

THE NATIONAL RENEWABLE ENERGY ACTION PLAN

2015 - 2020



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LIST OF ABBREVIATIONS

ARMS	Automated Revenue Management Services
CHP	Combined Heat and Power
DSO	Distribution System Operator
EU	European Union
FIT	Feed-In Tariff
kWh	kilowatt hour
kWp	kilowatt peak
LN	Legal Notice
MEPA	Malta Environment & Planning Authority
MML	Mott MacDonald
MRA	Malta Resources Authority
MS	Member State
NREAP	National Renewable Energy Action Plan
NEP	National Energy Policy
NSO	National Statistics Office
PA	Planning Authority
PV	Photovoltaic
UCO	Used Cooking Oil
RE	Renewable Energy
RES	Renewable Energy Sources
REWS	Regulator for Energy and Water Services
SWH	Solar Water Heater



KONRAD MIZZI

MINISTER - OFFICE OF THE PRIME MINISTER

We are all living in a challenging world. A world where changes occur at a fast rate. Not all of these changes contribute to long term benefit of mankind. Climate change is probably the most evident and dramatic effect and is largely attributed to anthropogenic carbon emissions which accumulated since the onset of industrialisation.

The global response to Climate Change at the recent COP21 meeting held in Paris culminated in a legally binding treaty on climate action which contains emission reduction commitments from 187 countries starting in 2020. The European Union has always been on the forefront in the battle against Climate Change and has set itself a number of headline targets for 2020 and as of 2014, also for 2030. These include targets for energy efficiency, greenhouse gas emissions and renewable energy. Malta is also committed to contribute towards this concerted effort and in this context the present government has entrenched at the core of Malta's energy strategy the necessity of providing Maltese citizens with affordable, sustainable and secure forms of energy.

Malta's energy strategy is being implemented through a clear roadmap which includes a number of important milestones. These include:

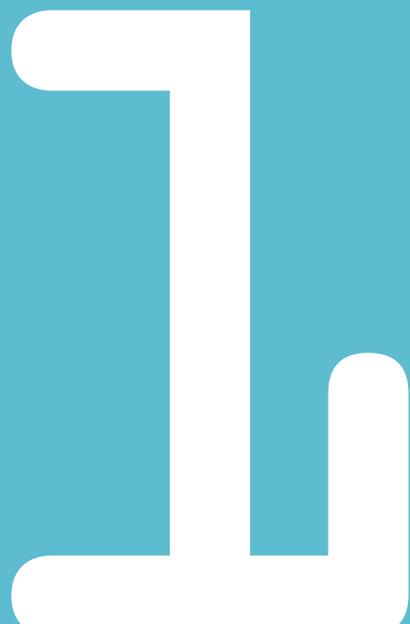
- a. Switch from heavy fuel oil to a much cleaner fuel, natural gas;
- b. Upgraded and more efficient generation capacity to ensure sufficient electricity to meet future demand, increased efficiency and significantly lower emissions;
- c. interconnection with mainland Europe for both electricity, which was energized in 2015, and also through a planned gas pipeline, which the European Commission has recognized as a Project of Common Interest;
- d. Support for renewable energy and energy efficiency projects to meet the 2020 targets and beyond.

These measures cannot be considered in isolation as they form part of a holistic strategy for a better and healthier environment, energy security and cheaper energy. Malta had already submitted to the European Commission a plan to meet its 2020 renewable energy targets. However, by 2013 it was already evident that this plan was at risk of being heavily derailed given that all three major Wind Projects faced significant environmental, social and technical concerns. Meanwhile photovoltaic technology was revolutionizing the renewable energy world with advances in efficiency and rapid reduction in panel prices. All this in the context of our island which is blessed with ample all-year sunshine and, as studies confirmed, limited potential for wind energy development.

This has prompted the government to launch a revision of the original NREAP to delineate a new, effective and cost efficient route towards achieving the 2020 and interim renewable energy targets. This involved extensive review of studies and commissioning of new ones, collection of data and analysis and assessment of various technologies. This will result in maximising Malta's renewable energy potential.

It is with pleasure that we present this updated National Renewable Energy Plan which will deliver greener future for the Maltese Islands.

In 2015, the Government of Malta has met the interim target for renewable energy. The implementation of this plan will sustain the momentum to achieve our 2020 targets and enhance our environment.



INTRODUCTION
TO THE
NATIONAL
RENEWABLE
ENERGY
ACTION PLAN



1.1 INTRODUCTION

Malta's National Renewable Energy Action Plan has to be viewed in the context of Malta's Energy Policy.

The main objectives of the national energy policy are:

- Promulgating energy efficiency and affordability
- Ensuring environmental sustainability
- Achieving security of supply

These objectives are consistent with the European Union (EU) policy, and in line with the Energy Union Package¹ which is based on five dimensions as follows:

- 1 Energy security, solidarity and trust
- 2 A fully integrated European energy market
- 3 Energy efficiency contributing to moderation of demand
- 4 Decarbonising the economy
- 5 Research, Innovation and Competitiveness

Renewable energy features prominently in Malta's Energy Policy. It delivers benefits on its own merits and its adoption in the country's energy economy is a national legal and moral obligation. Concerted efforts and significant investments are needed to achieve the set targets sustainably and efficiently, and so a carefully-considered knowledge-based action plan is necessary to ensure efficient use of resources.

