to include elderly citizens that could also be considered as vulnerable persons.

Moreover, the Energy and Water Agency will continue working with Agencies such as LEAP[67] to reach out to vulnerable communities through the Home Support scheme. In this scheme the Agency will be offering services such as households visits where an officer from the Agency will explain the concept of energy and water savings at the household level.

3.5 DIMENSION RESEARCH, INNOVATION AND COMPETITIVENESS

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

Under the Governance Regulation, Member States are required to set out national objectives and funding targets under the Research and Innovation Dimension for the upcoming ten-year period. Malta's National Strategy for R&I pertaining to this period is expected to be published by the end of 2020 by the Malta Council for Science and Technology (MCST), the official government body responsible for national R&I. This Strategy is set to retain the Smart Specialisation approach at its core,[68] in which thematic areas for future R&I investment are determined through a bottom-up approach after consultations with stakeholders who define R&I priority areas according to their judgement of the country's current and future economic specialisation; this is defined as the Entrepreneurial Discovery Process (EDP). The adoption of the Smart Specialisation approach and its continuation post-2020 is a conditionality for Member States to access the R&I portion of European Structural and Investment Funds (ESIF). As the bottom-up consultations of the EDP are still ongoing, the inclusion or otherwise of energy and low-carbon technologies in Malta's upcoming National Strategy for R&I was unclear during the time of development of the NECP.

In light of the above it was determined and agreed between the Parliamentary Secretariat for Financial Services, Digital Economy and Innovation and the Ministry for Energy and Water Management that a sector-specific strategy for R&I in energy and water will be developed by the Energy and Water Agency to take full advantage of the value-added and cross-cutting benefits of such targeted approach. The development of the National Strategy for Research and Innovation in Energy and Water (2021-2030) was thus concurrent with the finalisation of the NECP, enabling alignment between research objectives and national policy, and allowing for exploitation of synergies between the two policy documents. The beginning of 2019 saw the start of engagement with experts, academia, and public and private institutions, as well as the preliminary collection of data for an initial stock-taking exercise on the current level of R&I in energy and water. It is planned that this Strategy document will be

67 Anti-poverty and social exclusion centres.

68 The Smart Specialisation Strategy.

published for public consultation before the NECP is submitted, with a view to its finalisation and the start of its implementation in early 2020.

To achieve the objectives set out in the Draft National Strategy for R&I in Energy and Water, the draft document proposes the establishment of Platform-RINEW (Research and INnovation in Energy and Water). This is envisaged to be the primary tool to coordinate the implementation of the National Strategy for R&I in Energy and Water, and thus to achieve the high-level objectives outlined in Section 2.5.(i). Platform-RINEW will bring together government, academia, industry and the commercial sector within a structure that will enable multi-level coordination and cooperation, as well as streamline and effectively allocate resources for R&I in energy and water. The frequent exchange of information between these different bodies of actors is also considered to be imperative in ensuring the effectiveness of support measures and maintain the momentum of R&I at each stage, from defining support schemes to conducting R&I activities and the integration of successful outcomes within government and businesses alike. It is envisaged that national financing measures specific to the fields of energy and low-carbon technologies (as well as water) will be developed and issued by Platform-RINEW. These are outlined in Section 3.5.(iii).

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

So far, no coordination or cooperation with other Member States was carried out during the development of the National Strategy for R&I in Energy and Water 2021-2030. This does not exclude the possibility of future collaboration with other Member States during the upcoming decade on the development of policies and measures to support R&I in energy and low-carbon technologies, particularly under Platform-RINEW.

In terms of cooperation with other Member States on R&I projects, it is possible that the establishment of a specific fund to support R&I in energy and low-carbon technologies (and water) may, indirectly, have a positive impact on the participation of Maltese researchers in international projects. National financing may facilitate the retention of experienced members of research teams, increasing the domestic capacity and resources to apply for international projects. International collaboration, particularly with other EU Member States, has the potential to unlock additional innovation capacity through leveraging greater pools of funding and talent and providing an avenue for international best-practice sharing. Furthermore, support disbursed through national funding could act as an essential springboard for research teams to apply for the larger volumes of support required at higher TRL levels which are available through collaborative projects with other Member States.

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

The current support framework (2014-2020) for domestic R&I, both at the national and EU level, appears to be largely geared towards experimental development[69] and commercialisation, with limitted funding available for research at lower TRLs[70]. At the time of drafting of the National Strategy for R&I in Energy and Water, there was minimal visibility of the upcoming R&I landscape at the national level as MCST's National Strategy for R&I was still under development. Whilst direct EU funds such as those under Horizon Europe are expected to play an important part in funding future R&I in Malta, access to and use of European Structural and Investment Funds, is entirely dependent on the inclusion of this field in Malta's Smart Specialisation Strategy under the MCST's National Strategy for R&I for the post-2020 period. This is an essential consideration given that EU funds represent the most significant resource for R&I undertaken in Malta.

In view of existing and upcoming EU-level instruments supporting R&I at the higher TRLs, such as the European Innovation Council and the Innovation Fund, the draft National Strategy for R&I in Energy and Water (2021-2030) foresees the prioritisation of financial support for R&I from fundamental research to experimental design (TRL 2-6). In this manner, this Strategy seeks to avoid overlap of resources and instead address existing gaps in the R&I support landscape. The limited support available for research at these levels has been emphasised by local stakeholders and noted by the JRC Policy Support Facility (2019). It is planned[71] that a national fund specifically to support R&I in the fields of energy and water will be established, envisaged to function through two distinct mechanisms (similar to the set-up of Horizon 2020[72]):

1. Calls for bottom-up proposals relating to the Priority Areas outlined in the Strategy; and
2. Calls for proposals to structured research questions which relate to the Priority Areas.

EUR 500,000 was allocated to the implementation of the National Strategy for R&I in Energy and Water under the Maltese Government's 2020 Budget.

[69] Experimental development is defined, in line with the definition used by the NSO, as systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.
[70] Technology Readiness Levels (TRLs) is a method for estimating the maturity of technologies based on a scale from 1 to 9, that is, from basic scientific research to actual application of the technology.
[71] At this draft, pre-consultation phase of the National Strategy for R&I in Energy and Water.
[72] This is one of the proposals received from academics during consultation sessions.

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

i. Macroeconomic forecasts (GDP and population growth)

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 was developed by external consultants and endorsed by the Economic Policy Department within the Ministry for Finance,[73] and were consistently used by the various Ministries in all modelling exercises related to the development of the NECP. The same set of macroeconomic parameters feed into both the WEM and WPM scenarios.

Malta's current rise in population amounting to approximately 2% annually can be attributed to rapid economic expansion and associated increase in demand for labour, leading to high net inwards migration. Table 8 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 migration 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. This naturally translates into an increase in the number of households during the projected period. The source for historical 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[74] for 2016 published by the European Commission. The increased population will inevitably have a major impact on the energy system and future energy demand.

Table 8 - Projected total population and number of households as five-year averages.

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
Number of households	180,003	192,328	210,416	216,425	219,705

Table 9 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 10 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.

[73] 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.
[74] EU Reference Scenario 2016: Energy, Transport and GHG Emissions - Trends to 2050.

Table 9 - 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%

Table 10 - 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

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

Residential Sector

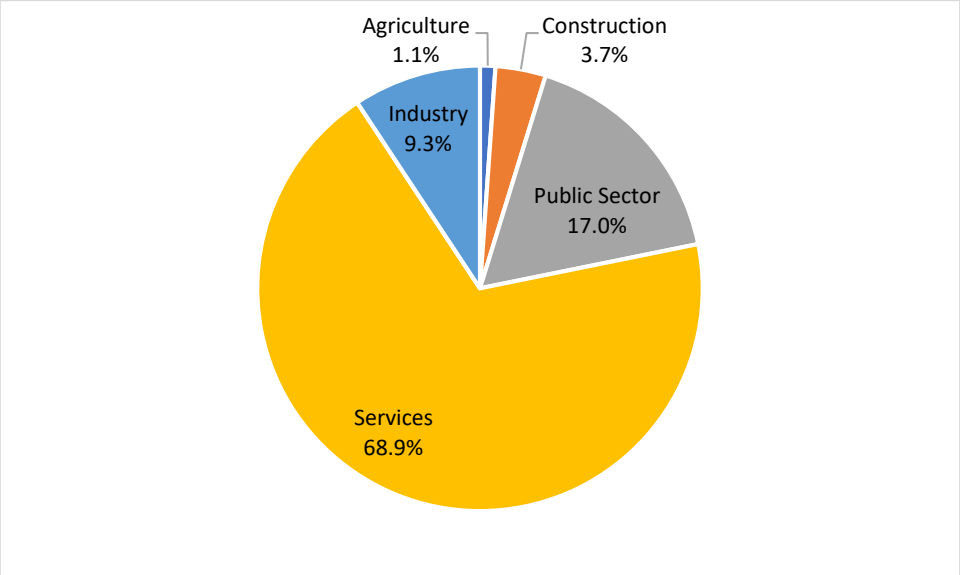
The main driver of consumption in the residential sector is the growing population, reflected by a higher number of households. The average energy consumption by households is expected to increase by 10% between 2016 and 2030[75], while a 25% increase is projected in the number of dwellings. The increasing disposable income per household is expected to manifest as further penetration and use of certain devices, such as white appliances and air-to-air heat pumps, creating a general increase in electricity demand on a per household basis. A gradual electrification of space heating and cooking is also projected, adding to the electricity demand for these end-uses. Indeed, residential consumption of electricity is expected to grow at a faster pace than that for fuels, although given the lack of district heating and cooling networks, LPG use for space heating and cooking is projected to continue to constitute a substantial portion of non-transport fuels (26% in 2016 and 24% in 2030).

Non-Residential Sector

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. Figure 30 illustrates the sectoral distribution of economic activity in 2017, indicating the dominant role played by the services sector, followed by the public sector. These two are expected to remain the most significant sectors in generating GVA, increasing slightly from constituting a combined 86% of GVA in 2017 to 87% in 2030 and 89% in 2040. Total GVA is projected to grow in this period, reaching €29.6 billion by 2040.

[75] 2016 is used as the reference year in this case as 2017 was a year of extremes in temperature, resulting in higher than expected energy consumption. Given that energy consumption was projected assuming average climatic conditions, comparison to 2017 data could not be made.

Figure 30 - GVA distribution in 2017, %.

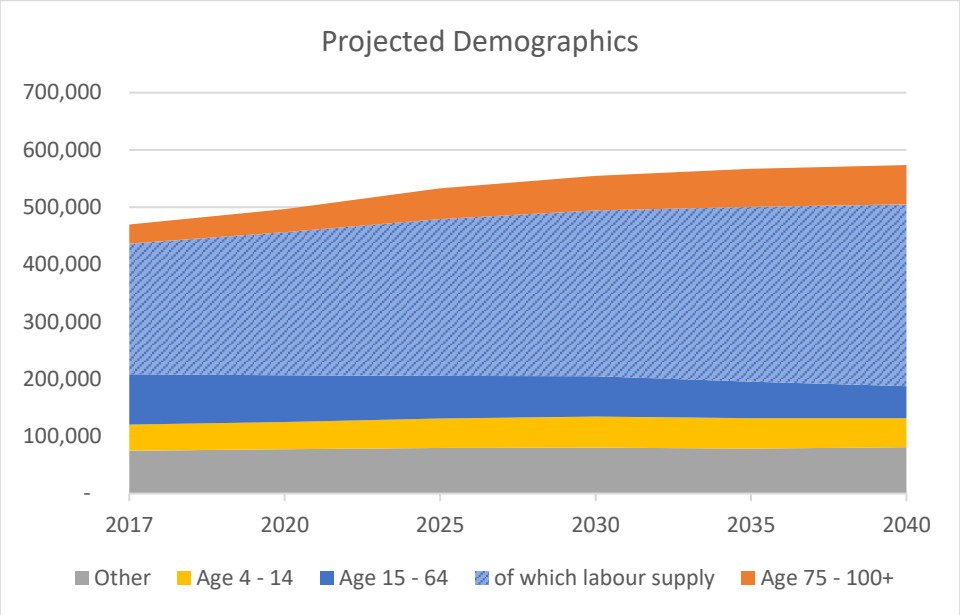


A significant expansion in the economic activity of services and the public sector is thus expected, based on the projected growth in GVA between 2017 and 2040 and with these two sectors retaining their predominant role in GVA generation. This growth in activity will likely lead to an expansion in floor area utilised by such economic activities, as this will be required to support new and enlarged businesses. This additional floor space will also be required to accommodate: (i) the number of employees within these sectors, expected to double between 2017 and 2040; (ii) additional bed spaces in the health care sector, required to cater for an increased population; and (iii) additional bed spaces in elderly care facilities, owing to the proportion of the population aged over 75 growing from 7% in 2017 to 12% by 2040. Based on this assumption of projected economic growth creating an associated growth in the physical terms, the energy consumption required to provide and support such activities is necessarily expected to increase.

Demographic and employment trends were estimated based on trends in age groups established by Eurostat projections, the expected labour participation rate[76], and recent trends in employment by economic activity type. They are depicted in Figure 31.

[76] Figures are based on policy note issued by the Central Bank of Malta in April 2019 entitled "A cohort approach to project the labour participation rate in Malta."

Figure 31 - Projected demographic trends.



In 2017, approximately 59% of the gainfully employed in the public and services sectors worked in office-based jobs or educational institutions; this is projected to increase to 64% and 66% by 2030 and 2040, respectively. Given the particular energy consumption profile of such activities, predominanly electricity for space heating and cooling and ICT equipment, electricity demand for such end-uses is expected to create additional load on the electricity grid. Expected investments in data centres housed locally will also add to the demand on the electricity grid, constituting approximately 5% of final electricity consumption by 2030.

Hospitality, while contributing to 7% of the services sector GVA, is a significant consumer of both electricity and fuels (31% of energy consumption in the services sector in 2017) and, based on the projected continued growth in tourist arrivals, this sectoral consumption is expected to increase further during the next decade, although at a slightly slower pace than offices and educational institutions. In 2030, hospitality is projected to contribute to 6% of the sectoral GVA and be responsible for 28% of the sectoral energy consumption. The health care sector, incorporating hospitals, medical institutions and elderly care facilities, is also a heavy consumer of both electricity and fuels. Thus, the projected increase in these services is expected to create an associated growth in electricity and fuel consumption.

The industrial sector contributed towards 9% of the total GVA in 2017 and, on average, is expected to keep the share around 8% over the time horizon until 2040. The physical output from the manufacturing sector is projected to increase in line with results from pan-European models and national projections and the new opportunities expected to arise within this sector, such as the Medical Cannabis Industry which is estimated to be worth €0.3 billion by 2028.

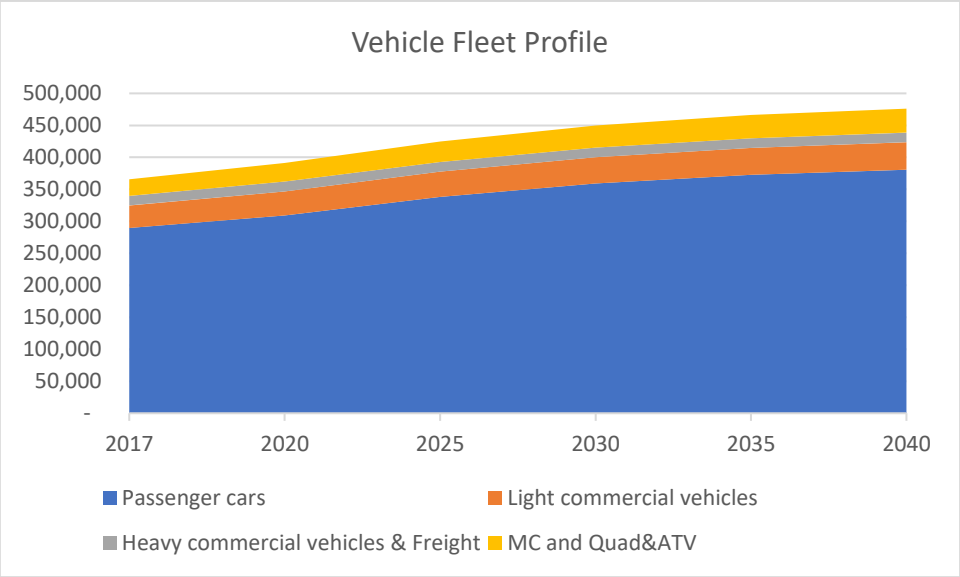
Water supply, sewage and waste management in Malta is closely linked with the energy system due to the country's dependency on reverse osmosis for desalinisation. Energy is also required for wastewater treatment, pumping and distribution. The overall demand for potable water is expected to increase, along with the volume of wastewater requiring treatment; however, the trend of increase in electricity demand for these end-uses shows decoupling from both population and economic

growth, largely as a result of investments in the sector and policies/campaigns to increase resource management efficiency.

Transport Sector

The number of road vehicles is projected to continue to increase as a result of population growth and sustained economic development (Figure 32). That being said, the average fuel consumption and emissions per vehicle is projected to decrease slowly at least until 2030, as manufacturers respond to recent EU Regulations which set emission reduction targets on the fleet average of vehicle manufacturers. Meeting such targets is expected require manufacturers to include an increasing share of electric cars in their fleet, a trend expected to be reflected in the stock of newly imported vehicles in Malta. The effect of this development may be somewhat delayed as a signficant portion of newly licensed vehicles tend to be imported second-hand vehicles (56% in 2017). An increasing number of electric vehicles is bound to impinge on the average consumption of electricity although the impact on peaks may be mitigated through effective demand management. In this context, an advantageous night-time electricity tariff, applicable to EV charging, is being introduced as from 2020.

Figure 32 The projected vehicle fleet profile by type of vehicle (fuel source not indicated), stock.



The projected increase in tourist arrivals is closely linked to the expected consumption of the aviation sector. This, along with increasing disposable income, is also projected to lead to growth in inland navigation, particularly the fuel consumption by leisure boats. These are two sectors which are considered difficult to decarbonise owning to current technological limitations and Malta's particular island-state context. Non-road transport is also expected to register an increase in energy consumption, albeit at a slower rate than road transport.

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

Projected natural gas prices provided by ENTSO-G were used in modelling exercises for the development of the WEM and WPM scenarios of Malta's NECP, while those provided by the European Commission were used in sensitivity analyses. ENTSO-G prices were selected for the NECP WEM and WPM scenarios as these are considered as better representative of specific regional gas prices.

Projections provided by the Commission for EU ETS carbon price were used. These prices are shown in Table 11 .

Table 11 Natural gas and carbon price (EU ETS) projections, EUR (2016)/MWh and EUR (2016)/t CO_2.

	2020	2025	2030	2035	2040
Natural gas	19.73	25.06	28.22	27.79	27.53
Carbon price	15.52	23.28	34.66	43.45	51.73

iv. Technology cost developments

The primary technology cost assumptions used in the development of Malta's WEM and WPM scenarios for the NECP are presented in this section.

Solar PV

Future cost assumptions for small-scale residential solar photovoltaics [77] 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.[78] Overnight investment costs and annual fixed operation and maintenance costs reported in EUR/kW are presented in the third row of Table 12 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 13. 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 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. Furthermore, capital costs in the ASSET database appear to exclude grid connection costs. In Malta, these costs are borne by the PV developer and were thus factored into national estimates of the CAPEX of commercial PV systems. However, grid connection costs are not fixed for systems with a capacity above 30 MW but are dependent on the particularities of the installation site; these costs can be relatively high, running into the hundreds of thousands depending on the site and the size of the installation.

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. These were factored into the total PV system costs based on projections published by Fraunhofer ISE (2015) on behalf of Agora Energierwende[79]. These are

[77] The present average size of residential PV systems is 3kWp.
[78] https://ec.europa.eu/energy/sites/ener/files/documents/2018_06_27_technology_pathways_-_finalreportmain2.pdf
[79] 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.

outlined in Table 12. 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 12 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
Small-scale rooftop	1435	930	745	610	24	17	15	13	20

Table 13 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

Battery Systems

Energy storage is becoming ever more essential for the integration of higher shares of intermittent RES. Traditionally, utility scale storage was restricted to pumped hydro, but with developments in battery storage, new solutions are becoming available. These can take the form of centralized, distributed or hybrid storage solutions. In light of this, the Energy and Water Agency commissioned the Institute for Sustainable Energy at the University of Malta to carry out a high-level assessment of battery storage solutions based on prevalent technologies. The assessment delved into their financial feasibility, local availability and potential business models within the local context. The study showed that there are already a number of domestic suppliers of lithium-ion batteries[80] with a typical lifetime of 10 years and an average of 6000 cycles, but their costs are rather steep with prices varying between €1000 – 1500/kWh. The conclusions of this assessment are being reviewed in view of future support schemes which also earmark EU funding opportunities.

[80] Certain local suppliers also stock lead-acid batteries but this study focused primarily on lithium-ion batteries.

Floating Offshore Wind

Given that the geospatial properties of the Maltese islands preclude the installation of onshore or fixed-foundation offshore wind turbines, a high-level review of projected cost developments of floating offshore wind turbines was performed.

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 few such projects have 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[81] were used as a base to calculate the total installation costs. These are presented in Table 14 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 14 - 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

Other Technologies

In calculating the projected investment needs for technologies (outlined in section 5.3), a number of assumptions were adopted regarding purchasing costs, average technical lifetime, and, in some cases, annual average load factors. These are presented in Table 15 and Table 16. The assumed technology costs are generally in line with the database provided by the European Commission although, when available, a number of adjustments were made for specific technologies (such as heat pumps) to better capture costs on the Maltese market. These costs assumptions also consider a certain level of efficiency uptake, in line with the projected WEM and WPM scenarios described in the NECP.

[81] 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.

Table 15 Technology assumptions for technologies in the residential and commercial sectors.

Sector	Energy service	Technology	Investment cost	Technical life
			*€2016/kW * €2016/unit*	*years*
Residential	Air conditioning	Electric A/C	240	23
	Space heating	Electric heat pump	240	23
		Electric heater	203	20
		LPG	156	20
		Biomass	232	20
	Water heating	Solar thermal	1650 *	20
		Heat pump	2500 *	20
		Electric	253 *	20
	Cooking	Electric	387 *	20
		LPG	387 *	20
	Appliances	Refrigerators and freezers	1126 *	12
		Washing machine	524 *	12
		Clothes dryer	470 *	12
		Dishwasher	402 *	12
Services	Air conditioning	Electric A/C (conventional)	227	23
		Electric A/C (high efficiency)	269	23
	Space heating	Electric heat pump (conventional)	151	23
		Electric heat pump (high efficiency)	186	23
		Diesel (conventional)	89	20
		Diesel (high efficiency)	137	20
	Water heating	Electric (conventional)	139	20
		Electric (high efficiency)	148	20
		Diesel (conventional)	89	20
		Diesel (high efficiency)	119	20
	Cooking	Cooker (conventional)	397	20
		Cooker (heat pump)	462	20
	Others	Cooling/refrigeration	732	20
		Processing	1,523	30
Industry	Electric uses	Motors (conventional)	513	30
		Motors (high efficiency)	732	30
		Machinery (conventional)	1,312	30
		Machinery (high efficiency)	1,890	30
		Drying & cooling (conventional)	1,032	30
		Drying & cooling (high efficiency)	2,127	30
		Heat processing (conventional)	416	30
		Heat processing (high efficiency)	672	30
	Processing & generation	Processing (conventional)	1,912	30
		Processing (high efficiency)	2,964	30
		Diesel generator	243	30
	Other uses	Space heating (conventional)	105	30
		Space heating (high efficiency)	137	30

	Water heating (conventional)	95	30
	Water heating (high efficiency)	119	30
	Cooling/refrigeration (conventional)	1,079	30
	Cooling/refrigeration (high efficiency)	2,450	30

Table 16 Technology assumptions for categories of vehicles.

Mode	**Type**	**Unit**	**Investment cost**	
			New	Second hand
Passenger car	Petrol	€$_{2016}$/vehicle	19,462	11,677
	Diesel	€$_{2016}$/vehicle	22,752	13,651
	Electric	€$_{2016}$/vehicle	25,039	15,023
LCV	Petrol	€$_{2016}$/vehicle	17,361	10,416
	Diesel	€$_{2016}$/vehicle	21,701	13,020
	Electric	€$_{2016}$/vehicle	22,203	13,322
HCV	<7.5 t	€$_{2016}$/vehicle	64,093	38,456
	>7.5 t	€$_{2016}$/vehicle	106,822	64,093
	Electric	€$_{2016}$/vehicle	86,005	51,603
Motorcycle	<125 m^3	€$_{2016}$/vehicle	2,515	1,509
	>125 m^3	€$_{2016}$/vehicle	6,014	3,608
Bus	Diesel	€$_{2016}$/vehicle	64,093	38,456

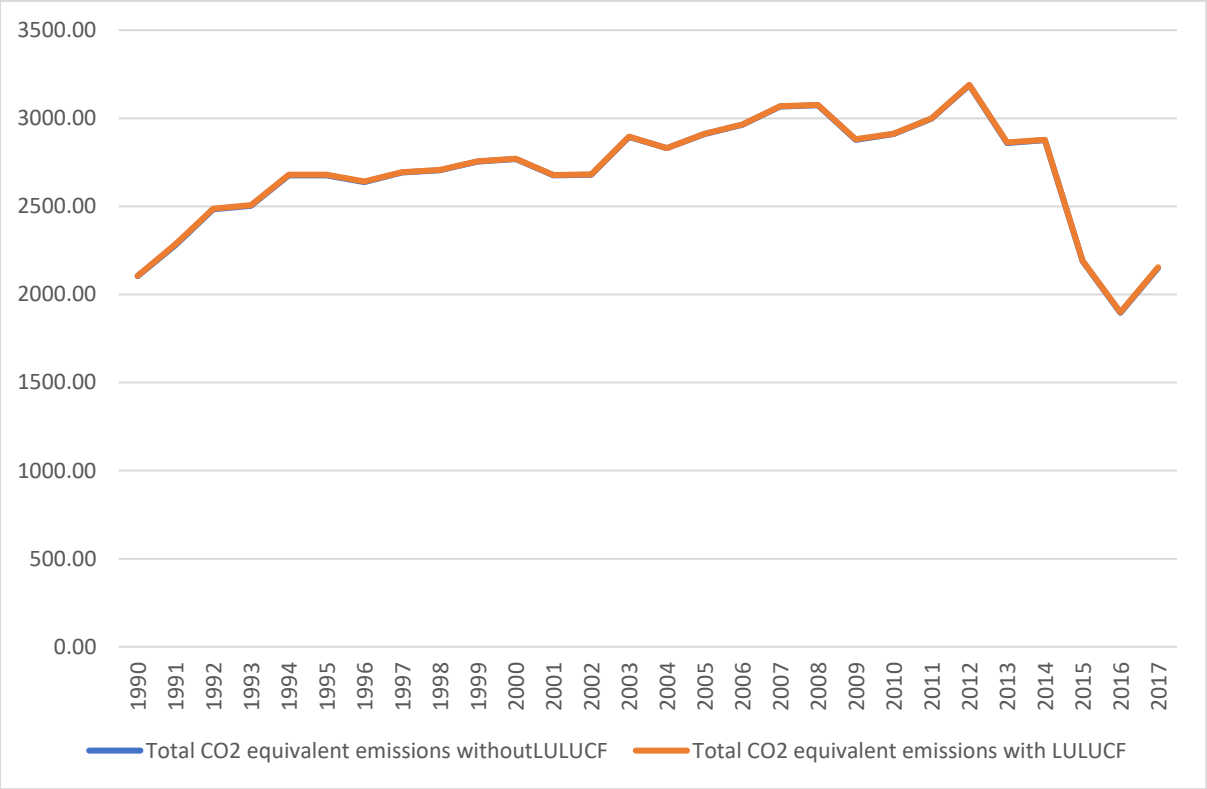
4.2 DIMENSION DECARBONISATION

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 (ETS and non-ETS) over the time-series 1990 to 2017 (Figure 33 and Table 17) show an increase in total emissions up until 2012, followed by a rapid decrease over a period of just four years, with emissions in 2017 being even lower than the emissions in 1990.

Figure 33 - Total GHG emission trends, 1990-2017



The peak of GHG emissions was recorded in 2012, where such emissions were 51% higher than in 1990. In contrast, the lowest level of emissions was recorded in 2016, wherein total national GHG emissions were around 10% lower than in 1990 (Figure 34). Between 2012 and 2017, there is a difference of more than 62 percentage points when both years are compared to 1990 emissions. The 2017 total national emissions are almost 41% lower than 2012 emissions[82]. The drop in the total emissions registered from 2012 onwards relates to the energy sector, with the onset of the electricity interconnection with Sicily and the subsequent shift from heavy fuel oil to natural gas in local power generation.

[82] 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.

Table 17- Total GHG emissions, with and without LULUCF

	Total emissions - without LULUCF	Total emissions - with LULUCF
	Gg CO_2 eq.	
1990	2103.18	2106.14
2005	2909.62	2911.33
2010	2909.94	2911.94
2011	2997.46	2999.70
2012	3187.40	3189.86
2013	2860.04	2862.74
2014	2874.93	2877.87
2015	2188.16	2191.34
2016	1895.68	1899.10
2017	2151.59	2155.24

Year-to-year changes across the period are presented in Figure 34. Up until 2012, there are sixteen instances of positive year-to-year changes, i.e. 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 two instances of a year-to-year increase (2013 to 2014 and 2016 to 2017). 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.

Figure 34 - Annual percentage change in total emissions year-to-year

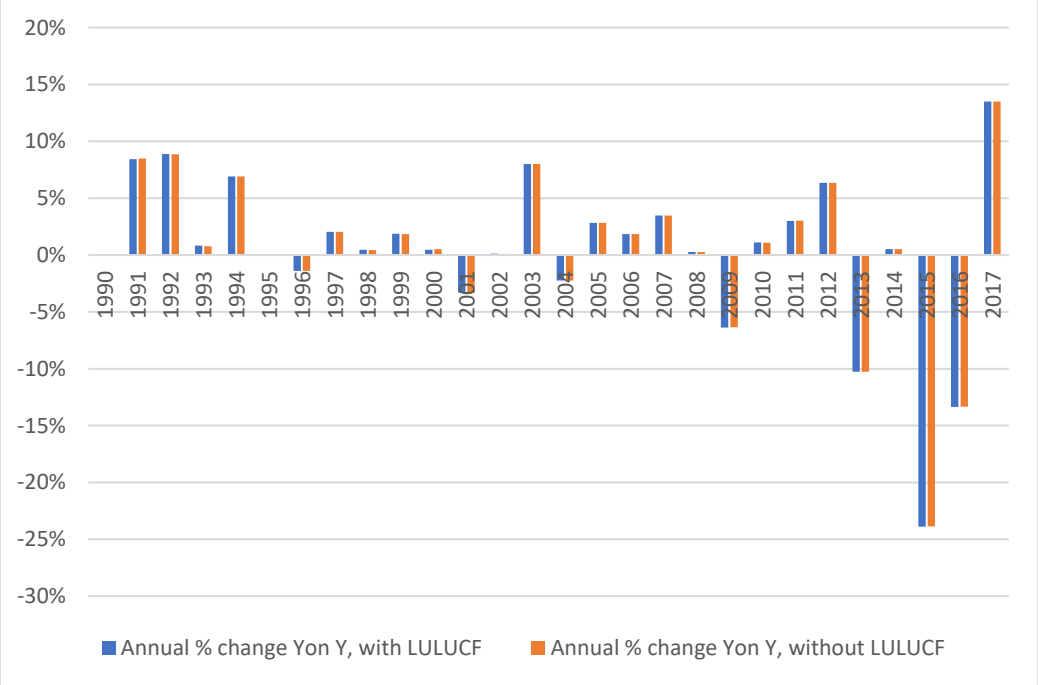
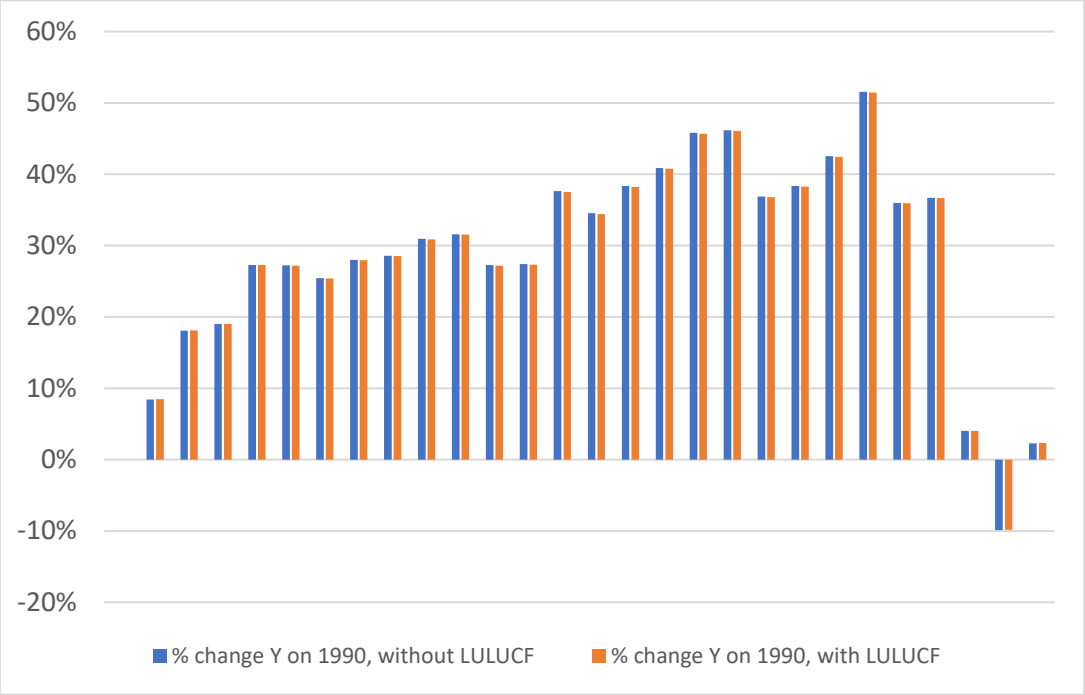


Figure 35 – Annual percentage change of total emissions compared to base year (1990)



Trends in GHG emissions per Capita

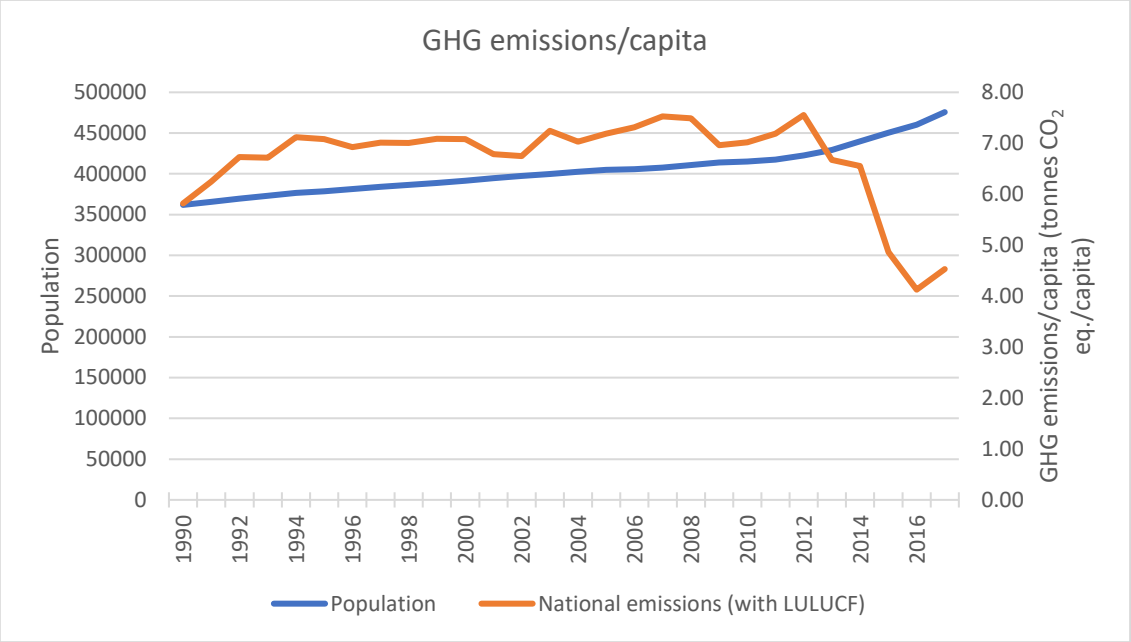
Figure 36 describes the correlation between the trend in total national emissions and the trend in population of the Maltese Islands, in terms of GHG emissions per capita. Population has grown steadily over the years[83]. As observed for the trend in total emissions, GHG emissions per capita also show a general increasing trend from 1990 until 2012; this trend is 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 2016 (4.2 tonnes CO_2 eq. per capita). A slight increase in 2017 (up to 4.5 tonnes CO_2 eq. per capita) was observed and this was due mainly to an increase in the energy production sector.

One can infer that 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, as will be seen later, the major contributors to overall emissions in absolute terms. However, targeted measures even in one sector or category 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, when very substantial emission reductions due to major technical

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

developments in the electricity generation sector, have counteracted any increase that one may have expected would occur due to continued population growth.

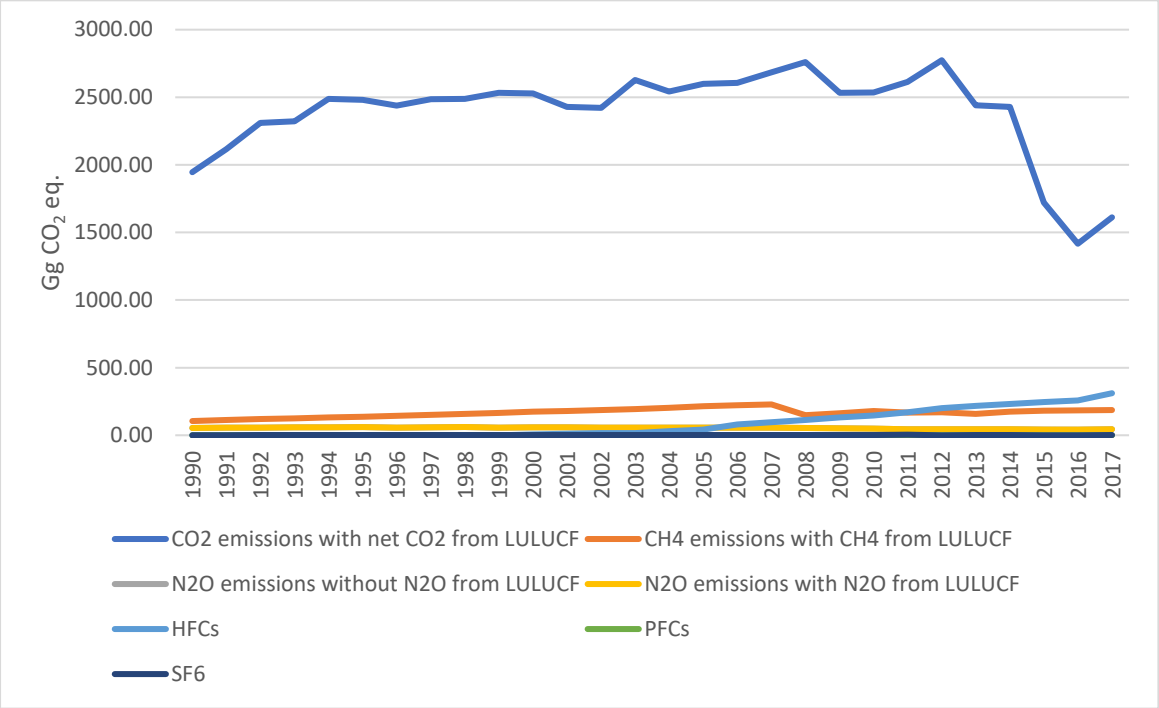
Figure 36 – Trend in emissions per capita compared to population growth trend



Emission trends by gas

Carbon dioxide (CO_2) emissions contribute the biggest share of total national emissions (ETS and non-ETS) with the trend mirroring that of total national emissions changes. Between 1990 and 2003 CO_2 accounted for more than 90% of total national GHG emissions, whereas between 2015 and 2017, CO_2 accounted for less than 80% of total emissions (Figure 37).

Figure 37 - Greenhouse gas emission trends by gas, 1990 – 2017



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.

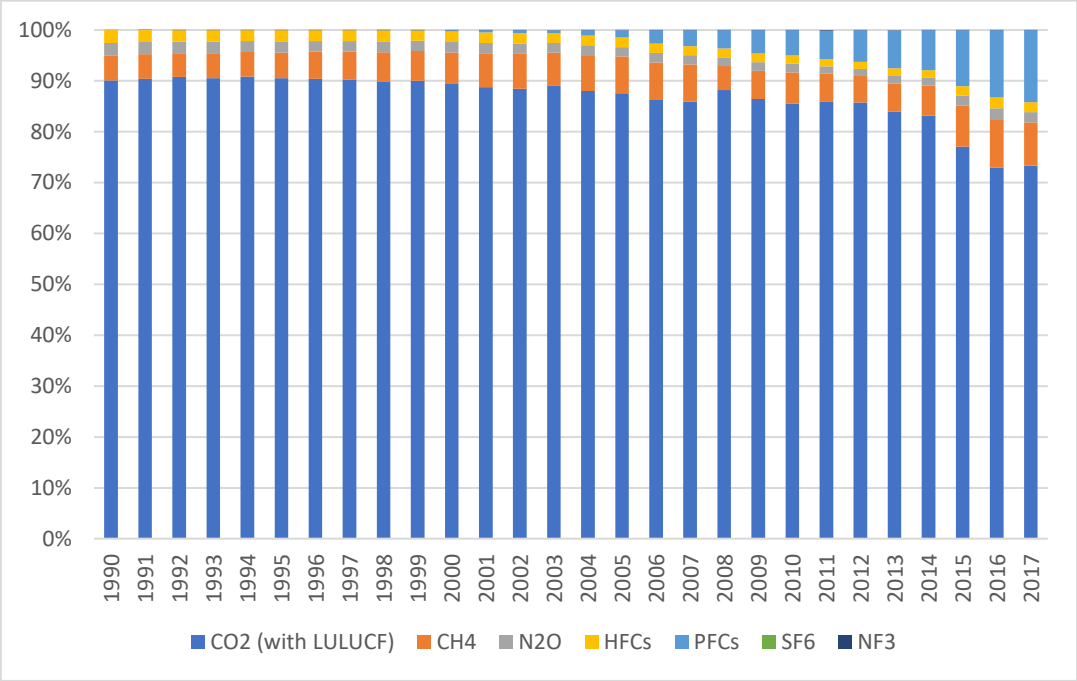
Table 18[84] - Greenhouse gas emission trends by gas

	CO_2 (with LULUCF)	CH_4	N_2O	HFCs	PFCs	SF_6	Total W/O LULUCF	Total With LULUCF
1990	1946.25	105.27	54.61	NO, NE, IE, NA	NO, NA	0.01	2103.17	2106.13
2005	2598.08	214.22	55.68	41.78	NO, NA	1.56	2909.61	2911.32
2010	2534.34	180.26	50.06	145.49	1.103E-06	1.79	2909.94	2911.94
2011	2613.77	168.63	43.59	169.02	1.103E-06	4.69	2997.46	2999.69
2012	2773.8	169.59	44.91	201.03	1.103E-06	0.54	3187.39	3189.86
2013	2440.88	158.9	43.88	216.32	1.103E-06	2.77	2860.03	2862.74
2014	2429.07	173.86	43.49	230.77	1.103E-06	0.68	2874.92	2877.86
2015	1720.78	181.65	42.26	246.37	1.103E-06	0.28	2188.16	2191.33
2016	1416.77	183.87	41.73	256.58	1.103E-06	0.14	1895.68	1899.09
2017	1612.31	187.49	43.51	310.93	1.103E-06	0.99	2151.58	2155.23

[84] 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. Please refer to CFR tables for exact emissions data.

The trend in relative share of each gas in total GHG emissions Figure 38 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: the trend in CO_2 absolute emissions, especially the decrease maintained over recent years, and a growth in emissions of HFCs. The latter will be explored in further detail later on in this section.

Figure 38 - Percentage share by gas of total GHG emissions



Carbon dioxide emissions and removals

As shown in Figure 39, 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 (reporting net emissions, 0.24%) and waste (0.05%). Within the energy sector, the category Energy Industries had a share of 45% of total national CO_2 emissions while transport had a share of 39%, in 2017 (Figure 40 - Share of sector/category in total CO2 emissions for). The increase in emissions seen in 2017 was due to major reliance on local electricity generation as opposed to purchased electricity through interconnection with mainland Europe.

Figure 39 - CO_2 emission trends by sector

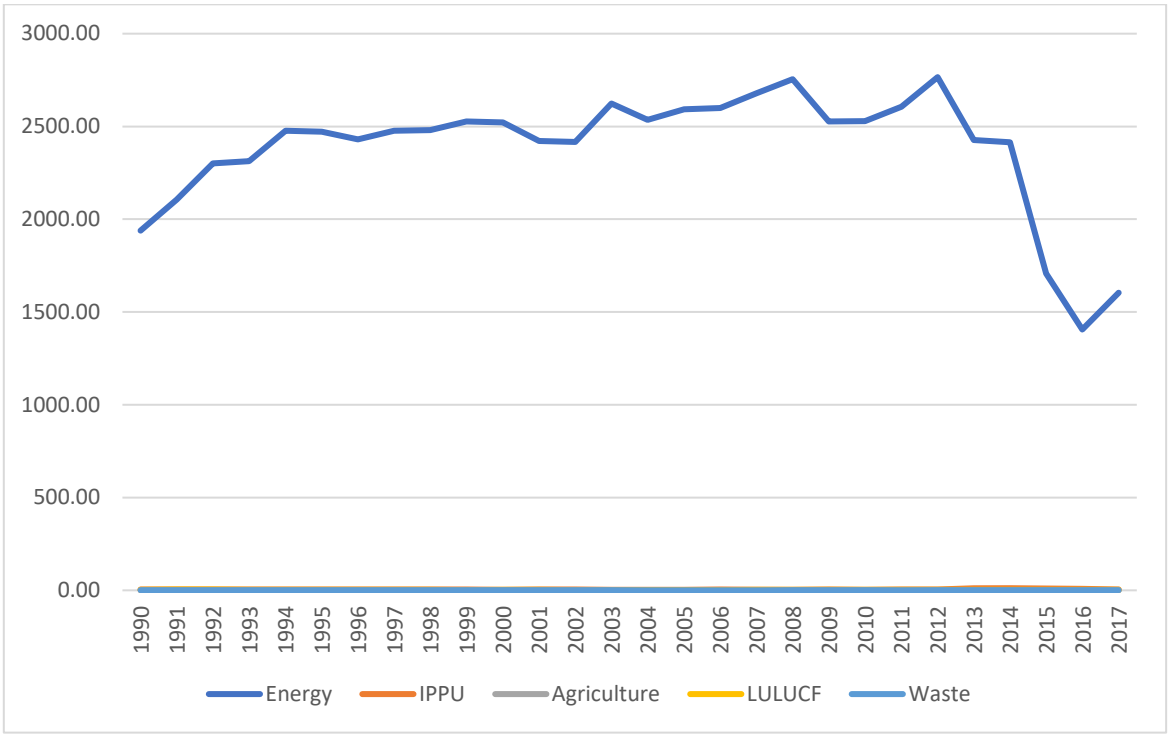
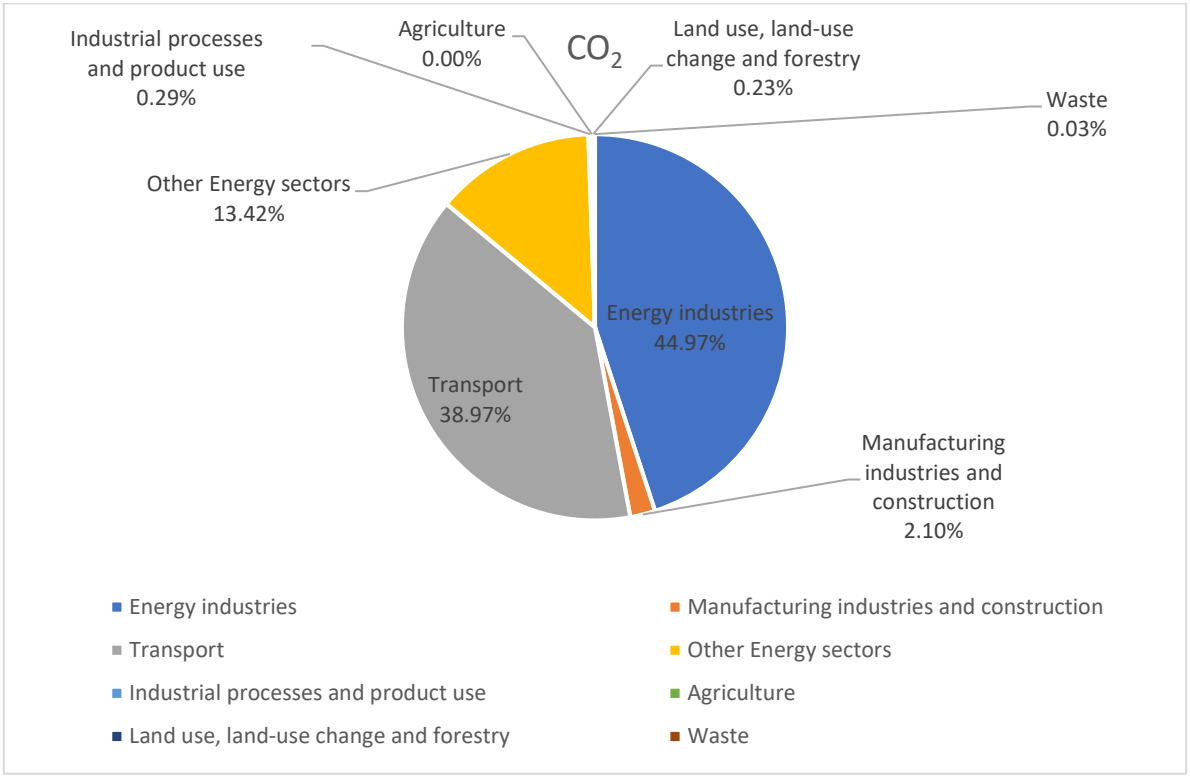


Figure 40 - Share of sector/category in total CO_2 emissions for 2017



Methane emissions

The waste and agriculture sectors are two main contributors to total national CH_4 emissions (Figure 41), with the share from the waste sector showing an increase over time. The significant drop between

2007 and 2008 resulted from the installation of a landfill gas capture system. In 2017, emissions from the waste sector accounted for 77% of total national CH_4 emissions, followed by 19% for agriculture (Figure 42).