1.2. BACKGROUND

1.2.1 The NREAP at the European level

The penetration of renewable energy sources (RES) according to agreed targets and timelines is given great importance by the European Union. Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources requires that Member States should achieve a share of energy of the gross final consumption from renewable resources. As per Annex I of this Directive, Malta has the obligation to achieve a 10% target for the share of energy from renewable sources in the country's gross final energy consumption in 2020. This gross final energy consumption includes energy consumed in transport, electricity, heating and cooling. A separate target of at least 10% RES share in the final consumption of energy in transport is also applicable.² Member States were required to adopt and publish a NREAP by 30 June

¹ http://eur-lex.europa.eu/resource.html?uri=cellar:1bd46c90-bdd4-11e4-bbe1-01aa75ed71a1.0001.03/DOC_1&format=PDF

2010³, indicating the local measures for uptake of renewable energy, certain energy efficiency strategies and any other measures required to reach the final target and intermediate trajectory, including cooperation with other Member States in joint projects, statistical transfers, joint support schemes as well as joint projects with third countries. Malta's National Renewable Energy Action Plan (NREAP) was first submitted in July 2010 and subsequently resubmitted in May 2011.

1.2.2. **A relevant up-to-date plan for Malta**

The implementation of Malta's National Energy Policy and NREAP has been re-assessed. This led to far-reaching initiatives that cover conventional energy (derived from fossil fuel) that in themselves impact RES, and other proposals that cover renewable energy directly.

The experience gained over the last years and the results of studies that have recently become available have indicated that a review of the NREAP is due. In this revision of the NREAP, as always, a holistic perspective of the energy sector will be retained.

This document presents a revised National Renewable Energy Action Plan for Malta, incorporating new priorities, projects and initiatives put forward for the energy sector.

1.3. **OBJECTIVES OF THE PLAN**

The objectives of this document are:

- to define a clear and knowledge-based roadmap of how the country intends to meet its RES obligations by 2020, and the trajectory in getting there;
- to provide the information, background and explanations into the context within which the Action Plan is relevant, as well as the characteristics of the various RES technologies from Malta's perspective, such that the choices made are seen to be justified;
- to provide a platform for meaningful consultation, through dialogue and input by stakeholders and the general public.

² Article 3 (4) of the Directive 2009/28/EC

³ Article 4 (2) of the Directive 2009/28/EC



1.4. SCOPE OF THE NREAP

The NREAP sets out the RES mix that is expected to deliver the 10% target by 2020, the trajectory towards 2020 and the measures to deliver results. The principles that guided these choices are also explained.

Current assessments of technologies and mechanisms that contribute to the RES targets, as well as other influences which ensure that the plan delivers, are considered in the NREAP. The document also discusses other technologies that are no longer being pursued due to various reasons, including technical, environmental and economic. Ultimately, the technologies and mechanisms considered in this action plan include:

Indigenous RES
RES - Electricity
Photovoltaic (PV) systems
Micro-wind
Waste-to-energy (electricity)
RES - Heating & Cooling
Solar water heaters
Waste-to-energy (heat)
Heat pumps
RES - Transport
Biodiesel produced locally from used cooking oil (UCO) and animal fats
Imported RES
Biomass imports
Biofuel

Further to the technologies/mechanisms considered, support through horizontal actions includes:

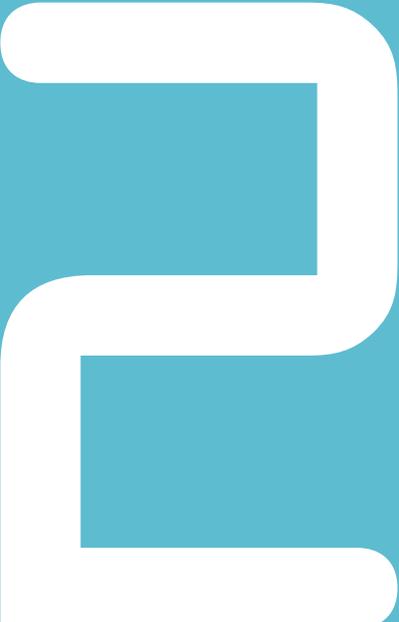
- Research and development;
- Public awareness and education;
- Participation in international fora.

In order to establish a level of comfort, whereby measures proposed in the NREAP document are realistic and the resources required attainable, other aspects tied to the implementation of renewable sources have been considered:

- economic concepts and data backing the NREAP;
- how RES features in other major national policies;
- timelines, funding requirements and entities responsible for implementation.

1.5 TIME HORIZON

The time horizon of this plan is 2020. It merges seamlessly with the ongoing activities and initiatives, while it should lead to the development expected post-2020.



THE
PRINCIPLES
UNDERLYING
THE
NREAP

The NREAP is underpinned by several principles as described below.

<p>Specific national RES obligations to be honoured</p>	<p>Malta is bound by specific targets at the international level in terms of the proportion of its energy consumption to be produced from renewable sources in the coming years to 2020. Government accepts this obligation to participate in international efforts to mitigate climate change while recognising that RES on its own merits is objectively beneficial for Malta. RES is considered to be a crucial element towards low carbon economy and thus also towards the development of Malta's Low Carbon Development Strategy.</p> <p>Another relevant consideration is that Malta has international obligations that could translate into sanctions if not respected.</p> <p>The NREAP seeks to provide a roadmap to reach the national RES targets. It demonstrates the country's strong commitment towards their achievement.</p>
<p>Energy efficiency</p>	<p>Efficient use of any energy resources is a basic first step in any energy policy. The cleanest and cheapest energy is that which is not produced. It is counterproductive to generate RES at great expense and not use the same energy wisely.</p>
<p>Green Economy</p>	<p>Contribution towards a Green Economy through the creation of sustainable green jobs.</p>
<p>RES and conventional energy are considered holistically</p>	<p>The local energy sector is driven by imported conventional fossil fuels (including that used for electricity generation), some RES and electricity imported through the interconnector from the European grid.</p> <p>All this must be considered holistically to reach the objectives of the Energy policy. Conventional and renewable energy generation mutually affect one another, while their integration must be optimised.</p> <p>The NREAP is to be consistent with all other initiatives in the energy sector being carried out in Malta.</p>