Figure 41 - CH_4 emission trend by sector

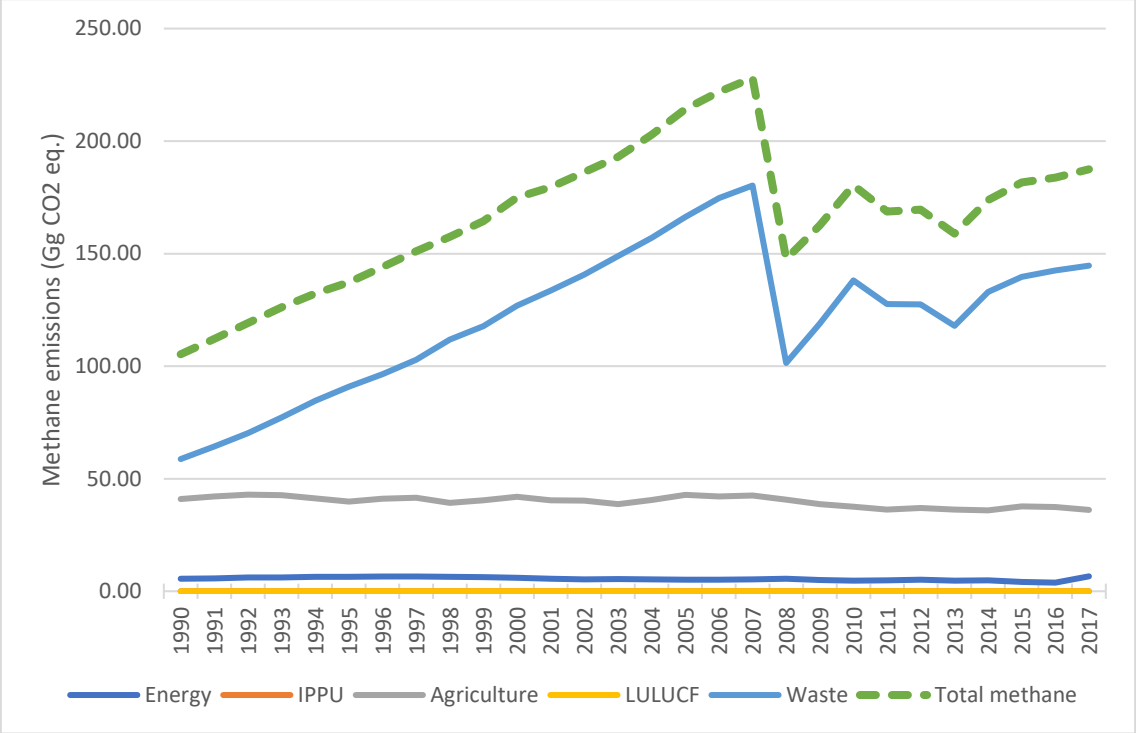
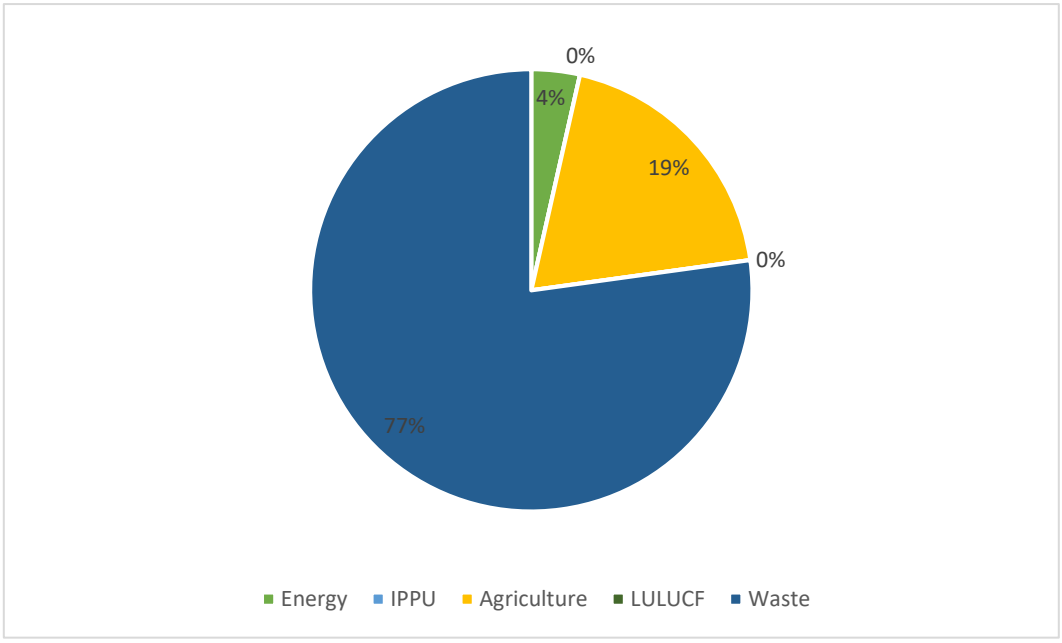


Figure 42 - Share of sector in total national CH_4 emissions, 2017



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 43). The share of Agriculture in total national N_2O emissions in 2017 was 66.7%, with Waste and Energy accounting for the biggest part of the remaining (31%) of total national nitrous oxide emissions between them.

Figure 43 - N_2O Emission trends by gas, total and by sector

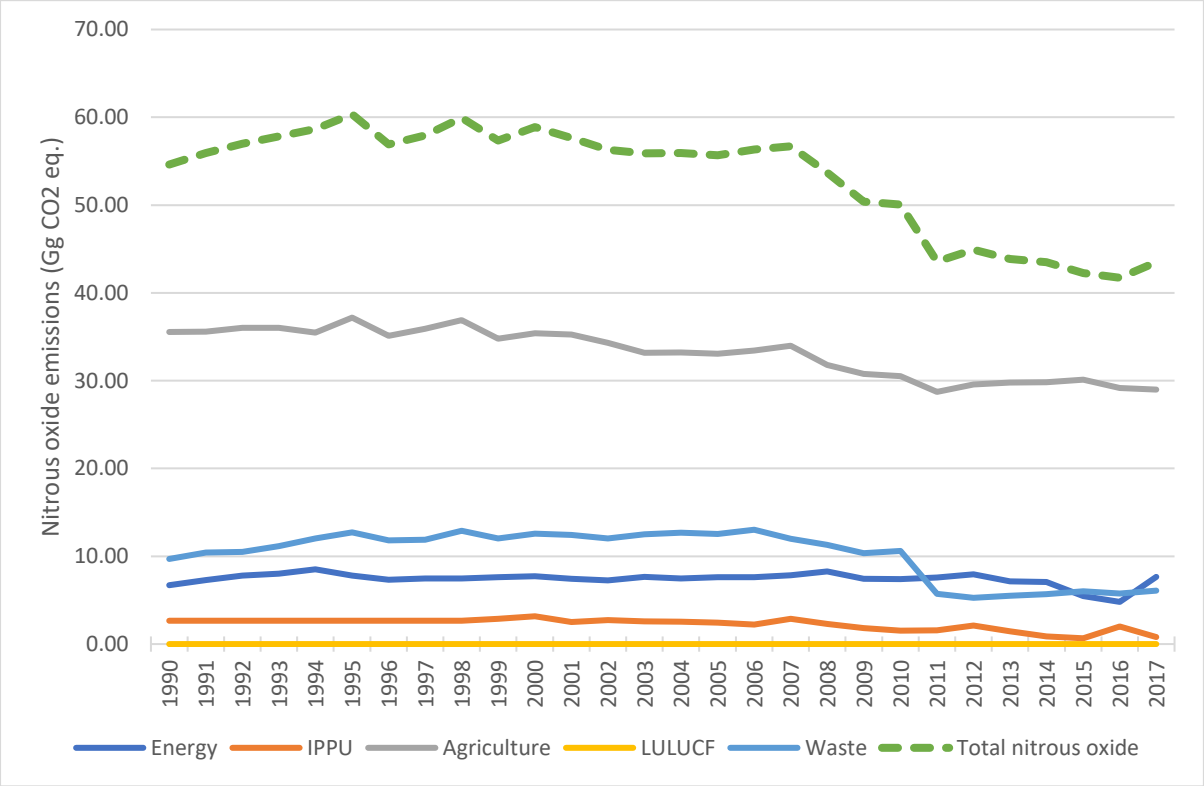
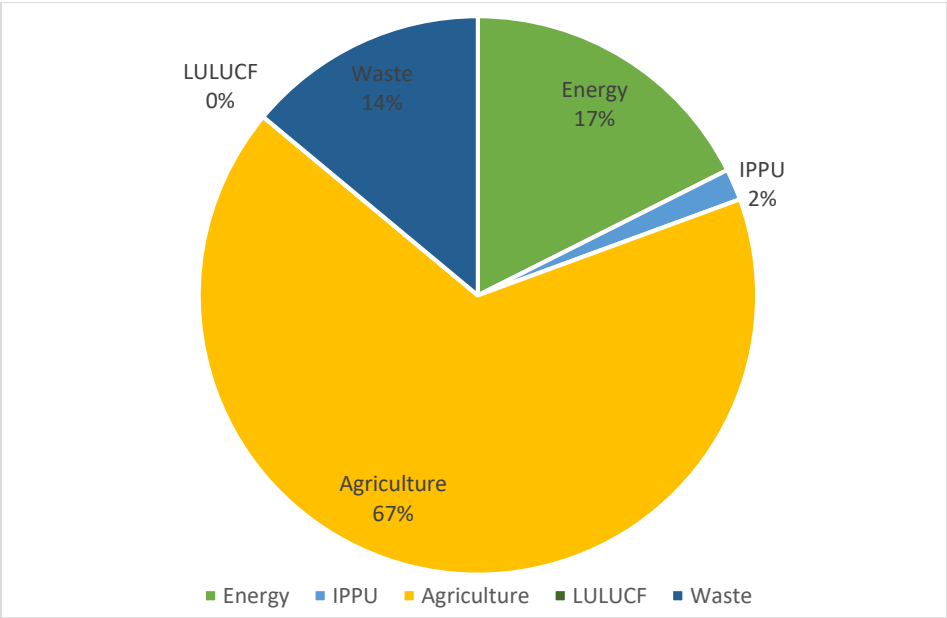


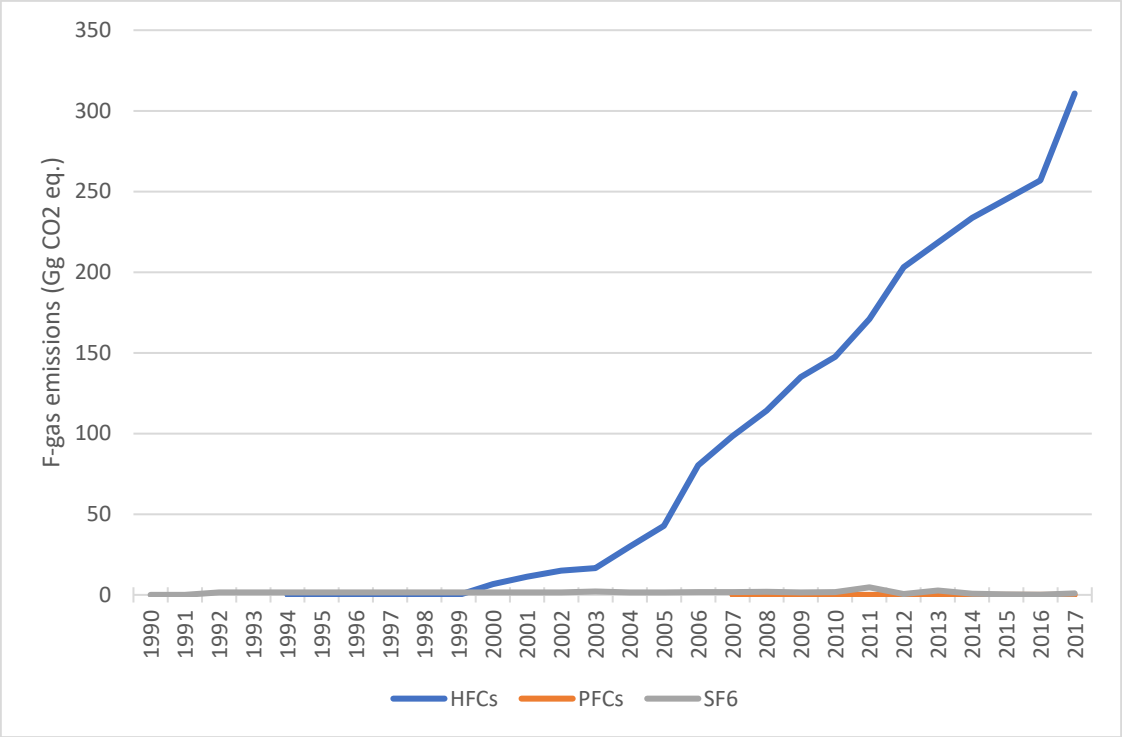
Figure 44 - Share of total national N_2O emissions, 2017



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 45). Prior to 2000, equipment for refrigeration and cooling predominantly used CFCs. Consequently, with the placement of equipment of HFCs on the market emissions of this F-gas increased. The rate of growth is identified by the gradient of the trend. All emissions of these gases fall within the sector IPPU. It is worth noting that emissions of HFCs in 2017 accounted for around 99% of total IPPU emissions.

Figure 45 - F-Gases emission trends by gas: HFCs, PFCs, SF, totals by gas



Description and interpretation of emission trends by sector

Figure 46 gives an overview of the total emissions (ETS and non-ETS) by sector for the time-series presented in this submission.

Figure 46 - Share by sector of total GHG emissions

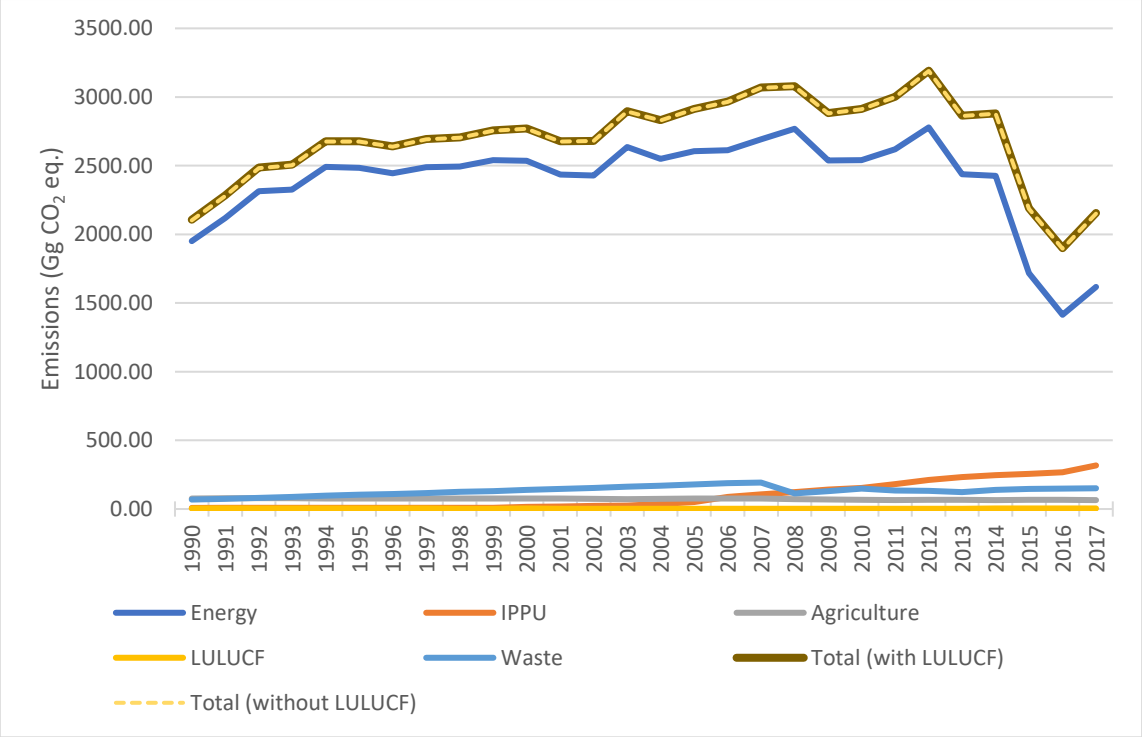
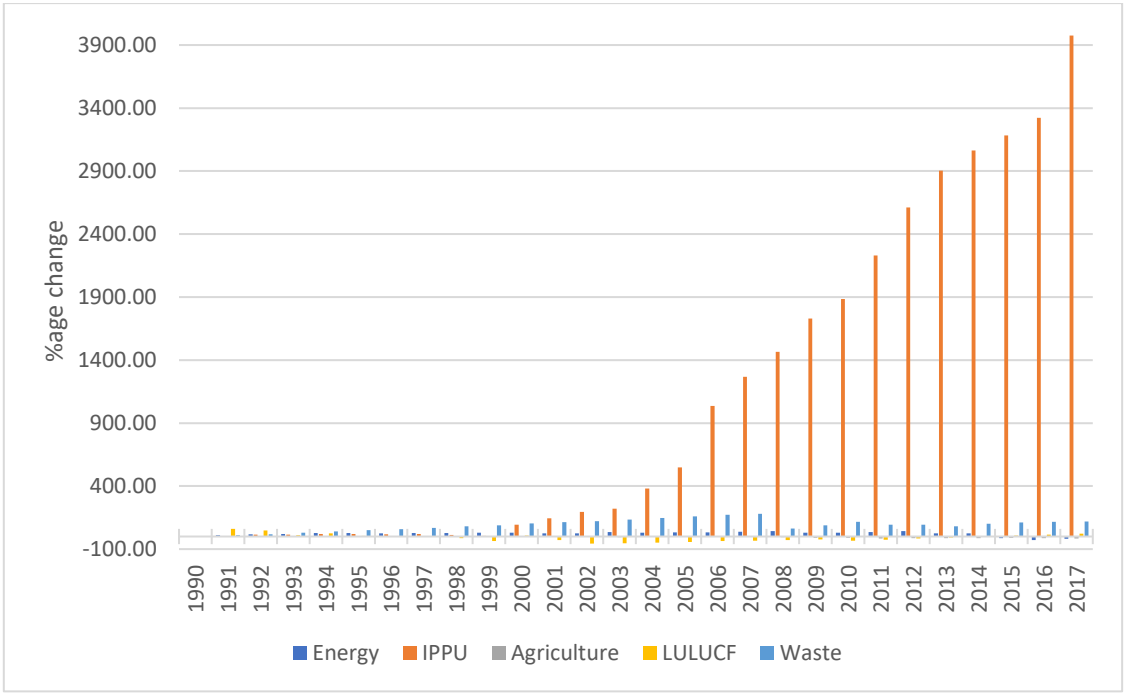


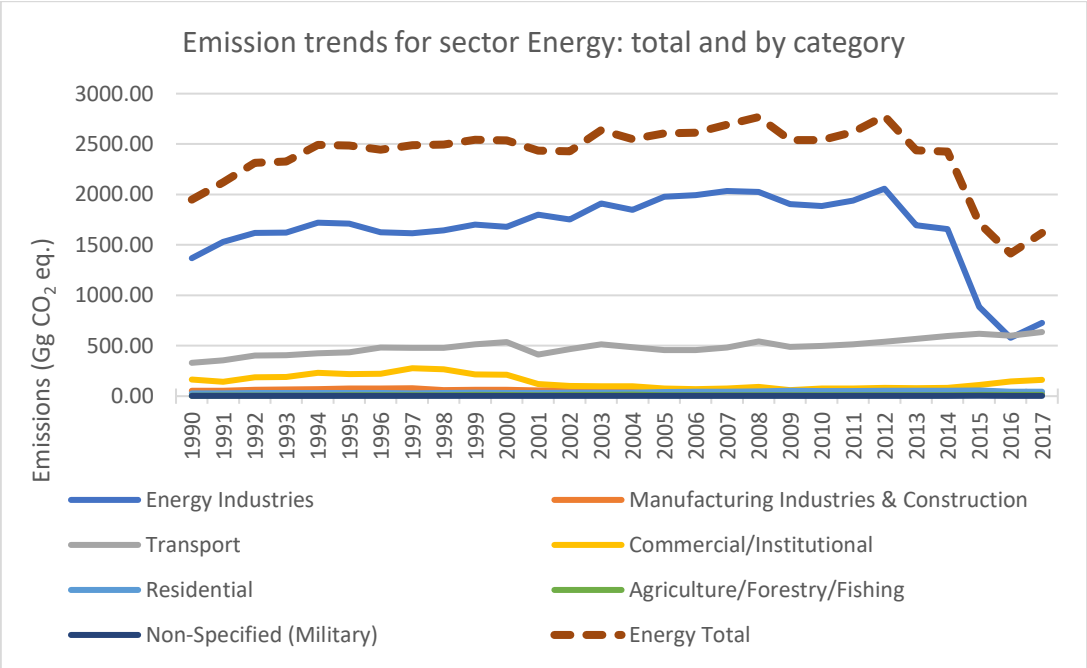
Figure 47 - Annual percentage change compared to 1990, by sector



Energy sector emissions

The trend profile for the energy sector can be distinguished by two sub-trends, 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 very substantial, and relatively quick, efficiency gains, in emission terms, in electricity generation over the more recent years. This albeit a slight increase in emissions from the electricity generation sector due to the higher share of local generation replacing importation of electricity.

Figure 48 - Emission trends in the energy sector



The very strong influence that the energy sector has always had on national GHG emissions in Malta has already been noted above. This can be further shown 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.

The majority of emissions from the energy sector can be attributed to CO_2, with methane and nitrous oxide emissions together accounting for just above 0.5% of the total energy GHG emissions in 2017. This state of play hasn't changed in any substantive manner from 1990.

Figure 49 - Annual percentage change in Energy sector emissions year to year

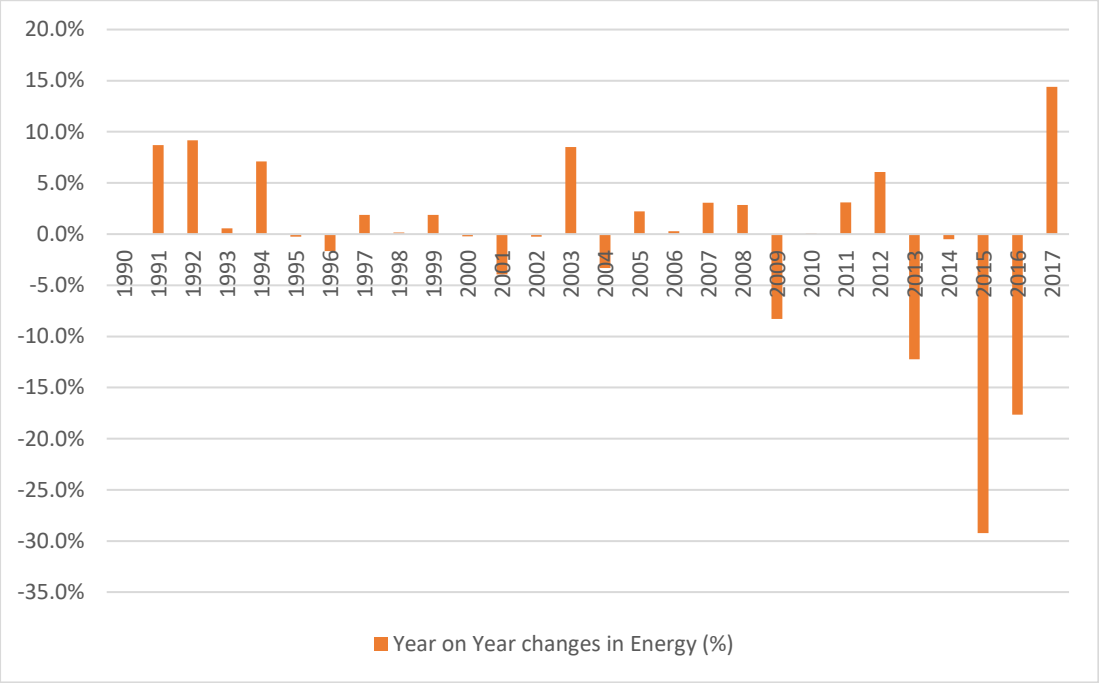
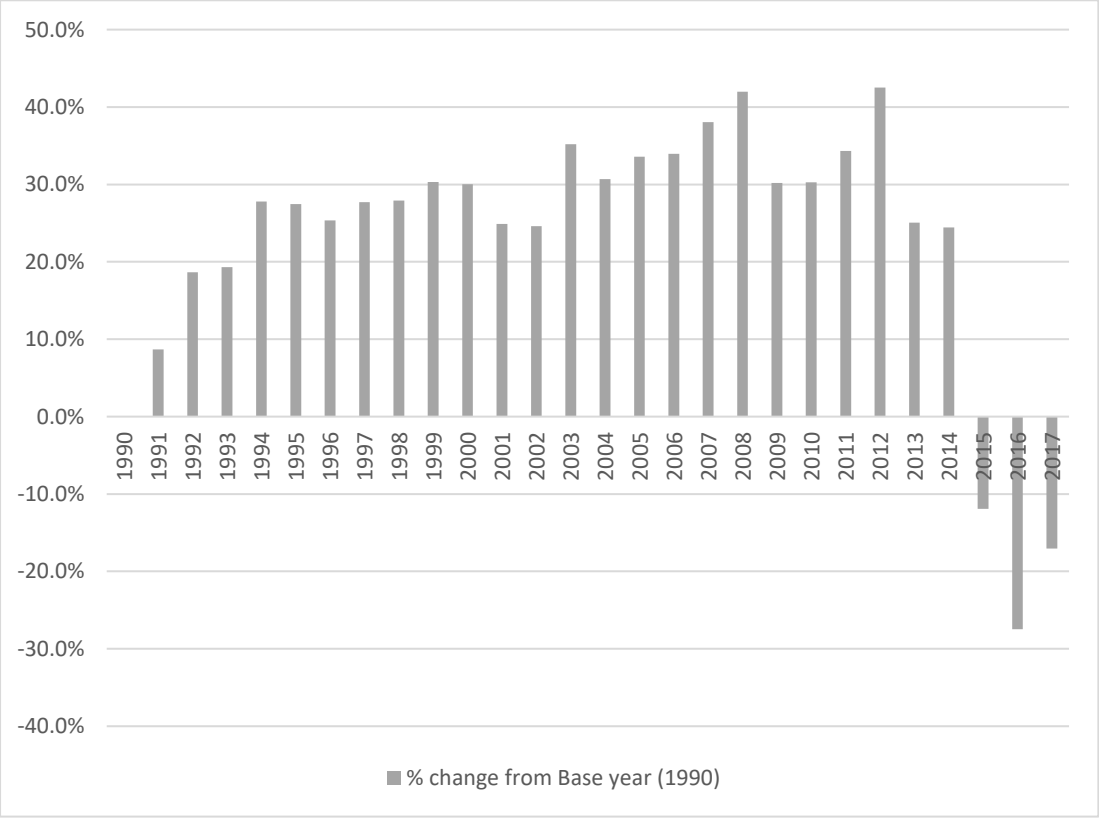


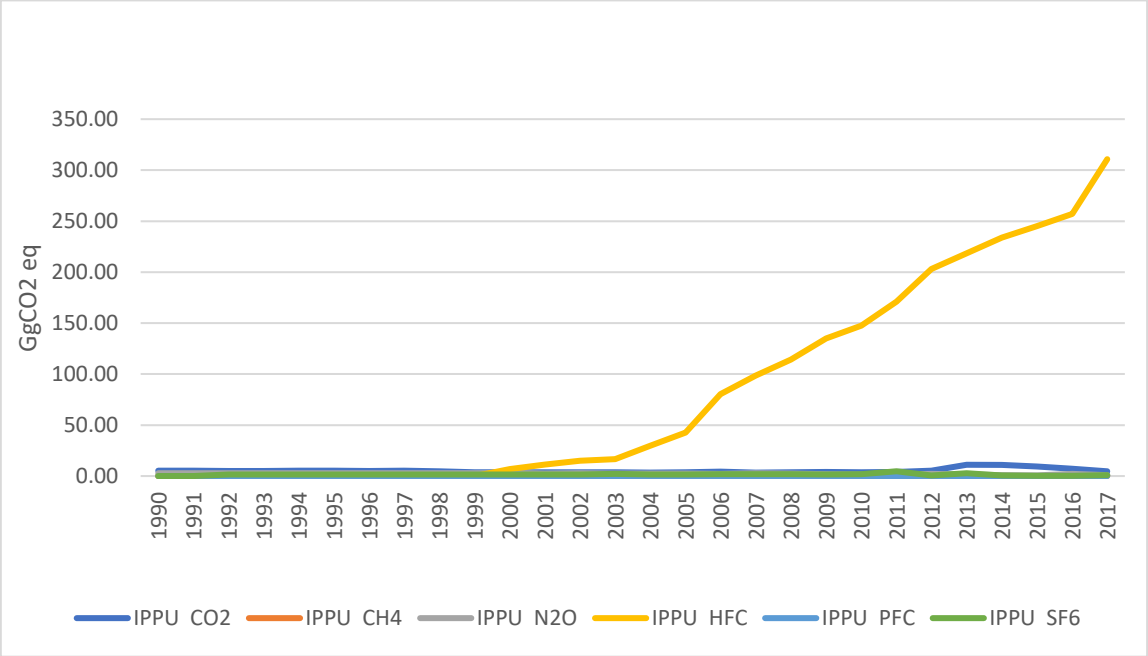
Figure 50 - Annual percentage change in Energy sector emissions compared to base year (1990)



IPPU sector emissions

The overall profile of IPPU emissions over the 1990-2017 period shows a consistent increase since the turn of the millennium (Figure 51). The major contributors to HFC emissions are activities under category 2F1 Refrigeration and Air-Conditioning, which on its own had a share greater than 98% in 2017 of total IPPU GHG emissions.

Figure 51 - Emissions trends by gas within IPPU sector



Agriculture Sector emissions

In general, emissions from the agricultural sector have seen a decrease in emissions over the 1990-2017 period (Figure 52), with emissions in 2017 being 15% 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 3.0% in 2017.

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 1990-2017, with methane emissions being always somewhat higher (CH4: 55%; N_2O: 45%; in 2017).

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.

Figure 52 - Emission trends by gas within Agriculture sector

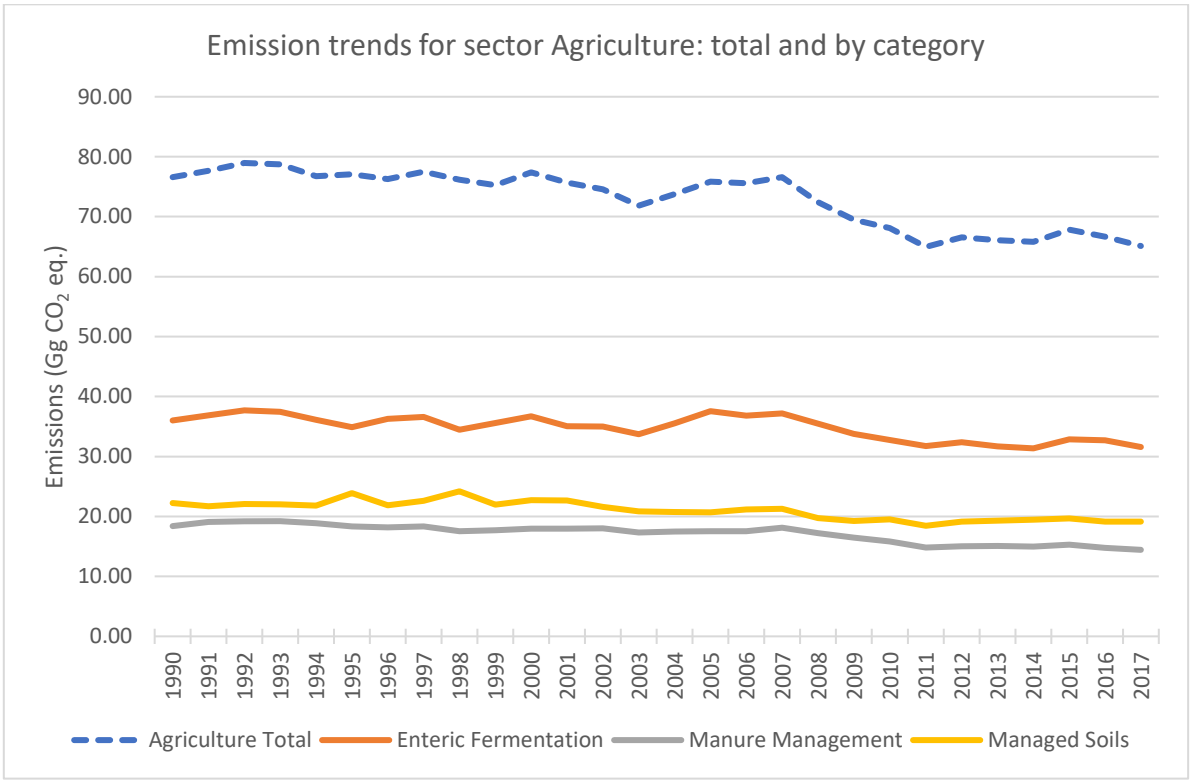
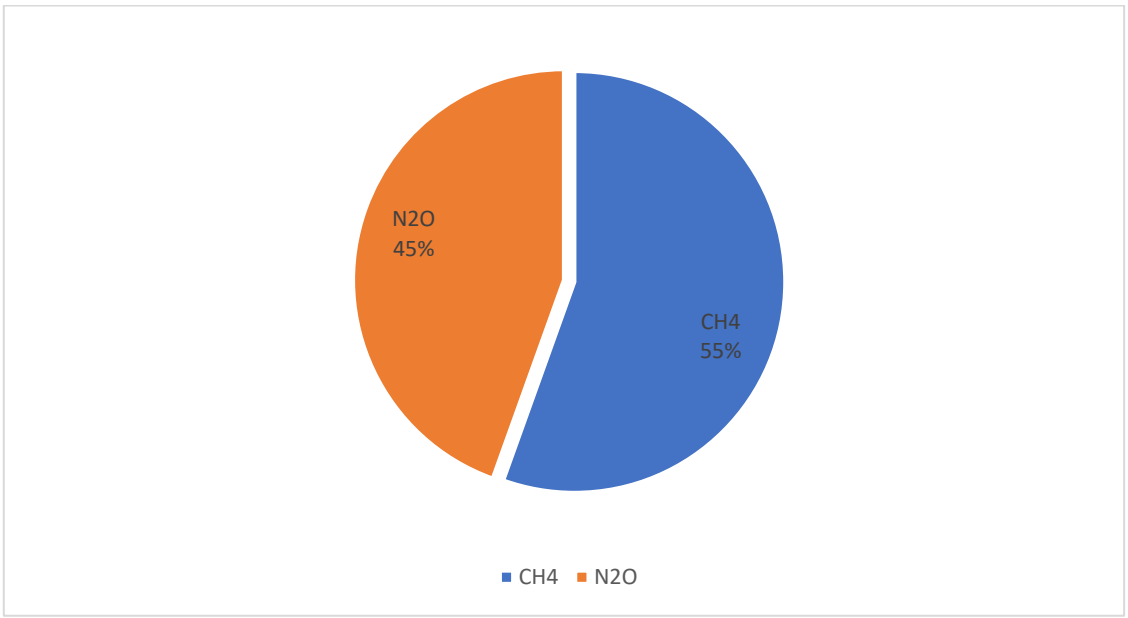


Figure 53 - Share by gas in total Agriculture emissions, 2017

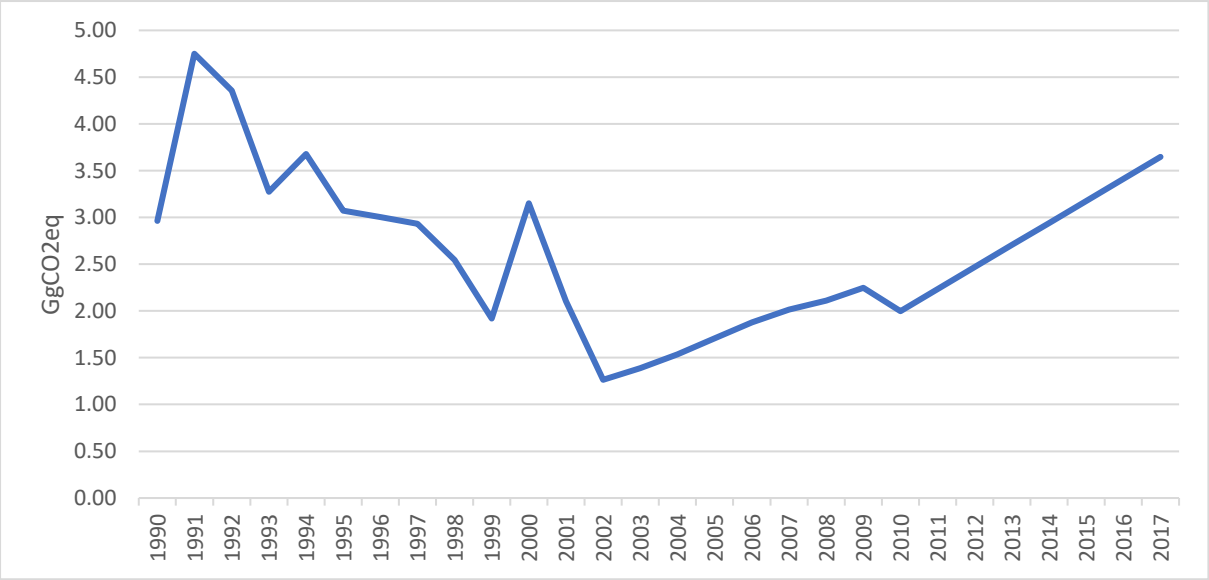


LULUCF sector emissions and removals

The LULUCF sector consistently shows the lowest share of total national GHG emissions throughout the time-series (0.1% in 1990; 0.2% in 2017).

Variations in year-to-year emission estimates seem relatively large (Figure 54); 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.

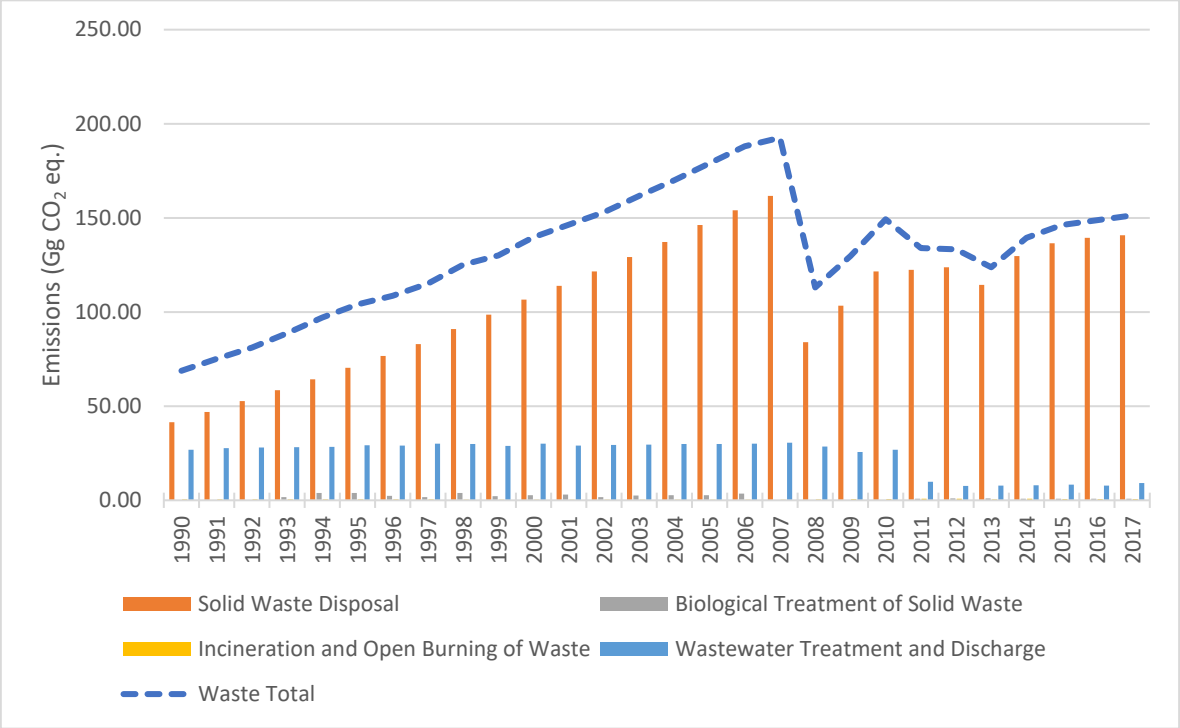
Figure 54 - Emission trends in LULUCF sector



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 55 - Emission trends in Waste sector



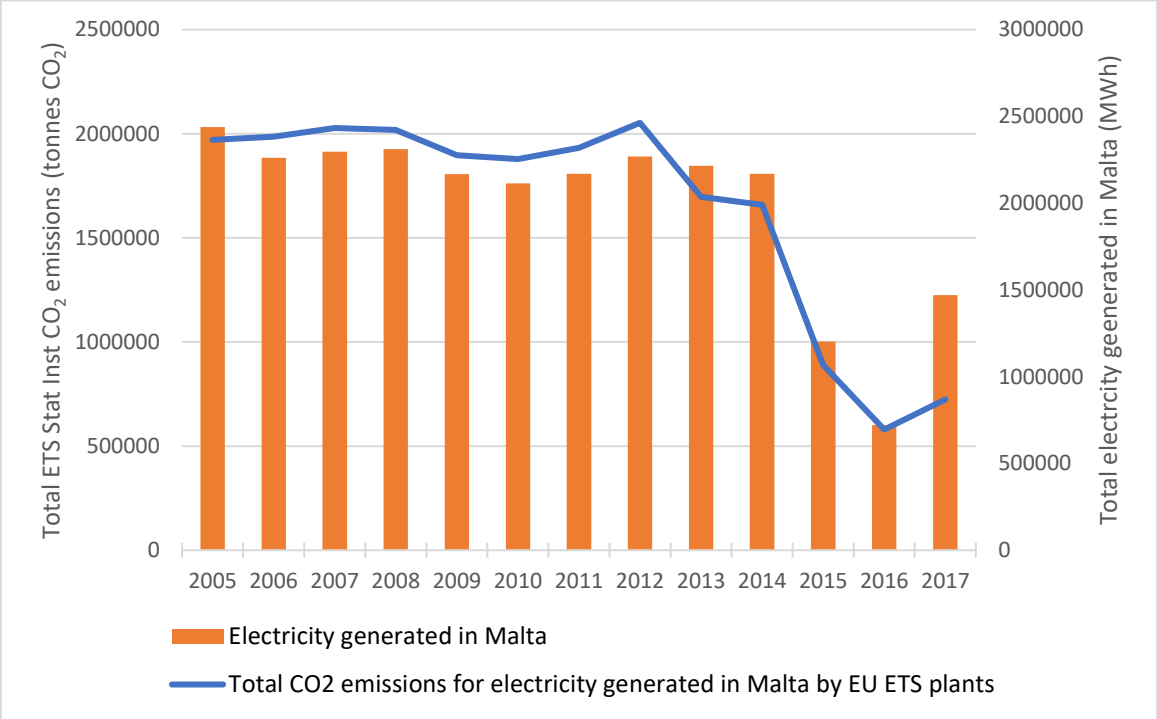
The distribution of waste sector emissions between gases sees the predominance of CH_4 as the GHG with the largest share of sector emissions, by far surpassing the contributions of N_2O and CO_2. Emissions from solid waste management account for the largest share of emissions in this sector.

EU ETS

The European Union has established the largest multi-country (to date covering 28 EU Member States, with the participation also of Norway, Iceland and Liechtenstein) and multi-sector emissions trading scheme, covering large, stationary, greenhouse gas-emitting industrial installations (since 2005) and, as from 2012, aviation activities.

The below figure isolates the ETS emissions as a result of the electricity generated in Malta, from the total GHG emissions reported and illustrated earlier in this section for the energy sector. For the purpose of this section, the below does not cover EU ETS for aviation.

Table 19 - Total CO2 emissions vs total electricity generated in Malta by power plants, 2005-2017



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 the reported for submission in 2019, i.e. latest historic year of 2017. Two main policy scenarios have been projected, namely

(1) the "*With Exiting Measures Scenario (WEM)*", which assumes that no further measures are implemented after the reference or base year (taken as 2017) and,

(2) the "*With Planned Measures Scenario (WPM)*", which takes into account currently implemented and adopted policies and measures as at end 2017, together with other planned policies and measures committed for implementation in the years thereafter.

Energy sector projections

Figure 56 illustrates the total GHG emissions from the energy sectors, including sectors falling under the EU ETS (i.e. power generation and international aviation) under the WPM scenario. Total GHG emissions as projected under the WEM scenario are also included. Figure 57 shows GHG emissions of the energy sector falling under the ESR (excluding power generation and aviation) for the WPM scenario, as well as the total for the WEM.

Figure 56 - Total GHG emissions from the energy sectors under WPM and total WEM, kt CO_2 eq.

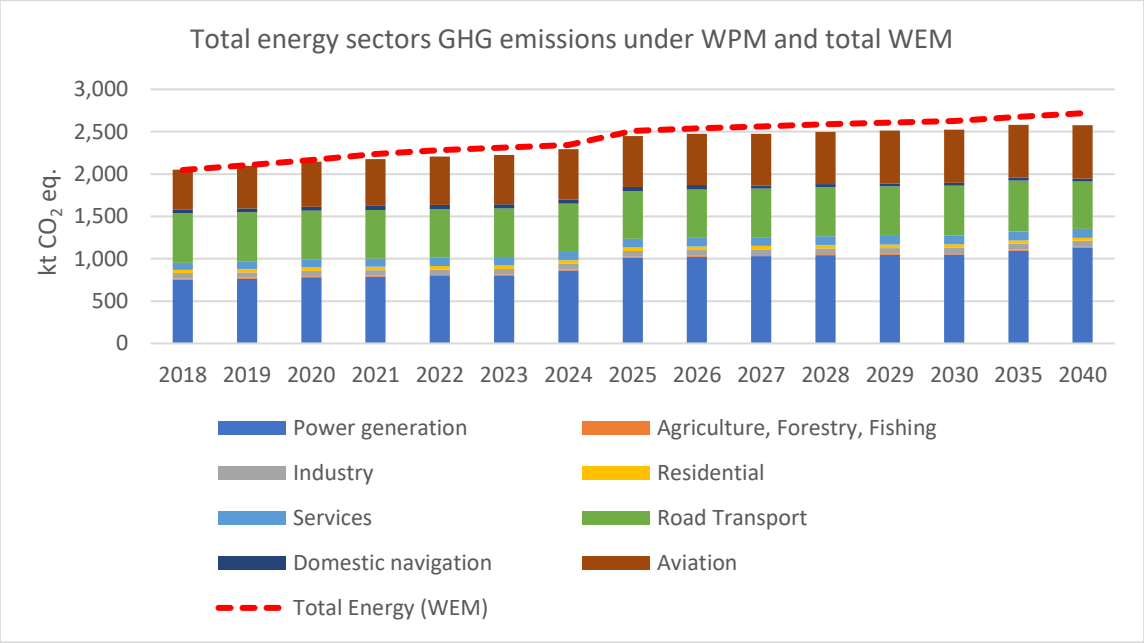
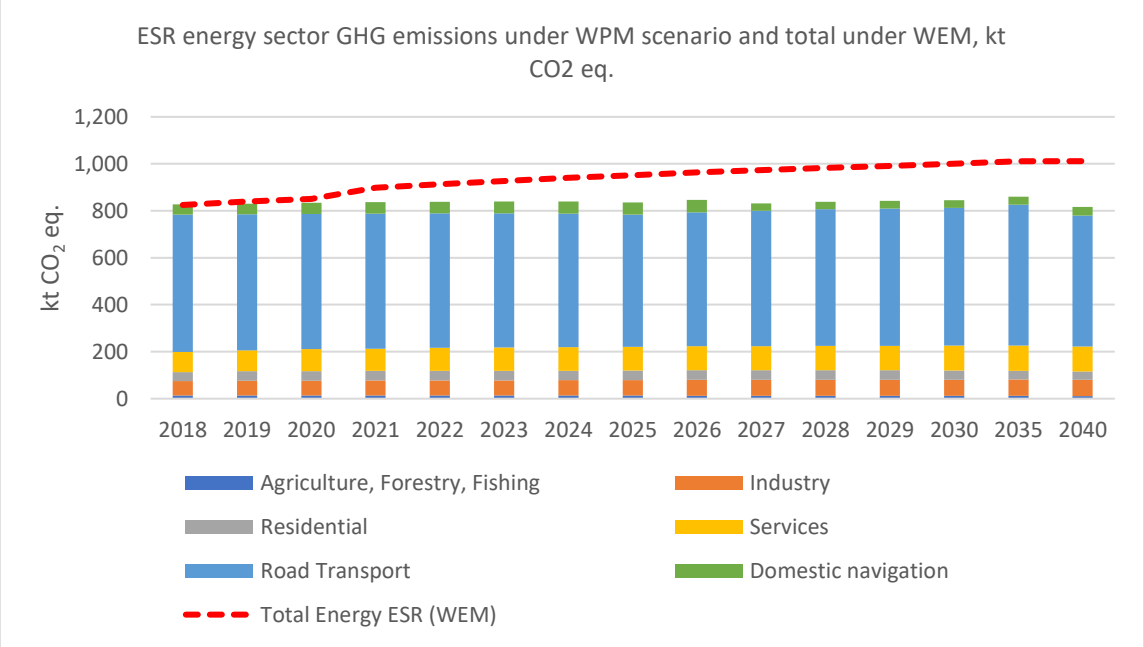


Figure 57 - ESR energy ssector emissions under WPM scenario and total WEM, kt CO_2 eq.



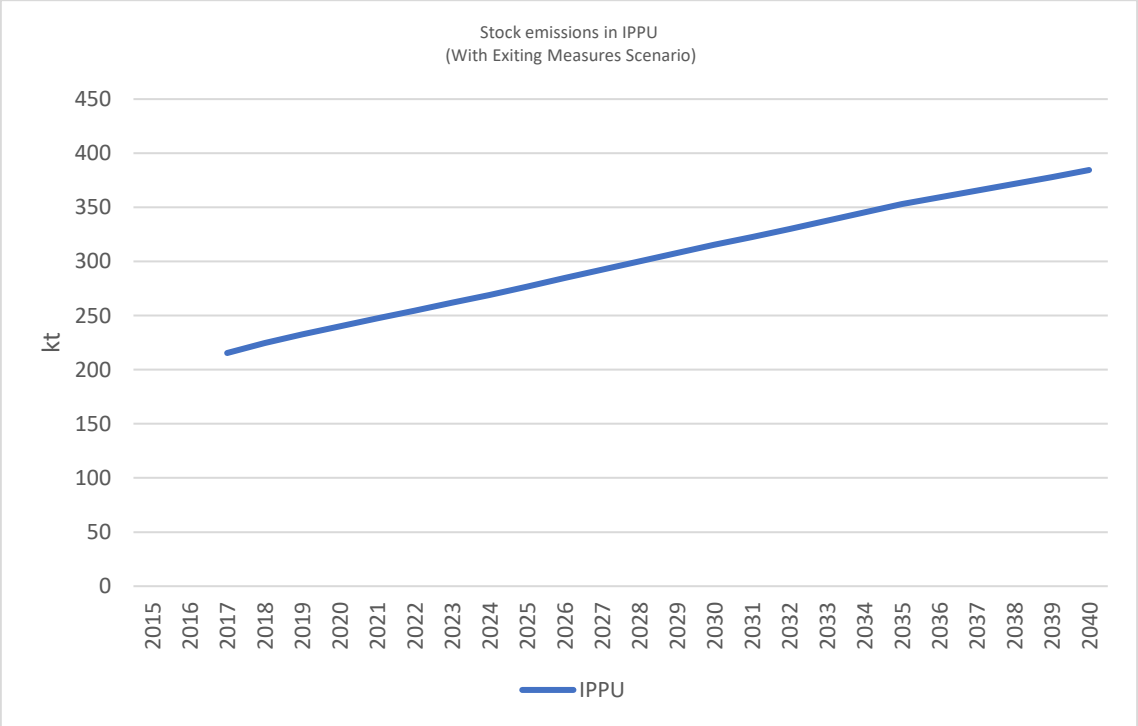
Industrial Processes and Product use Projections

The IPPU projections are based on a stock flow approach of f-gases. The GHGs identified as being emitted by this sector are CO_2, HFCs and SF_6, as reported in the national inventory under the categories: Soda Ash Production and Use, Carbide Production, Use of N_2O for Anaesthesia and Consumption of Halocarbons and SF_6. Since most of the sectors are relatively minor, projections are solely based on the refrigeration and air-conditioning sector, which covers more than 95% of the whole sector.

In view of the climatic conditions experienced in Malta, and the increased purchasing power, the demand for active cooling in the residential and commercial building stock is on the increase. Whilst in the development of the national long-term decarbonisation strategy, policies and measures are being assessed to curb the emissions generated from this sector, namely market-based mechanisms, at present the trend in projected emissions is on the rise as identified in the figure below illustrating the '*With Existing Measures*' (WEM) scenario.

In this iteration of the NECP, the GHG emissions for the IPPU sector under the WPM scenario have not been modelled, since the fluctuations of the European market and beyond which are set to come into play in the coming years should result in emission reductions across the board, however the trajectory of such emissions reductions is difficult to pre-empt at this stage. IPPU emissions are therefore identical under both WEM and WPM.

Figure 58 - Stock emissions in IPPU

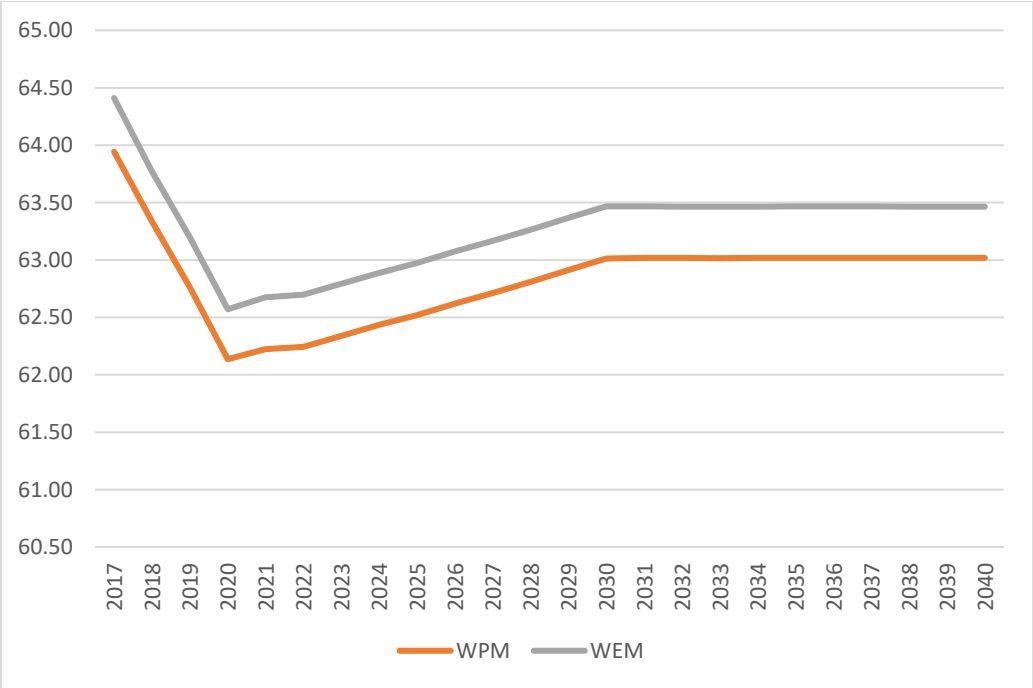


Agriculture projections

In agriculture, future GHG emission trends may be influenced both by measures taken to address directly 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.

A model was developed over 2017 to estimate the projections of activity data from which methane and nitrous oxide emissions from agriculture waste and managed soils are calculated. 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 – 2040. The WPM scenario takes into account the measure relating to the dewatering of slurries as a management measure to address emissions from manure. In view of the minor significance of the emissions generated by the agricultural sector, no considerable reductions are envisaged as the activity within this sector is projected to remain stable over the coming years.

Figure 59 - Agriculture GHG emission projections, WEM and WPM

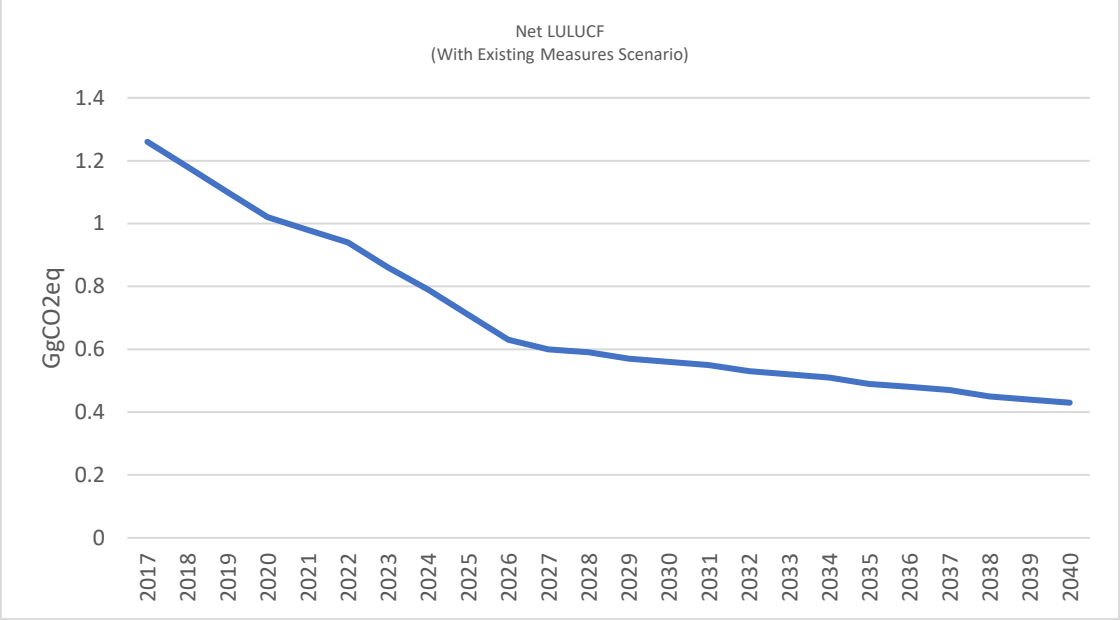


LULUCF Projections

Malta has developed the Forest reference level (FRL) relevant to Regulation (EU) 2018/841, and the final FRL value for 2021-2025 is -0.0376ktCO_2. A similar slightly higher FRL is estimated for 2026-2030 (-0.0479 ktCO_2). The very marginal nature of the sector is further shown in Figure 60 as projected under the WEM scenario, where a strong decrease in overall emissions from the sector is projected in percentage terms but only amounts to less than 1GgCO_2eq.

Whilst the policy direction in the years to come is to further augment afforestation projects to enhance the sequestration potential to its maximum, the scale of such projects and the scale of removals would still be very limited in view of the geographical limitations of ours islands. Hence, LULUCF emissions in the WPM scenario correspond to those under the WEM.

Figure 60 - Net LULUCF emission totals



Waste Projections

The waste sector will experience a significant reduction in the portion of municipal solid waste going to landfill, which shall be diverted to either biological or thermal treatment with energy recovery. The advent of thermal treatment 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 being more accentuated in the later period. This trade-off comes, in alignment with Malta's compliance to targets pursuant to waste regulations and land use conflicts which will result in view of the potential extension to the engineered landfill.

The projection of waste generation is based on the correlation between a relevant driver trend between 2013 and 2016, relative to the actual trend in waste generation 2013-2016. This correlation is represented by a constant, which is multiplied by the projected macroeconomic driver, leading to the projected waste generation for that particular year. This exercise was repeated for all waste

streams as published in the National Statistics Office waste statistics, with each waste stream associated with a specific relevant driver.

Following completion of a waste generation scenario, each waste stream was portioned into the different waste treatment options based on the WEM or WPM scenario. In the WEM 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 WEM scenario 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 WEM and WPM scenarios, is due to shifting of waste streams from one option (e.g. landfilling) to another option higher in the waste hierarchy (e.g. thermal treatment with energy recovery, anaerobic digestion 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 WEM and WPM scenario.

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

Figure 61 - Landfilling profile projections, by scenario

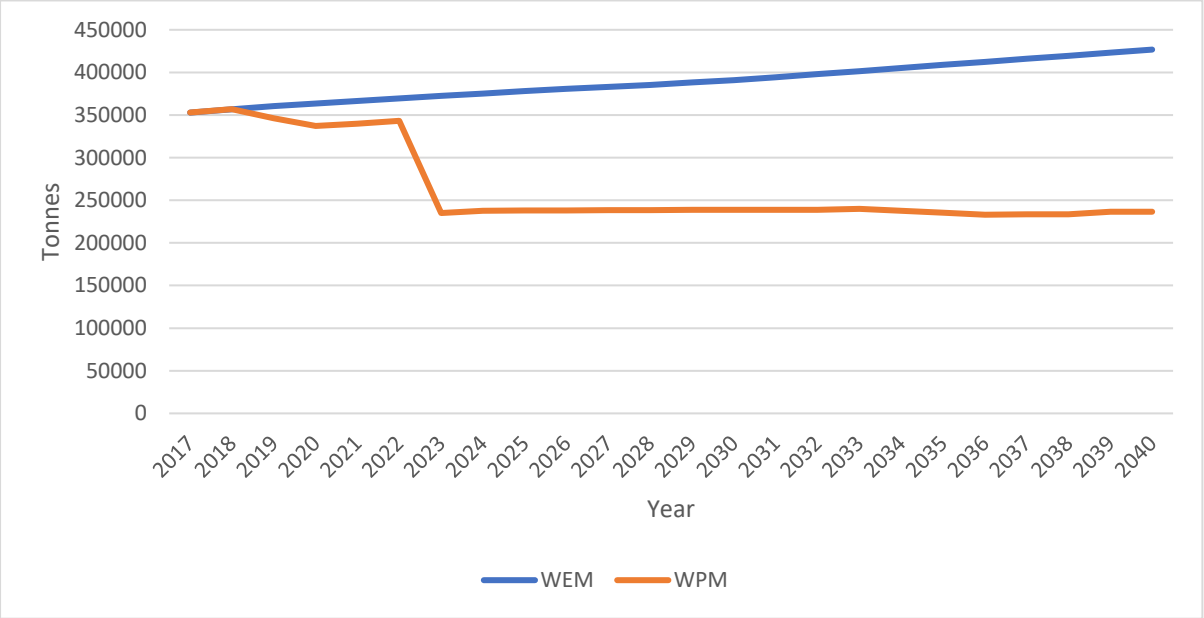


Figure 62 – Thermal treatment profile projections

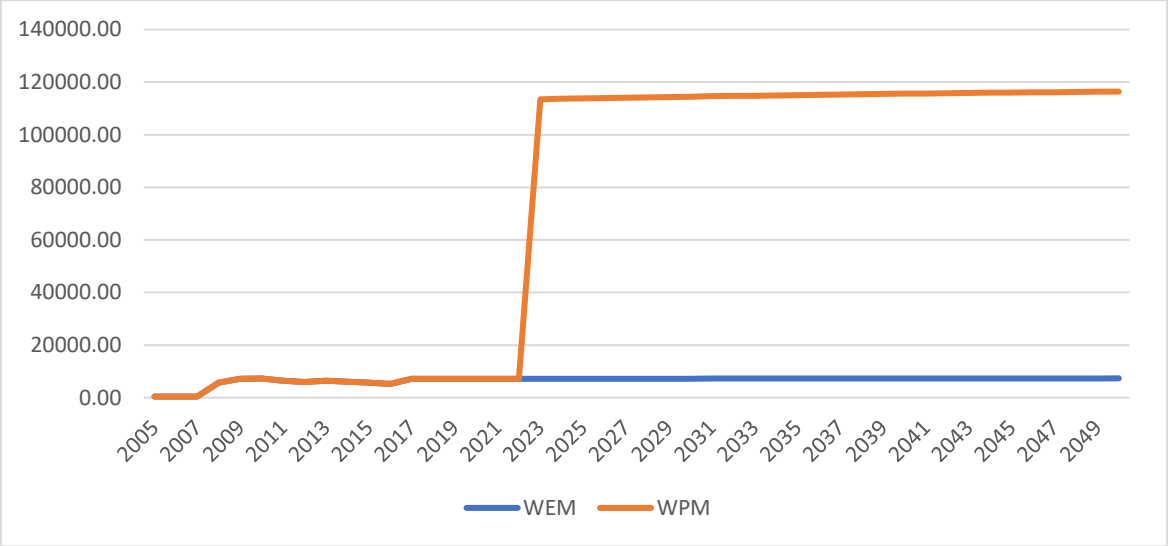
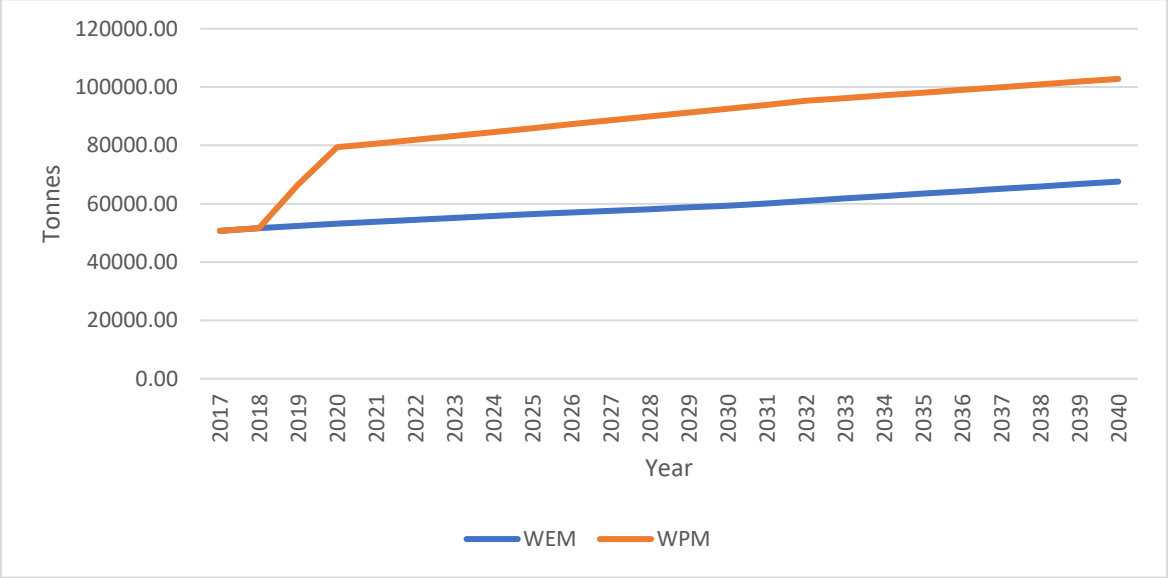


Figure 63 - Biological treatment, by scenario

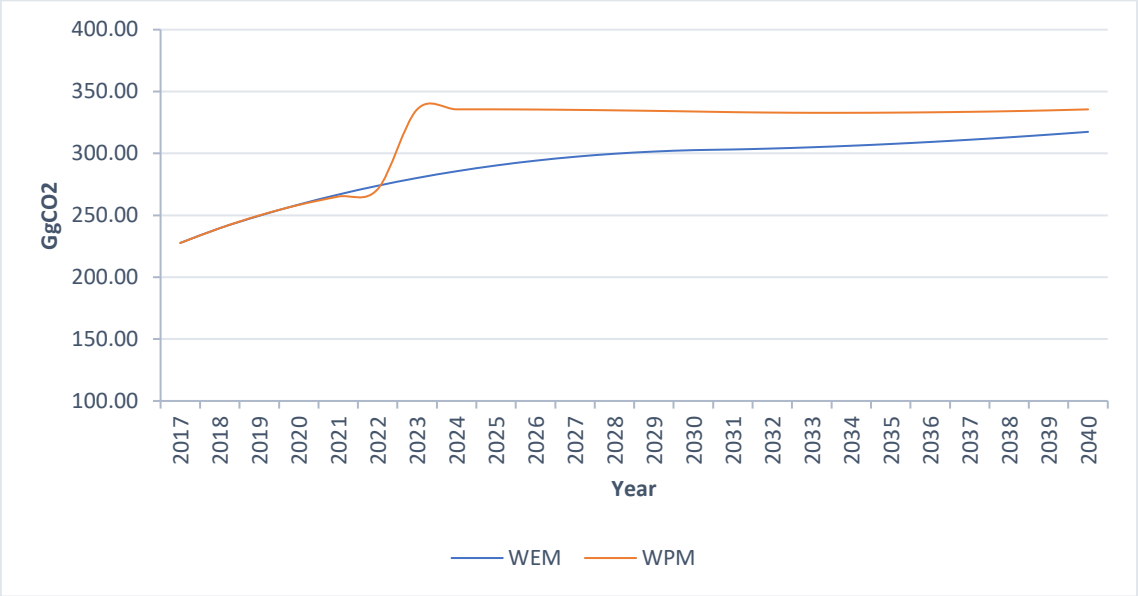


Following this distribution, the waste quantities were converted into emissions through inventory models based on the IPCC 2006 guidelines. The methodologies are described in the National GHG inventory 2018 submission.[85]

The resultant emissions are described in the figure below which identifies a peak with the commissioning of the waste-to-energy facility followed by the levelling off of emissions slowly in the years thereafter as landfilling practices decrease in favour of waste treatment options which are higher in the waste hierarchy.

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

Figure 64 - Emissions projections in Waste sector



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 20 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 7.3%, increasing from 6.4% 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 20 Share of renewable energy in gross final energy consumption, total and per sector 2010 - 2017

%	2010	2011	2012	2013	2014	2015	2016	2017
Heating & Cooling[86]	7.1%	12.2 %	10.9 %	14.5 %	14.9 %	15.5 %	17.2 %	19.7 %
Electricity	0.0%	0.5%	1.1%	1.6%	3.3%	4.3%	5.7%	6.8%
Transport	0.6%	2.2%	3.5%	3.8%	5.2%	5.3%	5.7%	7.2%
Overall RES share	**1.1%**	**1.8%**	**2.8%**	**3.7%**	**4.7%**	**5.3%**	**6.4%**	**7.3%**

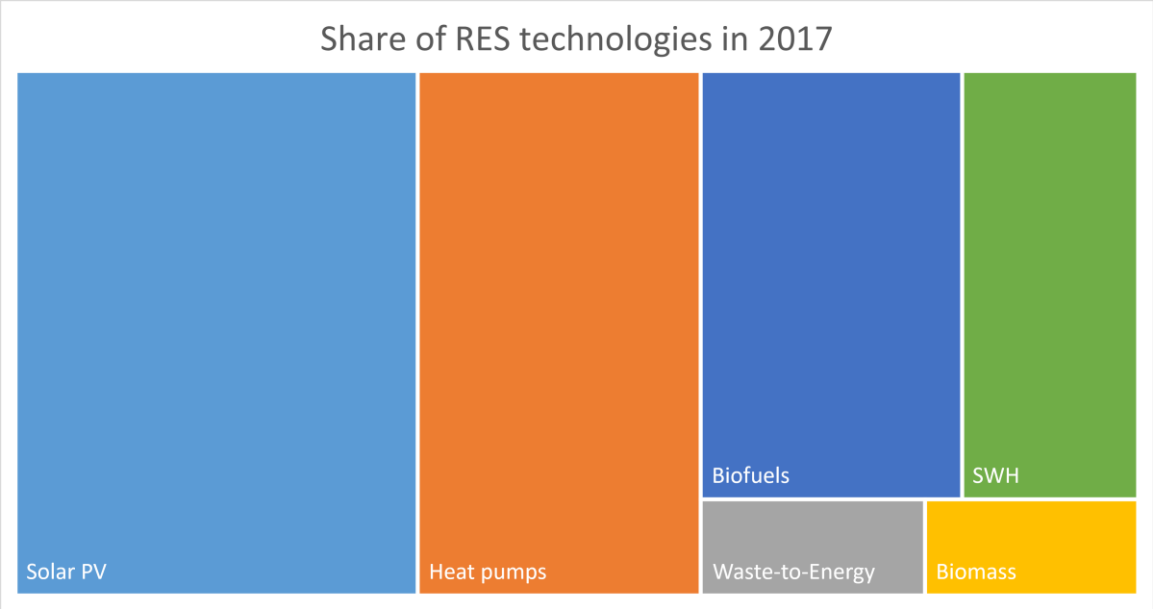
Total final energy consumption of RES in Malta in 2017 amounted to 454 GWh. This portrays a substantial annual increase from the 383 GWh registered in 2016, which can be attributed primarily to the continued deployment of solar PVs and greater use of biofuels on the Maltese market. This is to be compared 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.

[86] Excludes ambient heat from heat pumps in 2010-2012.

Government's current policy in the area of RES is to fully exploit potential of effective indigenous renewable energy sources 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. 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 65 below provides a visualisation of the share of renewables in final energy consumption by technology in 2017. 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 25%, the use of biofuels in the transport sector at 19% and solar water heaters, contributing with 13%. 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. Other sources of RES include electricity and heat produced by waste-to-energy plants, biomass imports and the electricity consumed by electric and plug-in-hybrid electric vehicles.

Figure 65 - Share of RES technologies in consumption in 2017



Share of RES in the heating and cooling sector

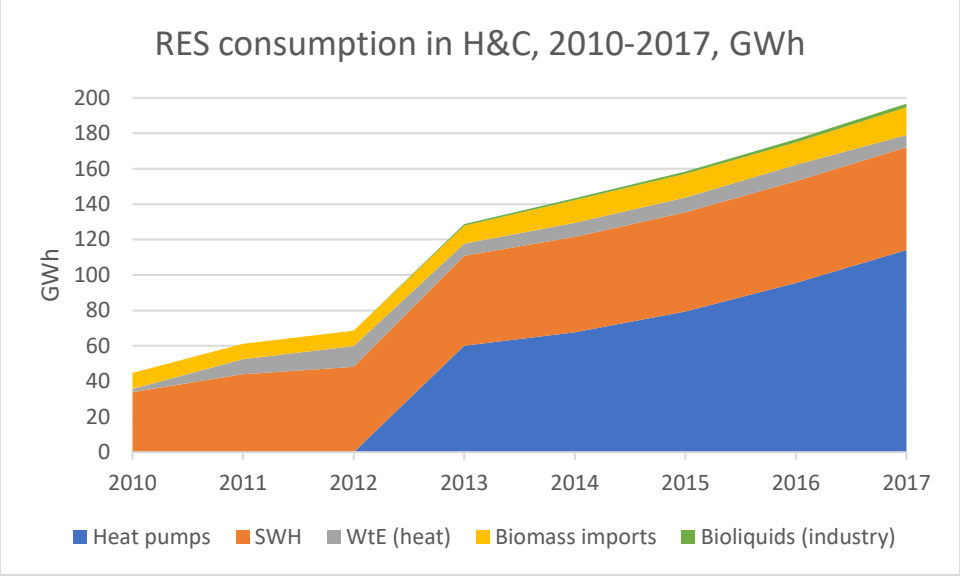
Malta does not have any district heating networks as past studies indicated and confirmed that district heating networks would not be cost-effective. In 2017, the consumption of RES in the heating and cooling sector is estimated to have reached 195 GWh, which represents an increase from 175 GWh in the previous year. In comparison, the consumption of RES in H&C in 2010 only accounted for 45 GWh[87]. Renewable energy share in the heating and cooling sector can be attributed primarily to the

[87] Ambient heat from air-to-air heat pumps is estimated to have provided 42 GWh, making the total figure for RES_H&C 87 GWh as opposed to 45 GWh. However, in the published energy balances and energy statistics, ambient heat from heat-pumps is not calculated before 2013, that is, prior to the publication of Commission Decision 2013/114/EU which established the guidelines for Member States on calculating renewable energy from heat pumps.

use of air-to-air 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 66 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. Renewable ambient cooling using air-to-air heat pumps is not included.

Figure 66 - Renewable energy consumption in H&C, 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, supplementing or, in some cases, replacing 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 heating and cooling has also been on the rise.

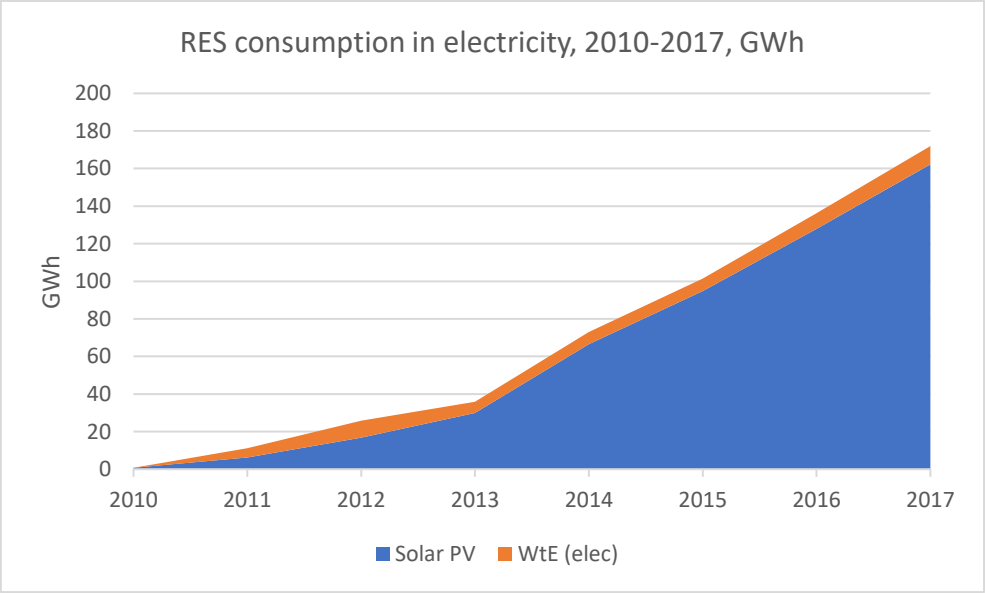
Solar Water Heaters (SWH) are favoured by the high solar intensity prevalent in Malta and they eliminate a good percentage of energy consumption otherwise going for water heating in the residential and to a lesser extent the commercial sector. However, their use is limited in summer when ambient temperature 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 just under 7 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 67 - Renewable energy consumption in the electricity sector between 2010-2017, GWh



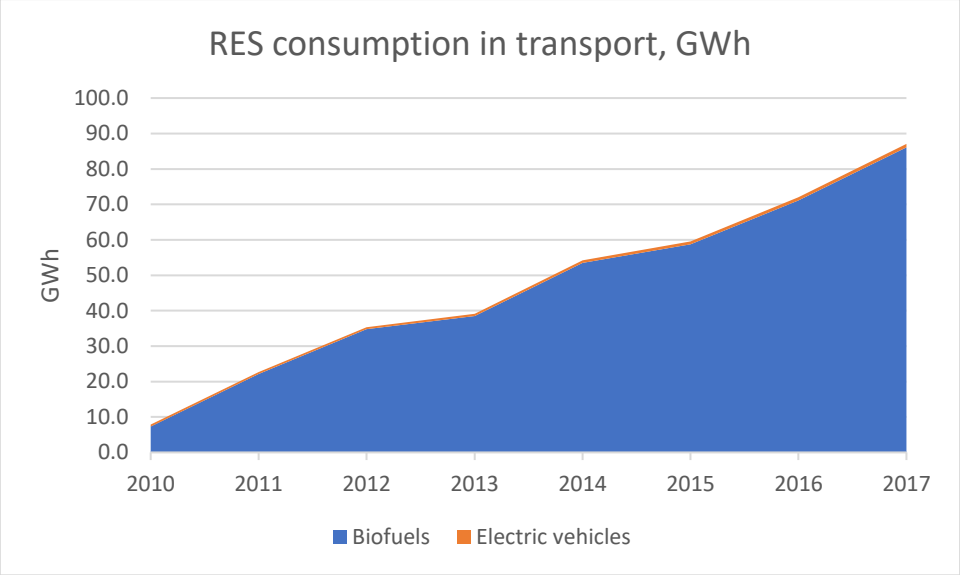
The share of electricity production from renewable energy in relation to total electricity consumption was 7.4% in 2017, an increase from 6.4% from the previous year. Apart from electricity generation from PV systems, the other contributor towards renewable electricity are the electrical output from 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 67. Renewable electricity generation in 2017 amounted to 172 GWh.

Share of RES in transport sector

In 2017, 2.1% of the transport sector's total 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 87.1 GWh, which constitutes a significant increase from the 7.9 GWh in 2010.

Figure 68 - Renewable energy consumption in the transport sector, GWh



As shown in Figure 68, 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 biofuels used in Malta are Hydro-treated Vegetable Oil (HVO) and FAME biodiesel. Malta requires that biofuels placed on the market fulfil 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 were obliged to blend conventional automotive fuels with at least 8.5% biofuels by energy content. The percentage blend shall rise to 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, 47 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 68 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.

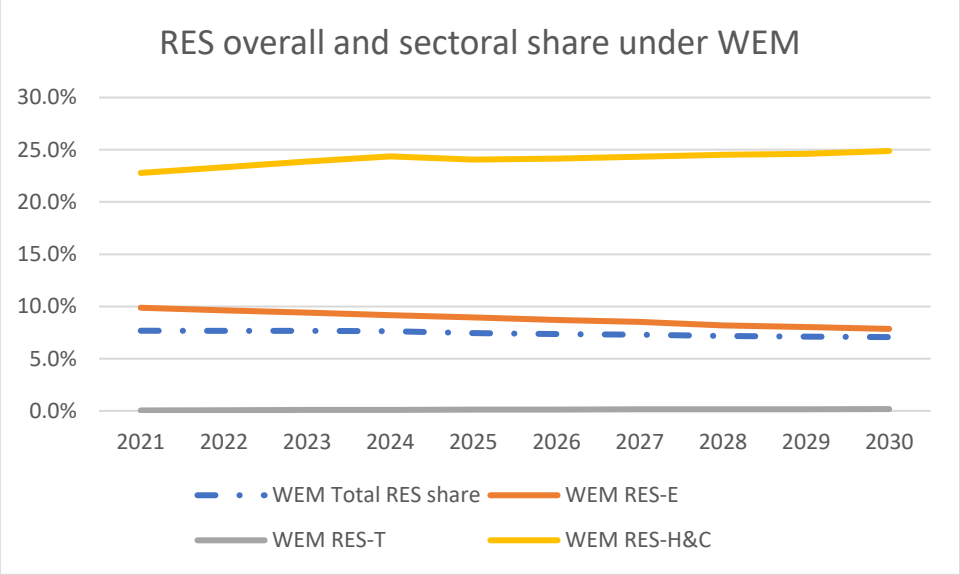
ii. Indicative projections of development with existing policies for the year 2030 with an outlook to the year 2040

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. Under the 'With Existing Measures' scenario of the NECP it is assumed that existing support for RES, such as the PV grants scheme and the substitution obligation on fuel importers will not be extended beyond their current timeframe. In view of this, it must be noted that the WEM scenario does not reflect Malta's RES contribution and expected development in the area of renewables until 2030; this is outlined in Section 2. Table 21 illustrates the overall RES share in Malta's projected gross final energy consumption until 2040 under the WEM scenario. While the overall RES share, as well as renewables in the electricity sector and transport sector would decrease, RES in heating & cooling would continue to increase because air-to-air heat pump technology deployment is not policy-driven. In the transport sector, the RES-T share would fall almost to zero due to the absence of an obligation for fuel importers to blend biofuels post-2020.

Table 21 - Overall RES share and sectoral shares under WEM scenario, 2021-2030, GWh

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total RES share	**7.7%**	**7.7%**	**7.7%**	**7.6%**	**7.5%**	**7.4%**	**7.3%**	**7.2%**	**7.1%**	**7.1%**
RES-E	9.9%	9.7%	9.4%	9.2%	9.0%	8.7%	8.5%	8.2%	8.0%	7.9%
RES-T	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%
RES-H&C	22.8%	23.3%	23.9%	24.4%	24.1%	24.2%	24.3%	24.5%	24.6%	24.9%

Figure 69 - RES overall share and by sector under the WEM scenario, 2021-2030, %



4.3 DIMENSION ENERGY EFFICIENCY

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

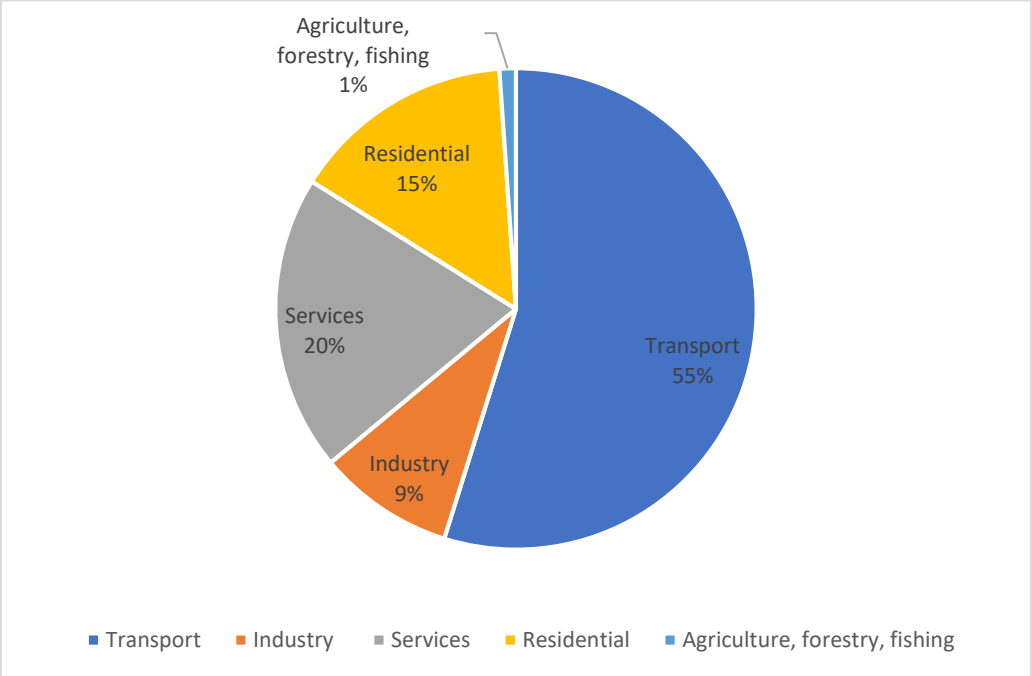
Malta's total primary and final energy consumption by sector from 2013 until 2017 is presented in Table 22. Figures provided in this table include ambient heat.

Table 22 - 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**	**829**
Total final energy consumption	**531**	**552**	**583**	**592**	**634**
Transport	*286*	*297*	*312*	*321*	*347*
Industry	*52*	*55*	*56*	*56*	*58*
Services	*107*	*114*	*122*	*122*	*126*
Residential	*76*	*77*	*84*	*83*	*95*
Agriculture, forestry, fishing	*6*	*6*	*6*	*7*	*7*

The distribution of final energy consumption by sector in 2017 (including heat pumps) is shown in Figure 70. 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 70 - 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.[88] 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 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 high-end high-rise buildings, centralized solutions have become more widespread leading to 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 spatial requirements for on-site fuel storage (mainly LPG) and applicable international standards.

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'*[89] 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.

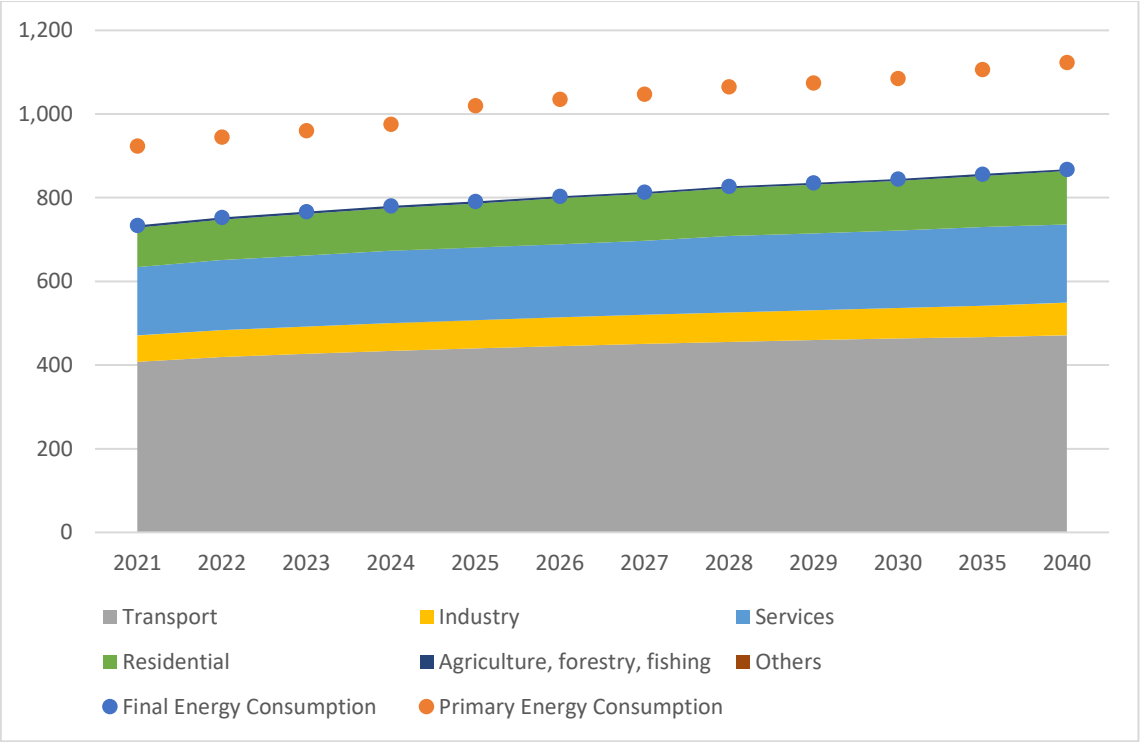
iii. Projections considering existing energy efficiency policies, measures and programmes for primary and final energy consumption for each sector at least until 2040

Figure 71 includes a projection for primary and final energy consumption under the WEM scenario, including heat pumps. As seen from the figure, Malta's primary and final energy consumption would continue to grow in the projected period under the WEM scenario. The highest consuming sector

[88] 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
[89] Ibid.

would remain the transport sector, with road transport contributing to approximately half of the total share of transport.

Figure 71 - Projections for energy consumption under the WEM scenario, ktoe (incl. 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 23) and the Overall Energy Performance Requirement for new non-Dwellings (Table 24), specifically for offices. Part 2 of Technical Document F focuses on the minimum requirements for building services in Malta.

Table 23 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 24 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 milestone which ended Malta's isolation from the European electricity network, and provided increased security of supply and flexibility of electricity services.

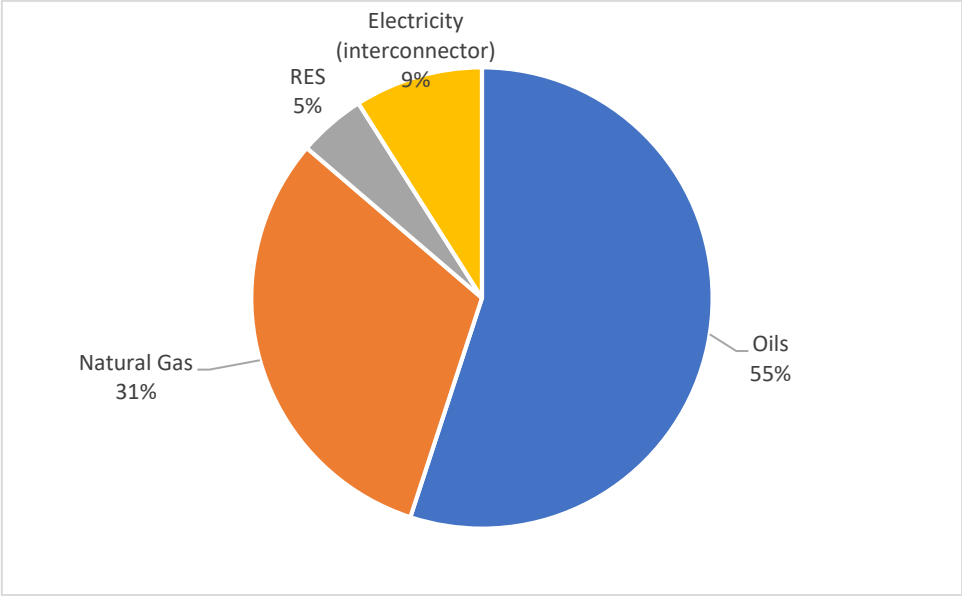
The energy mix of primary products as a share in gross inland consumption in 2017, as shown in

Figure 72, 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 55% in 2017, whereby the share of natural gas now amounts to 31% 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[90] in Malta reached 95.8% as all energy sources, apart from renewables are imported. Electricity is dispatched from local generation plants and the

[90] This indicator (as defined in Eurostat) measures the level of total net energy imports as a proportion of total gross inland consumption and the fuel supplied to international maritime bunkers. Net import dependency, as defined in Eurostat, may reach values of above 100% in cases of increasing stock levels. Negative dependency rates indicate that a country is a net exporter of energy.

interconnector with Sicily based on their order of economic merit, technical capacity and existing contractual arrangements.

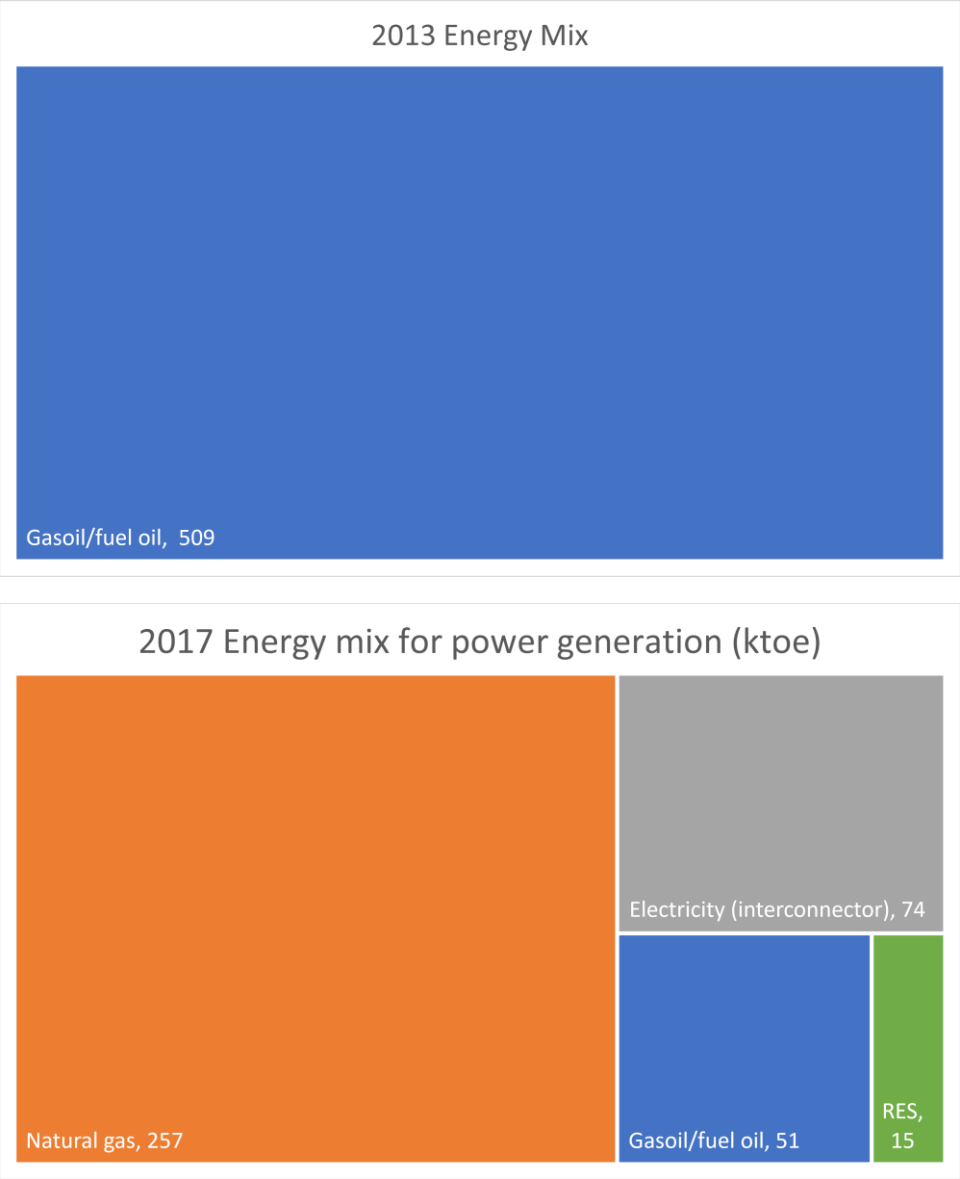
Figure 72 - Estimated energy mix as share in gross inland consumption, including electricity imported over the interconnector in 2017, %.



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 (for backup), renewables, and electricity imports through the interconnector (Figure 73). 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.

Figure 73 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 two power plants. There are no onshore LNG or gas storage facilities. The establishment of the LNG facility further diversified the sources of supply, as it provides access to an unlimited number of sources of LNG on the international market. Gas deliveries to Malta in 2017 and 2018 in bcm, and converted to energy, are provided below:

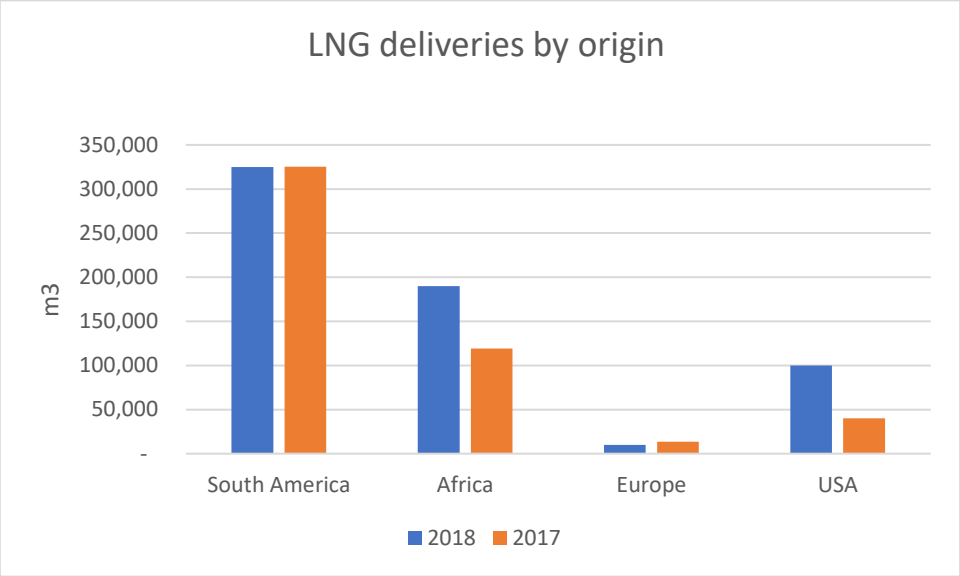
Table 25 - Gas deliveries to Malta, 2017-2018

Gas deliveries	*bcm*[91]	*TJ*[92]	*GWh*
2017	0.27	10,776	2,993.24
2018	0.35	13,614	3,781.70

[91] Standard Temperature and Pressure (15°C, 760mm Hg)
[92] Based on average higher heating value

Alternative third countries tapped for LNG imports since 2017 included the USA, Equatorial Guinea, Egypt,Trinidad and Tobago, Peru, Norway and Nigeria. LNG deliveries by sources of origin are shown in Figure 74.