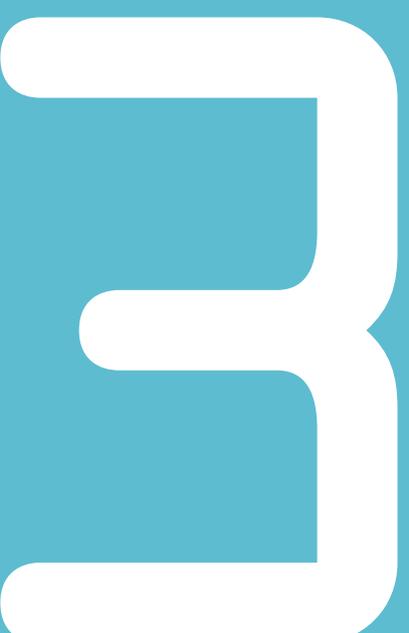
Indigenous sources of RES	<p>The NREAP seeks to fully exploit all reasonable indigenous sources of RES in a sustainable manner. The Sustainability Development Act defines sustainable development as one that meets the needs of the present without compromising the ability of future generations to meet their own needs. In this respect, exploitation of indigenous RES is to include environmental, financial and land use considerations.</p> <p>Indigenous RES reduces the country's dependence on foreign energy sources and adds security of supply, in proportion to its contribution to the energy mix. It has the potential for job creation and foreign investment.</p>
Malta's RES mix	<p>Local RES production is conditioned by specific geographic, environmental and spatial planning constraints. Malta's land area is very limited, its population density is high and its natural environment is rich but fragile. On the other hand, RES are typically land-intensive.</p> <p>Accordingly, several types of RES are used to exploit all possible advantageous sites and situations. The RES mix is characterized by different sources of RES, most of which make a small contribution to the final target.</p>
Timing of investment in RES	<p>Investment and incentives, which trigger economic activity within the sector, are to be staggered in such a way as to avoid creating shocks and an economic bubble which could have severe adverse effects on the renewable energy sector, green jobs, investment and the country's economy in general. A five-year period (2015-2020) is therefore considered.</p> <p>Results achieved by 2014 are in line with the trajectory determined by the RES directive and it is projected that the targets to 2020 can be achieved in a timely manner.</p>
Exploitation of the marine space	<p>The NREAP recognizes that it is highly desirable that some of Malta's marine space is used to generate renewable energy in preference to land-based exploitation. Malta's marine space is several times greater than its land area. The Strategic Plan for Environment and Development (SPED) published in July 2015⁴ promotes large-scale renewable energy infrastructure within the 12 nautical miles of the Territorial Waters that constitute the seaward boundary of the Coastal Zone. Through this policy, RES development is established as a legitimate maritime use along other uses such as fisheries, shipping and aquaculture, thus providing leverage for potential and viable projects. Malta is continuously investigating commercially available technologies and solutions to utilise the vast marine space for RES applications. The NREAP encourages further Research and Development (R&D) to assist in this mission.</p>

Cooperation with other countries (Flexible mechanisms)	Use of flexible mechanisms as envisaged by the Renewable Energy Directive is not excluded in principle; however priority will be given to developing indigenous sources where cost-effective. During the effective period of this plan, flexible mechanisms will be considered as a fallback position should Malta register a shortfall in the planned renewable energy production.
Knowledge base	<p>The NREAP has to be knowledge-based and quantitative in its approach, requiring statistical data and reports, and access to specialised knowledge of both technical and market solutions. This approach is necessary to achieve good planning and projections, to select the best options for future action, to assess accurately the resources needed, and to assess reliably progress and achievements.</p> <p>This action plan is based on quantitative data when available, which however had to be supplemented by recognised methodologies to estimate other parameters not quantitatively known. The NREAP benefits from synergy and consultation between learned institutions including specialised government and public entities, the National Statistics Office, the University and its Institute of Sustainable Energy and private industry.</p> <p>Knowledge management, reporting and information/statistics gathering and research have to be organised on a more structured basis.</p>
Research and development	<p>It is desirable that Malta considers on its own or jointly with other countries in particular island states, investment in research, development and commercialization of new technology that can help it achieve its RES objectives more cost-effectively, and that overcomes its peculiar geographic challenges and other natural handicaps. One such example is the exploitation of the vast marine spaces available to it.</p> <p>This is more likely to arise through indigenous-based research, development and innovation (RDI), which will therefore be encouraged.</p>

4 http://www.mepa.org.mt/Documents/sped_final_july22.pdf

<p>Incentivising investment in Renewable Energy</p>	<p>The NREAP recognizes that in most cases the cost of electricity⁵ generated from renewable energy sources has a higher cost-premium relative to the cost of conventional energy. This premium is further increased considering other national initiatives designed to lower the cost of electricity. Government-sponsored assistance schemes and measures are still necessary to incentivize households and the business community (while respecting state aid rules) to invest in RES technologies. These schemes also aim to increase public awareness about renewable energy technology and thereby expand the market.</p> <p>Incentive schemes shall be optimised to achieve their objectives at the lowest cost. Results will be monitored and lessons learnt will contribute to improve on future initiatives.</p>
<p>Volatile dynamics in technology and costs</p>	<p>The renewable energy sector is highly dynamic in terms of both technological developments and costs. The sector is closely monitored to take advantage of new or improved solutions.</p>
<p>Flexibility in approach</p>	<p>The direction provided in the NREAP remains subject to review in the light of developments in this highly dynamic area. A flexible approach towards the application of RES in Malta will be adopted. The measures in the NREAP may be complemented or substituted by other initiatives in line with changing circumstances.</p> <p>Experience has shown that desk-based studies for the potential of RES technology can be unreliable. Concrete projects need to be examined in detail during the permitting and application stage.</p>

⁵ *Levellized Cost of Electricity excluding externalities except the market price of carbon.*



THE
NEW CONTEXT
WITHIN
WHICH THE
NREAP IS TO BE
IMPLEMENTED

3.1 THE RES OPTIONS CONSIDERED IN THE 2012 ENERGY POLICY

The original NREAP was incorporated as one of four options within the Energy Policy published in December 2012. This option considered a 95 to 100 MW offshore wind farm, in addition to the onshore farms, that was estimated to generate 216 GWh per annum. Accordingly, the PV installation and production requirements were expected to reach 28 MWp and generate 43 GWh in 2020.

3.2 DEVELOPMENTS FOLLOWING THE PUBLICATION OF THE 2012 ENERGY POLICY

Several developments have taken place since 2012 and these had a significant impact on the implementation of the original NREAP.

The conclusions of several studies including the Environmental Impact Assessment (EIA) and the Appropriate Assessment (AA) reports for the 95MW wind farm became available, identifying a number of environmental impacts which could not be mitigated. As a result, no significant contribution by wind farms is expected by 2020. Experience also showed that several assumptions made in the calculation of the energy from waste were over-optimistic. There were also several changes in the national energy priorities, driven by new initiatives in conventional energy generation being undertaken by Government.

3.2.1 Changes in the Policy and Legislative Framework

The Government has prioritised energy as one of its main sectors of endeavour. Its strategy includes several initiatives that are of relevance to this exercise and which are reflected in the measures included in this action plan. A non-exhaustive list is being presented hereunder

- The Government will work according to a plan so that in a stipulated and relatively short time, the challenges in the energy sector will be robustly addressed. This plan will have, among its major objectives, increased generation from clean sources and financial sustainability.
- Retain the SWH support scheme.
- Organize educational campaigns to encourage reduction in energy consumption and changeover to alternative sources.
- Publish guidelines for the development of solar parks with full sensitivity to environmental considerations.

- Continue with fiscal incentives on the purchase of PV panels.
- Afford each family access to solar energy from PV panels independently of whether they have adequate space to accommodate them.
- Schemes whereby space on residential or industrial rooftops are offered to Government and/or the private sector for the installation of solar panels, with the benefits being shared between the parties.
- Actively encourage the installation of systems that generate green energy in new projects and buildings.

3.2.2 **Social and Economic Issues**

Some social and economic issues relevant to this action plan are:

- A key focus of the Government is financial sustainability and the lowering of the prices of energy to increase its affordability to households and the competitiveness of industry. New lower tariffs for electricity for the domestic sector came into effect in March 2014 whilst those for the non-residential sector came into effect in March 2015.

An important though not exclusive criterion for the adoption or otherwise of any category of RES will be the cost of the energy it delivers, when all available alternatives are considered. Most renewable energy comes at a premium over conventional energy. This has to be minimised.

- It is likely that the cost of technologies, especially PV, will come down further as increases in volume of production and technical efficiency increase over time and new opportunities arise. PV has been shown to be the most robust and suitable of all RES technologies for Malta. Judicious investments will be made, taking note of the trajectory to 2020 and the final target.
- Changes in housing patterns (e.g. move towards multi-dwellings rather than single block housing, hence reduced roof area for solar exploitation) and in building trends (vertically upwards where possible rather than horizontally, reflecting land scarcity) implies that it is becoming difficult for many individual households to invest in their own RES equipment. Moreover, rooftops in Malta are used for other purposes, such as hosting water storage tanks, natural drying and airing of clothes and family leisure. Such households would benefit from opportunities to invest in communal PV schemes, whether through

shares in projects or direct investment. This would also eliminate problems associated with solar rights, which are difficult to guarantee in Malta.

- Flexible mechanisms' (cooperation with other Member States and/or third countries within the framework laid down by Directive 2009/28/EC) may come in useful as a fallback position should minor shortfalls in the planned RES generation required to satisfy Malta's RES obligations to 2020 occur or if this option provides higher net benefits. However, in view of the situation at international level, costs and net benefits are still unclear and such opportunities will be discussed later on in this document.

3.2.3 Technological Issues

There have been several major technology-related developments that require a revision of the RES mix.

- The large offshore wind farm earmarked for Sikka I-Bajda, which was expected to be a major contributor to the RES target, cannot be considered further at this point in time.

An outline development application for an offshore wind farm at Sikka I-Bajda was rejected by the Planning Authority (formerly Malta Environment & Planning Authority) in February 2015, based on the conclusion that the detrimental consequential effects on the environmental protection, in particular the avifauna and marine ecology, of the surrounding area override the benefits achieved through the generation of renewable energy from the proposed wind farm, with no effective mitigation measures⁶.

- The further progress of the proposed medium sized wind farms on land is not encouraging. Serious concerns arose in the course of the EIA/AA studies required for the permitting process. These concerns include flicker and acoustic impacts on nearby dwellings and interference with the safety of operations at Malta International Airport (in the case of Hal-Far) and impacts on colonies of shearwater, visual and social impact (in the case of Wied-Rini).

No contribution by onshore wind farms has been included in the determination of the RES mix to meet the 2020 targets.