Figure 74 - LNG Deliveries by origin, 2017 and 2018

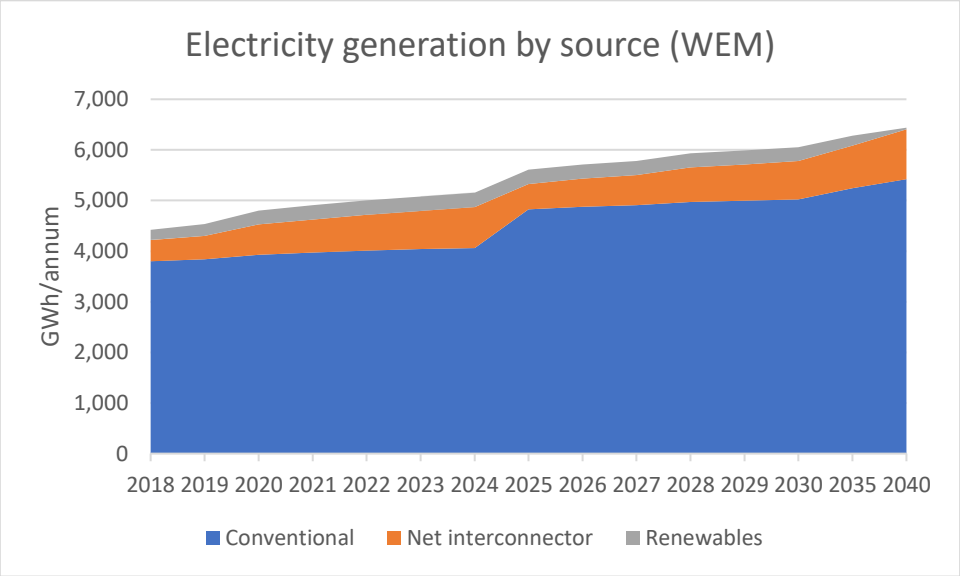


ii. Projections of development with existing PAMs at least until 2040

In the coming years, the energy mix for electricity generation shall be maintained and consolidated. The Malta-Sicily gas pipeline project would provide access to natural gas over the European gas grid and would be able to replace the present LNG supply. The pipeline would also allow for the possibility of scaling up the gas-fired power generation facilities at Delimara so as to meet the growing electricity demand, should this be identified as the preferred option. The existing LNG facility is sized to provide gas for the present configuration and would not be able to handle additional power generation units. 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[93], thus the WEM scenario maintains present levels of interconnection capacity. Figure 75 outlines the 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. Conventional fuels refer to natural gas, as well as gasoil in 2017. Renewable sources contributing to electricity generation include solar photovoltaics and biogas used in the existing waste-to-energy plants, which are expected to generate approximately 13-14 GWh in the projected period. Based on projected gas prices, the introduction of the gas pipeline in 2025 would increase the competitiveness of local generation vis-à-vis electricity imported over the interconnector.

[93] This is subject to the outcomes of the in-depth study on power generation commissioned by the Government

Figure 75 - Electricity generation by source under the WEM scenario, 2018-2040



Net import dependency is expected to remain at a level between 99.5 – 99.3% under the WEM scenario. The electricity generation of domestic energy sources, therefore renewables, is expected to peak in 2021, since under the WEM scenario no government support will be provided post-2020. Solar PVs would generate 273 GWh in 2021, which would decrease slightly to 261 GWh in 2030 as some PV systems reach their end of life.

Under this scenario, natural gas, used as fuel in the power generation sector, will be imported in the form of LNG until the commissioning of the MTGP pipeline in 2025. After 2025, natural gas and potentially biogas will be imported from the EU's Trans-European Network via Sicily.

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 31%, well above the 2030 interconnection target of 15%. Import interconnection capacity amounted to 200MW, while Malta's net nominal generation capacity in 2017 was 650MW. 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 installed generation capacity. The details of 200MW HVAC interconnector are outlined in Table 26.

Table 26 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 the Government.

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.

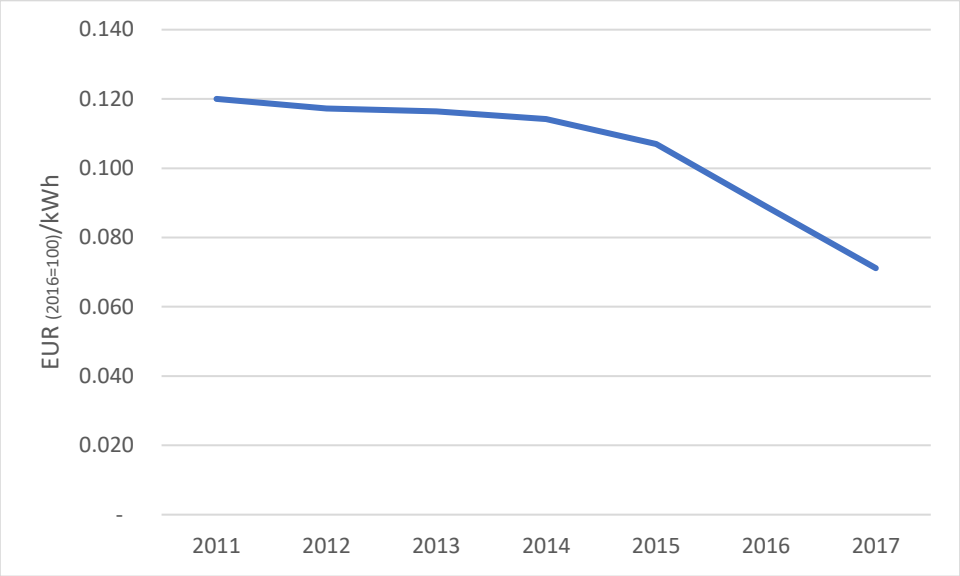
4.5.3 Electricity and gas markets, energy prices

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[94], 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 76) from €0.12/kWh in 2011 to €0.071/kWh in 2017.

[94] 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."

Figure 76 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 projected evolution of energy prices under both the 'With Existing Measures' and 'With Planned Measures' scenario, including the price projections used in the Malta's NECP modelling framework, are included under the internal energy market part of Section 5.1.i.

4.6 DIMENSION RESEARCH, INNOVATION AND COMPETITIVENESS

i. Current situation of the low-carbon-technologies sector and its position on the global market

As reported in the EU Innovation Scoreboard of 2019, Malta is considered a Moderate Innovator and has shown a performance increase overtime. As stated in the report, Malta has an Innovation-friendly environment and strong employment impacts with respect to knowledge-intensive activities and fast-growing enterprises. This has resulted in Malta ranking as the highest EU Member State when it comes to intellectual assets, with special focus on trademark and design applications. Malta's lowest performance is noted to be in its expenditures, specifically in R&I by the public sector and co-funding between the private and public sectors. This is reflected in Eurostat data, with public R&I expenditure at 0.01% of the GDP in 2016 which is low compared to the private and education sectors expenditures of 0.35% and 0.21% respectively. In terms of low-carbon technologies R&I, in 2016, Malta was reported to have the lowest expenditure at 0.002% of the GDP compared to the EU average of 0.027%.

R&I in Low-Carbon Technologies within National Policy

The National Energy Policy (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 early stage of

development of Malta's R&I sector at the time. 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.

Under the National Integrated Maritime Policy (2015), 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.

Under the Smart Specialisation Strategy of Malta's National Strategy for R&I, published and implemented by the Malta Council for Science and Technology (MCST), energy and low-carbon technologies featured under the theme of resource-efficient buildings. As a result, access to European Structural and Investment Funds for R&I in low-carbon technologies was limited to projects which focused on 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.

Funding for R&I in the Field of Low-Carbon Techologies

National Funding Schemes

FUSION Programme

FUSION[95] is the programme for the disbursement of public funding for R&I support, managed by the Malta Council for Science and Technology (MCST). The budget is set to approximately €2.2 million annually in the period 2018-2020. FUSION is composed of two programmes:

1. The Commercialisation Voucher Programme (CVP): this 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.
2. The Technology Development Programme (TDP): this 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.

In terms of energy and low-carbon technology projects, MCST has disbursed approximately €1.17 million between 2015 and 2018 through the TDP. No changes in expenditure expected until 2020, unless additional measures are implemented to increase interest in this field.

Research Innovation and Development Trust

The Research Innovation and Development Trust (RIDT) is a funding system established by the Government of Malta in 2011 and run by the University of Malta. RIDT was established to help bolster

[95] http://mcst.gov.mt/ri-programmes/fusion/

investment in research and development on a national level, with the Trust intended to attract funds from private and corporate bodies as well as foster the commercial exploitation of research within the University of Malta. A project aimed at developing of a model offshore hydraulic energy storage system (FLASC) is one of the projects which has received funding under the RIDT.

The Internal Research Grants Programme

The University of Malta established an internal funding programme, run by the Research Support Services Directorate, to support academics in carrying out their research and act as a springboard to obtain additional funding from other local and foreign sources. The programme offers, on an annual basis, an award of €60,000 to four research projects to be implemented over a two-year period. One project is selected from each of the four identified priority areas: (i) Life Sciences; (ii) Natural Sciences; (iii) Engineering, ICT and Built Environment; and (iv) Arts, Humanities and Social Sciences.

Malta Enterprise Support Measures

Malta Enterprise is the country's economic development agency, tasked with attracting new foreign direct investment as well as facilitating the growth of existing operations. It also provides incentives for the the promotion and expansion of industry and the development of innovative enterprises, including through R&I.

The “Innovation Aid for SMEs” is an incentive that allows qualified SMEs to recover, in the form of tax credits, part of the costs incurred for the loaning of highly qualified personnel. There are two other support measures: (i) “R&D Feasibility Studies 2014 – 2020” which supports enterprises intending to undertake Industrial R&D projects; (ii) “Research and Development 2014 – 2020” which provides support for industrial R&D carried out for the acquisition of knowledge leading to the development of innovative products and solutions. The maximum aid incentives percentages vary depending on the size of the enterprise and whether they are leading or collaborating on the project.

TAKEOFF

TAKEOFF is a business incubator located within the Centre for Entrepreneurship and Business Incubation (CEBI) at the University of Malta. It works alongside partner agencies in Malta to help people solve real world problems with real solutions. This is done through services such as training for various stages of enterprise growth and three intensive programmes dedicated to different enterprise levels, besides financing and capital. The campus also manages three seed funding programmes, two of which are relevant to topics under the Energy Union: “Maritime Seed Fund Awards” and “TAKEOFF Seed Fund Awards” (TOFSA).

The former, a collaboration between Malta Marittima and the University of Malta, offers €100,000 in support on an annual basis to finance researchers and entrepreneurs moving towards commercialisation of their maritime-related technologies. The project to develop FLASC was among those projects awarded under this Seed Fund. TOFSA, a joint intitiative between the CEBI and the Ministry for the Economy, Industry and Small Businesses, provides support for the commercialisation of business or research ideas. A total of €100,000 is earmarked for distribution, separated into grants

ranging from €2,500 and €20,000. One project that was awarded €20,000 is the Hybrid Boat project; this relates to the prototype of the Innovative Catamaran, a vessel which incorporates the latest technologies in electric drive system, battery monitoring and management, smart charging and flexible photovoltaics with integrated design.

EU LEVEL SUPPORT

Horizon 2020

Maltese entities are involved in a number of 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 projects under these actions amounts to €108 million, of which approximately €2.67 million has been allocated to Maltese beneficiaries. Of these allocations, the net EU finiancial contribution towards secure, clean and efficient energy amounts to approximately €1.174 million since 2014. Researchers from Malta also participated in the EU's Framework Programme for Research and Technological Development (FP), under which projects related to the areas of environment (including climate change) and energy amounting to a total of €44 million, with Maltese beneficiaries being allocated less than €800,000 and total project budgets amounting to around €14 million.

Other EU Funds

Operational Programme 1, which manages Malta's ERDF-CF funds for the 2014-2020 period, provides support for projects within its twelve priority axes; these include low-carbon economy, R&I and low-carbon transport. The total amount of funds available amounts to around €718 million. A number of R&I projects relating to the field of low-carbon technologies have received funding through this programme, particularly which establish research infrastructures; these have received over €55 million. The Solar Research Laboratory of the Institute for Sustainable Energy (University of Malta), designed with the primary focus of undertaking research on materials used for solar cells, and the Sustainable Living Complex at the University of Malta, were supported by ERDF funds.

ERDF funds were also accessed by Maltese researchers through Interreg Mediterranean and Interreg Europe 2014-2020. Projects which received support in areas relating to low-carbon technologies include: (i) the CONSUME-LESS project, led by the Energy and Water Agency; (ii) PROMETHEUS, coordinated by Transport Malta for a shift in low-carbon technology within the transport sector with emphasis on electric vehicles; (iii) SMART-HY-AWARE, a project addressing the transition to a low-carbon economy of the transport sector with special focus on hydrogen-electric mobility in which Transport Malta is a partner.

National Research and Innovation Projects

An initial stock-taking exercise was carried out by the Energy and Water Agency in 2019 to assess the level of domestic R&I in energy and low-carbon technologies from 2010-2018; information on R&I disaggregated to this sectoral level is not yet reported nationally. An overview of these projects, grouped by SET Plan Actions is provided in Table 27. This illustrates that the majority of domestic R&I in this field has, so far, been dedicated to energy use in buildings (due to the inclusion of "Resource

Efficient Buildings" as a Smart Specialisation Area 2014-2020, thus allowing access to ESIF) and the development of new technologies.

Table 27 - Overview of domestic R&I projects carried out between 2010-2018, grouped by Set Plan Actions

	SET Plan Actions	No. of Projects	Total Grant Value
1	Performant renewable technologies integreated in the system	7	€1,439,416
2	Reduce costs of technologies	0	
3	New technologies & services for consumers	6	€4,936,855
4	Resilience & security of energy system	7	€1,112,544
5	New materials & technologies for buildings	3	€6,151,588
6	Energy efficiency for industry	1	€194,987
7	Competitive global battery sector (e-mobility)	0	
8	Renewable fuels	9	€6,823,693.57
9	CSS/U	0	
10	Nuclear Safety	0	

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 2017, total expenditure on R&I in Malta amounted to €66 million, or 0.58% of GDP. The private sector contributed to 65.3% of the total R&I expenditure, while national funding constituting Government Sector and Higher Education Sector expenditure contributed to 34.7%.

3.9% of the total public expenditure, amounting to €2.4 million, was earmarked for projects in the fields of Energy and Environment. In Malta, sectoral disaggregation of R&I data is carried out in line with the Frascati Manual (2015[96]). Private sector expenditure within these fields amounted to €895,846 for the year 2017.

Table 28 - 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**	**2017**
Environment	2,524,362	1,034,181	2,122,278	2,340,757
Energy	91,497	22,138	49,116	54,449
Total	2,615,859	1,056,319	2,171,394	2,395,206

[96] http://www.oecd.org/publications/frascati-manual-2015-9789264239012-en.htm

Table 29 - 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**	**2017**
Environment	617,338	749,643	887,671	790,846
Energy	628,683	187,360	137,500	105,000
Total	1,246,021	937,003	1,025,171	895,846

Current Number of Patents

According to Eurostat, based Patent applications to the European Patent Office (EPO), a total of 6.63 registered patent applications were reported in 2017. In terms of Energy Union patents, Malta is reported by the SETIS database as having 2.33 patents per million inhabitants in 2014.

Current Number of Researchers

In 2017, 1,546 researchers in Malta were engaged in R&I. The highest number of researchers were registered with the Public sector, amounting to 62%, mainly attributed to the Higher Education sector specifically. The total number of researchers between 2014 – 2017, as reported by NSO, is shown in Table 30.

Table 30 - Total number of researchers between 2014-2017, (Source: Eurostat tsc00003 & NSO).

Current Number of Researchers	2014	2015	2016	2017
Public Sector	876	897	886	955
Private Sector	473	515	584	591
Total	1,349	1,412	1,470	1,546

Out of the total number of researchers, an average of 54% are engaged in fields relating to the Energy Union dimensions, that is Natural Sciences, Engineering and Technology and Agricultural sciences. The trend from 2014 to 2017 (Table 31) shows a growing number of researchers within these relevant fields.

Table 31 - Number of researchers by relevant fields of science between 2014-2017, (Source: NSO).

Total Number of Researchers Per Field of Study				
FIELD OF STUDY	**2014**	**2015**	**2016**	**2017**
Natural Sciences	332	355	340	348
Engineering & Technology	369	367	431	461
Medical & Health Sciences	207	214	231	232
Agricultural Sciences	24	35	26	26
Social Sciences	257	267	281	313
Humanities & The Arts	151	168	161	166
Not Classified	9	6	0	0
Total of relevant fields of science	725	757	797	835
Total of all fields of science	1349	1412	1470	1,546

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[97].

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 varies between 0.5 and 1.0 Euro/MWh). Table 32 lists the main price components as applicable to different tariff bands for the non-household sector.

Table 32 - 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

[97] The present tariff structure is available at: https://www.enemalta.com.mt/services/tariffs-billing-and-payments/

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

The Government's ambition is to provide its citizens with secure, affordable and clean energy solutions. Malta's recent investment in the energy sector is aimed to build sufficient capacity to match the forecasted growth in electricity demand in the foreseeable future. The strategy hinges on an electricity mix made up of renewables, interconnection capacity and high efficiency generators. It is important to note that the generation from renewables and cogeneration continue to benefit from priority dispatch and adequate financial support. Moreover, the Government is currently seeking to obtain the necessary permits for a gas interconnector by 2020, with the aim to have the pipeline commissioned by 2025.

Electricity generation from PV's is a principal contributor to meet the renewables target by 2020. However, the relatively high-cost of the technology compounded with issues of economies of scale has ever since the introductory phase required varying levels of support. Support schemes are issued periodically in line with State Aid Guidelines. Support schemes are usually in the form of feed-in tariffs and/or grants for both residential and commercial systems. Feed-in tariffs are funded from central budget, while ERDF funding is mostly used to fund grants. Standards and Guidelines for PV installations, tailor-made for Malta's specific conditions, have been developed. The standards clearly lay out best practices for improved quality, safety and aesthetics in PV installations. It is also worth noting that works on a communal solar farm are complete.

Other initiatives undertaken by the Government include the continued promotion of new electric vehicles and energy efficient cars/quadricylces/pedelecs/motorcycles/mopeds/tricycles, to ensure a more efficient usage of energy in vehicles and to reduce emissions.

Bearing in mind Malta's specificities, there are no plans to phase out any energy subsidies at this particular juncture, while remaining committed to, inter alia, encourage the adoption of technologies that can help reduce greenhouse gas emissions.

5 IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

5.1 IMPACTS OF PLANNED PAMS DESCRIBED IN SECTION 3 ON ENERGY SYSTEM AND GHG EMISSIONS AND REMOVALS

Section 5.1 of the Plan presents Malta's energy system and GHG emission projections when modelling the impact of PAMs under the "With Planned Measures" scenario. The key benchmark levels chosen for the comparative analysis and evaluation was the "With Existing Measures" projections (in order to evaluate the pros and cons of the "planned measures" on the system with respect to a base-line or "with existing measure" profile). The Impact Assessment section therefore focuses on an analysis of the impacts of planned policies and measures ('WPM') in comparison to the Malta's WEM scenario. It is important to note that the exogenous factors influencing the energy sector models used to project the main WPM scenario trajectories remain unchanged when compared to the ones used in the WEM. Therefore, reference is made to Section 4.1 of the Plan for further details related to exogenous factors such as macroeconomic assumptions.

Furthermore, as a complement to this analysis, scenarios in which certain key assumptions varied from those adopted for the NECP were analysed in order to explore other possible medium- to long-term responses of the energy system in reaction to such circumstances. The identification of these diverging assumptions was informed by uncertainties surrounding independent factors which may have an impact on the energy system and on the effect of the efficacy of PAMs outlined in the NECP. In this regard, two factors emerged as predominant: (i) the rate of efficiency increase, as a result of market factors; and (ii) the rate of electrification, as a result of market factors and behavioural change. Outcomes from the modelling of these two sensitivities are thus also outlined in this section. Indicators relating to the dimensions of the Energy Union were tracked in order to analyse the potential range of results under these different visions of the evolving energy system.

Definitions relevant to the Analytical basis of the NECP:

· *Energy/emission modelling framework***:** combination of tools, data, expert judgment, institutional arrangements, used for different purposes, for and beyond energy/emission projections aiming to support decision makers (e.g. for energy planning).

· *Energy/emission projection system*: combination of tools, data, expert judgment, institutional arrangements used specifically for energy and emission projections.

· *Integrated projections:* projections based on an holistic approach which addresses simultaneously as many perspectives or dimensions of the energy and climate dynamics as possible, and takes into account the cross-cutting nature and interactions between those dimensions; in the context of this analysis, the rationale behind "*integrated projections*" refers more particularly to the five dimensions of the Energy Union (*Decarbonisation, Energy efficiency, Energy security, Internal energy market, Research, innovation and competitiveness*).

· *Storyline of a scenario*: narrative description of a scenario, highlighting the assumptions and drivers which characterize a scenario and make it different from other scenarios.

· *Sensitivity analysis/ sensitivities:* modelled WEM and WPM scenarios in which a number of key assumptions diverged from those adopted for the purposes of the NECP.

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

Table 33 includes a list of the policies and measures under Malta's WPM scenario, as well as indication of whether these have been modelled within Malta's energy modelling framework and are explicitly represented in the results and outcomes of the WPM scenario presented in the sections hereunder.

Table 33 - All policies and measures under the WPM scenario

PAM number	Name of Policy or Measure	Modelled PAMs
E.2.1	Financial support schemes for Solar PV	✓
E.2.2	Solar Water Heaters / Heat Pump Water Heater Scheme	✓
E.2.3	Energy efficiency: electricity tariffs	✓
E.2.4	Support Scheme for Services and Industry	✓
E.2.5	Energy Efficient Street Lighting	✓
E.2.6	Projects in primary water network and wastewater treatment plant	✓
E.2.7	Biofuels Substitution Obligation (2021-2030)	✓
E.2.8	Acquisition of renewable energy credits from other Member States	✓
E.2.9	Gas Security of Supply	✗
E.2.10	Development of R&I Strategy for Energy and Water	✗
C.2.1	Management of Farm Slurries in the Maltese Islands	✗
C.2.2	WtE Facility	✓
C.2.3	Waste Management Plan 2020 - 2030	✓
T.2.1	Removing traffic bottlenecks and reducing severance between urban communities - Marsa Road Project	✓
T.2.2	Remove traffic bottleneck at Addolorata junction, Marsa	✓
T.2.3	Road and infrastructure projects	✓
T.2.4	Malta - Gozo Tunnel	✓
T.2.5	Implement Public Transport Quality Corridors (PTQC)	✓
T.2.6	Improvement of Ferry Landing Places	✓
T.2.7	Introduction of a low-emission zone (LEZ) in the 'hub'	✓
T.2.8	Smart Parking System for Valletta	✓
T.2.9	Fast passenger ferry link between Malta and Gozo	✓
T.2.10	Free Transport for Youths, Students, and school children	✓

T.2.11	Increase use of Intelligent Transport Systems in traffic management	✓
T.2.12	National bicycle sharing scheme	✓
T.2.13	Last-Mile Delivery for Valletta	✗
T.2.14	Implementation of a cycling corridor	✗
T.2.15	Car-Sharing Scheme	✗
T.2.16	Sustainable Urban Mobility Plan for Valletta	✗
T.2.17	National Bicycle Strategy and Action Plan	✗
T.2.18	Introduction of electric buses in Gozo	✗
T.2.19	Continuation of EV Grants and Electromobility Action Plan	✗

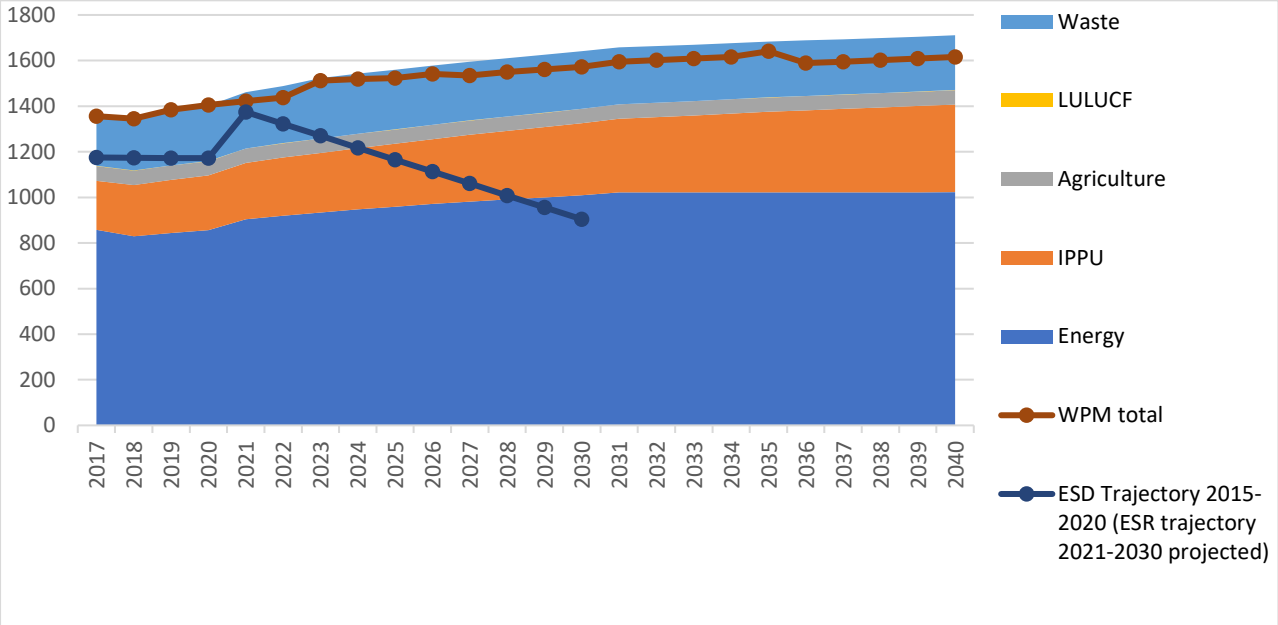
Dimension Decarbonisation – GHG emissions and removals

GHG emissions projections split by sector under the WEM and WPM scenarios are described in Section 4.2.1ii of the Plan. To avoid repetition, these are not reproduced hereunder.

Projections in the ESR sector

The aggregated effect of the WEM scenario in comparison to the WPM scenario is illustrated in Figure 77, providing for a comparative analysis between the WEM against WPM scenario for the non-ETS emissions sectors. The WEM scenario is denoted in the background with the stacked emissions of all non-ETS emissions sectors (energy, IPPU, agriculture, waste and LULUCF. The red dotted line shows the total effect of the WPM scenario, which as expected shows a reduction in emissions when compared to the WEM scenario, as a result of the implementation of domestic policies and measures. This reduction in emissions in the non-ETS emissions sectors under the WPM scenario, however is projected to still result in emissions generation above the ESR target for 2030, which is shown as a blue dotted line. The gap between the dotted lines has to be bridged either by means of additional domestic policies and measures to be committed to and reported in subsequent iterations of the NECP or by resorting to the flexibility mechanisms in line with the provisions of the ESR regulation.

Figure 77 - ESD/ESR projections by sector[98]



Projections of emissions of air pollutants

The projected emissions of air pollutants provided hereunder were produced by the Environment and Resources Authority (ERA) in accordance with the National Emissions Ceilings Directive (EU) 2016/2284. It is to be noted that these emissions were calculated primarily based on energy consumption projections reported in Malta's Draft NECP. During the development of the Final NECP, Malta's energy modelling framework was significantly revised and updated, which yielded new projections of primary and final energy consumption for the projected period up to 2040. Therefore, as a disclaimer, it must be pointed out that the projections of air emissions presented below do not necessarily reflect the projected evolution of Malta's energy system and the economy under the WPM scenario. The National Inventory for Emission Ceilings will be updated in the next reporting cycle based on the most recent energy consumption projections used for the Final NECP.

The National Emissions Ceilings Directive sets national emission reduction commitments for Member States and the EU for five air pollutants:

- nitrogen oxides (NOx),
- non-methane volatile organic compounds (NMVOCs),
- sulphur dioxide (SO_2),
- ammonia (NH_3) and
- fine particulate matter ($PM_{2.5}$).

Malta also calculated the projected black carbon (BC) emissions. These pollutants have a negative impact on air quality, human health and the environment. Emissions are provided for the latest

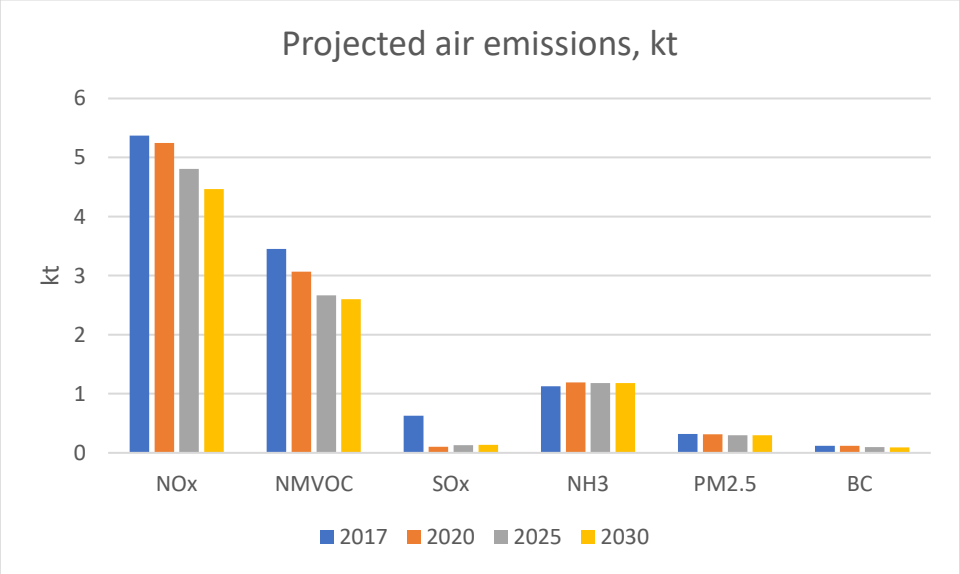
[98] **Note**: Base year emmissions used to estimate 2021-2030 trajectory equivalent to base year used in the 2013-2020 trajectory; base year emissions shall be amended once the implementing acts derived from article 4 of Regulation (EU) 2018/842 of the European Parlamament and Council enter into force.

emission inventory year (2017), and projections for 2020, 2025 and 2030. The projections presented within this section represent the 'With Planned Measures' scenario reported in the Draft NECP and therefore the measures Malta is committed to implement and are modelled and reported in the NECP. These emission projections were largely developed using the same models and activity drivers used for the development of the NECP.

The NEC Directive requires that Member States draw up a National Air Pollution Control Programme (NAPCP), which should contribute to the successful implementation of air quality plans established under the EU's Air Quality Directive. Alignment between Malta's Draft NECP and NAPCP processes was ensured, whereby the assumptions and outputs of one exercise fed into the other and vice-versa. ERA is the government body responsible for the development of the NAPCP. In addition, expert assistance was also provided through the capacity-building project on emission projections, funded by the European Commission. This capacity-building project specifically provided support in developing emission projections for road transport and national navigation sectors.

Figure 78 shows the national total emissions of air pollutants on the Maltese territory split by the five main pollutants, including black carbon. It is projected that apart from ammonia all other air pollutants are expected to decrease in the projected period until 2030 compared to 2017, the latest emission inventory year.

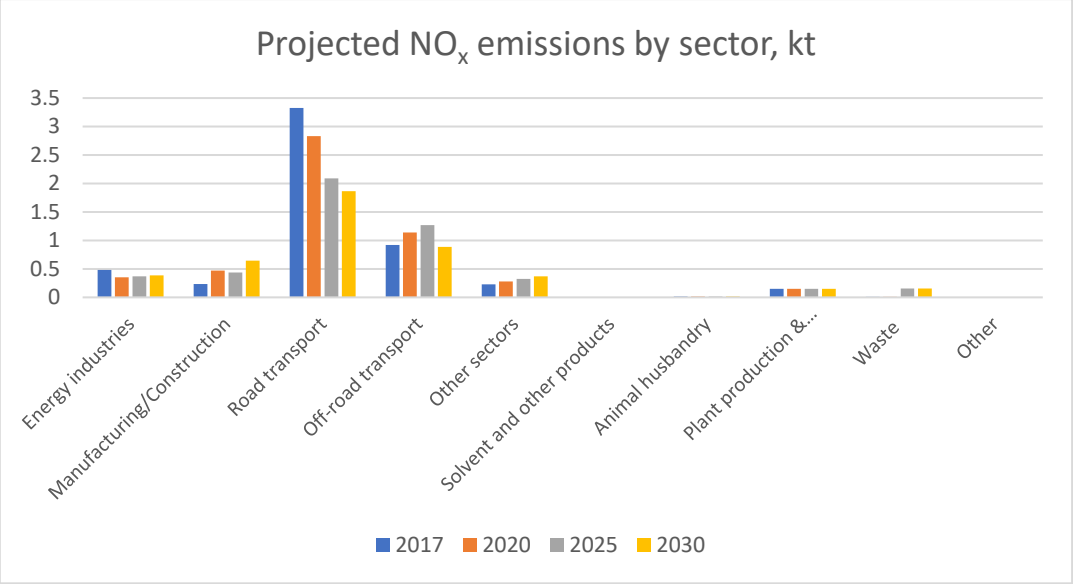
Figure 78 - National total air pollutant emission projections, kt



Nitrogen Oxides (NO_x) are expected to decrease in the projected period as a result of the implementation of measures under the WPM scenario. Nitrogen oxide emissions are most prevalent in the road transport sector – it is expected however that NO_x emissions in road transport should decrease by 42% by 2030, based on 2017 emissions, as a result of newer vehicle technologies, increased electrification and a number of sustainable mobility measures in transport. To calculate NO_x emissions in the road transport sector, the outputs of the vehicle profile model and vehicle kilometre projections were used as input to COPERT. The largest NO_x level increases, compared to 2017 emissions, are expected in the waste sector, as a result of the commissioning of the new Waste-to-Energy facility in 2024, followed by the manufacturing and construction sector. NO_x levels are also

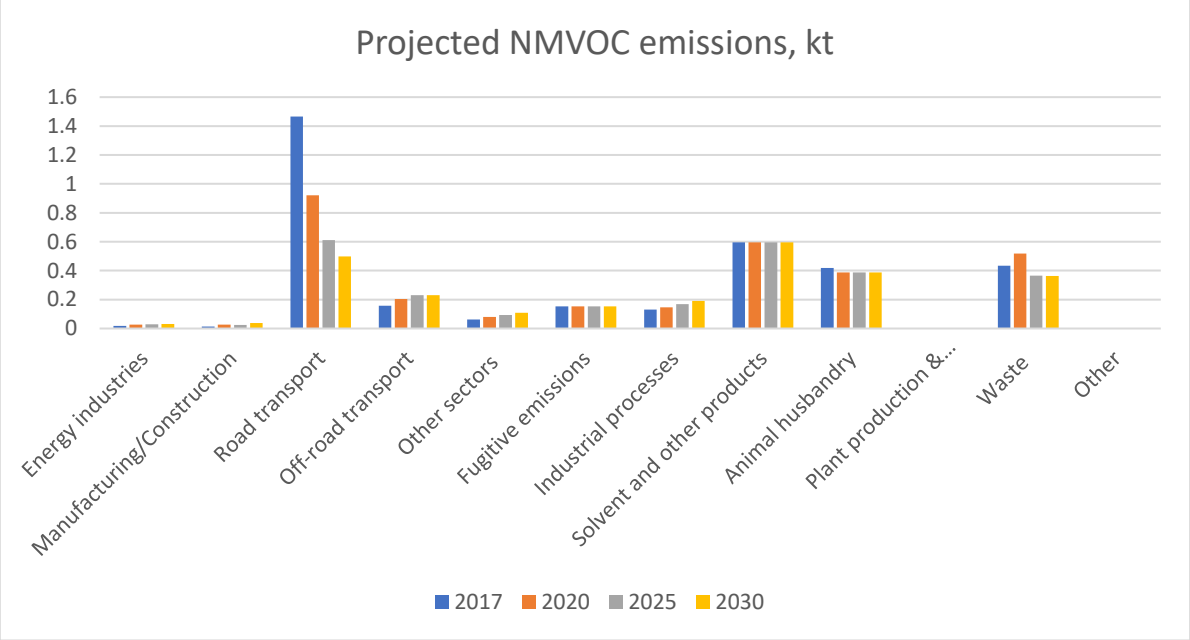
expected to increase in the other sectors category, which includes the commercial, institutional, residential and agriculture & fishing sectors as well as in the aviation and maritime transport sectors. Figure 79 shows the projected NO_x emissions by sector.

Figure 79 - NOx emission projections by sector, kt



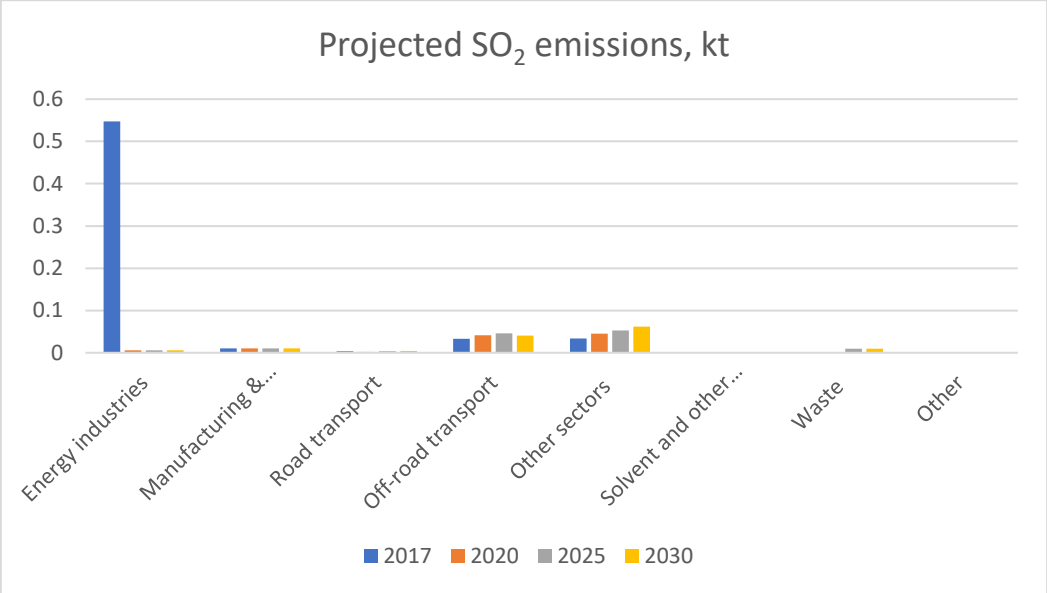
Non-methane volatile organic compounds (NMVOCs) are expected to decrease by 25% in the projected period compared to 2017, in particular due to the road transport sector, where it is expected that NMVOC emissions will decrease by 66% by 2030. On the other hand, NMVOC levels are expected to rise in all other sectors with the exception of waste. NMVOC emissions will remain stable in the category solvent and other products and animal husbandry. Projected NMVOC levels are shown in Figure 80.

Figure 80 - NMVOC emission projections by sector, kt



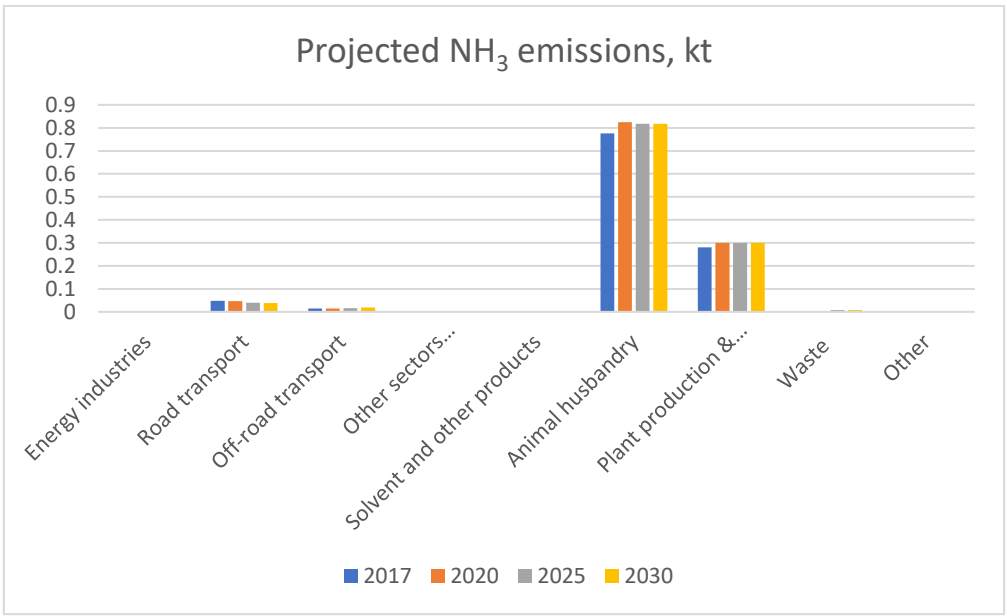
Sulphur dioxide (SO_2) emissions are projected to decrease, primarily in the power generation sector. Since 2017, local generation plants at the Delimara Power Station are fired by natural gas. Gasoil-based generation capacities are available as back-up in case of emergencies or when other sources are not available. It must be pointed out that the energy system modelling tools assume that electricity will be generated by the natural gas-fired units and therefore gasoil consumption is projected to remain 0 until the end of the projected period. In reality, a situation where gasoil-fired units are utilized as standby capacity in the event of an emergency is possible in the next decade. Therefore, while SO_2 emissions are expected to decrease drastically in the energy industries sector, they are expected to continue increasing in the aviation and maritime transport sectors as well as waste after the commissioning of the new waste to energy facility.

Figure 81 - SO_2 emission projections by sector, kt



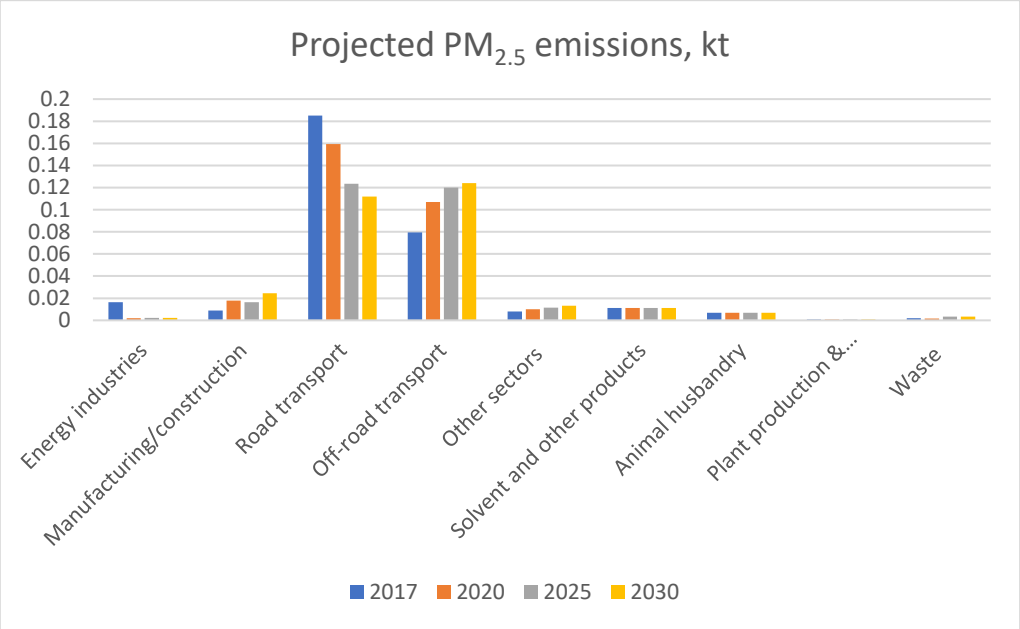
Projected **ammonia (NH_3)** levels are relatively high primarily in the animal husbandry and plant production and agriculture soils sectors. As highlighted above, ammonia emissions are the only air pollutant which is expected to increase in the projected period up to 2030, although only by 5% compared to 2017 levels. This is largely due to slight increases in animal husbandry by 2020 as well as the 7% increase in NH_3 emissions in the plant production and agriculture soils sector. Future projects implemented by the Governance of Agricultural Bioresources Agency (GAB) are expected to reduce NH_3 emissions. However, due to lack of information available at the time of the compilation of these projections, GAB projects are not included in the projected emissions levels. NH_3 emission projections are provided in Figure 82.

Figure 82 - NH_3 emission projections, kt



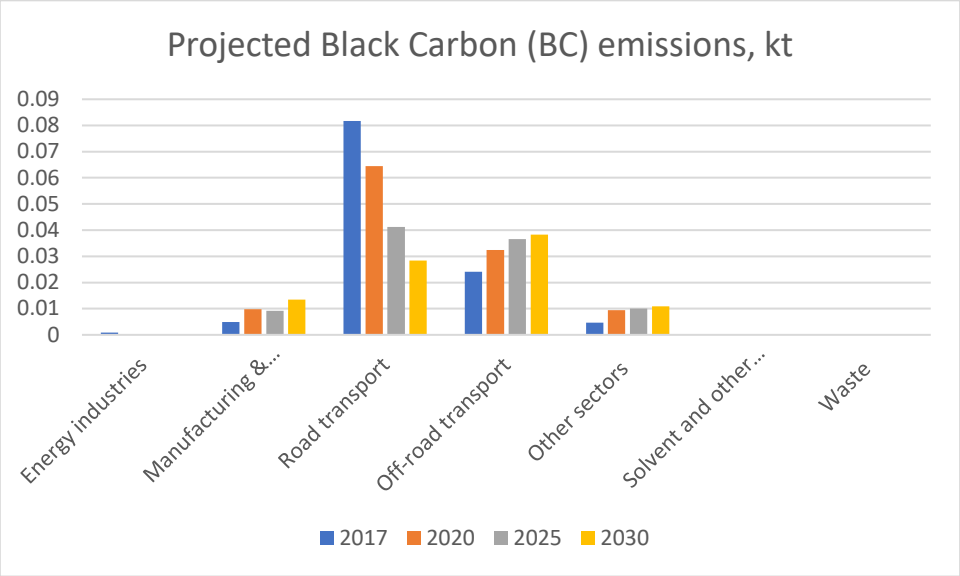
Fine particulate matter ($PM_{2.5}$) emissions are expected to decrease only slightly in the projected period, as shown in Figure 83. The projected decrease which will be registered in the road transport sector will be off-set by increased emission levels in off-road transport, which will surpass emissions of the road transport sector by 2030. Other sectors, such as commercial, residential and institutional, will increase slightly, as will manufacturing & construction and waste.

Figure 83 - $PM_{2.5}$ emission projections, kt



For the WPM scenario, Malta had also projected the emission levels of **black carbon (BC)** in sectors where such information was available. The projected emission level of black carbon in 2030 compared to 2017 will decrease by 22% due to decreasing emission levels in the road transport sector. Nevertheless, BC emissions will continue increasing off-road transport, manufacturing & construction and the commercial, residential and institutional sectors, as shown in Figure 84.

Figure 84 - Black carbon emission projections, kt



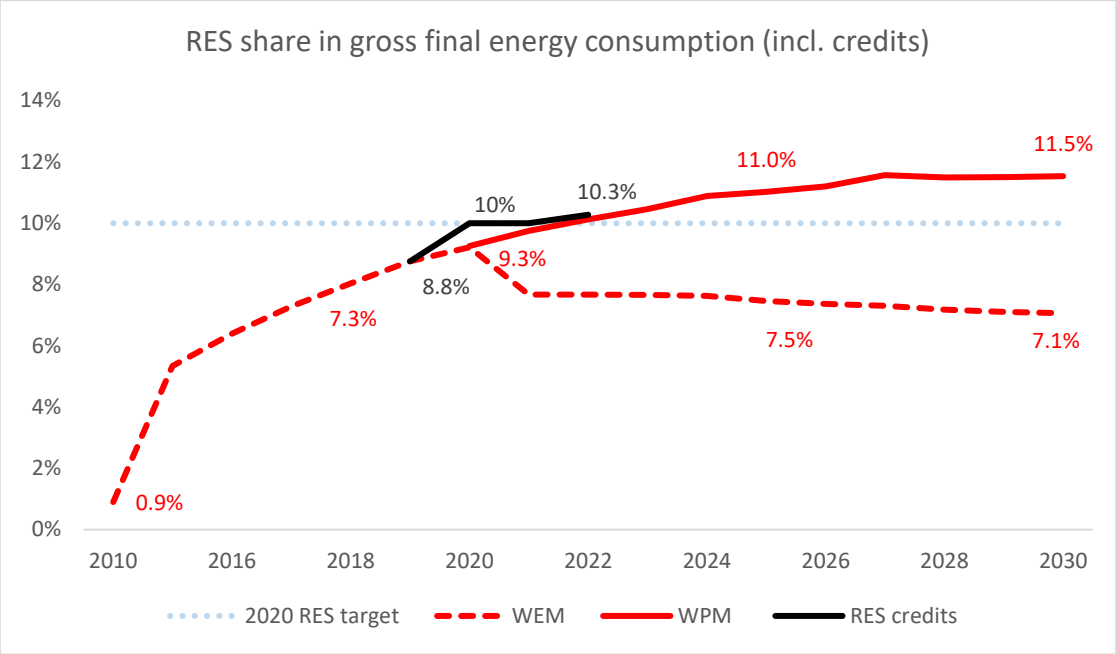
Dimension Decarbonisation – Renewable energy

In line with Annex I of the Governance Regulation (EU) 2018/1999, Malta's overall RES contribution in 2030 represented as a RES share in total gross final consumption of energy is presented in Section 2.1.2 of this plan. Likewise, estimated trajectories for the sectoral share of RES in final energy consumption and by technology are also provided within Section 2.1.2. For the sake of avoiding repetition, this section provides a general overview of Malta's WPM scenario projections in the area of renewable energy.