- After several years' experience of solid waste treatment, and a subsequent review of operations, it is evident that several changes from

⁶ MEPA <http://mepa.org.mt/news-details?id=989>

the 2012 action plan concerning waste need to be made, particularly with regards to energy output from the existing and proposed plants. The Ministry for Sustainable Development, Environment and Climate Change published a holistic policy reassessment from a waste management perspective entitled “Waste Management Plan for the Maltese Islands”⁷. The plan proposes that a cost benefit analysis is undertaken to establish the most economically and financially feasible option between local thermal treatment and the export of waste for energy recovery.

Changes from the 2020 energy policy relevant to renewable energy generation are the following:

- The composition of solid waste in Malta has been found to contain less energy than that assumed at the design stage of Sant Antrnin Solid Waste Treatment Plant (SAWTP). Accordingly, much less electricity has been generated than that projected in the NREAP (2010) - 2.5 GWh versus 7.6 GWh per annum⁸.
- The Siggiewi cattle manure digester will not be built. In any case, its contribution to the overall RES target would have been minimal (1.7 MWh). However, Malta’s Rural Development Programme 2014-2020 considers support to farms and rural enterprises for energy generation projects using a range of technologies including biomass from manure and waste. Specifically, support is considered for livestock producers to collaborate in order to plan and establish shared bio-digester facilities for the use of manure to generate energy⁹.
- Further treatment of waste streams has to be carried out, not least to extend landfill life. Energy will be recovered in the process.

The above is taken into account in the revised projections as reported in Section 13 of this document.

PV will have to carry a larger share of the target, in line with Option 3 of the 2012 Energy Policy and action plan.

The expected contribution of PVs towards Malta’s 2020 renewable energy share has to be expanded to generate about 278 GWh in 2020.

⁷ <http://environment.gov.mt/en/document%20repository/waste%20management%20plan%202014%20-%202020%20-%20final%20document.pdf>

⁸ Waste-to-energy data and projections in this document are as provided by the Ministry for Sustainable Development, the Environment and Climate Change.

⁹ Rural Development Programme 2014 - 2020 <https://eufunds.gov.mt/en/EU%20Funds%20Programmes/European%20Agricultural%20Fund/Documents/RDP%202014-2020/Malta%27s%20Rural%20Development%20Programme%202014-2020.pdf>

This increase in projected generation is further favoured by the steep drop in PV system prices which have declined by over 50% during the past 5 years¹⁰. This benefit, together with Malta's ideal geographical position and solar radiance, has resulted in the cost of renewable energy generated by PVs approaching (and in certain cases, even falling below) some tiers of the electricity tariffs.

The land area required to accommodate the level of PV penetration (~2.7km²), would ideally be met through rooftop space. Studies indicate that while this rooftop area exists, in practice only a small portion can be effectively utilised for solar exploitation. It is expected that once a new development framework is in place, a portion of new installations will be deployed on brown field sites such as former quarries or landfills, as set out in the Solar Farm Policy initiative in order to avoid the development of virgin land. All the above changes are reflected in this Action Plan.

¹⁰Source: www.epia.org

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THE
UPDATED
RES MIX
AND
CONTRIBUTING
TECHNOLOGIES

Work done so far in the implementation of projects and schemes based on suitable technologies, as well as initiatives taking place or planned for the future to achieve the 10% RES target, are being described in the proceeding sections.

One of the principles underlying the NREAP is that all types of indigenous RES that can sustainably and cost-effectively contribute to reach the national (10%) target are exploited. Malta's final RES mix, as now updated, includes a basket of sources which individually contribute a percentage share, with the majority produced from solar-based systems.

The expected contribution of each type of technology to the final RES target is represented in Table 1¹¹. The technologies and their distribution within the overall target are depicted in Figure 1.

	GWh	% of total energy 2020
RES - Electricity		
Photovoltaic (PV) systems	278.13	4.70%
Micro-wind	0.06	0.00%
Waste-to-energy (electricity)	16.00	0.27%
Total RES - Electricity		4.97%
RES - Heating & Cooling		
Solar water heating (SWH)	54.18	0.92%
Waste-to-Energy (heat)	11.91	0.20%
Heat pumps	89.93	1.58%
Imported biomass	11.19	0.19%
Bioliquid used in industry	3.70	0.06%
Total RES - Heating & Cooling		2.95%
RES - Transport		
Biofuels	124.29	2.10%
Renewable electricity in transport	0.59	0.01%
Total RES - transport		2.11%
Overall total		10.04%

Table 1 - RES contribution by technology and share

¹¹ Flexible mechanisms' are considered as a fallback position should there turn out to be a minor shortfall in the projected RES energy harvested.