In line with Annex I of the Governance Regulation (EU) 2018/1999, Malta's overall RES contribution in 2030 represented as a RES share in total gross final consumption of energy is presented in Section 2.1.2 of this plan. Likewise, estimated trajectories for the sectoral share of RES in final energy consumption and by technology are also provided within Section 2.1.2. For the sake of avoiding repetition, this section provides a general overview of Malta's WPM scenario projections in the area of renewable energy.

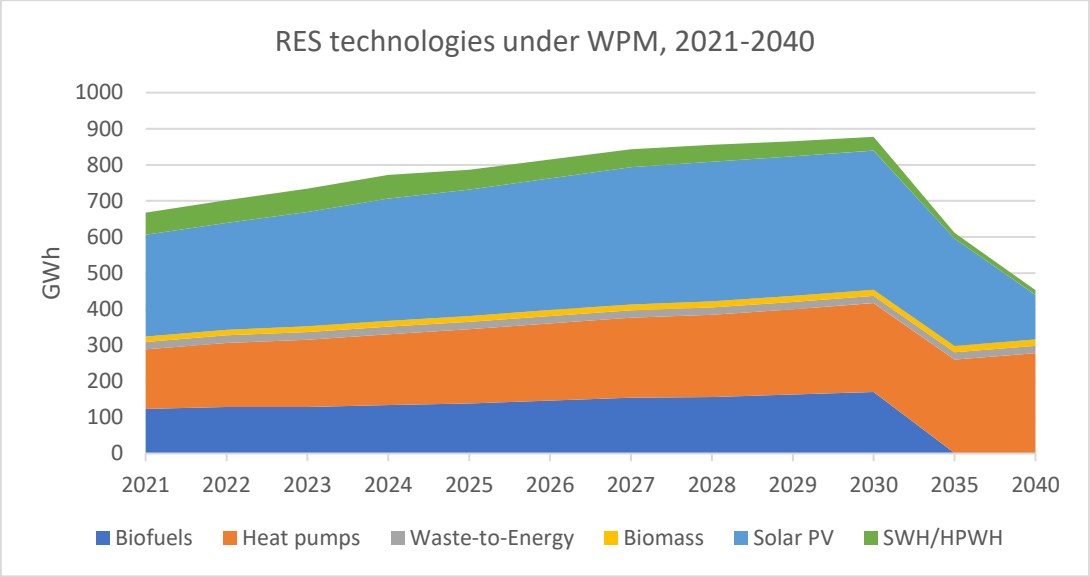
Figure 85 provides an overview of Malta's RES share trajectory from 2010 to 2030, whilst comparing the WEM and WPM scenarios. Based on these estimated projections, Malta will be required to purchase renewable credits or use other cooperation mechanisms to reach its 10% RES target in 2020, maintain this target in the following year (2021), and reach the first reference point in 2022 corresponding to 18% of its trajectory between 2020 and 2030. Malta's RES contribution in 2030 is 11.5%.

Figure 85 - RES share in gross final energy consumption for WEM and WPM scenario, incl. RES credits



The projected evolution of RES-share in final energy consumption under the WPM scenario from 2021 to 2040 is provided in Figure 86. An assumption is made whereby all planned policies and measures supporting the deployment of RES are discontinued post-2030. This would imply a significant decline in RES technologies reliant on government support, such as solar PV, biofuels in the transport sector and solar water/heat pump water heaters; this is indicative of the financial barriers which are foreseen to continue to inhibit the deployment of RES in the absence of Government intervention. The consumption of ambient heat from air-to-air heat pumps and electric and plug-in-hybrid electric vehicles would continue to increase post-2030 as their uptake is not dependent on continued government support. The assumption taken for the period post-2030 should not be interpreted as Malta's unwillingness to follow the road towards decarbonisation. Additional policies and measures for the period post-2030 will be outlined and included in the next NECP reporting cycle.

Figure 86 - RES technology consumption under WPM in 2021-2040, GWh



RES Heating & Cooling

Air-to-air 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 projected to increase from 204,500 at the end of 2017 to 461,000 in 2030 and 556,000 in 2040. This increase is driven by a growth in the number of households, and the number of units per dwelling. Projections take into account current trends of installation and average unit size, as well as a saturation level with regards to the number of air-to-air units per household, depending on the type and size of dwelling. 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 sustained demand for the importation of air conditioning systems employing heat pump technology. In all sectors, it is 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 when calculating consumption of ambient heat by assuming a minimum level of 2.7 SPF ($SCOP_{net}$)[99].

For the Final NECP, Malta also analysed the existing and projected capacity of VRF systems. A conservative approach was taken in this respect whereby VRF systems installed pre-2009 were not taken into account when calculating the contribution of ambient heat from VRF systems due to uncertainty on the share of units imported pre-2009 having a SCOP level of 2.7, that is, the minimum level set out in Commission Decision 2013/114/EU on calculating renewable energy from heat pumps.

[99] This is in line with the default values outlined in Commission Decision 2013/114/EU which established the guidelines for Member States on calculating renewable energy from heat pumps.

In contrast to air-to-air heat-pumps, solar water heaters (SWH) and heat pump water heaters (HPWH) 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, it is assumed that no new or replacement units will be installed without Government intervention. Indeed, in recent years, Malta has observed a downward trend in the sales new SWH installations despite the availability and promotion of grants. Post-2020, Malta is planning to launch new schemes to incentivise the installation of SWH/HPWH in the residential sector, amounting to 800 units/year until 2030.

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.

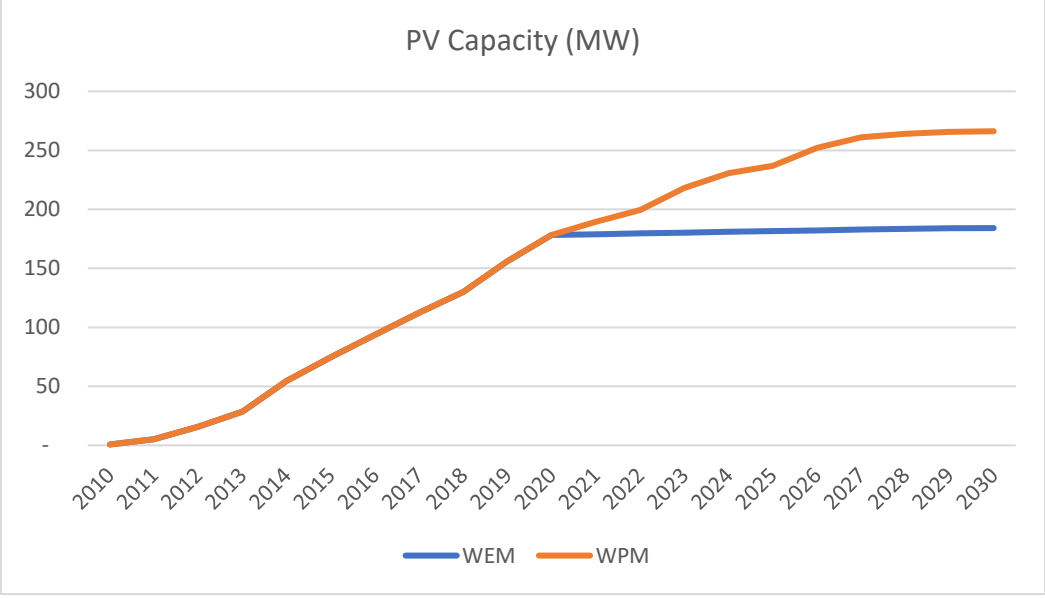
Generation of renewable energy in the form of heat from waste treatment is projected to remain largely constant. It is assumed that waste treatment plants reaching their end-of-life will be replaced by ones having a similar capacity.

RES-Electricity

Based on Malta's Waste Management Plan, the generation of renewable electricity from waste-to-energy plants is expected to remain largely stable in the projected period, amounting to approximately 14 GWh/year until 2040. However, this will continue to constitute only a small percentage of RES-E in Malta.

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 was already presented under Section 2.1.2. Under the WPM scenario, solar PV is expected to reach its technical potential of 266 MWp by 2030, as shown in Figure 87. Although not modelled, additional PV capacity post 2030 could be achieved through repowering.

Figure 87 - PV capacity for WEM vs WPM scenarios, 2010-2030, GWh



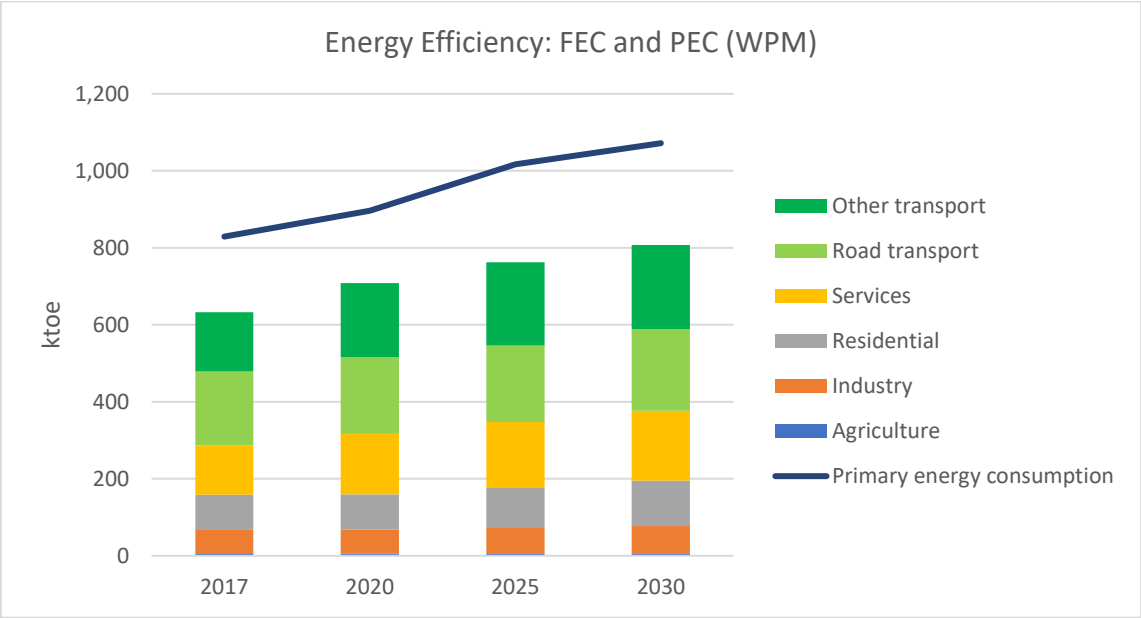
RES-Transport

The transport sector is dependent on policies and measures, namely the substitution obligation on fuel importers to achieve the sectoral RES-T target. As the substitution obligation on fuel suppliers does not extend beyond 2030 under Malta's WPM scenario, it is assumed that suppliers will no longer continue to import biofuels which are generally more expensive than their fossil fuel counterparts per unit of energy content. Therefore, contribution of biofuels in transport from 2030 onwards is expected to be nil under the WPM scenario. National strategies and action plans in the transport sector are committed to encourage the uptake of electric vehicles in Malta, while the new regulations on CO_2 emission standards post-2020 imposed on vehicle manufacturers is expected to result in a higher uptake of electric vehicles in Malta.

Dimension Energy Efficiency

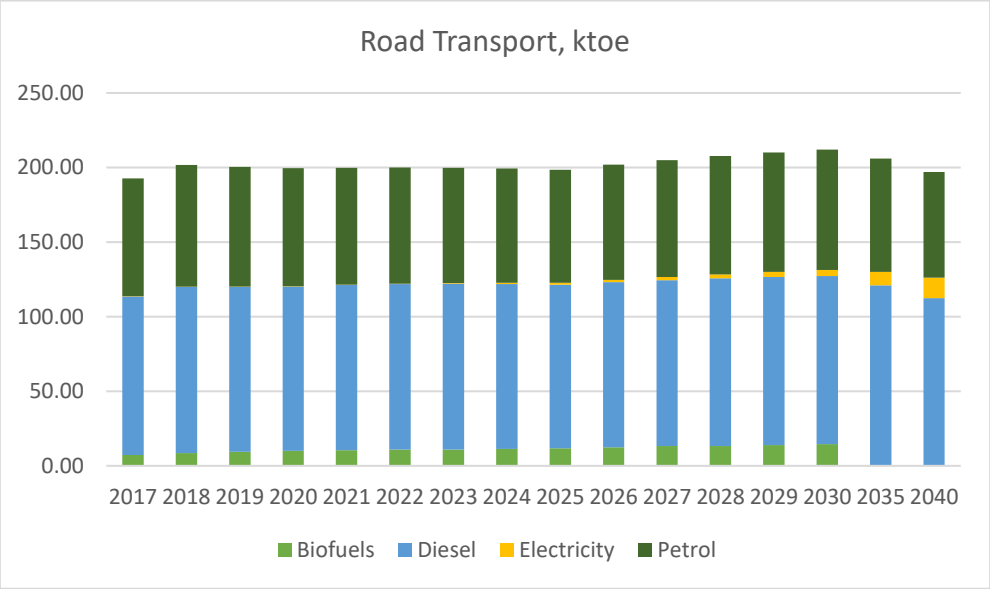
Under the WPM scenario, both the primary energy consumption as well as the final energy consumption achieve lower levels as compared to the WEM scenario outlined in Section 4. This is a result of the expected implementation of Malta's planned policies and measures. Figure 88 below shows projections for primary energy consumption and final energy consumption for all sectors. The transport sector will retain the largest share in final energy consumption, remaining at more than half of the total consumption throughout the projected period. Transport is split into road transport and other transport which includes aviation and navigation. Due to the geographical isolation of Malta and the importance of the services sector, including tourism, the potential for decreasing energy consumption in the aviation and inland navigation sectors remain very low. The charts that follow show an in-depth analysis of final energy consumption in each of the sectors.

Figure 88 - Projections for energy consumption under WPM, ktoe (incl. heat pumps)



Transport Sector

Figure 89 - Projections for final energy consumption for road transport sector, split by fuel, under the WPM scenario, ktoe



As can be seen in Figure 89 above and as already mentioned in other sections, the substitution obligation on fuel suppliers is only projected till 2030 under the WPM scenario (no obligation post 2030).

The increase in the share of electricity in transport is due to a projected increase in the share of electric vehicles in the road transport vehicle fleet. This is a result of the Regulations imposing CO_2 emission standards on vehicle manufacturers for passenger cars, light commercial vehicles and heavy-duty vehicles post-2020, the impact of which is expected to be reflected in the profile of new vehicles imported in Malta. National strategies and action plans in the transport sector are also expected to encourage and incentivise the uptake of electric vehicles in Malta. The stock of electric and plug-in-hybrid electric vehicles is expected to increase from just above 1,000 in 2020 to almost 26,000 by 2030, comprising 6% of the projected total fleet.

Figure 90 - Final energy consumption in aviation sector under WPM scenario, ktoe

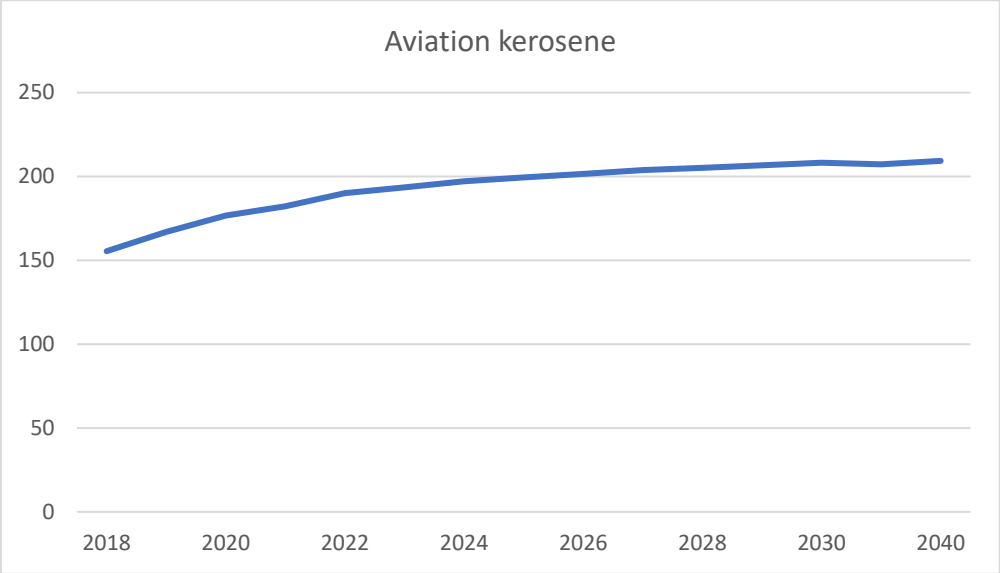


Figure 90 illustrates the projected final energy consumption for aviation under the WPM scenario. The increase in aviation kerosene is in line with the projected increase in tourism, set to continue over the upcoming two decades. This increase is expected to be steeper between 2018 and 2023 and then start to plateau from 2024 onwards.

Figure 91 - Final energy consumption in inland navigation sector, split by fuel under WPM scenario, ktoe

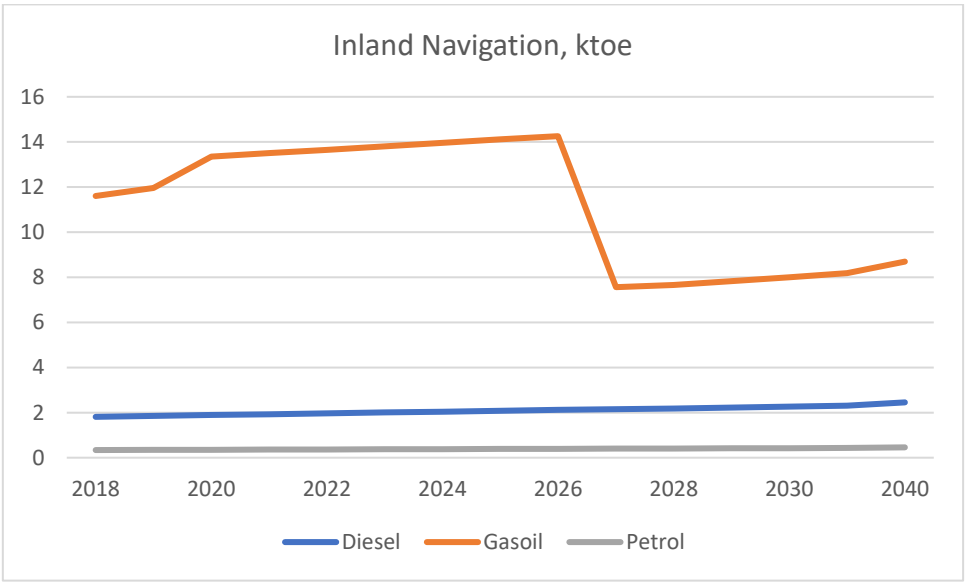


Figure 91 provides projections for final energy consumption under the WPM scenario for navigation by fuel type. In 2020, the Gozo-Valletta fast ferry is set to start operations, leading to a sudden increase in gasoil consumption between 2019 and 2020. The sharp reduction projected to occur between 2026 and 2027 is due to the expected completion of the Malta-Gozo tunnel which will have a direct impact on the number of trips carried out by vessels operating between Malta and Gozo. From 2027 onwards, it is assumed that the current ferries will be substituted with one vessel having 1/6 of the current total vessels' capacity and double today's vessels' fuel efficiency. The fast ferry between Gozo and Valletta

is assumed to operate for a maximum of seven years, and thus would see its operations ending in 2027.

Economic Sectors

Figure 92 - Final energy consumption in industry, split by fuel under the WPM scenario, ktoe

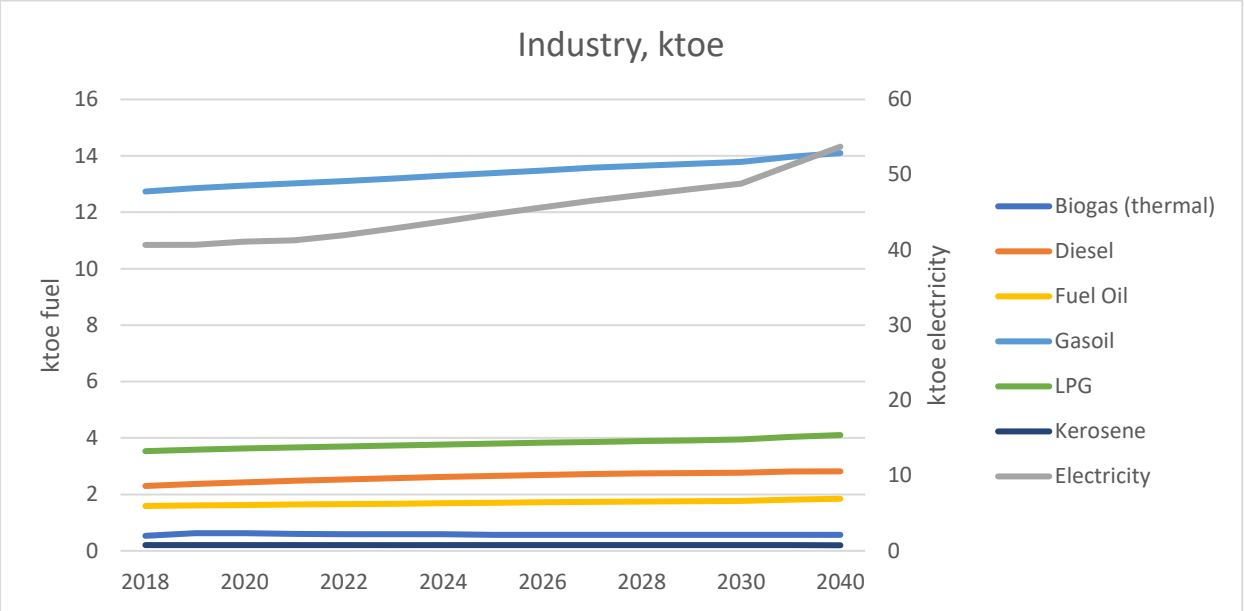


Figure 92 includes projections for final energy consumption by industry under the WPM scenario. Whilst most fuels are projected to remain largely constant, electricity and gasoil consumption is projected to continue increasing.

Figure 93 - Final energy consumption split by fuel for services sector under WPM scenario, ktoe

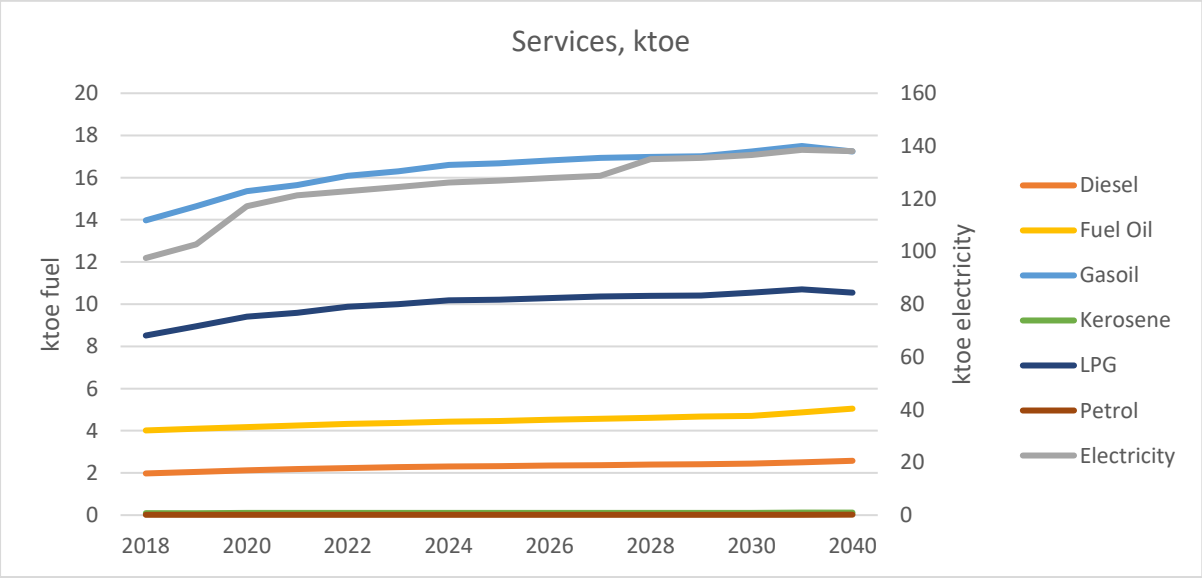


Figure 93 illustrates projections for final energy consumption under the WPM scenario for the services sector. Electricity consumption in this sector is projected to increase until 2030, along with certain key fuels such as gasoil and LPG; the consumption of other conventional fuels is set to remain largely constant.

Figure 94 - Final energy consumption split by fuel for agriculture sector under WPM scenario, ktoe

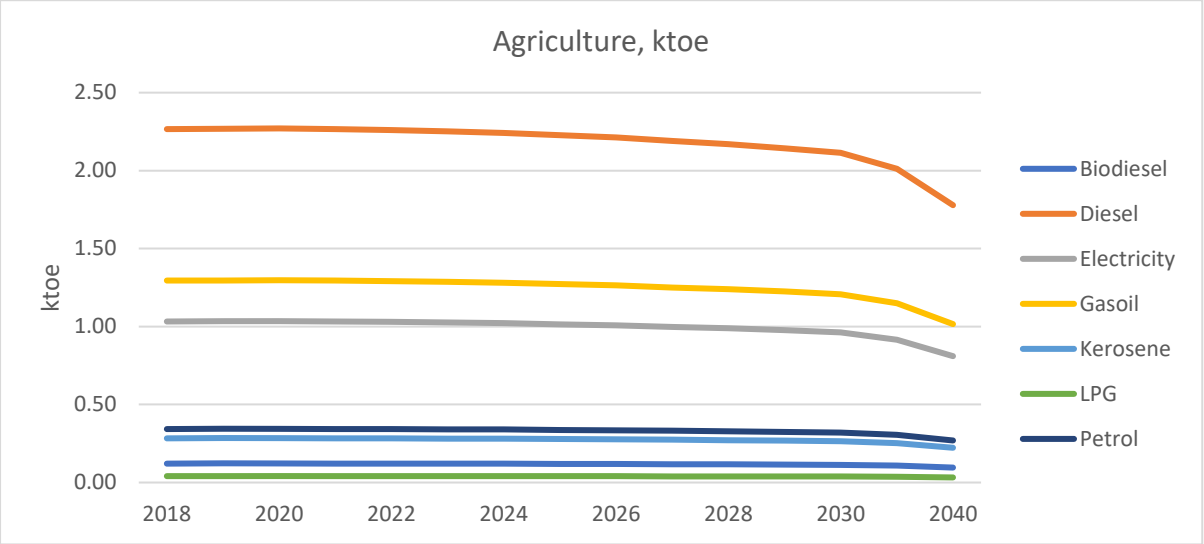


Figure 94 shows final energy consumption under the WPM scenario in the agriculture sector. As agricultural output is expected to remain largely constant, no significant change is expected in terms of its energy consumption. A slight decrease is observed over the time horizon, largely owing to the natural replacement of technologies with more efficient ones, owing to availabilities on the market. As energy consumption of this sector is minimal, the effect of any planned measures is expected to be negligible.

Residential Sector

Figure 95 - Final energy consumption split by fuel in residential sector under WPM scenario, ktoe

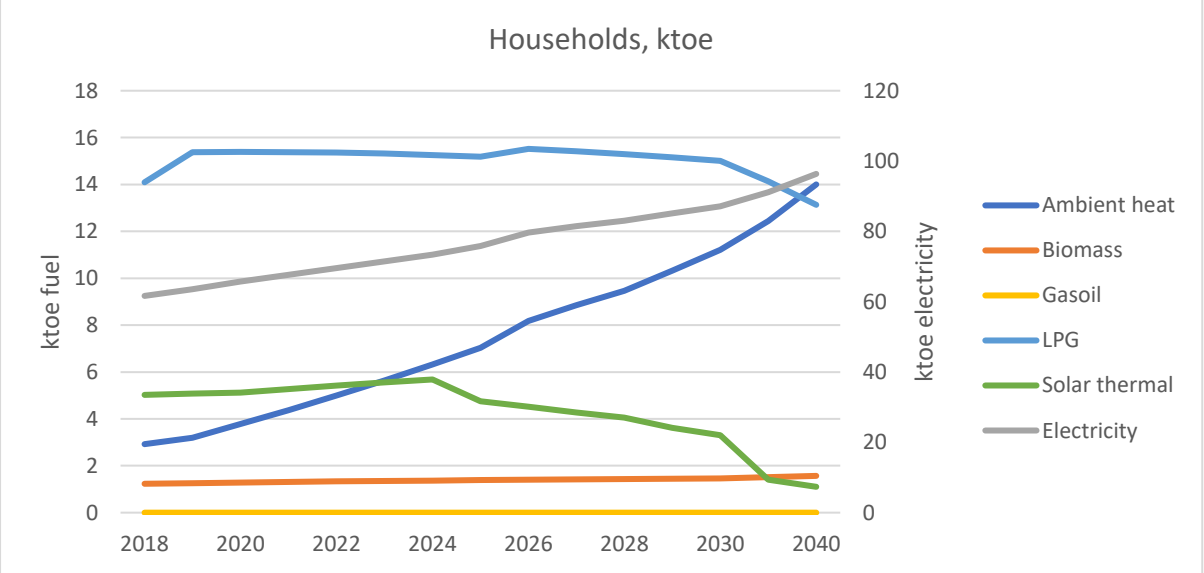


Figure 95 displays projections for final energy consumption under the WPM scenario for the residential sector. The consumption of electricity in this sector is set to continue increasing, owing to a projected increase in the number of dwellings, as a result of population growth, as well as an increase in the average consumption per household. The latter is a result of expected changes in lifestyle and expected thermal comfort, particularly in terms of the installation and use of new devices, such as

white appliances and air-to-air heat pumps. The slow decline in solar thermal energy, more evident from 2030 onwards, is a result of a significant number of these units reaching their end-of-life and not being replaced at a sufficiently fast rate until 2030; after 2030, no additional SWH are installed and no replacements take place without policy support. The increase in ambient heat is a result of a growing installation rate of air-to-air heat pumps as people's thermal comfort levels are expected to increase.

Dimension Energy Security

Power Generation

The projected growing energy demand until 2040 under the 'With Planned Measures' scenario implies the need for more energy in the coming decade and beyond, which in turn will require more generation capacity and/or imports over the interconnector, as well as a more flexible electricity system. These developments will have a direct impact on how Malta shall continue to ensure the desired level of security of supply. It is also expected that towards the end of the next decade Malta will find it increasingly challenging to meet its electricity demand with the current and projected (under WPM) power generation infrastructure. In these projections, it was assumed that any existing infrastructure reaching its end-of-life before 2040 will be replaced by a system with a similar generation capacity and technical profile. The projected electricity generation by source, split into conventional gas-fired power plants, net imports over the electricity interconnector, renewables and the projected waste-to-energy facility are shown in Figure 96.

Figure 96 - Electricity generation by source under the WPM scenario, 2018-2040

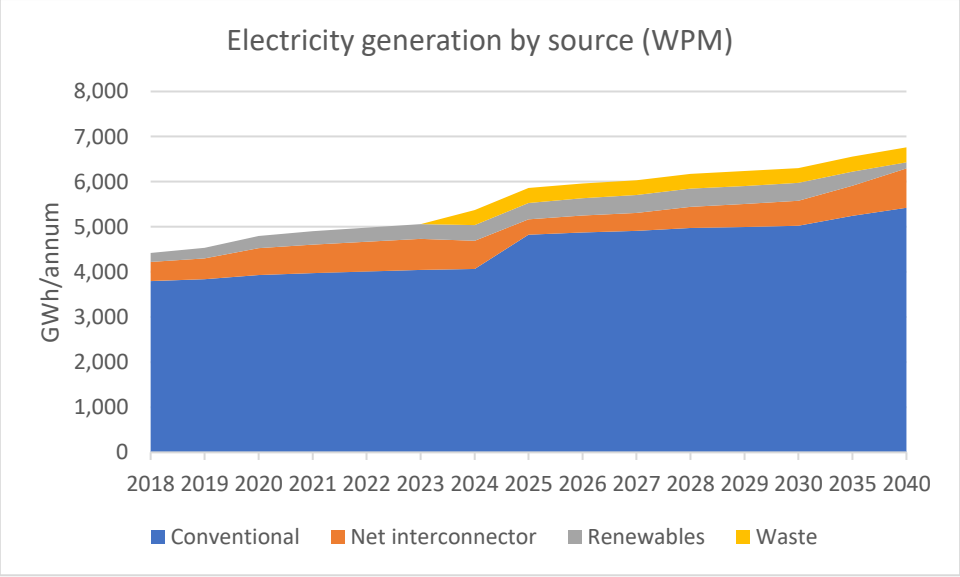
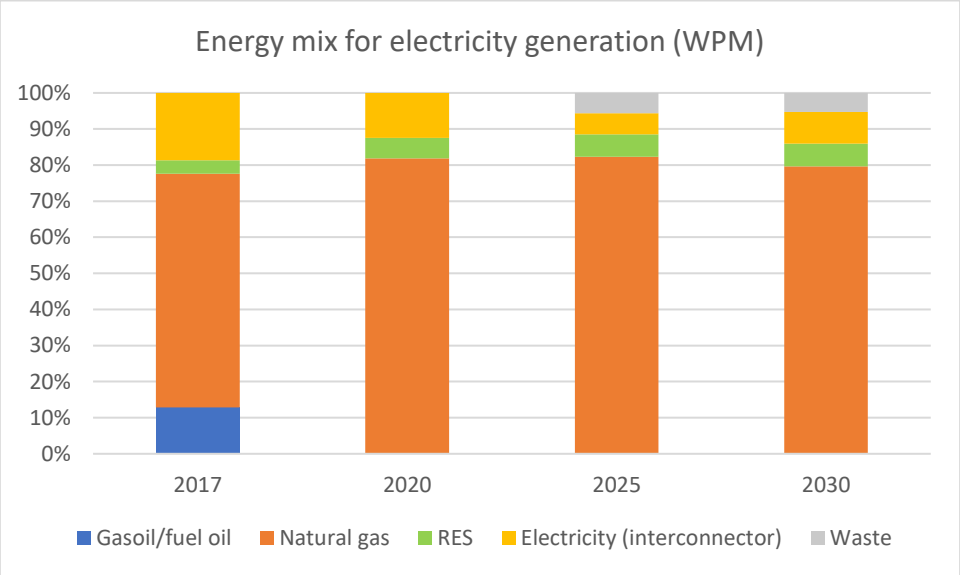


Figure 97 portrays the energy mix used to generate electricity in Malta in terms of primary energy consumption under the WPM scenario for 2017 and projections for 2020, 2025 and 2030. The energy mix in 2017, based on natural-gas, electricity imported over the interconnector and renewables will be largely sustained over the projected period. An increased penetration of renewables, i.e. solar photovoltaics, in the electricity generation mix is expected, as well as the introduction of a thermal Waste-to-Energy facility in 2024.

Since 2017, local generation plants at the Delimara Power Station are fired by natural gas. Gasoil-fired capacities are available as back-up in case of emergencies (having black-start capabilities), for use during maintenance of main plants and to meet exceptional peak loads. Energy system modelling tools used for the development of the WEM and WPM scenarios for Malta's NECP assume that electricity demand needs to be met by the main power plants, electricity imported over the interconnector and renewable/distributed energy sources. Backup plants are not included when determining the order of merit by the dispatch model, and therefore gasoil consumption post-2017 is projected to be zero until the end of the projected period. In practice, there will be situations where the use of gasoil-fired units is required such as in emergency situations or in cases where other sources are not available. However, the amount of gasoil consumed is expected to be negligible.

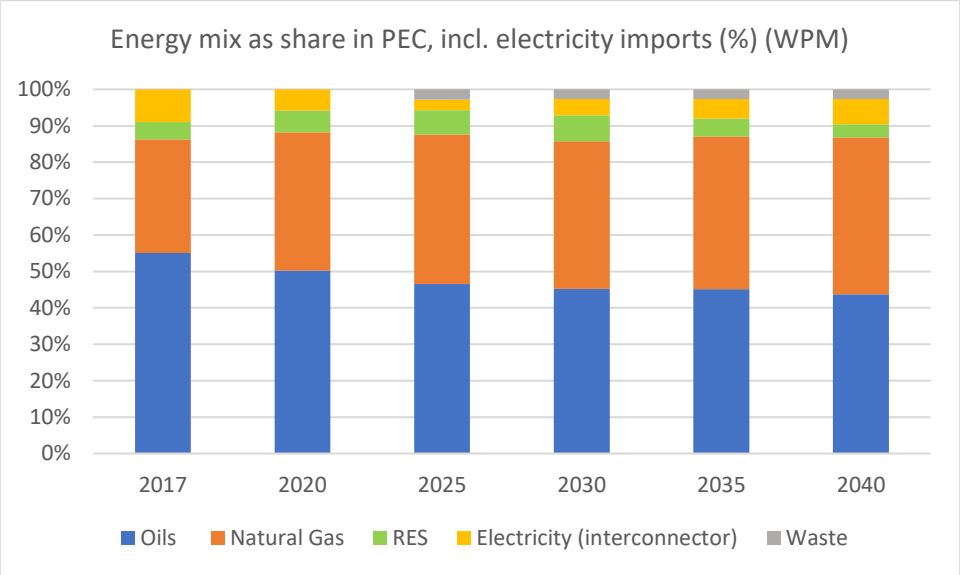
Figure 97 - Energy mix for electricity generation under WPM scenario (%)



Primary Energy Consumption

The projected energy mix for Malta under a WPM scenario, calculated as the share of fuels in Malta's primary energy consumption is shown in Figure 98. Increasing energy demand will lead to higher consumption of natural gas (by power plants). On the other hand, a decreasing share of oil products in the energy mix is mainly due to the increasing number of electric vehicles on the road which will slowly shift the demand away from petrol and diesel. WPM projections also show an increasing share of renewables until 2030. Policies and measures focusing on the deployment of RES, outlined in the renewables section of the Plan, have a time-horizon until 2030 as they are expected to contribute to the 2030 RES target as stipulated in the Renewable Energy Directive. No further policies are assumed post-2030 (support for RES is discontinued at end of 2030). This is reflected in Malta's WPM projections, whereby the share of renewables after 2030 starts decreasing, due to the discontinuation of the biofuels substitution obligation and the end-of-life of Solar PV and SWH technologies within Malta's energy modelling framework. This assumption should not be interpreted as Malta not remaining committed to implement measures for the promotion of RES after 2030 and the long-term goal of decarbonisation. Policies and measures in the area of RES for the period after 2030 will be included as part of the next NECP cycle.

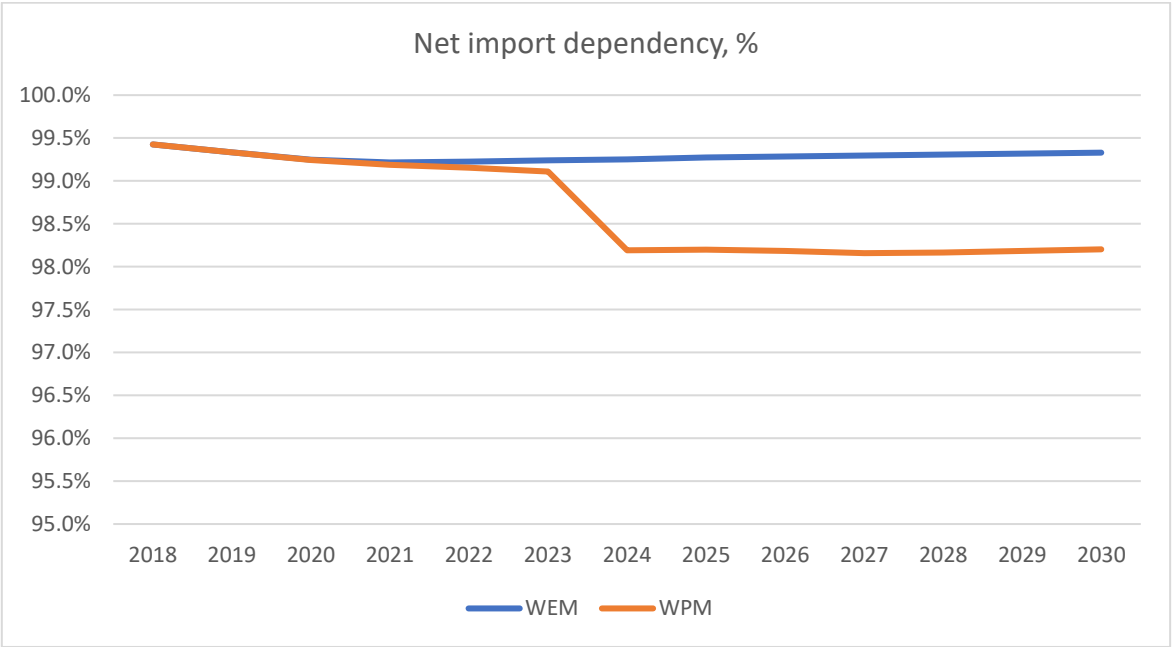
Figure 98 - Projected energy mix as a share in PEC under WPM scenario (%)



Net import dependency

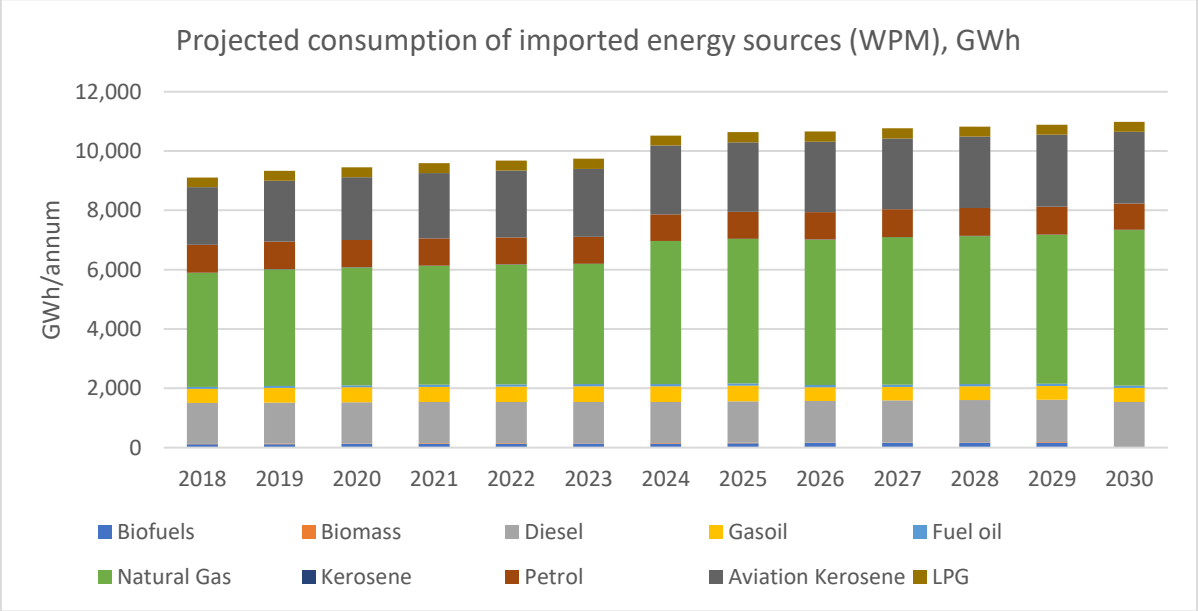
Due to the specificities of Malta's geographical isolation and lack of domestic energy sources, Malta's net import dependency is expected to remain high under the WPM in the whole projected period, although decreasing slightly due to the continuous deployment of renewables, which constitute the sole indigenous source of energy. Import dependency is also expected to decrease slightly in 2024, when the new Waste-to-Energy facility is expected to be commissioned. A comparison of the projected net import dependency under the WEM and the WPM scenarios until 2030 is provided in Figure 99 while the projected primary consumption of imported energy sources is shown in Figure 100.

Figure 99 - Net import dependency of WEM and WPM scenarios (%)



The role of oil products is expected to decrease, primarily in the transport sector, reflecting a more efficient vehicle fleet and a shift towards electrification in the road transport sector. Natural gas demand will increase to meet the expected growth in electricity demand required to satisfy a thriving economy. Due to the absence of district heating and cooling networks in Malta, the consumption of LPG by the residential sector for heating purposes is assumed to remain stable throughout the projected period as it is expected that new dwellings will be equipped with electric heating systems using heat pump technology. This also reflects the inherent difficulty in offering a viable alternative to households and other users of LPG for cooking purposes, and is one of the major barriers to further decarbonise the heating and cooling sector in Malta.

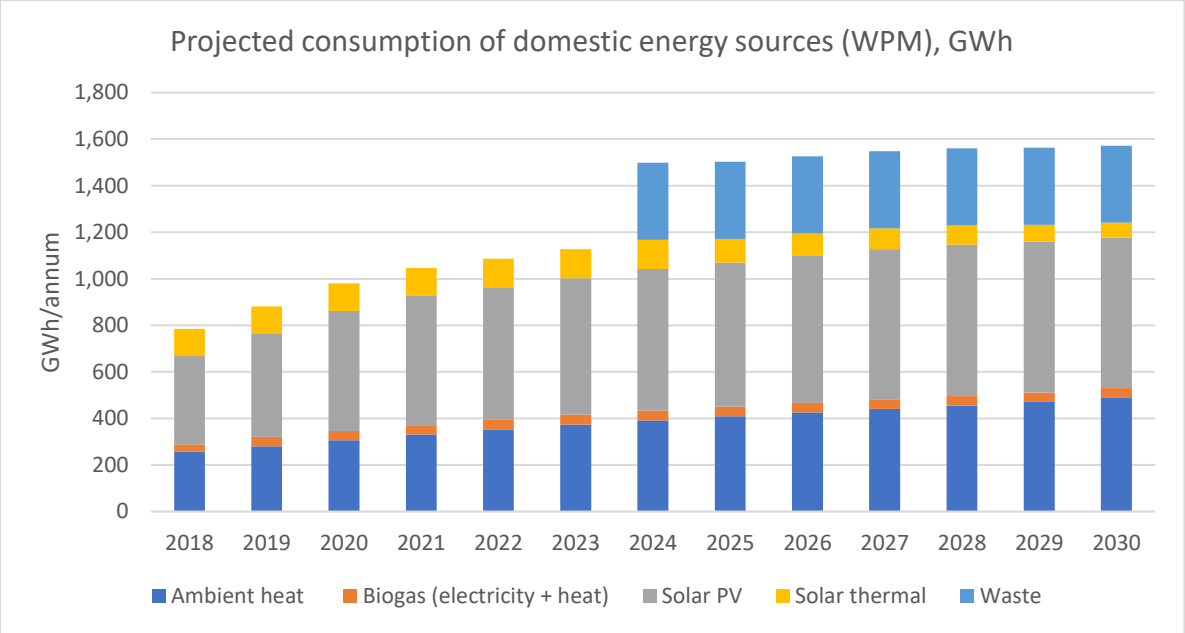
Figure 100 - Projected consumption of imported energy sources (WPM), GWh



The energy market concentration is likely to remain high in the projected period. Due to the size of Malta's energy system, the existence of a sole electricity supplier and distribution system operator and the small number of actors and fuel suppliers operating on the Maltese market, the concentration of market suppliers will remain high in Malta.

The projected evolution of primary energy consumption of domestic energy sources is portrayed in Figure 101. The consumption of domestic sources, all of which are renewable except for electricity generation from waste incineration, is expected to grow in the period until 2030 and beyond. The figure shows the expected increase in the consumption of ambient heat, which is linked to the increased deployment of heat pump technology, especially in households. Electricity and heat produced from biogas in existing CHP waste-to-energy plants is expected to remain stable. Solar PVs will remain the largest domestic energy source.

Figure 101 - Projected consumption of domestic energy sources (WPM), GWh

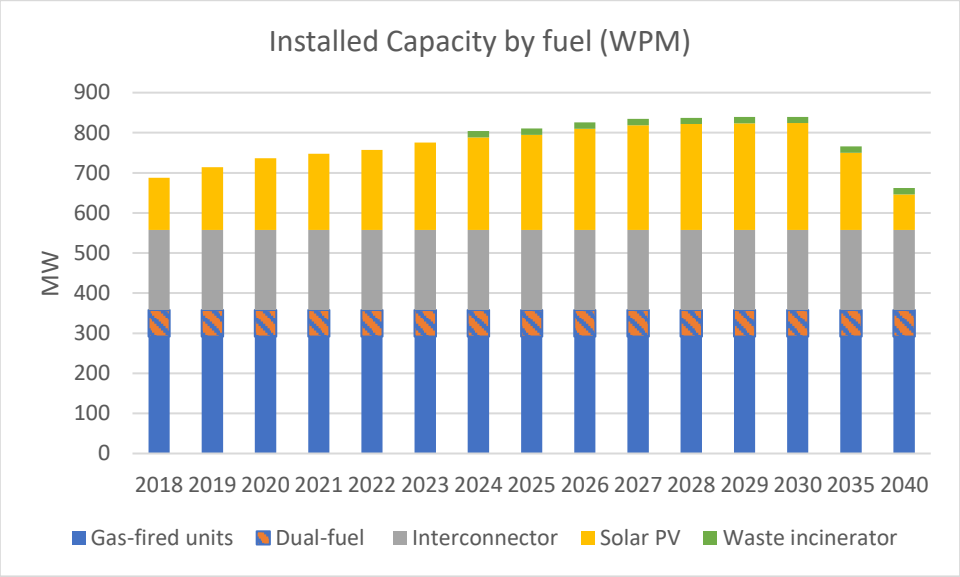


Dimension Internal Energy Market

As repeated under the relevant sections of the Internal Energy Market dimension, 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. There is no electricity transmission system in Malta and hence no transmission system operator (TSO). Malta was also granted derogations from the application of provisions on unbundling of DSO, third party access and free choice of supplier under the new Electricity Market Directive (EU) 2019/944. Under the energy system modelling framework used for the development of the NECP, these factors are taken into consideration and assumed to continue to apply throughout the projected period. Projections of electricity interconnectivity, including the indicators of urgency of action are already outlined in Section 2.4.1. of the NECP, while the key relevant indicators for natural gas, such as gas demand and supply, the electricity generation mix and energy mix are included under the Energy Security dimension of the Plan. The sole use of natural gas in Malta is in the power generation sector.