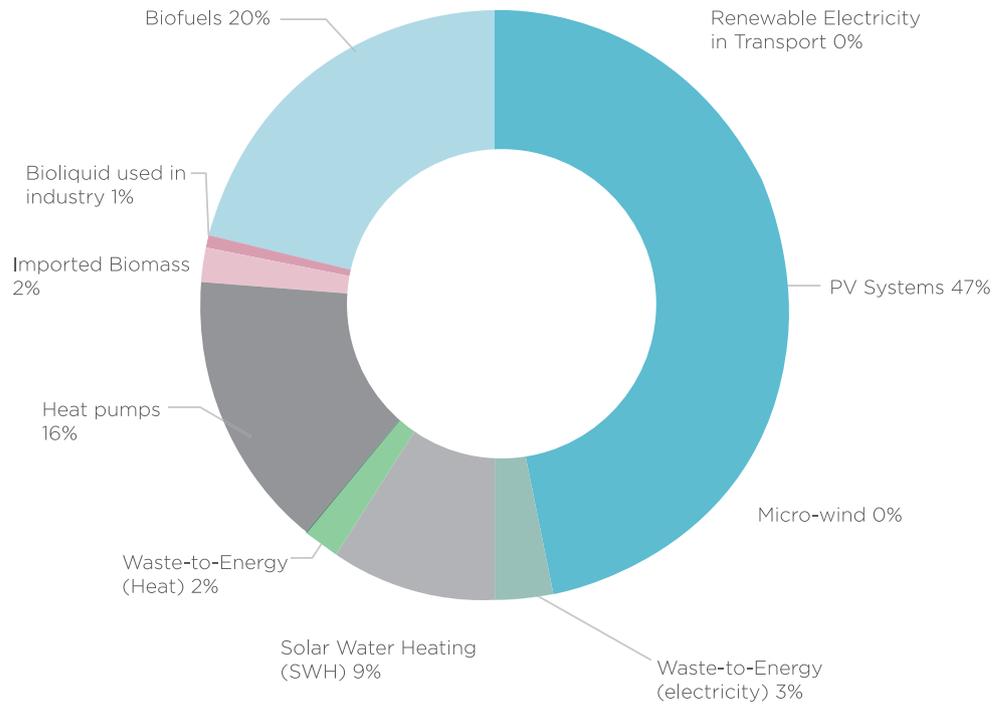


Figure 1 - Contribution by technology as a percentage share of the overall target

5

THE
CONTRIBUTING
TECHNOLOGIES

-

PV
TECHNOLOGY

5

5.1 INTRODUCTION

Government's policy is to fully exploit all reasonable potential indigenous sources of RES and to support the private sector in similar endeavours.

PV technology has turned out to be the most robust of all indigenous sources. It has a successful history of public and direct Government initiatives and also of substantial Government support to the private sector to promote this technology to its maximum reasonable potential in Malta.

Installations of PV systems are expected to contribute 4.7% out of the 10% national RES target by 2020. About 160MWp of installed PV capacity over and above the 28MWp originally envisaged (under the scenario with full deployment of wind farms¹²) is required to maintain equivalence in RES generation. This additional PV capacity is required by the end of 2019 and entails a total footprint of circa 2.7km².

5.2 PV TECHNOLOGY FROM MALTA'S PERSPECTIVE

The characteristics of Malta and its environment, as well as those of the technology, explain why overall PV has turned out to be a suitable RES technology for Malta.

5.2.1 Characteristics of the local resource

Solar radiation is very stable and predictable in Malta¹⁴. Solar intensity is also high – amongst the highest in the EU. Yield of PV systems is amongst the highest in Europe. PVs are generally considered as a low risk investment in Malta with very predictable returns.

PV output is sensitive to varying cloud cover and can create some operational difficulty to distribution network when PV output is satisfying a significant portion of the electricity demand.

However this solar potential may not be accessible if 'solar rights' of individuals and sites are not respected. 'Solar rights' are not protected by legislation in Malta. Such protection is difficult as it interferes with other property rights which have developed over time as a result of the characteristics of property ownership in Malta – limited availability and high value of land, parcelling and inheritance. The lack of legal protection of solar rights is a handicap to an individual's investment in solar energy. Reports by the Building Regulation Office have identified the lack of protection of solar rights and the traditional land ownership rights and parcelling as unfavourable to PV installations on domestic roofs.

¹² Option 3 under the Energy Policy 2012.

¹³ The annual global solar irradiation on a horizontal surface is circa 1825kWh/m² (±3%) (G. Oña Quecedo, C. Yousif and J. Bilbao Santos, Comparison of Solar Radiation in Marsaxlokk, Malta and Valladolid, Spain, World Renewable Energy Congress, XI, Abu Dhabi, U.A.E., 25-30 September 2010).

¹⁴ Over 62% of the year is characterised by clear sky with only 11 days (3%) considered as very cloudy. (R. N. Farrugia, M. Fsadni, C. Yousif, and E.A. Mallia, The Renewable Energy Potential of the Maltese Islands).

Result of the characteristics of property ownership in Malta – limited availability and high value of land, parcelling and inheritance. The lack of legal protection of solar rights is a handicap to an individual's investment in solar energy. Reports by the Building Regulation Office have identified the lack of protection of solar rights and the traditional land ownership rights and parcelling as unfavourable to PV installations on domestic roofs.

5.2.2 **PV systems and their operation**

PV technology is commercially established. PV installations are modular in construction. Units are relatively light and simple structures for support are sufficient. They are not unduly disadvantaged by economies of scale from a technical perspective. If access to sunlight is available, PV units can be installed directly on the flat roofs characteristic of buildings in Malta.

PV systems can be stand-alone, servicing isolated buildings or providing isolated services, e.g. some street-lighting or telephone booths where grid connection is difficult or uneconomic. Their full potential is better exploited when they are grid integrated as this allows renewable energy to be consumed away from its point of generation. Virtually the whole of Malta is covered by the national electricity grid.

Given their stability, PV systems can be easily integrated with other sources of electricity. At the present penetration rate, grid connection problems and operational costs are minimal. The main source of fluctuation in power generation is that caused by cloud cover which, on a national scale, can be taken care of by the spinning reserve at the power station (or the interconnector), whilst fluctuations in voltage on the Low Voltage electricity network are catered for through appropriate control gear installed in substations.

The production of electricity by PV systems is quite stable and generally continuous over daylight hours. This simplifies dispatching. PVs produce electricity during the daylight hours when demand is relatively high, particularly in summer when it coincides with the demand for air-conditioning (cooling).