The projected installed power generation capacity by source under the WPM scenario is shown in Figure 102. This amounts to the current and expected operational capacity in Malta, excluding gas-oil fired stand-by capacity. The currently existing power generation capacities running on natural gas at the Delimara Power Station, as well as the stand-by generation capacity running on gas-oil is expected to remain largely the same. In the projected capacities, it is assumed that any power generation facility reach its end of life would be replaced by an equivalent plant. Solar PV capacity will increase throughout the projected period until 2030, reaching 266 MW under the WPM scenario. Under Malta's energy modelling it is assumed that Government support in the form of policies and measures post-2030 is not continued, therefore RES deployment wanes significantly after 2030. In 2024, it is also expected that the waste incinerator plant comes into operation.

Figure 102 - Installed capacity by source under WPM scenario (MW), 2018-2040

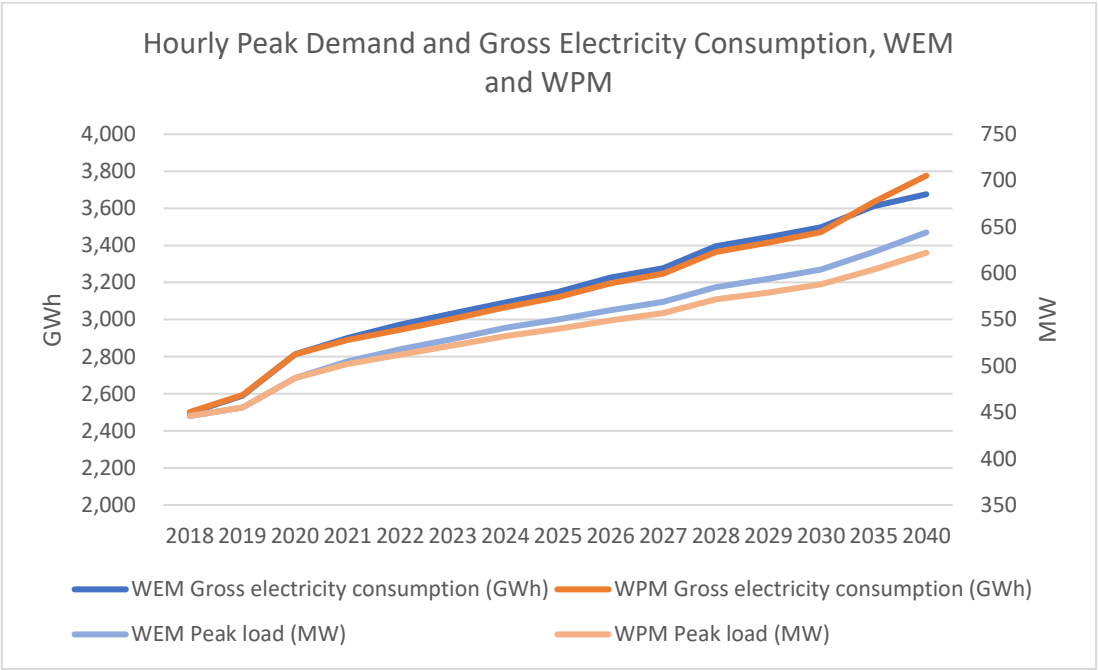


Projections of peak electricity demand[100] and annual gross consumption of electricity, based on an average climatic year[101], under both the WEM and WPM scenario are portrayed in Figure 103. It is expected that peak demand, expressed in MW, will continue to increase throughout the projected period, in line with increased population and economic activity, as well as a result of uneven grow rates of certain end-use services, such as the projected increase in electric consumption for space cooling. Likewise, gross electricity consumption will increase in the projected period. As illustrated, peak demand and gross electricity consumption are expected to be lower under the WPM scenario as a result of implementation of policies and measures. Gross electricity consumption under the WPM scenario is projected to be higher than under a WEM scenario from 2035 onwards, primarily as a result of electrification in transport.

[100] Includes final electricity demand, distribution losses and electricity consumed on-site at power station.

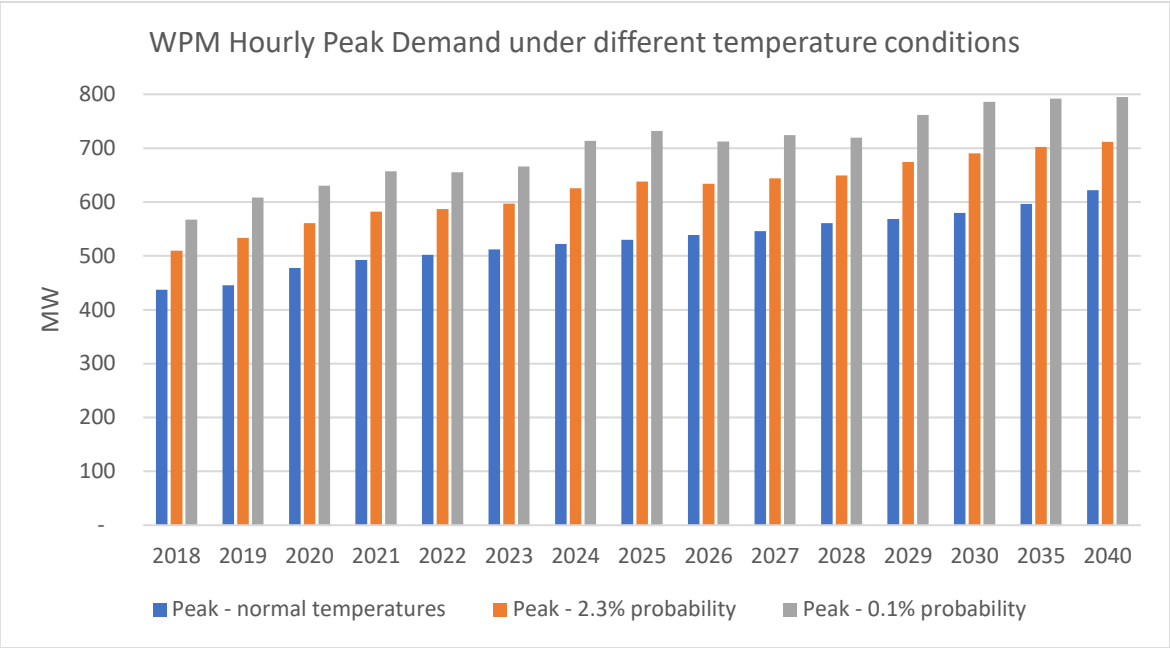
[101] Projections were made assuming seasonal variations in temperature correspond to the thirty-year average, thus, the impact of yearly changes to temperatures were not taken into account (eg. a warmer than average year will result in an increased demand for space cooling).

Figure 103 - Peak load (MW) and gross electricity consumption (GWh) under WPM and WEM scenario, 2018-2040



A preliminary assessment of the impact of temperatures on electricity demand was undertaken, with the scope of quantifying the potential increase in hourly peak demand in the case of deviations from the climatic norm, particularly on peak days. Based on an analysis of thirty-years of temperature data, three daily temperature profiles were defined: (i) climatic norm; (ii) high temperatures with a 2.3% probability of occurring in thirty years; and (iii) high temperatures with a 0.1% probability of occurring in thirty years. In Malta, temperature extremes are bound to occur during the summer months. Should these temperature extremes coincide with the day of annual peak demand (normal year), the hourly peak demand has been estimated to increase by 15-20% (2.3% probability) or up to 30-35% (0.1% probability). Annual estimates are shown in Figure 104. It is to be noted that this is a preliminary assessment which is subject to revisions and updates. A separate assessment of the potential variation in projected peak demand as a result of temperature will also be undertaken through the ongoing Electricity Supply Study.

Figure 104 WPM Annual Peak Demand (MW) under different temperature conditions: (i) normal climate; (ii) extreme temperature with a 2.3% probability; and (iii) extreme temperature with a 0.1% probability.

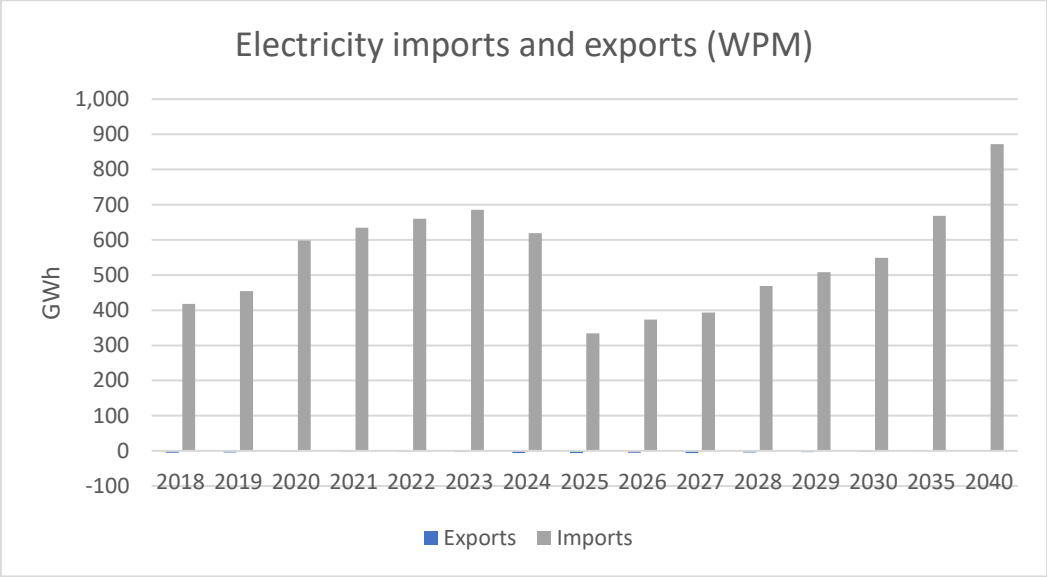


Projections of electricity imports and exports over the interconnector with Sicily are presented in Table 34. Although the interconnector provides for the option of bi-directional flow, it is expected that Malta would be a net importer of electricity from Italy, with electricity exports reaching only approximately 2-6 GWh/annum, similar to current levels of exports, throughout the period, which can be considered as negligible. The imports of electricity through the interconnector are expected to decrease in 2025 due to the projected commissioning of the gas pipeline whereby, based on the assumed ENTSO-G prices of natural gas, domestic generation of electricity by the gas-fired power plant facilities would be higher in the order of economic merit more frequently than the interconnector (whose prices fluctuate on an hourly basis)(Figure 105). As a result, import volumes over the interconnector in 2030 are projected to be similar to those expected in 2020.

Table 34 - Electricity imports and exports under the WPM scenario, GWh

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
Exports	-5	-4	-2	-2	-2	-2	-6	-6	-6	-6	-4	-4	-3	0	0
Imports	418	454	598	635	660	685	619	334	373	393	469	508	549	669	872

Figure 105 - Electricity imports and exports over the interconnector (WPM), 2018-2040



The energy modelling framework used for the development of Malta's Final NECP also examined the peak electricity demand 'shortfalls' under the projected period for both the WEM and WPM scenarios, therefore situations when Malta's existing and projected power generation capacity would be insufficient to meet the peak electricity demand projected for an average climatic year. Under the WEM scenario, Malta would be expected to start experiencing challenges meeting its peak demand starting from 2027, while under the WPM scenario Malta would face such difficulties in the period post-2030 (Figure 106). This is due to the additional generation capacity provided by the waste-to-energy incinerator and the deployment of solar PV facilitated by Government policies.

In the case of variations from the climatic norm, shortfalls in meeting the electricity demand are likely to be exacerbated as a result of increased load and these may be experienced earlier than 2027 (WEM scenario) or 2030 (WPM scenario). In the case of high temperature extremes with a 2.3% probability in a thirty-year period occurring on a day of peak electricity demand, it is estimated that there is the potential for slight hourly shortfalls to occur from 2021 onwards. The potential of experiencing shortfalls under a scenario of high temperature extremes with a probability of 0.1% exists from 2018, the first year of modelling (Figure 107).

However, it must be noted that the shortfalls (Figure 106) were projected assuming that back-up capacity (circa 190MW derated gasoil-fired OCGT/CCGT units) is not utilized. In extreme situations it is also possible to overload the interconnector with an additional 100 MW for short periods. However, relying on either of these sources to meet peak demand would be in breach of the N-1 system adequacy standard. The Electricity Supply Study will assess possible solutions to tackle any future shortfalls, and shall also validate and update as necessary the methodology used to estimate these peak events.

Figure 106 - Peak electricity demand shortfall expressed in MW and total number of hours, WEM and WPM

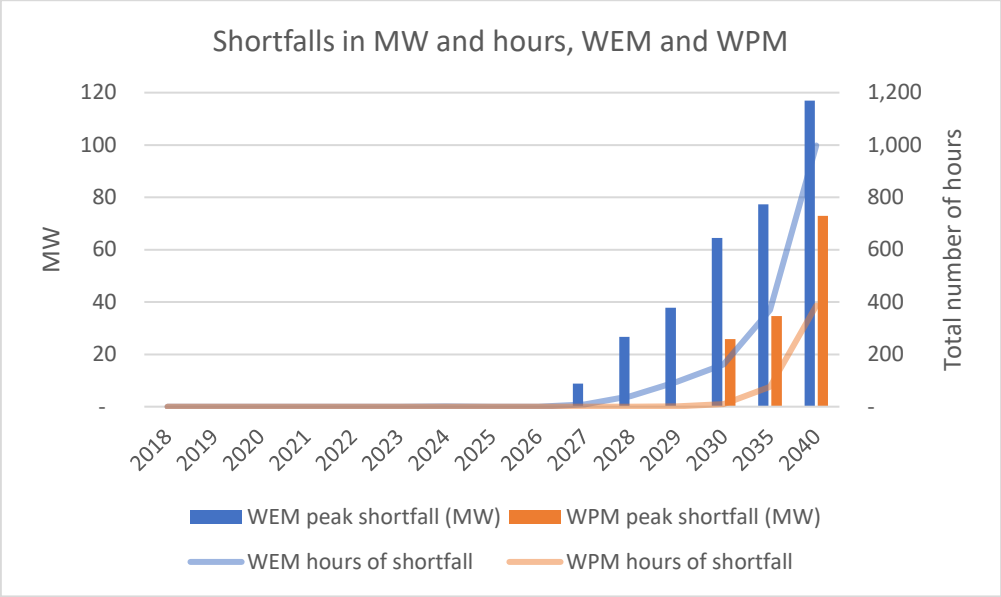
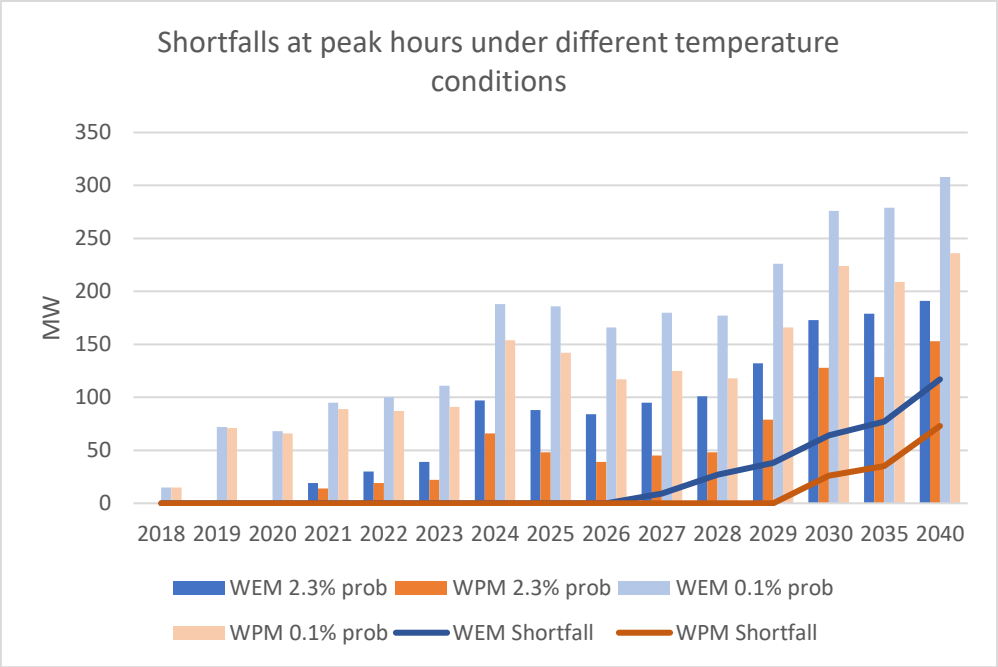
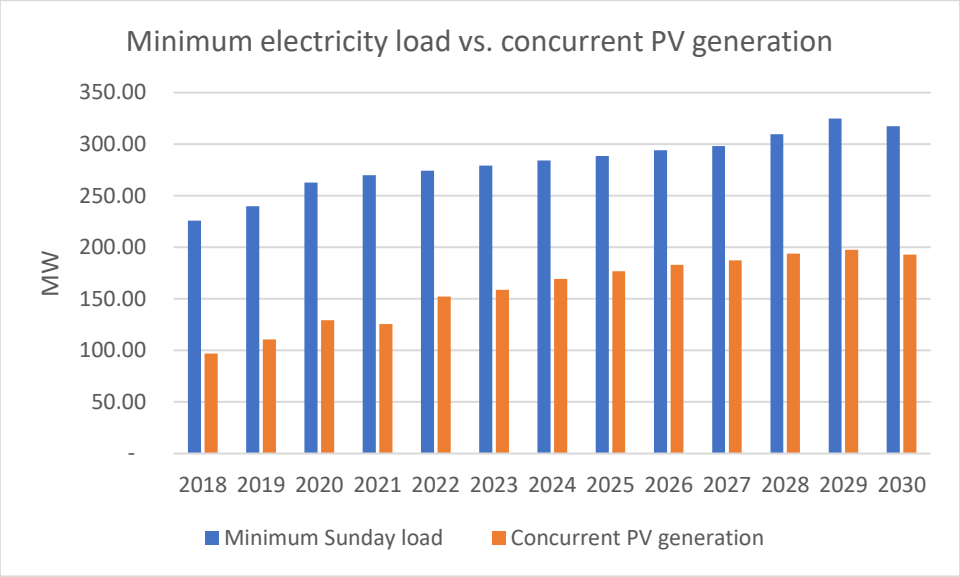


Figure 107 - Shortfalls (MW) at peak hours under different temperature conditions: (i) normal climate; (ii) extreme temperature with a 2.3% probability; and (iii) extreme temperature with a 0.1% probability.



In addition to the above, Malta will begin to face potential instances of grid stability issues and imbalances in light of the projected increasing share of renewable production in the electricity generation mix. Figure 108 compares the projected minimum load on Sundays (as the weekday with the lowest hourly peaks) and the concurrent PV generation. Hourly PV generation is expected to make up more than half of the electricity generation during these hours by 2021, increasing to more than 60% by 2030. In view of the small size of Malta's electricity grid and highly variable cloud coverage, there may be instances where Enemalta would have to cater for the unforeseen loss of more than half the generation capacity at certain hours. This would have serious implications on interconnector imbalances, as well as load shifting and the required start-up of conventional generating power plants.

Figure 108 - Projected minimum Sunday load and concurrent PV generation under WPM scenario (MW)



Projected development of energy prices

The evolution of Malta's wholesale electricity price was projected by taking into account the impact of increased PV installations, the commissioning of the planned waste-to-energy incinerator, and projected natural gas and EU ETS prices.

Figure 109 illustrates the projected trends in electricity prices under the WEM and WPM scenarios, as well as gas prices. The projected increase in wholesale electricity prices in nominal terms is driven by the projections of regional gas prices provided by ENTSO-G at the Italian Virtual Trading Point PSV[102]. With the commissioning of the Malta-Gela pipeline by 2025, connecting Malta to the Trans-European Gas Network, it is assumed that Malta will be subject to the same wholesale gas prices within the region from 2025 onwards. The projected EU ETS carbon price provided to Member States by the European Commission was incorporated into future wholesale electricity prices based on the efficiency of local generation plants. The effect of the growing EU ETS carbon price becomes more pronounced post-2025 and 2030, when a substantial increase in carbon price is expected (Table 35).

Based on current projections of gas and EU ETS prices, wholesale electricity costs are projected to increase from €$_{2016}$ 0.072/kWh in 2018 to €$_{2016}$ 0.075/kWh in 2024, after which they would decrease to €$_{2016}$ 0.063/kWh in 2025 should the MTGP pipeline come into operation. A higher penetration of solar PV and the commissioning of a waste-to-energy plant, as expected under the WPM scenario, will result in the wholesale price of electricity falling to €$_{2016}$ 0.060/kWh in 2025 and remaining below the WEM trend throughout the policy period. In 2030, the impact of these policies manifests as a projected difference of €$_{2016}$ 0.003/kWh. The projected wholesale prices should not be considered a forecast.

[102] PSV - Punto di scambio virtuale.

Figure 109 - Projected wholesale electricity and gas prices from 2018-2040, EUR (2016)/kWh.

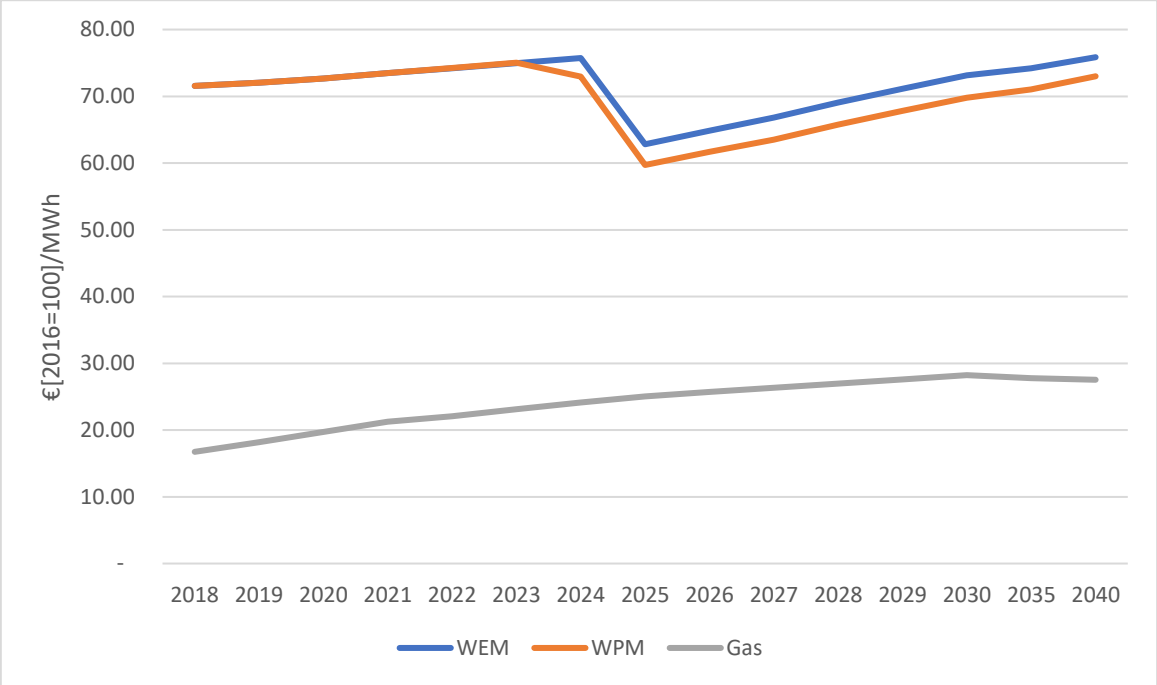


Table 35 Projected EU ETS carbon prices according to EU Reference Scenario 2016

	2015	2020	2025	2030	2035	2040
EU ETS carbon prices (€'16/ t of CO2)	7.8	15.5	23.3	34.7	43.5	51.7

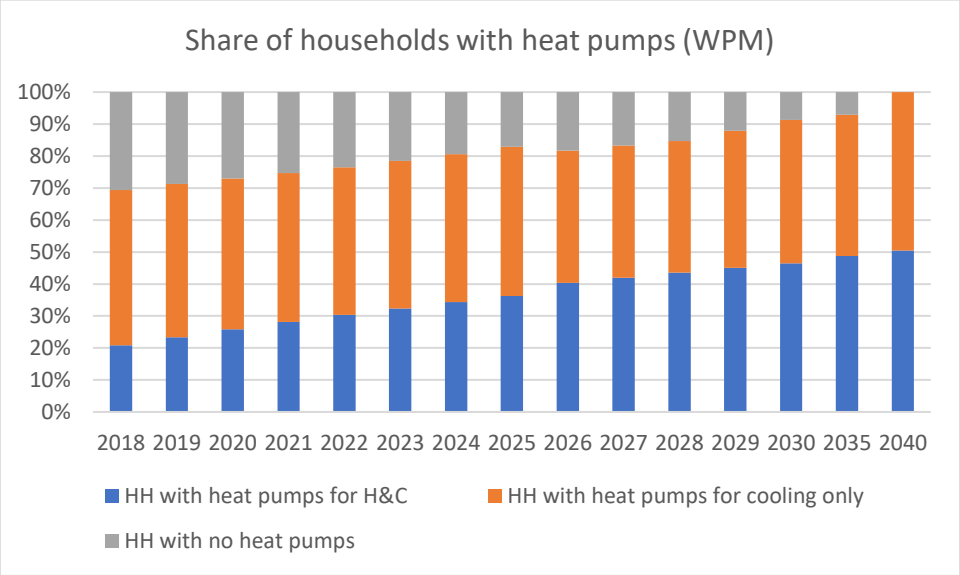
Typical annual consumption of households (kWh/year)

The following set of figures provide an overview of the projected typical annual consumption of electricity of households in Malta under the WPM scenario, split by three different household types which were defined for the purposes energy modelling undertaken for the NECP:

- Households with heat pumps used for heating & cooling;
- Households with heat pumps used for cooling only;
- Households with no heat pumps;

The distribution of these three types of households under the WPM scenario is shown in Figure 110. It is expected that the proportion of households with heat pumps will continue increasing until 2040, without the need for any policy intervention incentivizing the deployment of heat pumps in the residential sector. It is also expected that the share of households using air-to-air heat pumps for both cooling and heating purposes will continue increasing.

Figure 110 - Share of households with heat pumps by end-use and households with no heat pumps under WPM scenario (%)



The typical annual electricity consumption profile of households with heat pumps for both heating and cooling purposes, split by type of end-use is provided in Figure 111. The representative household in this category is expected to consume on average slightly more than 5,000 kWh/year, with space cooling and space heating contributing to 24% and 18% of the total consumption of the household in 2030, respectively. Appliances and lighting will remain the highest consuming end-use for all three types of households. The total electricity consumption of households with heat pumps used for cooling purposes is expected to reach just under 5,000 kWh/year by 2030. Space cooling is expected to be the second most-important end-use for this type of household (Figure 112). Figure 113 shows the electricity consumption of households without heat pumps, which remains in the range between 3,000 – 3,500 kWh/year per representative household. In this type of household, electricity is used predominantly for lighting & appliances and water heating, while electricity used for space cooling and space heating is almost negligible; it is assumed that space heating in these households is exclusively LPG-based.

Figure 111 - Typical annual electricity consumption of households with heat pumps for heating and cooling under WPM (kWh/year)

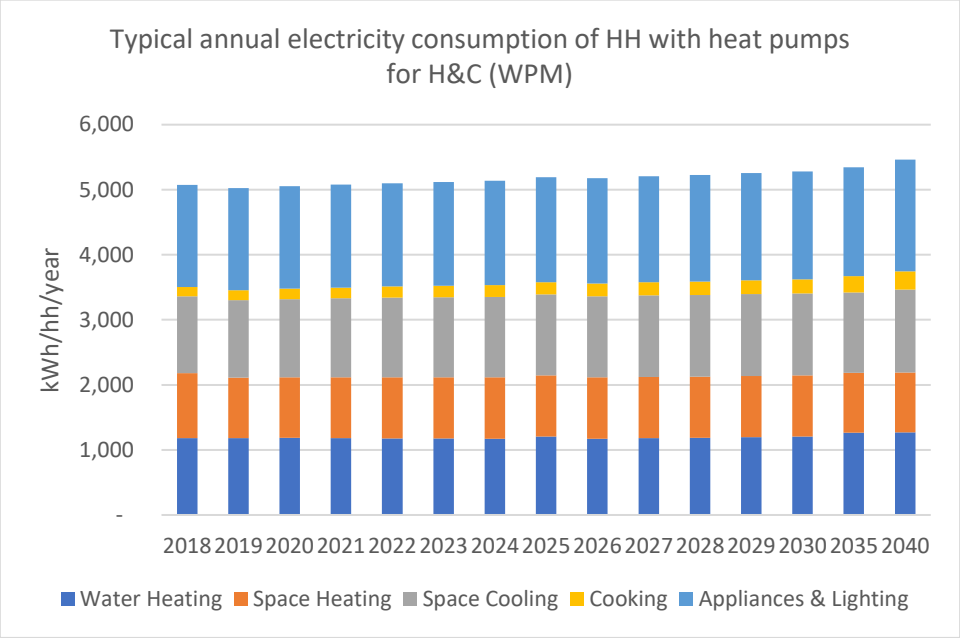


Figure 112 - Typical annual electricity consumption of households with heat pumps for cooling only under WPM (kWh/yr)

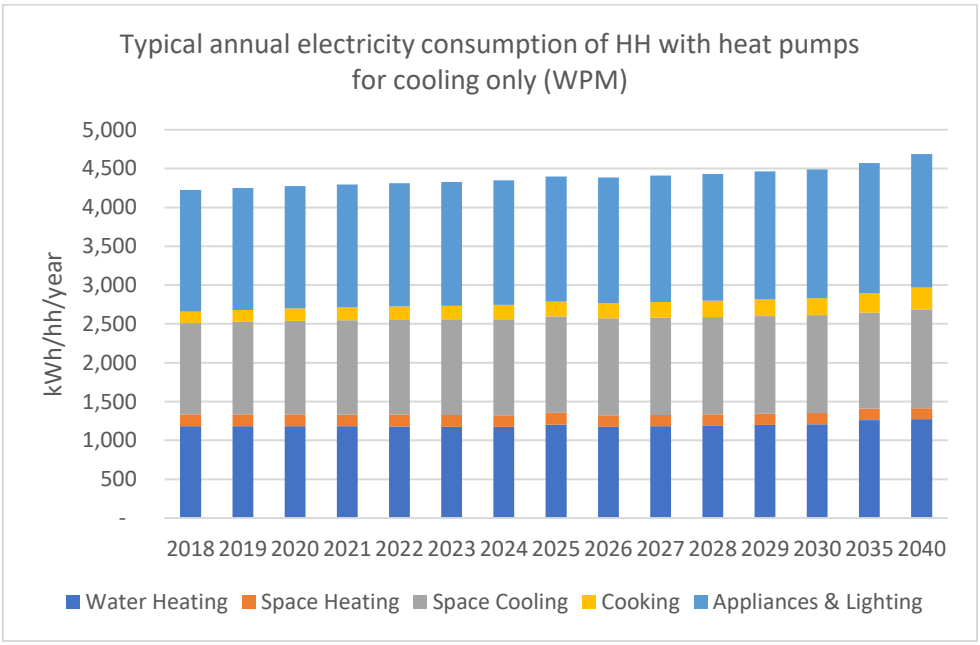
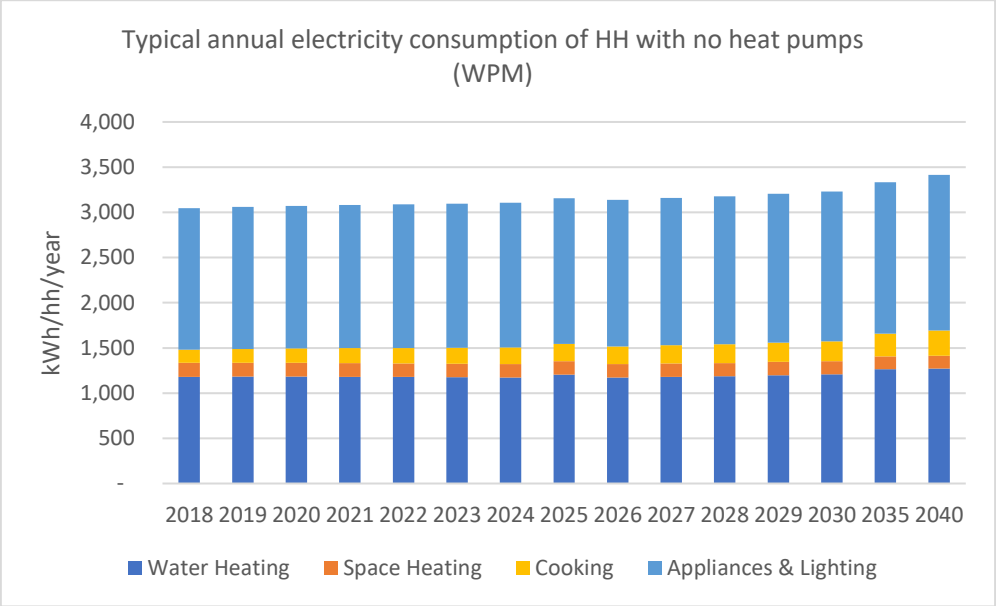


Figure 113 - Typical annual electricity consumption of households with no heat pumps under WPM (kWh/yr)



Sensitivity analysis

As mentioned in the introduction to this section, two sensitivity scenarios were modelled to highlight the potential resulting range of outcomes of key indicators in the case of different exogenous factors, namely: (i) higher than expected levels of energy efficiency of technologies on the market; and (ii) higher than expected rates of electrification.

The first scenario diverges from that outlined in the NECP in its assumption of the rate of overall efficiency increase in all sectors due to exogenous market factors. This was simulated using the projected rates of efficiency provided by the European Commission defined as 'ordinary, improved, advanced or best', applied in the following manner to different sectors:

- In the industrial and services sector, it was assumed that additional or replaced technologies from 2018 onwards were of an 'improved' standard as opposed to an 'ordinary' standard. Certain technologies in the industrial sector were assumed to be of an 'advanced' standard, such as those used for space heating and water heating, as existing stock is likely to be relatively old and therefore the increase gained in efficiency from these new appliances would be greater.

- In the residential sector, a gradual increase in the efficiency of all appliances and lighting was assumed from 2018 onwards, reaching a moderate 10% overall increase by 2040.

- It was assumed that imports of air-to-air heat pumps from 2021 onwards had a COP of 3.5, increasing to a COP of 4 in 2031. This is equal to and slightly higher than the 'best' standard assumed by European Commission. This assumption was adopted as the COP of heat-pumps on the Maltese market has tended to be high in recent years and this trend is likely to continue. As a result, the efficiency of the overall stock of heat-pumps in the residential and non-residential sector increases by a factor of 18% by 2030 and 36% by 2040.

- Under the WEM and WPM scenarios of the NECP, no improvements in the efficiency of ICE vehicles and EVs were assumed post-2020; the rates of improvement assumed by the European Commission were deemed to be highly optimistic according to national experts. The impact of assuming such efficiency rates was tested in this sensitivity by adopting 'improved' rates of improvement in new ICEs and EVs by 2030 and 'advanced' by 2040. The number of hybrid vehicles within the fleet was increased by 10%. The stock of vehicles in each category was otherwise kept the same as under the NECP WEM and WPM scenarios.

The factors outlined above were introduced in both the WEM and WPM of this sensitivity scenario as the changes are solely a result of a more optimistic view of the market as opposed to the introduction of additional PAMs.

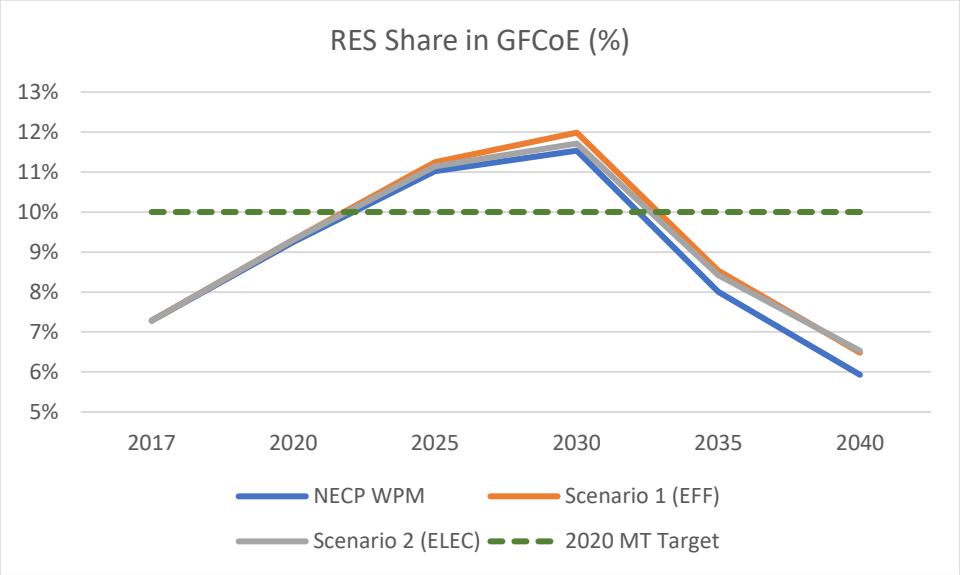
The second scenario tested impacts on the energy system as a result of faster rates of electrification for certain end-uses in all sectors, particularly for space heating, water heating and cooking. Projections of the energy system outlined in the NECP are based on a largely constant (and minimal) rate of electrification stemming from national historical trends. A faster shift towards electrification would have implications for a number of key areas of the energy system, and thus was introduced as a sensitivity by adopting the following assumptions:

- In the industrial and services sector, it was assumed that additional load from 2018 onwards for space heating, water heating and cooking was met by electric appliances (heat-pumps for space heating and electric boilers for water heating) as opposed to fuel-based technologies. Existing stock reaching its end-of-life was replaced by these electric appliances. Fuel consumption for water heating in laundries, whether in hotels or specific entities such as dry cleaners, was excluded from electrification as it is assumed that current technologies would continue to be used in view of the high temperatures required for such processes.
- In the residential sector, the rate of electrification of space heating (from individual gas heaters to heat pumps) and cooking (gas cookers to electric cookers) was assumed to occur at a higher rate than current trends, at an average of 2% per annum. In this scenario and the WEM and WPM of the NECP, it is assumed that all new dwellings exclusively use electric devices (heat pumps or resistance heaters) for space heating.
- In order to continue to 'stress' the power generation system, this scenario also assumed a higher percentage of electric vehicles in the fleet.

The factors outlined above were introduced in both the WEM and WPM of this sensitivity scenario as such changes could result from a combination of unforeseen market factors and behavioural trends.

The sensitivities modelled show there may be a range in terms of the RES-share achieved by 2030, as displayed in Figure 114. However, deviation from the WPM scenario described in the NECP is minimal, with the highest RES-share reaching 12% in 2030 under a scenario of higher efficiency of new technologies.

Figure 114 - Share of RES in gross final consumption of energy (GFCoE) under the different sensitivity scenarios, %



Under all three scenarios, the indicative increase in RES-H&C by an annual average of 1.1% is not achieved (Figure 115). As noted in Section 2.1.2, this is a challenging sector to address. This is perhaps further highlighted by Sensitivity Scenario 2; even assuming a faster and more significant shift towards electrification of end-uses such as space heating, water heating and cooking, Malta will still fall short of its indicative trajectory for RES-H&C during the second half of 2021-2030. In particular, the expected increase in consumption of fuels in the economic sectors, driven by Malta's projected levels of GDP and population growth, outstrips the effect of decarbonisation of the heating and cooling sector through increased electrification and thus its effect on RES-H&C. A higher than expected rate of efficiency in new and replaced technologies is not projected to have a significant impact on RES-H&C.

Figure 115 - The trajectory of increase in RES-H&C under the different sensitivity scenarios, %

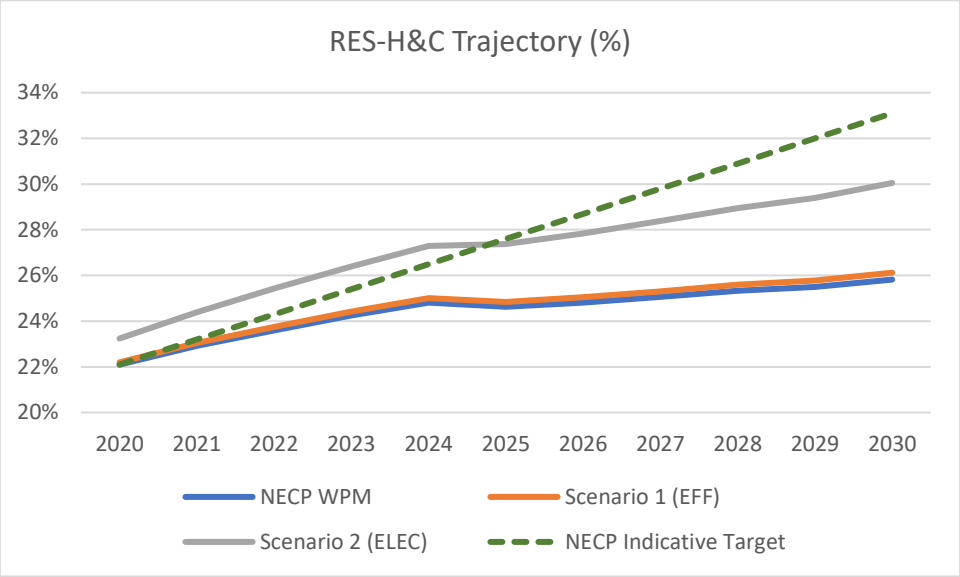
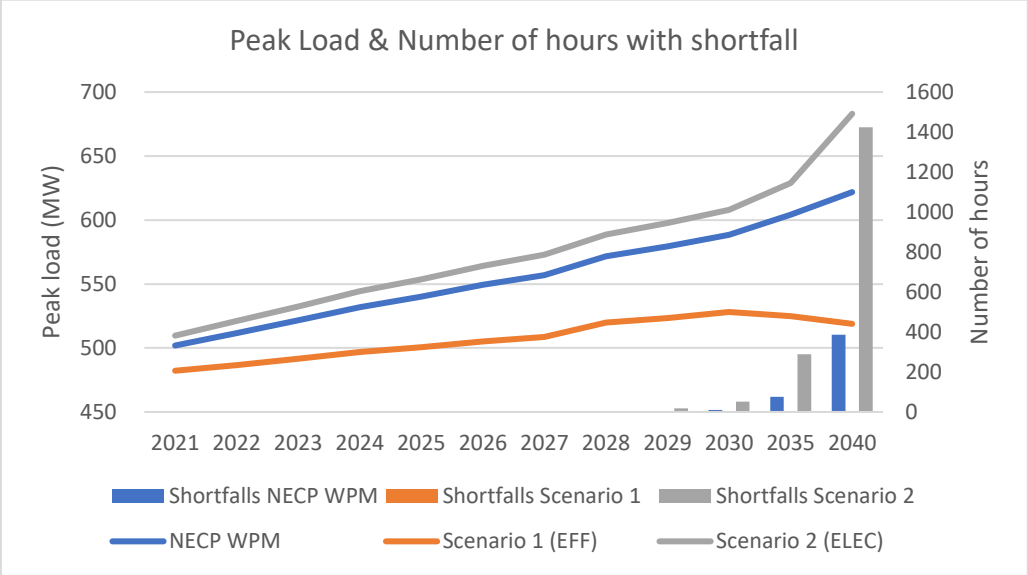


Figure 116 shows the peak load under the different sensitivities and it can be noted that both scenarios show a resulting significant impact. Under a scenario with higher levels of efficiency, peak load increases at a slower pace and even decreases slightly after 2030, as a larger portion of the stock of technologies is replaced (through natural turnover) with systems of higher efficiency. As a result, it is projected that there will be no hours where installed generation capacity cannot meet national demand. By contrast, under a scenario of increased electrification, the peak load is projected to be higher than that of the WPM scenario presented in the NECP. Similarly, shortfalls in meeting peak electricity demand will occur earlier and with a higher level of frequency.

It must be noted that these projections do not take into account the effect of deviations from average temperatures. In years when temperatures are cooler or warmer than the climatic average, the additional impact on electricity demand for space heating and cooling can be significant, particularly during the summer months where electricity demand is consistently high as a result of seasonal factors (such as tourism) and high levels of electric space cooling.

Furthermore, the dispatch model does not account for the requirement of maintaining the power system to the desired level of adequacy (N-1) and therefore an assessment to determine when the system is effectively under stress would need to take into account not only any unmet demand but also the available backup capacity, any demand flexibility as well as the adopted system adequacy standard. The ongoing study on Malta's future electricity supply shall provide better insight into possible options which shall be considered to ensure that future electricity demand is duly met.

Figure 116 - Projected peak load and number of hours with electricity shortfall under the different sensitivity scenarios



ii. Assessment of policy interactions at least until the last year covered by the plan in particular to establish a robust understanding of the impact of energy efficiency/energy savings policies on the sizing of the energy and to reduce the risk of stranded investment in energy supply

Projections indicate that, notwithstanding the planned implementation of a number of energy efficiency measures, energy demand shall continue to rise. The plan does not envisage investments in additional conventional power plants over the 2021-2030 time window, although more detailed options, and subsequent decisions would be taken once the Electricity Supply Study is completed (Q3/2020), and the capability of the electricity demand model to account for unusual climatic effects (deviating from the normalized year) is validated. Investments in renewables also need to take into account the capacity of Malta's small grid to further integrate intermittent sources, keeping in mind the similarity between the local demand profile and that of Sicily, towards which excess electricity could potentially be exported.

The only significant energy supply investment being proposed is the gas pipeline linking Malta to Sicily. The project is at the design stage, and elements are being included to ensure that the pipeline would be able to cater for the transmission of biogas and alternative gases such as hydrogen in the future. This will ensure that the pipeline will contribute towards Malta's long term decarbonisation strategy and provide the basis for conversion of conventional plants to run on green gases.

iii. Assessment of interactions between existing and planned national PAMs and Union climate and energy policy measures

Malta's policies and measures included under the WEM and WPM scenarios are aligned to the Union energy and climate acquis. Existing and planned policies are expected to be implemented to contribute and fulfil objectives and targets at the national, EU and international level. PAMs under the decarbonisation dimension are set out to contribute to the Paris Agreement and the Effort Sharing

Regulation, while policies to promote the deployment of renewables align with the requirements of the Renewable Energy Directive. This can also be said for energy efficiency policies and the Energy Efficiency Directive, including policy measures in the remaining dimensions, such as obligations stemming out of the Gas Security of Supply Regulation.

Table 36 below shows the relevance of individual policies and measures of the WPM scenario within each Energy Union dimension. Most policies and measures featured under the WPM focus on the decarbonisation dimension largely due to the large scope of this dimension, which comprises of policies falling under the climate acquis, as well as renewable energy.

The energy security, internal energy market, and R&I and competitiveness dimensions all form new reporting obligations under the Energy Union Governance framework. In view of this, it can be said that there is some disparity between the number of measures affecting the decarbonisation and energy efficiency dimensions, and the other three dimensions of the Plan. The R&I dimension is comprised of one policy: *E.2.10 Development of R&I Strategy for Energy & Water*. It must be noted that this sector-specific strategy in itself entails further sub-measures which will boost R&I in the area of energy and water. This is also relevant for PAM *E.2.9 Gas Security of Supply* within the Energy Security dimension, which includes Malta's obligations within the Security of Gas Supply Regulation, such as the risk assessment and other preventive and emergency measures; and policy documents related to decarbonisation such as the T.2.17 *National Bicycle Strategy,* the *Electromobility Plan,* or the *Waste Management Plan.*

Table 36 – Policy interactions under WPM scenario between Energy Union dimensions

PAM number	Name of Policy or Measure	Decarbonisation	EE	Energy Security	IEM	R&I and competitiveness
E.2.1	Financial support schemes for Solar PV	✓	✓	✓	✓	
E.2.2	Solar Water Heaters / Heat Pump Water Heater Scheme	✓	✓			
E.2.3	Energy efficiency: electricity tariffs		✓		✓	
E.2.4	Support Scheme for Services and Industry		✓			
E.2.5	Energy Efficient Street Lighting		✓			
E.2.6	Projects in primary water network and wastewater treatment plant		✓			
E.2.7	Biofuels Substitution Obligation (2021-2030)	✓			✓	
E.2.8	Acquisition of renewable energy credits from other Member States	✓				
E.2.9	Gas Security of Supply			✓	✓	
E.2.10	Development of R&I Strategy for Energy and Water	✓				✓
C.2.1	Management of Farm Slurries in the Maltese Islands	✓				
C.2.2	WtE Facility	✓		✓	✓	
C.2.3	Waste Management Plan 2020 - 2030	✓				

T.2.1	Removing traffic bottlenecks and reducing severance between urban communities - Marsa Road Project	✓				
T.2.2	Remove traffic bottleneck at Addolorata junction, Marsa	✓				
T.2.3	Road and infrastructure projects	✓				
T.2.4	Malta - Gozo Tunnel	✓				
T.2.5	Implement Public Transport Quality Corridors (PTQC)	✓				
T.2.6	Improvement of Ferry Landing Places	✓				
T.2.7	Introduction of a low-emission zone (LEZ) in the 'hub'	✓				
T.2.8	Smart Parking System for Valletta	✓				
T.2.9	Fast passenger ferry link between Malta and Gozo	✓				
T.2.10	Free Transport for Youths, Students, and school children	✓	✓			
T.2.11	Increase use of Intelligent Transport Systems in traffic management	✓				
T.2.12	National bicycle sharing scheme	✓				
T.2.13	Last-Mile Delivery for Valletta	✓				
T.2.14	Implementation of a cycling corridor	✓				
T.2.15	Car-Sharing Scheme	✓				
T.2.16	Sustainable Urban Mobility Plan for Valletta	✓				
T.2.17	National Bicycle Strategy and Action Plan	✓				
T.2.18	Introduction of electric buses in Gozo	✓				
T.2.19	Continuation of EV Grants and Electromobility Action Plan	✓		✓	✓	

5.2 MACROECONOMIC AND, TO THE EXTENT FEASIBLE, THE HEALTH, ENVIRONMENTAL, EMPLOYMENT AND EDUCATION, SKILLS AND SOCIAL IMPACTS OF THE PLANNED POLICIES AND MEASURES

i. Introduction

In the framework of the NECP, an impact assessment has been conducted to look at what possible outcomes the future configuration of the (energy) system of Malta can have under a 'With Planned Measures' scenario. In particular, the assessment was designed and approached like a strategic assessment (at plan/scenario level) with the aim to evaluate the integrated/combined responses of the planned measures against a number of additional relevant criteria (economic, social, and environmental impacts) which are not included in other sections of the impact assessment and the NECP.