Such protection is difficult as it interferes with other property rights which have developed over time as a result of the characteristics of property ownership in Malta – limited availability and high value of land, parcelling and inheritance. The lack of legal protection of solar rights is a handicap to an individual's investment in solar energy.

Reports by the Building Regulation Office have identified the lack of protection of solar rights and the traditional land ownership rights and parcelling as unfavourable to PV installations on domestic roofs. result of the characteristics of property ownership in Malta – limited availability and high value of land, parcelling and inheritance. The lack of legal protection of solar rights is a handicap to an individual’s investment in solar energy. Reports by the Building Regulation Office have identified the lack of protection of solar rights and the traditional land ownership rights and parcelling as unfavourable to PV installations on domestic roofs.

5.2.3 Land-use issues

Land-use issues are of paramount importance in Malta given its size and high population density¹⁵. As highlighted by Eurostat, 33% of Malta’s land coverage is developed (buildings/roads/artificial areas) which is by far the highest percentage¹⁶ in the EU¹⁷. PV technology is land-intensive. This is a major problem for Malta, where land is scarce and expensive and visual impact inescapable. Large PV farms in open countryside will be visually intrusive. In this respect, the Planning Authority (PA) drafted a Solar Farm Policy which sets out the fundamental criteria which the authority deems appropriate to guide the planning and design of solar farm development. The policy furthermore, encourages solar farm development which achieves dual or multiple uses of land, mainly due to land availability restrictions in Malta, to ensure that urban areas are exploited in a more efficient manner. It also provides for solar farms development with a priority given to large scale rooftops, car parks, industrial areas and quarries. The policy has been subject to public consultation and scrutiny by the Parliamentary Standing Committee for Environment and Development.

It is Government policy to incentivise investment on roofs and brown field sites, maximising their potential. Once brown field sites cannot be exploited further, it will be impractical for Malta to increase its PV RES generation, as it is not deemed acceptable to deploy PVs on arable or environmentally sensitive areas such as Natura 2000 sites, Special Areas of Conservation, Specially Protected Areas and other protected sites including Areas of High Landscape Value.

¹⁵ 315 sq km, 1,400 persons/sq Km

¹⁶ EU average is 5%

¹⁷ <http://ec.europa.eu/eurostat/documents/4031688/5931504/KS-03-13-587-EN.PDF/4ee08a33-36ee-40c3-bf59-3b2f5baa28e1?version=1.0>

Support in terms of EU/national capital grant incentives and feed-in tariff schemes, as well as the reduction in cost of module production, have resulted in roof-mounted PV systems becoming more attractive and affordable, and hence larger and more numerous. This proliferation of systems is generating increasing concern on their visual impact affecting the urban landscape and skyline in village cores. PV systems on rooftops are often highly visible from street level and adjoining streets. The 2015 Development Control Design Policy, Guidance and Standards¹⁸ issued by the PA aims to tackle this issue.

PV installations on industrial rooftops create fewer visual concerns, and a mapping exercise to estimate the potential of Malta Industrial Parks (MIP) sites (Government-owned factories) has already been carried out. However, the available roof space is limited by property issues and still needs to take into account structural limitations and shading.

Low value sites such as parking areas can be utilised for constructing PV systems, thereby adding value to the site without eliminating activities not requiring access to sunlight at the site.

5.2.4 **Compliance with Energy Policy**

PV systems produce energy that is green and secure, and fits very well with two of the main objectives of the energy policy. Although still more expensive than conventional fossil-fuel-generated electricity, the gap is closing especially when externalities are considered.

5.2.5 **Security of supply**

PV systems exploit indigenous energy and so reduce import of fuels. This contribution is proportional to their share of the energy mix and is expected to reach around 4.7% of the gross final energy consumption in 2020 or 11.5% of the gross final consumption of electricity.

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5.2.6 Cost

There has been significant reduction in the price of PV panels over the years, driven by greater demand and mass production. This is likely to continue, though at a slower pace. This downward price trend has established PVs as a credible source of renewable energy and has resulted in an increase in the number of applicants benefitting from Government support schemes. The cost of electricity from PV is still high relative to that of conventional fossil-fuel-generated electricity. This holds true even after allowing for the volatility of fuel prices that determine the cost of conventional electricity and for the fact that PV systems produce electricity during periods of high/peak demand, when the market price of electricity is generally highest.