The impact assessment framework has been designed and shared with the different departments/ministries which are owners of the policies and measures included in the NECP and are responsible for the decision-making process. The Ministries are also represented on the Inter-Ministerial Steering Committee on the development of Malta's NECP. Their specific feedback

(collection of data and information) have formed the basis for the comprehensive analysis of the impacts presented in this chapter.

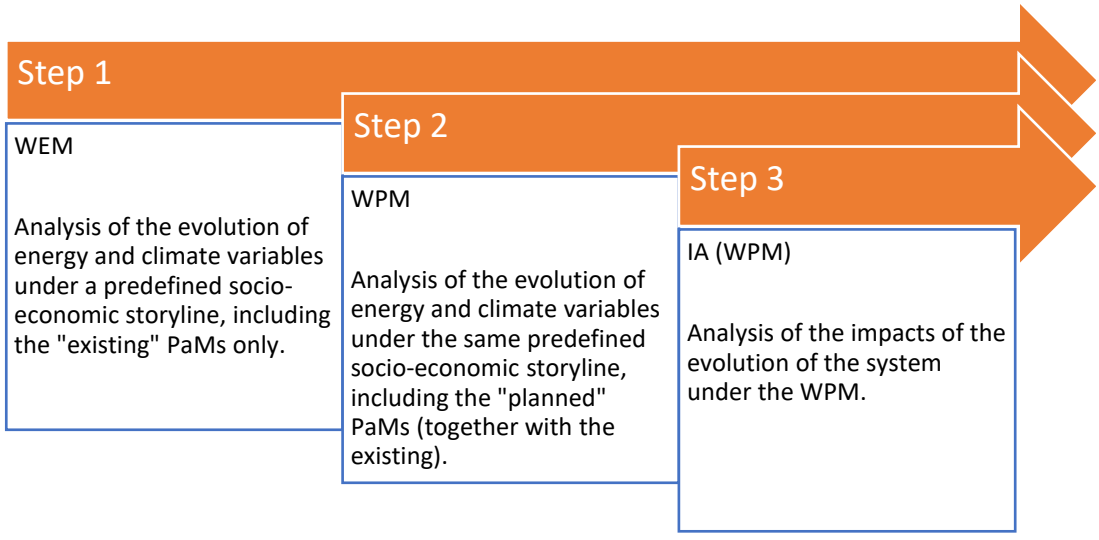
The ultimate objective of such assessment is to control and verify the robustness of the package of planned measures against their impacts thus providing analytical evidence of the trade-offs related to adopting and implementing the measures as well as the barriers and complexities with respect the implementation of the planned policies and measures.

ii. Criteria and Metrics

The approach in the preparation of the IA has been driven by a number of goals and conditions. In particular, the method employed for the IA aimed:

- to be able to inform local decision makers about relevant impacts of the projected energy/climate system;
- to be transparent and unbiased by construction, so to make clear potential benefits and drawbacks of the evolution of the Maltese system, while providing a space for a simple evaluation of multiple "conflicting[103]" criteria, and contribute to the continuous/wider learning process;
- to provide an instrument for further applications through a "dual" mode of use: more quantitative-oriented and/or qualitative);
- to be fully consistent with the modelling approach used for the analysis and projection of the energy and climate variables in section 4 in terms of overall rationale outlined in the figure below;

Figure 117 - NECP modelling rationale



[103] The selection of criteria (type of impacts), and in particular of potentially "conflicting" criteria is key for a robust IA.

Figure 117 indicates that the WEM and WPM scenarios are modelled in a cascading fashion. No feedback from the IA is explicitly returned to step 2 for redesigning or adjusting the planned measures, or for changing the key underlying assumptions[104].

This section provides an "ex-post" assessment of the impacts on the system in a manner that identifies the key causalities; the outcomes of the analysis; and the coherence of the IA results with the key elements and assumptions taken to model the WPM scenario.

Impacts and Definitions

Following the NECP template requests and based on the elements emerged during the problem structuring and the discussion with the experts, six criteria have been selected for the impact assessment[105].

Some of the identified relevant impacts can be expressed in quantitative terms (out-of-model calculations), while others are more semi-qualitative by nature. The inclusion of semi-qualitative metrics (performances based on expert judgments) provides additional space for a comprehensive evaluation of the causalities.

Table 37 - Impacts Assessed: Economic (ECO), Social (SOC), Environmental (ENV), Others (OTH).

Impacts/Criteria	Brief Description	Theme
Economic impact	Effect of PAM on the local economy, including business development, competitiveness and inward investment.	ECO
Technical constraints	Level of technical issues associated with PAM, including complexity and skills required for implementation.	OTH
Social acceptability	Acceptability of PAM to local citizens.	SOC
Legal issues	Legal and regulatory issues which may constitute a barrier to the implementation of PAM.	OTH
Quality of life issues	The effect of the PAM on the citizens' quality of life in terms of health, comfort, social and environmental impacts.	SOC/ENV

Engagement Process

In order to collect all qualitative and quantitative data necessary to carry out an Impact Assessment of the WPM, an "Impact Assessment Matrix" was designed to collect PAM-specific information related to each criterion outlined in Table 37. This matrix included a section designed to collect data feeding into quantitative metrics and a section designed to collect data feeding into semi-qualitative metrics through a five-points Likert scale.

[104] For instance, the macroeconomic drivers have been assumed to be almost "rigid" against the analysed impacts/PaMs and therefore no GDP / GVAs changes are taken into consideration as response to the simulation of the planned measures.
[105] Including quantification of the social cost of carbon was discussed. However, it was determined that the period covered by the plan (short to medium-term) and the geographic scope (national) were incompatible with the period of impact (long term) and geographic area of impact (global).

For all the semi-qualitative questions, a short explanation of the metric being assessed was provided to assure improved clarity and transparency. For the semi-qualitative portion of the assessment, short meetings were scheduled with Government ministries responsible for individual PAMs that make up the WPM scenario. These meetings were used to present the Impact Assessment data collection process and to explain how the Impact Assessment matrix should be filled-in. Technical officers were given the opportunity to seek assistance is interpreting and completing the data collection task. Following an iterative process, the final set of PAM-specific data was used to compile an analysis of the expected impacts of the package of policies that make up Malta's WPM scenario.

Impacts and Metrics

In order to measure the expected impacts of the chosen criteria, the following data was collected:

Economic Impact:

a. Quantitative: Job creation (*based on annual labour units*[106]) divided into temporary (construction, installations) and permanent (maintenance, operation).

b. Semi-Qualitative: Effect of PAM on local economy, incl. business development, competitiveness and inward investment - 5-points metric (from desirable to non-desirable state): *Major improvement to economic development / Significant improvement to economic development / Minor improvement to the national economy / No economic impact / Reduced economic development*.

Technical Constraints:

a. Quantitative: Time-to-realisation (*months, years*)

b. Semi-Qualitative: Two sets of 5-points metrics to define technical constraints will be used (from desirable to non-desirable state):

- Level of technical issues associated with PAM measured in terms of complexity of the project: *No technical difficulties / Minimal technical difficulties / Some technical concerns / Significant technical issues / Major technical obstacles*.
- Level of technical issues associated with PAM measured in terms of level of skills required: *Only standard skills required/ Mainly standard skills required/A mix of standard and medium skills required/ Significant high skills required/Major high skills required*.

Social Acceptability:

[106] Full-time equivalent (FTE) = number of full-time equivalent workers required per year to fulfil the workload introduced by the PAM. When using FTE a full-time employee working a 40 hour week for the whole year would be equivalent to 1, whereas a person working 20 hours per week would be equivalent to 0.5.

a. Semi-Qualitative: Acceptability of PAM to local citizens - 5-points metric (from desirable to non-desirable state): *very high societal acceptance / high societal acceptance / Average societal acceptance / Low societal acceptance / Very low societal acceptance*.

Legal Issues:

a. Semi-Qualitative: Legal and regulatory issues which may constitute a barrier to the implementation of the PAM – 5-points metric (from desirable to non-desirable state): *No legal issues / Minimum legal issues / Minor legal issues / Significant legal issues / Major legal and regulatory issues*.

Quality of Life Issues:

a. Semi-Qualitative: the effect of the PAM on the citizens' quality of life in terms of health, comfort, social and environmental impacts - 5-points metric (from desirable to non-desirable state): *Major quality life improvement / Significant quality life improvement / Minor quality life improvement / No effect on quality of life / Decrease quality of life*.

Prior to the analysis of results, it is important to clarify that Section 5.2 results apply to a sub-set of PAMs reported in Malta's integrated PAMs template. Primarily, several PAMs were excluded from this analysis because the current suite of models used to generate Malta's WPM trajectories could not simulate their effect. This allowed Section 5.2 to remain consistent with the results presented in Section 5.1. Table 38 identifies which sub-set of PAMs were modelled.

Methodological Note

In order to model the way decision-makers who were engaged in the analysis perceived the measurement and semi-qualitative scale of the criterion, a so-called 'preference function' was associated to each criterion. The key idea was to transform the collected inputs (performance of the PAM, from 1 to 5) through a normalisation of the preference levels measured from 0 to 1, so to make them additive and calculate an overall (unique) indicator of performance of the PAM against all the criteria.

A Gaussian preference function was used to transform the data "d" (collected in the 1 to 5 scale) into a normalised 0 to 1 preference level:

$$P(d) = 1 - e^{\left(\frac{-d^2}{2s^2}\right)}$$

The "threshold" point "s" was selected to set the inflection point of the Gaussian curve (different per each criterion).

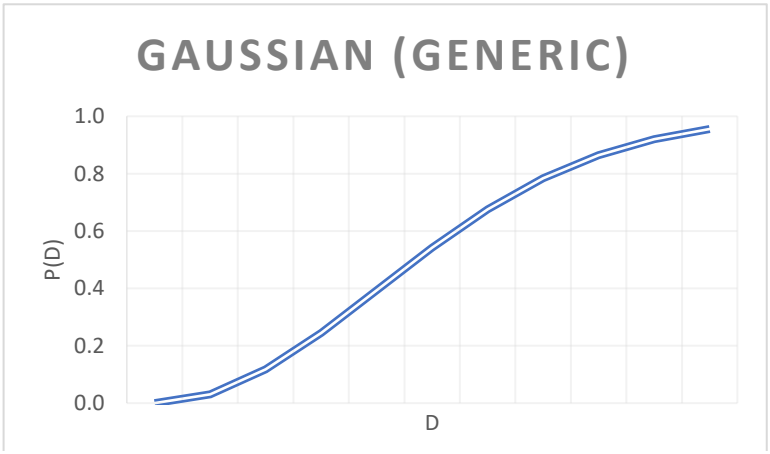


Table 38 - Modelled WPM PAMs

PAM number	Name of Policy or Measure	PAMs modelled in Section 5.1
E.2.1	Financial support schemes for Solar PV	✓
E.2.2	Solar Water Heaters / Heat Pump Water Heater Scheme	✓
E.2.3	Energy efficiency: electricity tariffs	✓
E.2.4	Support Scheme for Services and Industry	✓
E.2.5	Energy Efficient Street Lighting	✓
E.2.6	Projects in primary water network and wastewater treatment plant	✓
E.2.7	Biofuels Substitution Obligation (2021-2030)	✓

E.2.8	Acquisition of renewable energy credits from other Member States	✓
C.2.2	WtE Facility	✓
C.2.3	Waste Management Plan 2020 - 2030	✓
T.2.1	Removing traffic bottlenecks and reducing severance between urban communities - Marsa Road Project	✓
T.2.2	Remove traffic bottleneck at Addolorata junction, Marsa	✓
T.2.3	Road and infrastructure projects	✓
T.2.4	Malta - Gozo Tunnel	✓
T.2.5	Implement Public Transport Quality Corridors (PTQC)	✓
T.2.6	Improvement of Ferry Landing Places	✓
T.2.7	Introduction of a low-emission zone (LEZ) in the 'hub'	✓
T.2.8	Smart Parking System for Valletta	✓
T.2.9	Fast passenger ferry link between Malta and Gozo	✓
T.2.10	Free Transport for Youths, Students, and school children	✓
T.2.11	Increase use of Intelligent Transport Systems in traffic management	✓
T.2.12	National bicycle sharing scheme	✓

iii. Key findings

This section of the text summarises the key findings of the impact assessment process. It provides a summary of the results and findings of the analysis of semi-qualitative data (economic impact, technical constraints, social acceptability, legal issues, and quality of life) as well as the analysis of quantitative data (economic impact).

Semi-Qualitative Analysis

The Semi-qualitative data was compiled into a single score which encapsulates the overall performance of the package of WPM PAMs in terms of economic, social, environmental, and other impacts. Figure 118 indicates that average overall ranking. This indicates that although policy-makers should expect some challenges when implementing the measures under the WPM scenario, the overall outlook is positive and that after accounting for potential impact trade-offs, implementing the entire set of PAMs will bring about a net-positive effect.

Figure 118 - Overall semi-qualitative score of modelled WPM PAMs

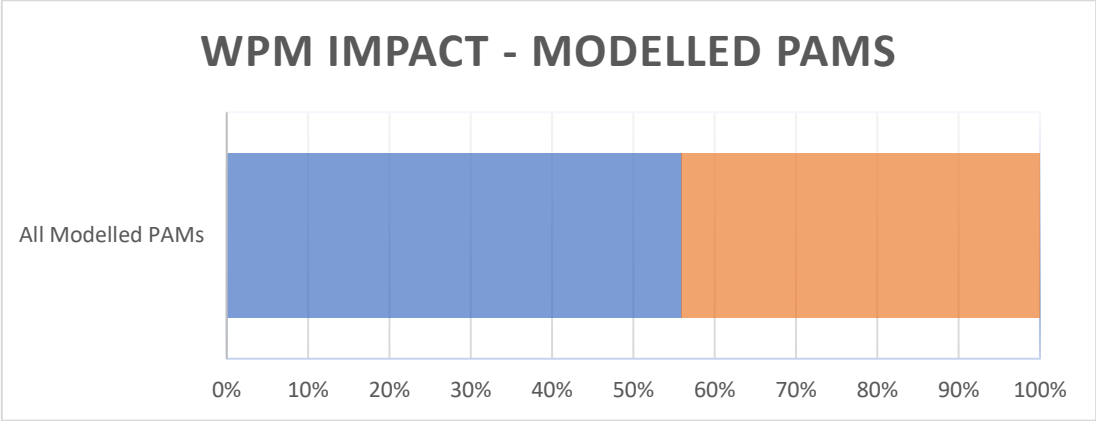


Figure 119 shows a representation of PAM-specific multivariate scores generated through the data collected from the Impact Assessment Matrix where for each criterion, 1 is the best and 5 is the worst score. This figure presents the scores of the best performing and worst performing (critical) PAM and visualise the presence of trade-offs, even for the best performer. Based on the compilation of the multivariant analysis score, the measure which is most likely to have a negative impact is E2.8, the acquisition of renewable energy credits from other Member States to reach and maintain the national RES target as required by the Renewable Energy Directive (2009/28/EC). This representation of collected data allows policy-makers to identify impact trade-offs for each PAM. Taking PAM 2.8 as an example, the data clearly indicates that although the measure is simple to implement due to very low levels of technical complexity, it performs poorly in terms of social acceptability. This reinforces Malta's commitment to use cooperation agreements for statistical transfer of renewable energy credits as a measure of last resort; opting to prioritise measures which, irrespective of their increased levels of technical or legal complexity, would generate direct net-positive benefits for Malta.

Figure 119 - Individual PAM semi-quantitative score

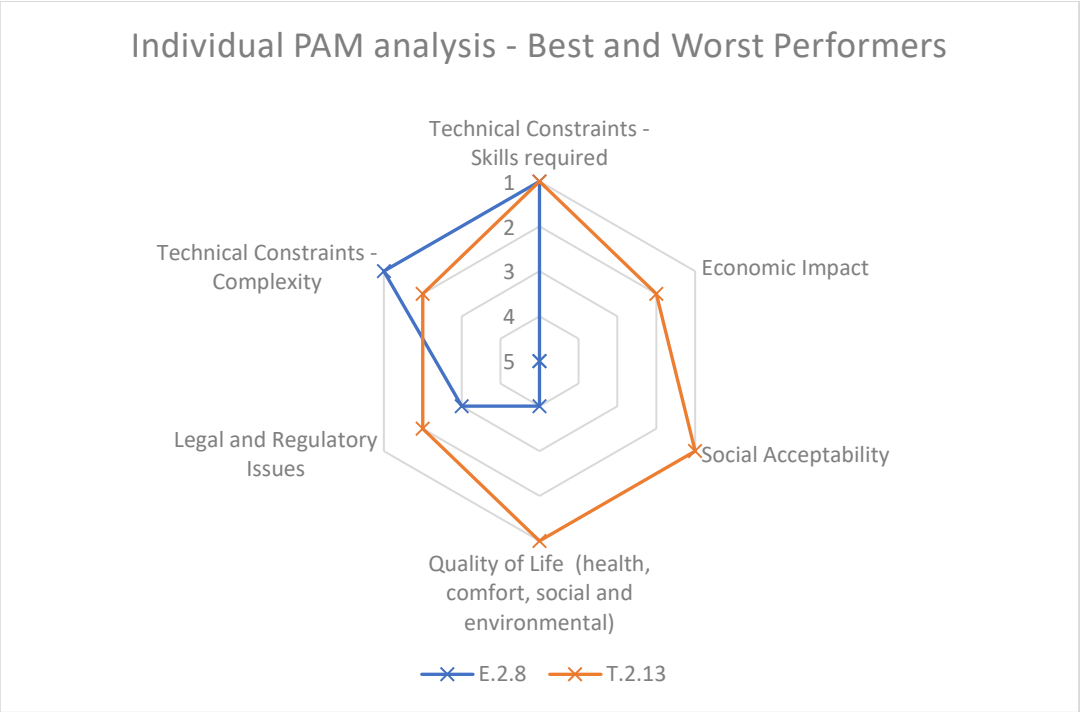
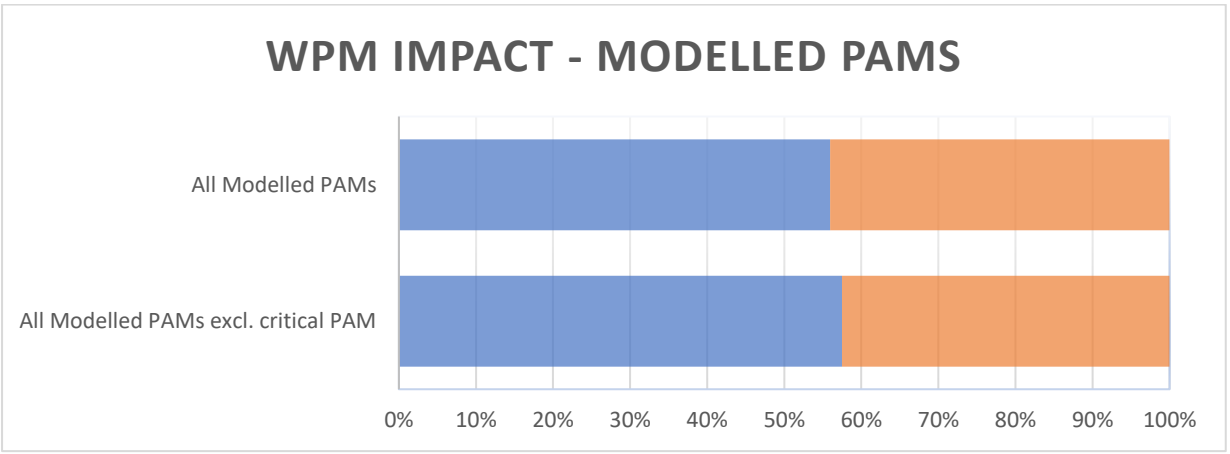


Figure 120 indicates the improvement in the WPM's overall score should renewable energy statistical transfer agreements not be utilised. In fact, only a marginal improvement in performance is achieved. This minor effect is due the impact trade-offs associated with each PAM. Having said that, the removal of PAM 2.8 brings about the highest improvement in the overall score.

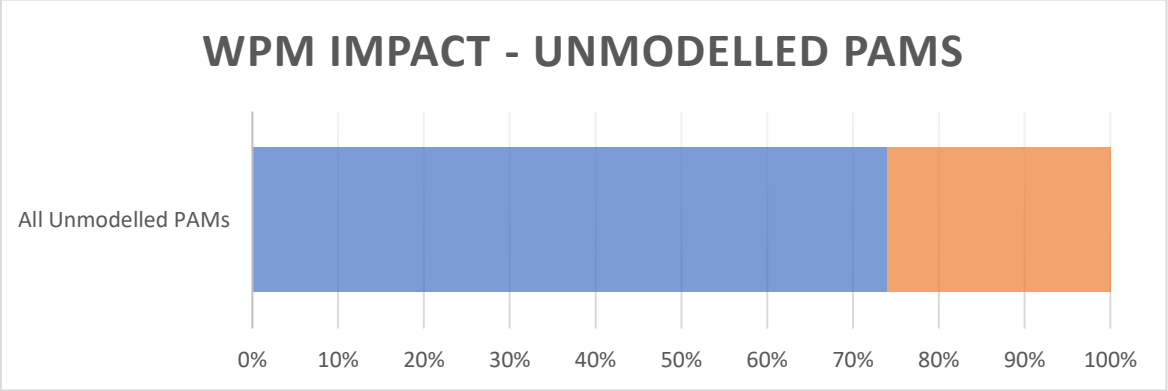
Figure 120 - Overall Semi-qualitative score of WPM PAMs excluding the Critical PAM



As tabulated above, several PAMs were not modelled when estimating the energy and climate trajectories presented in Section 5.1. Therefore, Figure 121 indicates the WPM's overall achieved exclusively by unmodeled PAMs.

The results indicated that the group of unmodelled PAMs score significantly higher in terms of economic, social, and environmental impact than the group of modelled PAMs. Therefore, this implies that although the effect of these measures on Malta's energy and climate systems could not be estimated, it is very clear that they represent a sub-set of measures which should bring about significant net-positive effects when measured using alternative metrics. In conclusion, the expected benefits from the sub-set of unmodelled PAMs should be included in future iterations of Malta's energy and climate trajectories. Moreover, a dedicated multi-criteria analysis of unmodeled PAMS (Figure 121) shows that their implementation is expected to generate significant benefits in economic, social, and environmental terms with very limited trade-off effects between the six semi-qualitative criteria assessed.

Figure 121 - Semi-Qualitative Score of all Unmodelled WPM PAMs



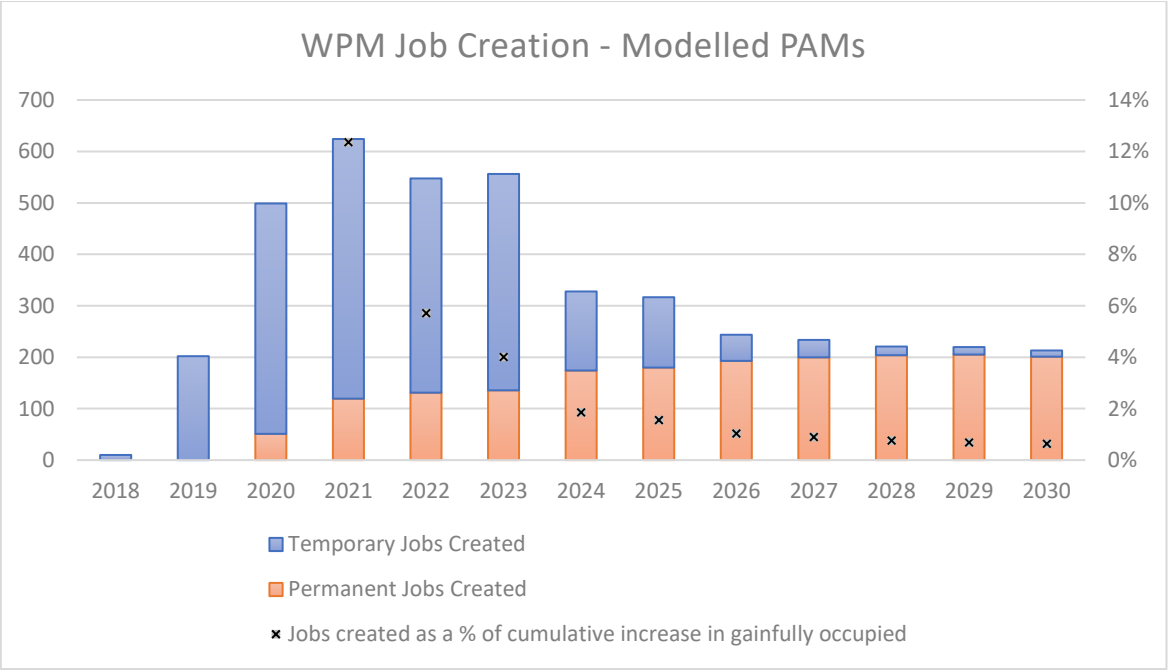
Quantitative Analysis

Macroeconomic projections used as exogenous variables within the energy and climate-system models designed to output results for the WEM and WPM scenarios of this Plan do not explicitly account for the PAMs designed in the WPM scenario but account for the overall (aggregate) trajectories expected. Having said that, government expenditure as a percentage of ex-ante projected GDP is expected to peak around 1.7% in 2021 (see Section 5.3). Therefore, given the low magnitude of this metric, it is reasonable to assume that aggregate macroeconomic projections capture the effect of the WPM.

In order to capture the effect of the WPM on the macroeconomy, the Impact Assessment Matrix was used to collate information on the number of jobs created as a result of implementing the WPM scenario. In terms of job creation, annual quantitative data in "full-time equivalent" terms were collected. Officers in charge of individuals PAMs were asked for estimates split into temporary work created, such as construction and installation), and permanent work created, such as operation and maintenance. Although several simplifying assumptions had to be taken in order to determine the number of additional jobs created over the period covered by the NECP, a general finding is that none of the PAMs are expected to generate job losses. Therefore, in Malta's case, the WPM is only expected to create additional economic opportunities. This aligns with Malta's current economic boom, driven by higher levels of domestic demand, partially due to higher levels of disposable income resulting from a strong labour market. Figure 122 indicates that once the initial boom of temporary work associated

with the WPM PAMs levels-off, the WPM is expected to generate approximately 200 permanent jobs (work created in terms of full-time equivalent) towards the end of the upcoming decade.

Figure 122 - WPM Impact on job creation



In order to gauge the effect of the expected increase in jobs created by the planned measures, values presented in Figure 122 were expressed as a percentage of cumulative projections for the year-on-year increase in the number of gainfully employed workers in Malta between 2021-2030 (obtained by a third study, and used as a driver for some sectoral projections). By utilising the cumulative effect of additional jobs created in Malta in the denominator, the metric accounts for the effect of jobs which were created in one period and which remain existing in other periods of the numerator. It is important to note that projections for the number of gainfully employed do not account for part-time workers whereas the data collected through the Impact Assessment Matrix is the full-time equivalent of both full-time and part-time workers. Having said that, this ratio shows that although the initial boom of temporary jobs created by modelled WPM PAMs has a significant effect when compared to the overall jobs created in that year, the overall effect of jobs created vis-à-vis the cumulative jobs created is low. This provides further justification as to why the macroeconomic indicators feeding into the models used to project the WEM and WPM scenarios were estimated ex-ante rather than iteratively.

iv. Conclusions

The analysis of semi-qualitative data indicated that the PAMs set out under Malta's WMP scenario bring about an overall positive effect in terms of impacts on Malta and its citizens; even when accounting for their potential detrimental technical, legal, and environmental effects. In fact, estimates of overall scores is always closer to the ideal positive point of (100%) than to the worst-case scenario (0%). Moreover, in terms of macroeconomic impacts, the WPM follows a 'no-regret' approach where the impact of the PAMs on job creation is positive for each projected year. It is also

expected that the WPM would not bring about any adverse effect on the overall Maltese economy and would, to a limited extent, support further economic expansion.

The analysis also indicates that PAMs which could not be captured in the analysis presented in Section 5.2 are in fact the best performers in terms of overall economic, social, and environmental impact. Therefore, unmodeled PAMs are expected to bring about a positive effect on Malta's energy and climate performance. However, there is uncertainty as to the scale of this expected improvement over and above what is presented in Section 5.1 of the Plan.

v. Strategic Environmental Assessment

Following the completion of the Draft NECP in December 2018, it was deemed necessary to subject the NECP to a Strategic Environmental Assessment (SEA). In line with Subsidiary Legislation 549.61, which transposes EU Directive 2001/42/EC, an SEA is required when a policy or programme is expected to have a significant effect upon the environment. The Energy & Water Agency, responsible for the development of Malta's NECP, commissioned AIS Environment Ltd. through the public procurement system (EWA/TD/2/2019) to carry out the task of conducting the SEA.

The SEA process was initiated in 2019; however, it is not expected to be completed before the second quarter of 2020. Therefore, there is a misalignment between the timeframes for the completion of the Final NECP (end of 2020) and the SEA process, and thus the integration of the outcomes of the SEA in the Final NECP. At the time of drafting of the Final NECP, the scoping stage of the SEA, including a period of consultation, was completed and work on the environmental assessment was initiated. Due to this, the main results and outcomes of the SEA on Malta's NECP are not yet included hereunder. The finalised SEA report will be made public in line with the SEA Regulations upon completion.

The scoping stage identified the environmental factors to be assessed in relation to the NECP. During the reviewing process, the following key environmental themes were identified:

- Air quality;
- Biodiversity;
- Climate change;
- Cultural heritage
- Energy & water;
- Human health;
- Landscape;
- Transportation and infrastructure;
- Waste and resource management;

Research will first be conducted to establish an environmental baseline, following which the effects of the NECP policies and measures on the environmental baseline will be assessed qualitatively vis-à-vis the relevant themes. Monitoring schemes will be proposed for each of the environmental factors in the baseline. Public and stakeholder consultation are considered an important element of the SEA process and are given the appropriate attention during the SEA analysis.

5.3 OVERVIEW OF INVESTMENT NEEDS

i. Existing investment flows and forward investment assumptions

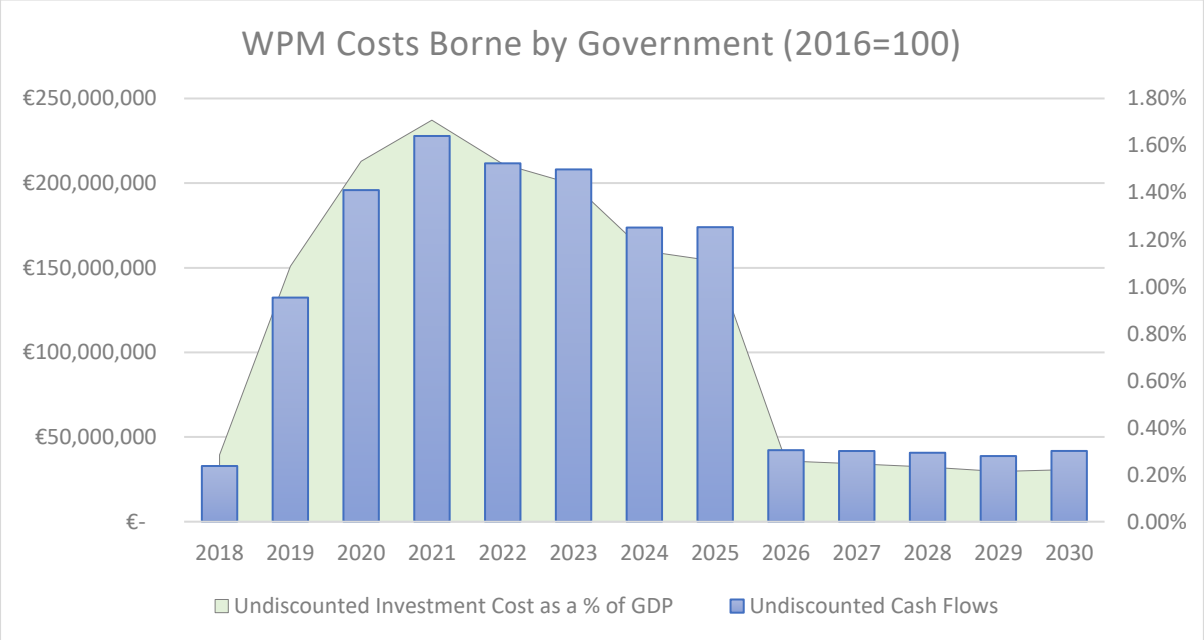
The "Impact Assessment Matrix" used to collect data feeding into quantitative and semi-qualitative metrics used in Section 5.2 was used to collect information related to the costs borne by Government under a WPM scenario. Therefore, technical experts responsible for the design and implementation of individual WPM PAMs submitted the following information for each PAM under the WPM:

The "Impact Assessment Matrix" used to collect data feeding into quantitative and semi-qualitative metrics used in Section 5.2 was used to collect information related to the costs borne by Government under a WPM scenario. Therefore, technical experts responsible for the design and implementation of individual WPM PAMs submitted the following information for each PAM under the WPM:

1) Investment costs (capital expenditure);
2) Operating and maintenance costs (operating expenditure); and
3) Replacement costs (when applicable).

When aggregated, the total undiscounted cost borne by Government amounts to approximately EUR 1.66 billion for the period between 2018 and 2030. Figure 123 depicts how costs would be distributed between 2018 and 2030. When estimating the cost as a percentage of GDP, the expenditure is expected to peak at approximately 1.7% of real GDP in 2021. As portrayed by the figure, costs borne by the Government as a result of the implementation of the package of policies and measures under the WPM is most prevalent during the first 5 years of the next decade. This implies a short-to-medium term implementation period of the WPM scenario, which, however is expected to be supplemented by long-term oriented measures once the Low Carbon Development Strategy is completed.

Figure 123 - Costs borne by Government under a WPM scenario



Although the graph indicates that Government expenditure will decrease towards the end of the decade, it is important to note that this analysis does not include PAMs which fall under the WEM and which might have a significant impact on Government expenditure, such as Malta's connection to the European gas grid through a pipeline with Italy. Therefore, the cost borne by Government is expected to be significantly higher than what is reported here. Furthermore, PAMs financed privately due to planned concession agreements, such as the Malta-Gozo fixed link, are excluded as these are not costs borne by the Government. It is also envisaged that additional policies and measures would be identified in the foreseen update of Malta's NECP in 2024-2025.

Financial burden as a result of the WPM Scenario

As part of the analysis of investment needs, estimates of the expected direct financial and voluntary financial burden of three energy-related PAMs was carried out (Table 39). This is dependent on the affected agent[107] for each PAM. A direct financial burden is a burden imposed on an agent as a result of the PAM while a voluntary burden is a burden which the agent chooses to bear as a result of the PAM.

Malta intends to reach its renewable transport target of 14% by 2030 via the implementation of an obligation on fuel suppliers to blend biofuels with diesel. Since the blending obligation will be reflected in higher fuel prices, this direct financial burden will be borne by the vehicle owners purchasing the fuel. As shown in Table 39, the burden of this measure per vehicle owner per annum is expected to remain rather low, while allowing Malta to meet its obligations under the Renewable Energy Directive.

A voluntary financial burden is expected to be borne by an 'agent' willing to invest in a certain technology. In the analysed sub-set of PAMs below, the voluntary financial burden was estimated for the deployment of solar PV and solar water heater/heat pump water heaters, technologies which the government is committed to support in the period from 2020 to 2030. The expected costs borne by the residential sector (i.e. household/individual investing in a PV system) and the non-residential sector (i.e. entity investing in a PV system) are expected to maintain a decreasing trend in the projected period, in line with the assumed decreasing CAPEX costs attributed to residential and non-residential PV systems in the upcoming decade. As regards the financial support scheme for Solar Water Heaters/Heat pump Water Heaters, the household/individual investing in such a system will be required to finance 20% of the cost of such a system, which is assumed to be constant until 2030.

Table 39 - Direct and Voluntary Financial Burden of a sub-set of PAMs

Direct Financial Burden	Agent	**2021**	**2025**	**2030**
E.2.7 - Biofuels Substitution Obligation (2021-2030)	Vehicle Owner	€ 19.24	€ 22.29	€ 31.35

Voluntary Financial Burden	Agent	**2021**	**2025**	**2030**
E.2.1 - Financial support schemes for Solar PV	Residential	€ 6,439.91	€ 5,539.47	€ 4,611.05

[107] Agent involved is defined as the representative "player" who is assumed to pay for the cost of the change introduced by the PAM, such as the State, citizen, representative household, representative industry per sector, representative supplier of energy or commodity, etc.

E.2.1 - Financial support schemes for Solar PV	Non-Residential	€ 37,132.69	€ 36,200.43	€ 35,035.12
E.2.2 - Solar Water Heaters / Heat Pump Water Heater Scheme	Residential	€ 330	€ 330	€ 330

Assessment of additional costs related to the design and assumptions of Malta's WPM scenario

Complementary to the above section, which analysed the costs borne by the Government to implement the planned policies and measures under the WPM scenario, the following section examines the costs associated to the expected technology change, both as a result of the natural replacement and evolution of technologies within the respective sectors, and as a result of policies and measures targeting the deployment of renewable and more efficient technologies, such as support schemes for solar PVs, solar water and heat pump water heaters, and energy efficiency measures in the services and industry sectors. This analysis was conducted for both the WEM and WPM scenarios, which provides insight into both absolute and relative investment needs, i.e. the additional required investment costs to implement the WPM on top of the WEM. Nevertheless, it's important to note that within the framework of Malta's NECP the '*With Existing Measures*' (WEM) scenario is considered to be unrealistic due to the assumed expiry of policies and measures and government support in the period post-2020 and does not correspond to the designated scenario for the period post-2020. By virtue, emphasis is placed on quantifying the investment needs of the WPM scenario, which is reflective of the expected evolution in the period until 2030. This analysis does not aim to provide a precise estimate of the total cost associated to technology change, but rather assess the order of magnitude of the expected investment should the implementation of Malta's WPM scenario be carried out. It shall also serve as a signal to policy-makers and investors alike whereby it illustrates the degree of expected investment needs in the various end-use sectors and within pre-defined technology clusters.

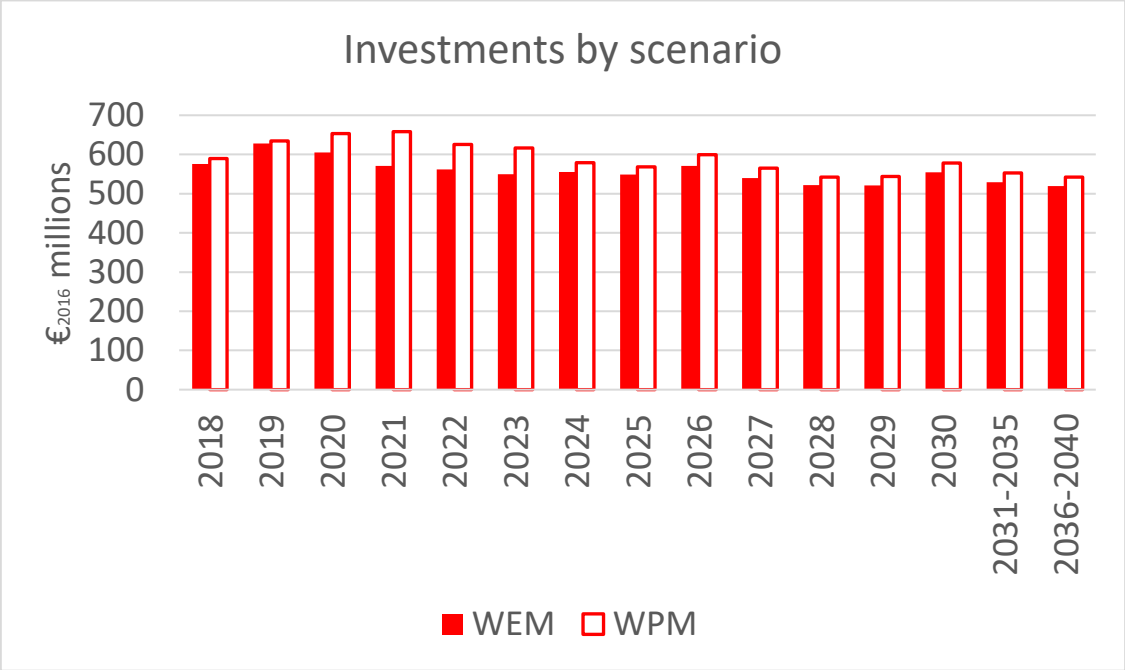
A modelling-based approach was adopted to deliver this assessment. It employs directly sectoral bottom-up models to generate the impact assessment to assess current technology stocks and future requirements. The resulting investment needs account for:

- Natural replacement rate of existing technologies (i.e. technology substitution);
- New stocks due to increasing energy demand;
- Policy-driven technology stocks, namely investments driven by specific policies accelerating substitution or technology options;

Key assumptions were made regarding technology purchasing costs, average technical lifetime, and in some cases, the annual average load factors. The assumed technology costs are generally in line with European Commission assumptions, however, when available, few adjustments on specific technologies were made (i.e. heat pumps) as to better capture the specificities of the Maltese market. These costs assumptions also consider a certain level of efficiency uptake, which are consistent with projections under the WEM and WPM scenarios. This analysis is limited to energy-related technologies, while other investments, such as planned road infrastructure projects, the gas pipeline project, etc. are not included within the assessment.

Reported results assumes that the whole investment take place at the exact time of which a new capacity is installed (overnight). This representation is not in line (hence not fully comparable) with the methodology employed by other modelling analyses, which generally assume annualised investment cash flows, but was preferred as to explicitly track financing requirement streams and identify possible peaks which may constitute barriers to the implementation of planned policies. When relevant, discount rates of 3.5% are applied for discounting. The assumed technology costs are described in more detail under Section 4.1.iv. of the Plan.

Figure 124 - Total investments by scenario, mil. €$_{2016}$



Total annual investment costs as a result of the technology change related to the design of Malta's WEM and WPM scenarios are presented in Figure 124. While the average annual investment costs of the WEM scenario in the period between 2018 and 2030 would amount to 562 mil. €$_{2016}$, the average estimated investment costs of the WPM scenario in the same period would reach 597 mil. €$_{2016}$. Annual investment costs are relatively stable throughout the projected period under both scenarios, with the first half of the decade experiencing levels of increased investment.

Investment costs by sector

Figure 125 - Investment costs by sector under the WPM scenario, mil. €$_{2016}$

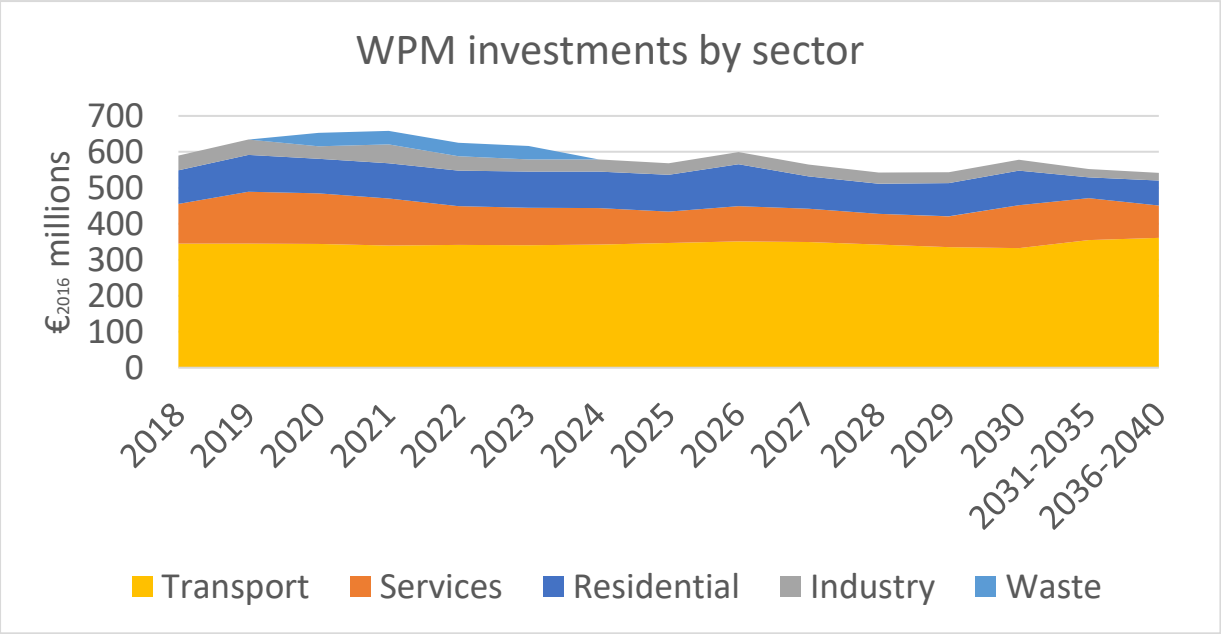


Figure 125 provides a visual representation of the investments under the WPM scenario split by end-use sectors and the waste management sector. The transport sector is expected to maintain the largest share in terms of estimated investments due to the expected high substitution rate of vehicles tied with a continuous rate of electrification envisaged in the sector. Under Malta's WPM scenario it is expected that the number of electric vehicles would reach approximately 26,000 by 2030. The average annual investment costs taken up by the transport sector between 2018 and 2030 are estimated at around 343 mil. €$_{2016}$. In terms of order of magnitude of investment costs, the transport sector is followed by the services and residential sectors, which fall on average just below and just above the mark of 100 million/annually, respectively. Largely due to the size of Malta's industrial sector and the absence of heavy industry, the annual average investments in industry in the period between 2018 and 2030 are estimated at 36 mil. €$_{2016}$ per annum. Under the WPM scenario, investments in the waste management sector are envisaged to arise in 2024 as a result of the commissioning of the new waste-to-energy facility.

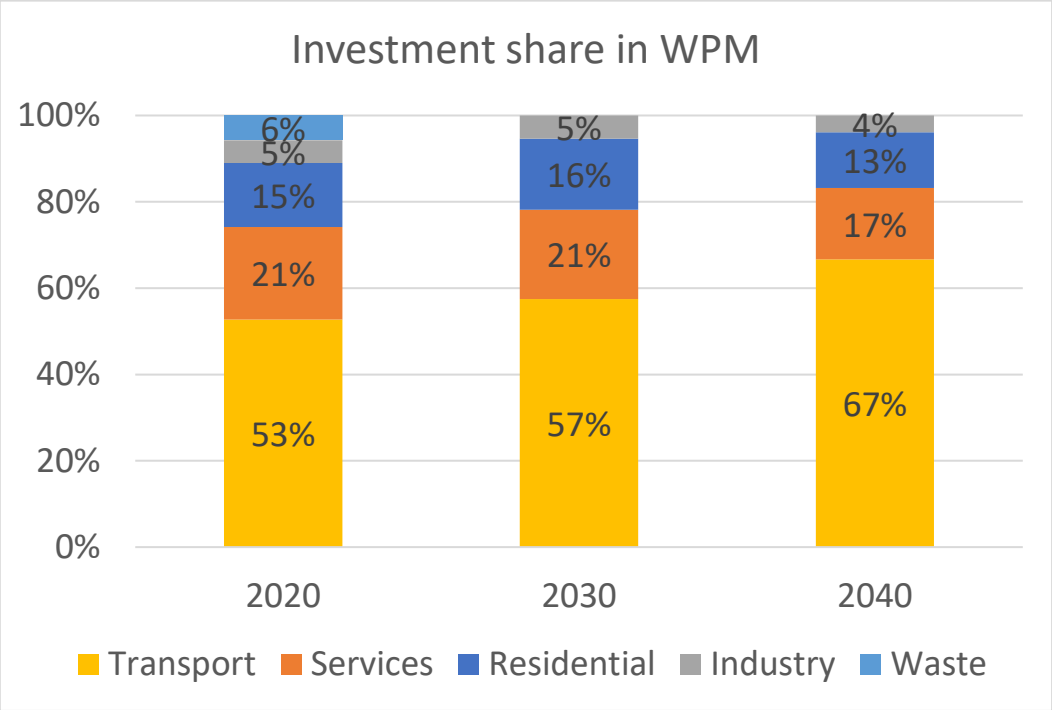
In 2019 we are estimating higher investment costs due to increased deployment of solar PV systems primarily in the services sector complemented to a lesser extent by additional PV installations in the residential sector. Increased investment in 2030 is an outcome of the installation of new appliances linked to the growth of the services sector, as well as the replacement of an increased number of appliances in the services sector which were installed in 2018 and which have reached the end of their lifetime.

This analysis does not take into account the estimation of investment costs related to maintaining the adequacy of Malta's power system. Subject to results from the ongoing study commissioned by the Government, it is foreseeable that investments will be required to ensure system adequacy and to

further integrate solar PV systems, which are projected to reach a capacity of 266 MW by 2030. The degree of investment needs covering this aspect would be estimated upon completion of the study.

The investments as a share in the various sectors taken as snapshots in 2020, 2030 and 2040 are illustrated in Figure 126. The share of investment costs in the various sectors will remain largely constant in the period until 2030. After 2030, a 'no-policy' approach is assumed under the WPM scenario and therefore the share of investment in the services and residential sectors starts dwindling due to the lack of uptake of solar water and heat pump water heaters and solar PVs. However, this approach should not be seen as contradictory to Malta's commitments on decarbonisation. Additional policies and measures focusing on the period post-2030 will be included in the next NECP cycle.

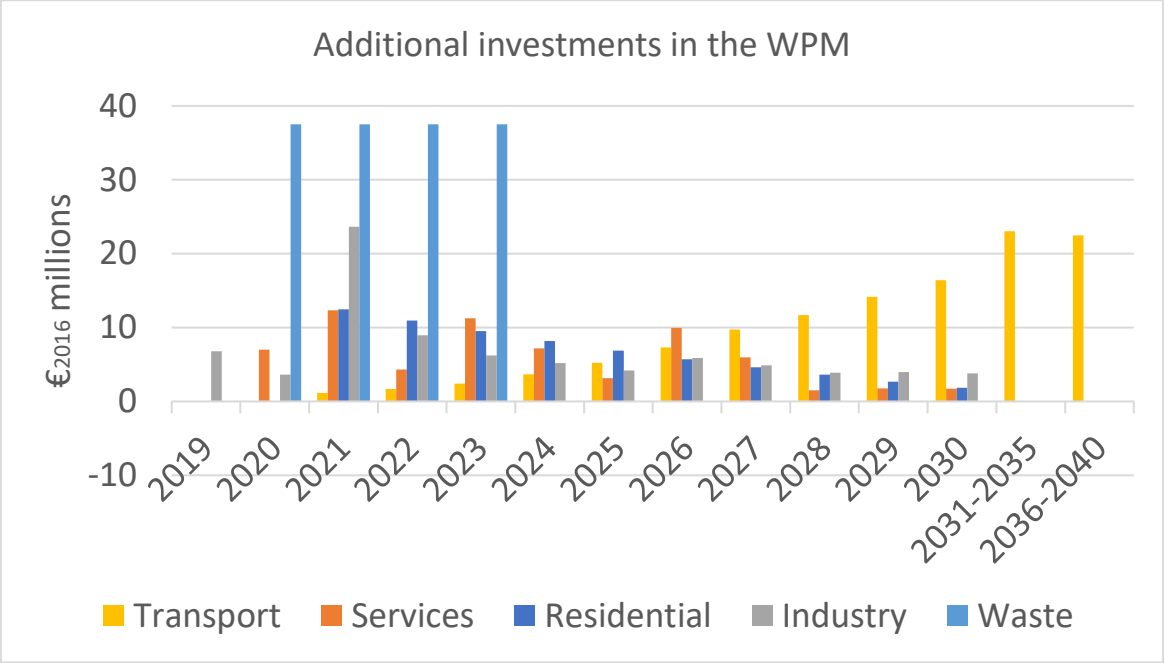
Figure 126 - Investment shares by sector under the WPM scenario (%)



Additional investments in WPM compared to WEM

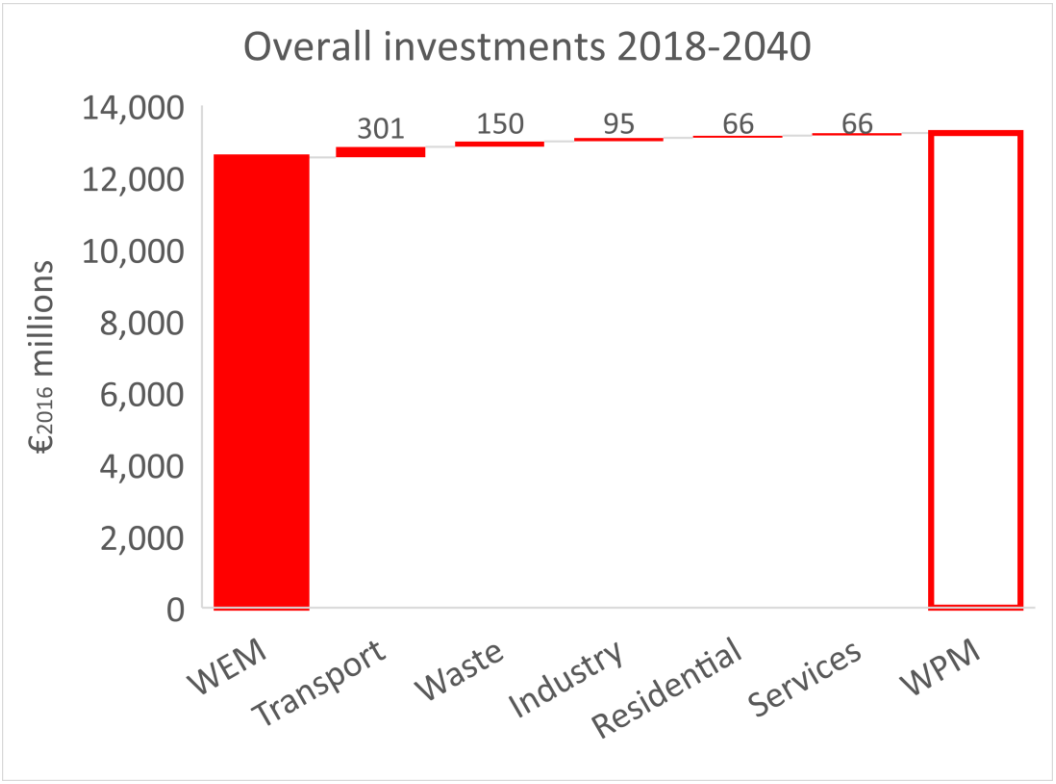
Additional investments under the WPM scenario as compared to the WEM are presented per sector in Figure 127. The largest investment corresponds to the development of the Waste-to-energy facility in the period until 2024. In the short-term, investments are also envisaged in the residential, services and industrial sectors, while the element of electrification of the road transport vehicle fleet will be intensified towards the end of the next decade and beyond. Increased investments in the industrial sector in 2021 and subsequent years can be attributed to envisaged projects in the primary water network and wastewater treatment plants carried out by the government water utility company.

Figure 127 - Additional investments under the WPM scenario



The figure above is supported by the overall discounted investments in the period 2018 – 2040 between the WEM and the additional investments in the various sectors in the WPM, which is illustrated in Figure 128.

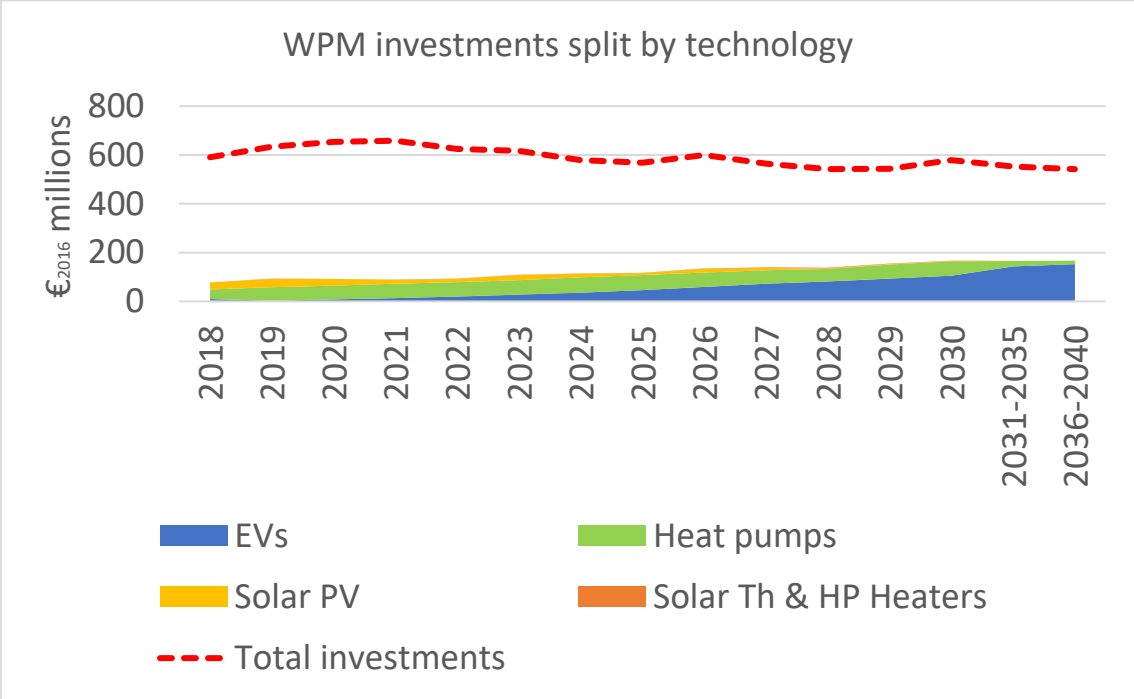
Figure 128 - Overall discounted investments as a difference between WEM and WPM



Investments by technology and technology cluster

The outcome of the analysis of the investment costs in the WPM scenario for a selection of mitigation technologies is illustrated in Figure 129. The investment costs for heat pumps are expected to remain significant and largely stable throughout the projected period. Investments in solar PV technologies are expected to be most prevalent in the first half of the next decade, as towards the end of the decade solar PV will begin to reach its technical potential. In line with the expected total investments split by sector, electric vehicles are expected to assume the role of the largest technology type with respect to investment flows.

Figure 129 - WPM investments split by technology type, 2018-2040



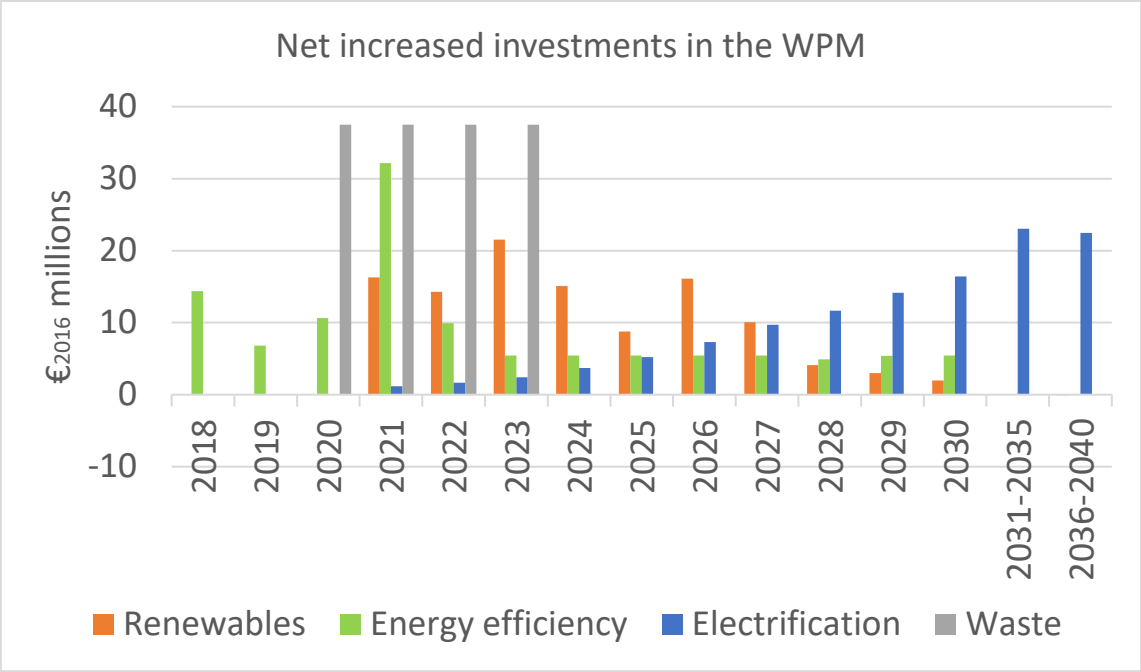
Another element of the analysis of investment costs included observing the expected flow of investments by technology clusters. This required pre-defining the technology clusters, which were split into the following four categories:

- Renewables
- Energy efficiency
- Electrification
- Waste

The net increased investment costs in the WPM split by technology clusters is reported in Figure 130. The spike of net investments under the energy efficiency cluster in the first examined years is attributed to projects in the primary water network and wastewater treatment, complemented by additional investments for the roll-out of more efficient street lighting, expected to be finalized in 2021. The large investment costs in the waste sector is attributed to the development of the Waste-to-energy facility. Renewable technologies will be driven by the availability of financial support and limited towards the second half of the decade by the assumed technical potential. Electrification will

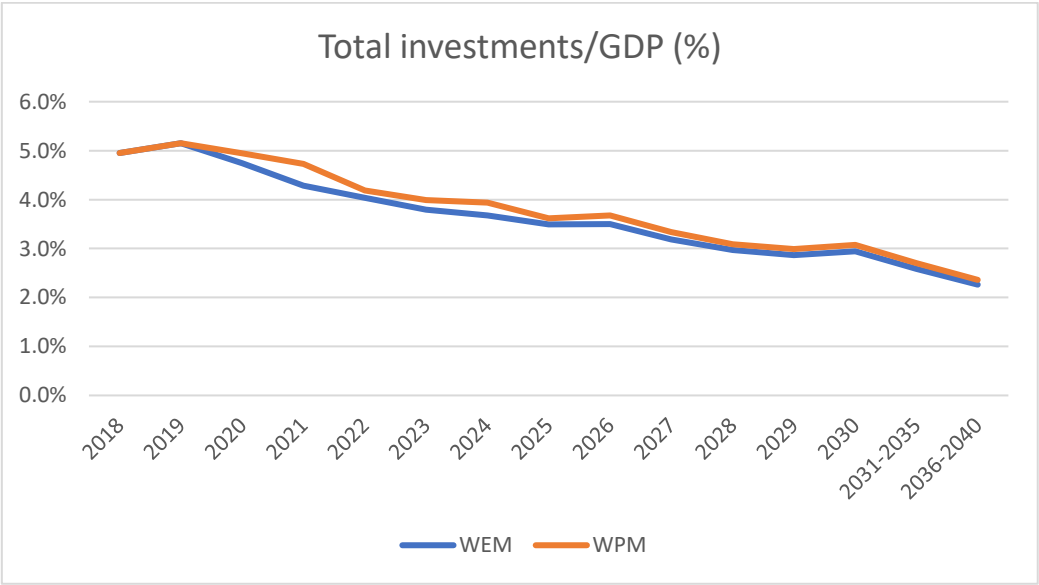
be dominated by the uptake of electric vehicles, linked with the expected increased efficiency as a result of stricter CO_2 regulations.

Figure 130 - Net increased investment in the WPM scenario split by technology cluster



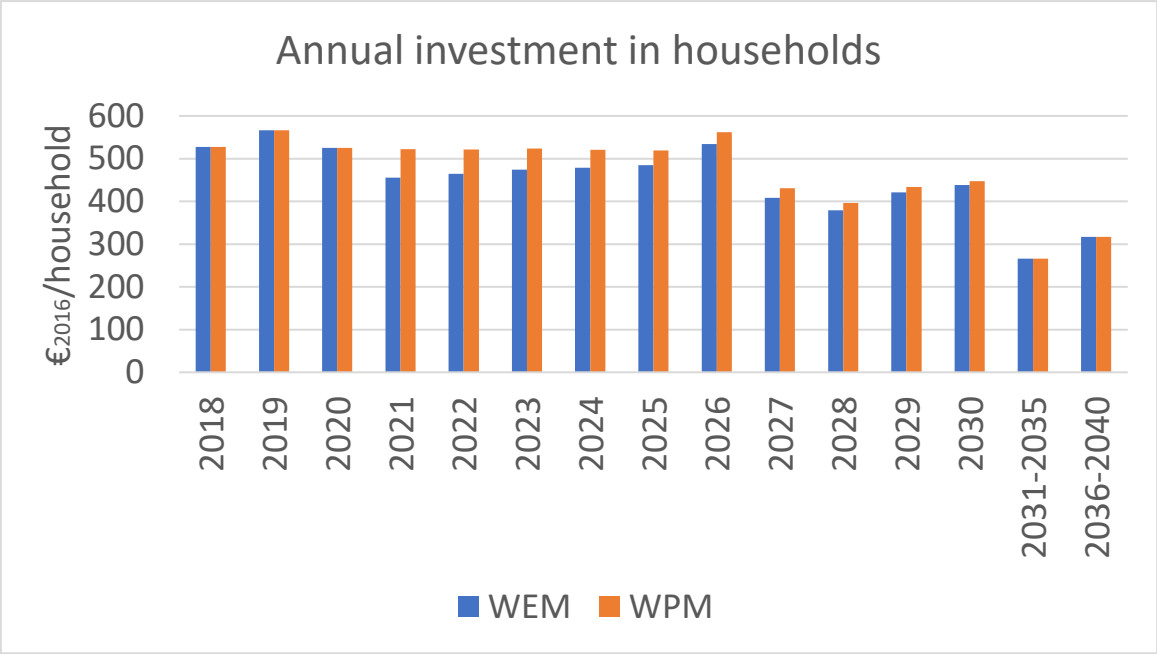
The exploration of investment costs also enabled the comparison of investments in contrast with specific macroeconomic indicators. The share of investment costs as a percentage of Malta's projected GDP for the WEM and WPM scenarios is presented in Figure 131. While at the beginning of the next decade the share of investments will amount to approximately 5% of GDP, it is projected that this share will have a decreasing trend. This should not be read as a decreasing trend in investments in technology change, but rather as continued annual increase in economic growth throughout the projected period.

Figure 131 - Total investments as a share of GDP (%)



The average annual investment per household is illustrated in Figure 132. The average investment per household in the period 2018-2030 under the WPM scenario is estimated to be at 500 €$_{2016}$. Households are expected to invest in the installation of new and replacement of old appliances. As expected, the average annual investment of a representative household will be higher in the WPM scenario when compared to the WEM. This is a result of the uptake of solar PV technology and solar water and heat pump water heaters. The annual investment in households also includes investments in heat pump technology, which remain constant between the WEM and WPM scenario as their uptake is not policy-driven.

Figure 132 - Annual investment in households (€$_{2016}$/household)



In the transport sector, the estimated average investment made by a vehicle owner in the period 2018 – 2030 under the WPM scenario amounts to almost 850 €$_{2016}$. This level of investment cost in the transport sector is expected to be to a large extent sustained in the projected period, primarily as a result of the expected increase of the number of vehicles.

ii. Sector or market risk factors or barriers in the national or regional context

Other than budgetary constraints which might arise when allocating national funds for the implementation of WPM PAMs, no significant risks or barriers are foreseen in terms of the expenditure needed for Government to implement the WPM PAMs. The lack of risks or barriers foreseen should be seen in light of the bottom-up approach Malta has undertaken for the identification of policies and measures falling under the WPM scenario of the NECP. In this sense, the package of WPM measures indicates the projected attained levels in 2030 (in terms of energy consumption, share of renewables, GHG emissions, etc.), as opposed to applying an approach where the setting out of targets in the relevant dimensions would precede the identification of measures to reach this target. Therefore, due to the nature of planned measures which are realistic and considered attainable under current and foreseen conditions, significant barriers or risks posing challenges to their implementation are not expected. Nevertheless, situations might arise where national funding streams would not be sufficient

to ensure the implementation of certain measures or projects and would need to be complemented by EU funding mechanisms.

With regards to the assumed costs related to the natural rate of changes of technologies, it is important to note that Malta is a technology-taker and is therefore highly dependent on how markets operate without having a significant effect to either the demand or supply side. It is therefore worth noting that although how markets are expected to evolve was factored into the assumptions taken when modelling the WPM scenario, Malta has and foresees no power in manipulating markets related to present and future technologies.

iii. Analysis of additional public finance support or resources to fill identified gaps identified under (ii)

Please refer to above.

5.4 IMPACTS OF PLANNED PAMS ON OTHER MEMBER STATES AND REGIONAL COOPERATION

Due to the small nature of Malta's economy and energy system and due to its geographical isolation, which positions it on the periphery of the EU, the impact of Malta's national planned policies and measures, described in Section 3, on other Member States is considered to be practically negligible.

The measure under the WPM scenario with the most significant regional importance is the Malta-Italy gas pipeline project. Should Malta become connected to the Trans-European Gas network via the gas pipeline, Malta would be affected by the application of harmonised transmission tariff structures for gas and thus any developments in the European gas market would affect gas and subsequently electricity prices in Malta. Within Malta's energy modelling framework used for the development of the NECP it is assumed that the Malta-Italy gas pipeline is put into operation in 2025. The impacts of the gas pipeline are described in further detail under the Energy Security and Internal Energy Market dimensions of the Plan.

Given that Malta imports electricity from Sicily through the interconnector, the convergence of electricity prices between Sicily and that of the PUN[108] would ultimately have an effect on electricity prices in Malta. Furthermore, since the Maltese vertically integrated DSO is responsible for both acquiring electricity from local generation capacity and the electricity market in Sicily as well as balancing the Maltese electricity grid, further deployment of solar PV in Malta will also depend on the possibility for the DSO to bid as close as possible to gate closure time.

[108] National Single Price in Italy

ANNEX I – DETAILED SUMMARY OF PUBLIC'S VIEWS DURING PUBLIC CONSULTATION PROCESS

Feedback received during the public consultation process	Malta's comments
GENERAL AND CROSS-SECTORAL COMMENTS	
Malta's Draft NECP did not sufficiently build on previous plans.	The National Energy and Climate Plan replaces previous reporting obligations, such as the National Energy Efficiency Action Plan (NEEAP) and the National Renewable Energy Action Plan (NREAP). These, along with the existing climate-related reporting obligations are now streamlined into one coherent and integrated plan, with the addition of new elements under the Internal Energy Market, Energy Security and Research, Innovation and Competitiveness dimensions. The scope of the NECP is much broader compared to previous sectoral plans in the area of energy or climate.
There was insufficient involvement of NGOs during the preparation of the Plan, further consultation with researchers and academics in the development and execution of PAMs is required.	Researchers and academics, including anyone from the general public was invited to take part in the public consultation process for the NECP. Researchers and academics are being consulted in more detail for the purpose of the development of the R&I strategy in the areas of energy and water management.
Health issues and impacts are not considered in the Plan. Reframing climate change as a public health issue tends to have a greater buy-in from the public.	The impacts of planned policies and measures on health are being considered as part of the Impact Assessment in Section 5.2 of the Plan. As part of this section the macroeconomic, health, environmental, employment, skills and social impacts of the planned policies and measures included are being assessed.
The success of the NECP is dependent on a change in mindset and behaviour of various stakeholders at different sectors, which could be mediated by educational campaigns targeting the various stakeholders	The involvement of stakeholders is duly considered at all stages of the development of the NECP, starting from the drafting stage, at the stage of identification of policies and measures as well as the implementation stage. At the drafting and development stage, an Inter-Ministerial Steering Committee was set

	up to ensure that all national stakeholders and government bodies contribute effectively towards the national plan. The involvement of local authorities, social partners, civil society organisations, the business community as well as the general public was carried out through early stakeholder consultations (bilateral meetings), an official public consultation process on the online government platform and a public consultation event where the Draft NECP was presented. Malta's NECP contains policies and measures which directly target stakeholder engagement, including via educational campaigns. For example, Malta is planning to engage with key stakeholders to encourage their involvement in the increased deployment of renewable energy technologies.
How is the government planning to lead in the areas of green transport, green buildings, RES applications?	In the area of energy efficiency, the Government is committed to lead by example through the implementation of a number of measures to achieve energy savings. These measures include the continued roll-out of energy efficient street lighting as well as projects in the primary water network and wastewater treatment plant by the national water utility company which would improve system efficiency and reduce electricity consumption. <u>Green buildings:</u> Work on the cost optimality studies is underway during 2019 and NZEB obligations beyond 2020 will be identified after their finalization. In the area of Green Buildings, The Building Industry Consultative Council (BICC) has worked in collaboration with the University of Malta and the EU for the exercise of a green rooftop project that was undertaken and studied on the roof of one of the buildings at the University of Malta. <u>Green transport:</u> In the area of green transport, incentives are already being provided for the purchase of electric vehicles. Malta already has an extensive network of public charging points, advantageous incentive schemes for electric cars and scrappage

	grants for old inefficient vehicles. Transport Malta has also extended the current EV grant scheme to be availed by commercial companies with grants ranging up to €200,000 in line with state aid regulations. A fully electric park and ride bus transport in Gozo will also be implemented during 2019. A description of incentives provided in the area of green transport is included under Section 3.1.3. iii on measures to achieve low emission mobility.
Schemes based on tax rebates are not sufficiently attractive in Malta	Based on experiences from a number of ongoing schemes, it is indeed the case that tax credits are not considered as sufficiently attractive, in particular in the area of energy efficiency schemes for industry and services. In this regard, Malta is considering the inclusion of a grant element in future schemes to further encourage and boost measures targeting energy efficiency.
RENEWABLE ENERGY	
Malta's RES target is not sufficiently ambitious. Setting progressive RES targets would kick-start a new business model for Malta which would empower companies to offer installation and maintenance of RES systems in Malta and abroad.	The suggested increase in Malta's RES share is progressive in line with the indicative trajectory. Malta's RES contribution reflects the Government's efforts to fully exploit indigenous RES sources within the present technical and geographical limitations. Growth in the renewables market is expected, including further opportunities for companies offering installation, maintenance and repowering of RES systems. As explained in section 2.1.2.i of the NECP, Malta has numerous limitations with respect to deployment of RES technologies. The relevant circumstances affecting renewable energy deployment taken into account during the development of the Plan are outlined in line with Article 5(1)(e) of the Governance Regulation. As highlighted, Malta's potential for renewable energy deployment is mainly affected by physical and spatial limitations, technological advancement and resource potential, with the availability and cost of land being the predominant restrictions for further deployment. Notwithstanding, PV capacity is estimated to double in 2030 compared to 2020. Thus, even though Malta's RES contribution in terms of increase in RES share seems low, efforts by Government will be ongoing. To note

	that the RES share also depends on energy demand increase, which is expected to increase rapidly in the next decade based on the current demographic and macroeconomic trends and projections.
Alternative sources of RES, such as wave, wind and off-shore PV need to be considered. Investments in small wind project prototypes should be prioritized.	Article 5(1)(e) of the Governance Regulation requires Member States to indicate in their NECPs the relevant circumstances affecting renewable energy deployment that have been taken into account. The Plan explains why sources such as wind and wave technology are not included in the current plan for the period 2021-2030. Due to restrictions imposed by bathymetry, intensity of commercial activity, concentration of marine protected areas, conventional off-shore wind energy cannot be considered economically, socially or environmentally viable at the current technological state. Nevertheless, as explained in Malta's Plan, the Government is committed to continue and monitor developments primarily in floating off-shore solar PV and wind technologies. If deemed viable during future assessments, these technologies might feature in future updates of Malta's NECP. Additionally, wave technology is not expected to make any contribution towards Malta's 2030 RES target as a result of technology readiness, reliability and affordability.
Economic incentives, such as subsidies to initial capital investment, improved FIT and ad-hoc grants could secure a safe uptake of RES, especially by households and the private sector. It is important that already existing grants, such as the Feed-in-tariffs are continued and enhanced.	Grants for households and other support schemes for non-households are already included in the NECP. In view 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 households and private investors to opt for renewables. A wide range of economic incentives is therefore explored. For example, the Government is planning to engage in discussions with banks to include economic incentives in loan policies for the installations of RES technologies. Additionally, further capital grants are explored which would provide support for the installations of solar water heating systems, as well as discussions with the relevant stakeholders on incentive schemes for the installation of PVs on new or newly refurbished buildings and offices. The framework for economic incentives targeting RES is already robust.

A system of penalization of users of 'dirty fuels' in the industry sector is required to incentivize RES.	The Government is currently assessing policy options for consumers of fossil fuels (excluding LPG) which are used for heating & cooling and industrial processing.
Establishment of a one-stop-shop for RE incentives, schemes and technical advice should be considered.	In line with the RED recast, Malta has initiated discussions with the relevant stakeholders on how to facilitate the application process for future RES installers. In the area of Solar PVs, a system of fast-track permitting, taking the form of a notification process was adopted by the Regulator (REWS). The Government also intends to adopt a simplified procedure for repowered systems of larger capacity.
Joint RES projects with other Member States should be prioritized over statistical transfers as they can have the added benefit of mobilizing and improving the economy.	Exploitation of all viable indigenous sources of RES will be prioritized. Nevertheless, Malta will consider joint projects as well as other possibilities, such as tapping into the EU renewable energy financing mechanism proposed within the Governance Regulation. The purpose of the financing mechanism will be to provide a voluntary option to Member States for gap-filling on the road to the Union's 2030 target, but also a tool to tender support for new renewable energy projects in the Union. In case Malta will need to use the RES financing mechanism, all costs and benefits will be considered. Priority will be given to the financial situation.
The Government should consider issuing a call to suppliers of Solar Water Heaters and guarantee a number of grants through a best-price process.	Currently households can benefit from a grant scheme when buying a SWH. In order to be eligible for the SWH grant scheme, suppliers need to register their products/systems with REWS.
Energy community incentives, such as purchasing of PVs or roof-space are necessary to give power to the community to be able to produce its own energy. Solar PV farm schemes should be extended to citizens who will be given the opportunity to invest.	During 2018, work on the Government's first communal solar farm project at the site Il-Fiddien was completed. A total of almost 1MWp of virtual PV capacity was made available for households and within a few days, the scheme was fully subscribed. Following the success of this project, the Government encourages 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.

	The Government is assessing various options on how to encourage the uptake of other RES and energy efficient technologies, apart from solar, for consumers without access to a private roof to participate in the shift towards renewable energy generation.
ENERGY EFFICIENCY	
Draft NECP lacks serious approach in addressing energy efficiency on the demand side and there are no effective incentives for energy savings or curbing future energy consumption. Energy efficiency measures in the commercial sector are not sufficiently addressed. Plan misses the opportunity of mobilizing new local markets to invest and propel energy efficiency	A major scheme addressing energy savings in industry and services is included in the plan. 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. Increasing population, growing demand in the housing market and the growth of tourism are indeed making it difficult to restrain the increase in energy consumption. Although there is an element of decoupling between energy and GDP, increasing energy demand in absolute terms is expected to continue post-2020 mainly due to the expected increase in population. However, due to technological improvements and various measures, the energy intensity of Malta is projected to improve. Heavy consumers of energy in the industrial and services sectors are targeted through regulations and voluntary agreements which encourage the adoption of energy efficient technologies. A new energy cluster launched by stakeholder organisations will bring together experts, suppliers, and clients in order to facilitate knowledge transfer, exchange of best practice and help identify solutions to challenges that businesses are facing on energy. The aims of this cluster include supporting increased take up of energy efficiency projects in businesses; supporting businesses in decreasing their utility bills and acting as a catalyst for increased business action in the area (energy efficiency).

INTERNAL ENERGY MARKET, SECURITY OF SUPPLY, RESEARCH & INNOVATION AND COMPETITIVENESS	
Future plans for a gas distribution network to serve domestic users after the commissioning of the gas pipeline. The gas pipeline project should be discontinued forthwith due to high security, high ecological, high technological and high governance risks. Instead, the same level of financial commitment and enthusiasm should be directed towards emerging sustainable options to build a long-term sustainable energy future for Malta	The Melita TransGas Pipeline (MTGP) project would end Malta's isolation by connecting the island to the trans-European Natural Gas Network and so, allowing the transportation of gas from the Italian gas network necessary to meet Malta's gas demand for power generation and possible future inland market. MTGP Project poses a means to fulfil EU strategic energy policy goals on energy solidarity between Member States, the formation of an Internal Energy Market, diversification of sources, reduced dependency on a single supply source and improved energy security. The gas pipeline would replace the Floating Storage Unit of LNG which is currently being used for the supply of gas for electricity generation. This seeks to enhance Malta's energy supply security and economic competitiveness and to contribute towards the reduction of GHG emissions as the current need for liquefaction, shipping and regasification would be eliminated. In parallel, the Government is continuing its efforts to support sustainable renewable energy and energy-efficient technologies.
Battery storage systems should be considered for security of supply reasons	Battery storage solutions are being studied by both Government and Enemalta. Utility scale battery storage is being studied not only for security of supply reasons, but also with respect to grid stability considerations, which is currently one of the barriers limiting Malta's renewable energy potential post-2020. Investments in storage infrastructure will facilitate further deployment of renewable energy. For instance, potential schemes for investment in battery storage systems in households can be expected to increase the share of self-consumed renewable electricity, which would then curb the impact on the low voltage network and in turn smoothen the demand.

The liberalization of Malta's energy market. One has to consider the interests of the electricity and business markets and not only the interests of protecting the sole electricity supplier	The new EU electricity market Directive (2019/944/EU) for the period post-2020 grants Malta derogations related to third-party access (Article 6), unbundling of DSOs (Article 35) and Ownership unbundling of transmission systems and transmission system operators (Article 43). Article 4 (free choice of supplier) shall not apply to Malta until 8 years after the entry into force of Directive. That period may be extended for a further additional period, not exceeding eight years. Derogations applicable to Malta are outlined in Article 66 of the Directive.
The progressive rising block residential tariff should be tied to the number of people in a household	Residential tariffs are tied to a number of units within each band. However, residential consumers benefit from an eco-reduction scheme, which is a scheme whereby the household benefits from a reduction if the number of units consumed per person is not superseded.
Smart meters currently do not provide any useful information to users and do not enhance energy efficiency	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. Whilst the use of a smart meter eliminates manual meter reading by the utilities and eliminates the need of estimated bills, further measures are needed to improve the possibility of offering detailed feedback on energy use to the consumer and useful information to adjust consumption habits. The deployment of new smart meters and replacement of old inefficient smart meters will continue post-2020 in line with the requirements of Articles 19 and 20 of Directive (EU) 2019/944 on common rules for the internal market for electricity. Smart metering systems will have to comply with the minimum functional and technical requirements and provide final customers with information on actual time of use and real-time consumption data in order to support energy efficiency programmes as well as demand response.

The energy poverty assessment made in the document contradicts EU studies and should also include the inability to cool in summer to reflect the situation in Malta Low-income households need to be put front and centre when designing policy	The MT assessment is based on one of the four primary indicators available on the EU Energy Poverty Observatory and is line with EU studies and official data cited by the European Commission. The Energy Poverty Observatory also includes an indicator on whether the dwelling is comfortably cool during summer time, however, the only data point based on the SILC study is from 2012 and doesn't capture recent trends, such as the significant increase in the deployment of air-to-air heat pumps in households which significantly improved the thermal comfort in the summer period. In the European Commission's Communication on the assessment of Member States' Draft NECPs[109] the Commission acknowledged the good level of detail provided in Malta's assessment of energy poverty. The underlying energy policy rooted at the core of Malta's NECP is the necessity to ensure affordable, sustainable and secure forms of energy for Maltese citizens and businesses. Low income households are included in MFCS' list of priorities. Malta's commitment to reduce poverty and social exclusion is reflected in the National Strategic Policy for Poverty Reduction and for Social Inclusion 2014-2024. Section 4.5.4 of the NECP also outlines the existing national policies and measures focusing on fighting energy poverty and supporting low-income households.
More funding for energy and climate research is required. Malta could become a hub for testing of advanced low-carbon technologies. Future research should focus on areas such as distributed ledger technology in energy trading or deep off-shore wind technology.	In order to strengthen and encourage further research in low-carbon technologies, Malta is developing a sector-specific National Strategy for Research and Innovation in Energy and Water for the period 2021-2030. This document will outline priority areas for research under the theme of energy and water, based on ongoing consultations with experts in industry and academia, key stakeholders and the public. It is expected that the sector-specific Strategy will be implemented through periodic action plans, the first being published by the end of 2020.

[109] Communication from the Commission COM(2019)285: '*United in delivering the Energy Union and Climate Action – Setting the foundations for a successful clean energy transition*'. Page 20.

TRANSPORT-RELATED COMMENTS	
Malta's planning is focused on the use of individual cars and currently ongoing infrastructural works only aggravate the situation. There are no alternative options for public transportation, whilst modal shift is not being incentivized.	There is a network of public transport ferries and buses which is extensive, one of the most extensive public bus transport systems in Europe. Modal shift is being incentivized but not disincentivised. Incentives include free public transport for various users and reduced fares for others, integrated ticketing, VAT and other fiscal incentives for bicycles, pedelecs etc, also incentives for the purchase of electric cars. One might say that the market is saturated with incentives but has no disincentives.
Support for a mass-transit system whereby the benefits of such a system for the citizens (i.e. CO2 emission reductions, reduced energy use, health benefits and improvement in the image of the country) overweigh an assessment strictly on financial feasibility	In the Strategic Plan for Environment and Development (SPED), spatial planning is seeking to accommodate socio-economic development in those parts of the Urban Area well served by public transport and existing infrastructure, to contain urban sprawl and minimise the need to travel. The SPED has designated a hierarchy of urban areas which includes a Principal Urban Area to accommodate major employment, social and residential development needs. This approach has the intention of supporting the creation of a critical mass to enable a feasible mass transit system. However, the critical elements to create the critical mass are population and economic growth. The Government of Malta has already expressed its commitment to invest in mass-transit systems that are environmentally and financially sustainable. In fact, several preparatory studies are currently being compiled. Infrastructure Malta is committed to continue supporting all upcoming planning and implementation phases of the introduction of such systems, in collaboration with other entities and authorities.
Unwanted modes of transport should be taxed, while others such as electric vehicles should be incentivized. Malta, due to its size could be a role-example in the area of electrification of transport. The implementation of EVs in high-usage fleets (i.e. taxi operators, buses,	This is already the case, incentives are provided for the purchase of electric vehicles. Furthermore, the slow death of the diesel vehicle has already begun with many European cities not allowing them in their streets. The Maltese market will eventually respond when demand diminishes and production will be stopped due to lack or drop in sales. Malta already has an extensive network of public charging

rental cars, tourist transport) tied with initial government support should be considered to ease the transformation.	points, advantageous incentive schemes for electric cars and scrappage grants for old inefficient vehicles. Transport Malta has already extended the current EV grant scheme to be availed by commercial companies with grants ranging up to €200,000 in line with state aid regulations. Fully electric park and ride bus transport in Gozo will also be implemented during 2019.
There should be incentives for the charging of electric vehicles from renewable energy sources.	Enemalta is in the process of studying and assessing different policy and technical options for the charging of electric vehicles in households. The outcome of this study will be a system for charging that would facilitate and promote further deployment of electric vehicles in line with the Government's policy in the area of low-emission mobility.
The electrification of private vehicles is not a solution as it will only be beneficial from an air pollutant standpoint and these vehicles will be charged from a grid reliant on non-renewable energy.	The road to decarbonization by 2050 will inevitably require a push by all the relevant sectors. The electrification of transport via the introduction of electric vehicles and the electrification of industrial and services sectors will have to be strengthened in conjunction with increased deployment of renewable sources of energy. The electrification of private vehicles will be supported by other policies and measures targeting the modal shift to alternative low-emission modes of transport. Nevertheless, electrification of the transport sector in itself is expected to lead to a significant reduction of CO2 emissions.
Government work in past years to reduce emissions from transport is non-existent, while existing policies and projects continue to increase overall emissions from transport	Notwithstanding a number of fiscal measures, such as the registration tax and road circulation fee, emissions from the ageing vehicle fleet remain an issue. Effective measures have been taken in the renewal of the public transport fleet. Currently, the government is studying measure to reduce emissions from road transport and the move towards non-ICE vehicles.
The majority of newly registered vehicles are second hand imports, which doesn't contribute to increasing of efficiency and decreasing of	Government ensures that such second-hand car imports are in line with EU Regulations and Standards and they contribute to the faster replacements of older vehicles due to affordability by the consumer.

age of the stock of vehicles in Malta. How does the government plan to address this phenomenon?	
TEN-T projects marginalize and discourage the use of walk and bicycle lines and do not contribute to achieving climate targets	Where space permits, new infrastructure to encourage modal shift is being integrated in the majority of the TEN-T projects being planned and implemented by Infrastructure Malta. In fact, through ongoing and upcoming investments in road infrastructure (such as the Marsa Junction Project, the reconstruction of Triq Hal Luqa, Triq il-Buqana and Triq Hal Qormi, and the new Santa Lucija Tunnels and Central Link Project) Infrastructure Malta is introducing safer bus laybys, over 12 kilometres of new cycle tracks, mostly segregated, and many more kilometres of new footpaths. Infrastructure Malta is also investing in the introduction of several new pedestrian bridges, as a safer alternative to existing pelican crossings which put pedestrians at a greater risk of accidents and other consequences. Moreover, a 2019 analysis of seven of Infrastructure Malta's ongoing and upcoming arterial road projects will lead to a 62,000 tonne reduction in carbon dioxide emissions every year, for the next 25 years.
The Plan does not provide references to any plans for LPG and natural gas used for heavy duty transport.	A study commissioned by the Ministry for Transport and Infrastructure is underway. The Clean Fuels Infrastructure Directive requires the introduction of infrastructure for CNG by 2020 and LNG by 2025 if economically feasible.
Use of hydrogen for big machinery and in the maritime sector should be considered	Malta believes that the electrification of transport is the solution to achieve a viable and sustainable future transport system. Hydrogen Fuel Cell Technology is expected to power larger electric drive trains used for trucks and buses while Battery Electric Vehicles will power passenger cars. In this regard, the Ministry for Transport and Infrastructure together with Transport Malta will pursue future technology developments and facilitate demonstration and lighthouse projects accordingly. The Malta National Hydrogen and Fuel Cell Technology Innovation Programme (MNHFCTIP) will be part of the Malta National Electromobility Action Plan which will step up its efforts to promote battery and all-electric drive

	technologies. The Government will also follow technological developments in Hydrogen Fuel Cell Technology applications for the maritime sector.
The government should consider the introduction of tele-working for its employees (i.e. 2 days/month for each employee) to decrease traffic and congestion whilst promoting more efficient working practices.	The proposal for teleworking is one which is viewed very favourably Government wide, since it falls within Malta's environmental and traffic policies, and contributes towards the creation of a better work/life balance. In fact, statistics show that within the public sector, teleworking is constantly increasing.
BUILDINGS-RELATED COMMENTS	
The area of energy performance of buildings is lightly considered in the Draft NECP.	A new building code for the Maltese Islands is currently being drawn up and being supported by a working group on Energy efficiency and energy conservation, Smart Buildings. Deep energy retrofits that save more than 70 % of the current energy usage are being considered. In addition, Government is also looking into the gathering of energy and its reuse at peak times together with other initiatives.
The government should consider incentives to promote green rooftops and energy-efficient buildings. Green rooftops can be beneficial for stabilizing indoor temperatures.	The Building Industry Consultative Council (BICC) has in fact already worked in collaboration with the University of Malta and the EU for the exercise of a green rooftop project that was undertaken and studied on the roof of one of the buildings at the University of Malta. The exercise was a success with much information obtained on the quality of species that would be used in such a project and the implementations of the plant boxes without causing any damage or maintenance obstacles to the roof.
NZEB obligations beyond 2020 are not addressed in the NECP, while Technical Document F is not being enforced on new buildings.	Work on the cost optimality studies are currently underway and before these are finalized it would be premature to identify NZEB obligations beyond 2020. Government believes that the professionals concerned, i.e. architects and engineers, are in the best interest of their clients applying the provisions of technical document F on new buildings. Furthermore, legislation places substantial fines in the case of defaults.
The first draft of the Long-term renovation strategy (LTRS) should be included in the Plan by the end of 2019. This strategy is a key opportunity to make buildings more energy-positive.	The LTRS is an obligation of Directive 2018/844, Article 2a, and the deadline for the submission of this strategy is 10 March 2020. The Ministry for Transport will be submitting the strategy by this date.

The enforcement of energy efficiency measures in new buildings must be strengthened. The insulation of single walls, either limestone or hollow concrete block could result in significant energy savings and could ensure a reduction in heating and cooling requirements.	This issue will be addressed when the new Building & Construction Authority will be statutory and established, and the respective Enforcement Directorate will start effectively functioning and monitor the element of energy efficiency in buildings.
The Plan should consider the introduction of obligations for new and refurbished dwellings to install renewables.	The priority of compliance is related to sustainability, especially, where there is much waste of energy and safety requirements for the general public. The BICC in its working group 'Regeneration of property' is currently discussing how older buildings can get incentives for retrofitting and is offering courses in the maintenance of older properties. The courses are led by experts that explain what materials should be used for alterations, maintenance and modernization. The BICC is currently working on a launch of a book that discusses in detail how older buildings could be renovated in a sustainable manner using green passive systems.
More space should be allocated for the installation of Solar Water Heaters on residential rooftops. The integration of SWHs in new high-rise buildings needs to be considered at the design stage. This should be a mandatory requirement in all new buildings for the placing of a solar water heater. If most buildings had a SWH system the load on the power station would be considerably lower. Building-integrated PVs should be considered in the Plan.	The allocation of roof-space for the installation of SWHs is presently being discussed in a wider context and is expected to be emphasised even more with the setup of a regulatory body for building sector. The possibility of solar PV cladding on the exposed sides of high-rise and mid-rise buildings is a relatively new concept that is being developed. Building-integrated photovoltaics (BIPV) may be considered by the Government in the future pending the economic viability of the technology. Currently, the price of active facades and rooftops per square meter remains relatively high which hinders the wide-spread use of such technologies in the construction industry.
The integration of RES in buildings needs to be made more financially attractive from a developer's point of view.	RES systems are often interpreted by developers as solar PV cells. There are many more initiatives that can be taken at an early design stage to make the building more energy efficient. There are a variety of passive cooling systems that can be incorporated at building stage with no or little cost difference. Should the

	developers not incorporate the RES system, the building should, at least, be built in a method that facilitates the implementation of the same at a later stage.
The issue of solar rights has not been addressed.	Although not featured in Malta's NECP, the issue of solar rights is being followed by the Government with potential solutions being assessed.
CLIMATE AND GHG EMISSIONS COMMENTS	
The level of progress towards the -19% ESR target is not explicitly explained in the Plan. The Plan needs to address mitigation and adaptation to climate change and acknowledge that climate change is affecting Malta, both in terms of energy demand as well as in terms of the negative effects on the environment, health and other sectors.	The draft NECP had pending issues on sectors, namely the transport sector, the responsibility of which falls under the respective Ministries. The gaps were addressed in the final plan. The Ministry for Environment, Sustainable Development and Climate Change (MESDC) is currently in the process of assessing the mitigation potential of all sectors through the LCDS to ensure compliance with the ESR regulation. This strategy will aim to consider national circumstances and realities, especially those aspects that link socio-economic development with climate action to better identify the sectors with the highest mitigation potential, followed by the attribution of sectoral targets. A roadmap of implementable measures addressing the various sectors will be charted out to transition towards decarbonisation of Malta's economy by 2050. Malta is committed to fulfil the scope of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action.
Malta has failed its emission reduction targets and is the only Member State which has had to purchase allowances.	Malta has always complied with the Regulation by using the tools provided for all Member States within the same legal instruments.
Doubts about projections in relation to CO_2 emission reductions given the current rate of car use and increased car ownership per capita	The modelling framework used in the development of Malta's Draft NECP was updated and revised during the course of 2019. Technical assistance provided through the Structural Reform Support Service (SRSS) focused in part on the peer-review of the existing modelling framework, including a model used to project road transport fuel consumption. After thoroughly reviewing and updating the models methodology, it was deemed that CO_2 emission reductions were not an accurate representation of real-life conditions. This resulted in an underestimation of fuel

	consumption in projected years. Updates to the model ensure that fuel consumption factors used are based on real-life conditions faced by the Maltese vehicle stock. The updated set of projections, both for the WEM and WPM scenarios feature in Malta's Final NECP.
The maritime sector is an enormous polluter and therefore regulatory measures are required to allow only vessels meeting specific 'green' standards to enter MT ports	Under the provisions of the Effort Sharing Regulation, the maritime sector, except for Malta to Malta, is not taken into consideration. It is important to note that shipping and maritime is vital for Malta's socioeconomic wellbeing. Apart from tourism, Malta imports all essential commodities. Additionally, there are already measures in place to ensure the reduction of pollution, with some measures enforced and other planned, such as: • Sulphur Directive 2012/33/EU allowing the use of marine fuel with a maximum 3,50% Sulphur content, whilst vessels at berth to use 0,10%. • The 2020 global reduction in sulphur content of marine fuel from the current 3,50% to 0.5% in line with MARPOL Convention Annex 6 and Directive 2012/33/EU • Ship-Source Pollution Directive criminalizing pollution from vessels, including negligence (Directive 2005/35/EU) • Monitoring, Reporting and Verification of Carbon Dioxide Emissions from Maritime Transport Regulation (EU) 2015/757 • Ports Regulation – Regulation (EU) 2017/32 enshrining the principles of environmentally sustainable port operations and introducing environmental charges/dues • Alternative Fuel Infrastructure Directive 2014/94/EU All vessels in Maltese ports to which the above applies to must follow the provisions of these Regulations.

Polluter-pays principle needs to target businesses since they, through the services sector, are the second main energy consumer after transport	The current legislative framework in itself enshrines the PPP. The most relevant example being the emission trading scheme, which covers all non-renewable electricity production in Malta. In the area of road transport, there is a registration tax and an annual circulation tax which is founded on the polluter pays principle as it's based on the length of the vehicle and CO2 and PM emissions of the vehicle. Private companies can benefit from up to 200,000 EUR in cash grants to change their car fleets.
Employment of green infrastructure (GI) in urban and rural settings is required to mitigate climate change.	The GI aspects will be considered under the climate change adaptation. Afforestation projects embarked upon by the Ministry contribute albeit minimal to climate mitigation.
In the area of agriculture more sustainable farming practices are needed, support needs to be provided for farmers to move away from animal husbandry and into plant-based agriculture. The government should also promote the consumption of local vegetables.	Measures regarding sustainable farming practices and the promotion of local produce are catered for under the National Agricultural Policy for the Maltese Islands for 2018-2028.

ANNEX II – NOTIFICATION OF DETAILED METHODOLOGY TO IMPLEMENT ARTICLE 7 OF DIRECTIVE 2012/27/EU

Pursuant to point 5 of Annex V to Directive 2012/27/EU for the operation of the energy efficiency obligation schemes and alternative policy measures referred to in Articles 7a and 7b and Article 20(6) of that Directive, Member States shall notify their detailed methodology.

The notification will be submitted to the European Commission together with Malta's Final NECP in the suggested excel template format.