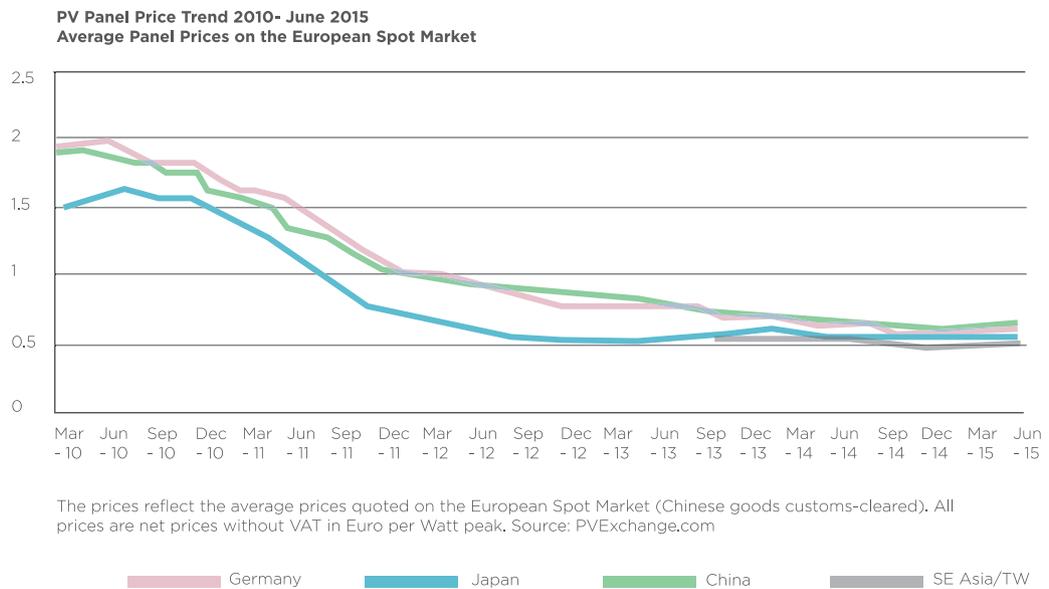


Figure 2 - PV panel price trend 2010 - 2015

5.2.7 **Green Job Creation**

Business in PV systems is ideally suited for Maltese SMEs. Many small retailers have entered the field favouring competition and hence higher market penetration.

No high engineering expertise is necessary for deploying PV systems; a short period of training is sufficient to train competent installers. In line with the requirements of Directive 2009/28/EC, as from 31st December 2012 installers of solar photovoltaic and solar thermal systems must be certified. Courses approved by the Regulator for Energy and Water Services (REWS) for installers are organised by the University of Malta and the Malta College for Arts, Science and Technology (MCAST). Following the successful completion of such a course, the candidate would have to apply for Certification of Installers as requested in legislation under the REWS Act. The Certification is valid for five years and can be extended following the successful outcome and attendance of refresher courses. The list of Certified Installers is published on the Regulator's website¹⁹. By August 2015, the number of certified personnel engaged in RES installations amounted to over 145.

Compared to Malta, solar intensity is higher in nearby North African countries, and there is much more space available for the deployment of large solar farms. When the political situation in the North African countries stabilises, there is a likelihood that large scale investment happens there. Large-scale development in these neighbouring countries may provide investment and job opportunities for Malta, as well as favouring the establishment of international interconnections for energy transmission and trading – a hub for energy trading and transfer in the region. The potential for green job creation is in line with Malta's EU 2020 targets as well as the Sustainable Development Goals. The Green Economy Action Plan²⁰, expected to be finalised in 2016, will assess the green job potential associated with the development of RES and its value added.

5.2.8 **End of Life**

PV panels are largely made from fully recyclable materials. Silicon is a valuable material which can be reused after module end-of-life. However, large quantities of panels reaching end-of-life at the same time may pose a problem and a significant cost to correctly dispose/recycle.

¹⁹ <http://www.rews.org.mt/#/en/a/81-providers-res-and-energy-audits>

5.2.9 Future Development in technology

Photovoltaic cells have benefited from significant advances in manufacturing and improved efficiency over the last decades. However, a potential for further improvement still exists. This involves cutting edge research and could require a long timeframe unless a breakthrough is achieved. The University of Malta has tapped EU funding through its Institute for Sustainable Energy to establish a solar research lab which will also be useful in other areas of renewable energy and materials.

Development of large-scale efficient energy storage technology will extend the versatility of PV systems for stand-alone systems. This is not particularly relevant to Malta, since practically all of Malta is covered by the grid and the saturation level of PV uptake can be handled by Enemalta. Nevertheless storage can be an effective way of shifting the load profile and can provide for the possibility of operating under a pseudo net metering arrangement.

Development leading to other non-conventional PV formats should extend the potential for their deployment. For example, the production of fully transparent photovoltaic material, already achieved under lab conditions²¹, could have dramatic effect on the deployment of PV panels, as they could effectively replace glazing. Integration of PV panels in buildings is a major challenge as so far standard poly/mono crystalline panels do not readily blend with the local urban landscape, especially within urban conservation areas. Semi-transparent panels are already available on the market, but are not widely deployed as they are still sold at a significant premium above standard PVs. Nevertheless opportunities exist to integrate PV panels in structures such as greenhouses, new commercial buildings and sheds.

Other technologies such as flexible panels and membrane-type panels also offer opportunities for deployment on roofs of buildings located in sensitive areas. Finally, a closely related product is high-concentration PV, which requires a dual axis tracker and is therefore greatly conspicuous, limiting its applicability in Malta.

5.3 INSTALLATIONS OF PV SYSTEMS IN MALTA

PV panels are largely made from fully recyclable materials. Silicon is a valuable material which can be reused after module end-of-life. However, large quantities of panels reaching end-of-life at the same time may pose a problem and a significant cost to correctly dispose/recycle.

²⁰ Consultation Document - Greening our economy : Achieving a sustainable future https://socialdialogue.gov.mt/en/Public_Consultations/MSDEC/Documents/Green%20Economy/Consultation%20Document%20-%20Green%20Economy.pdf

²¹ <http://mitei.mit.edu/system/files/20130617-energy-futures-magazine.pdf>

5.3.1 **Total PV Capacity installed**

	Total Cumulative Installed capacity
By December 2012	15.6 MWp
By December 2013	28.4 MWp
By December 2014	54.8 MWp
By December 2015	74.0 MWp ²²

Table 2 - PV Installed Capacity

There was a sharp increase in the uptake of PV between 2010 and 2015, as can be seen from Figure 3 below. This has happened due to the incentives offered through various schemes, mainly due to ERDF co-financed grants (but also due to EAFRD 2007-2013 funds), attractive feed-in tariffs and the decreasing price of the technology, which increased the attractiveness of investment. Thanks to the contribution of PVs, Malta reached and exceeded the 3% interim target for 2013-2014, as required by Annex 1 of the Renewable Energy Directive.

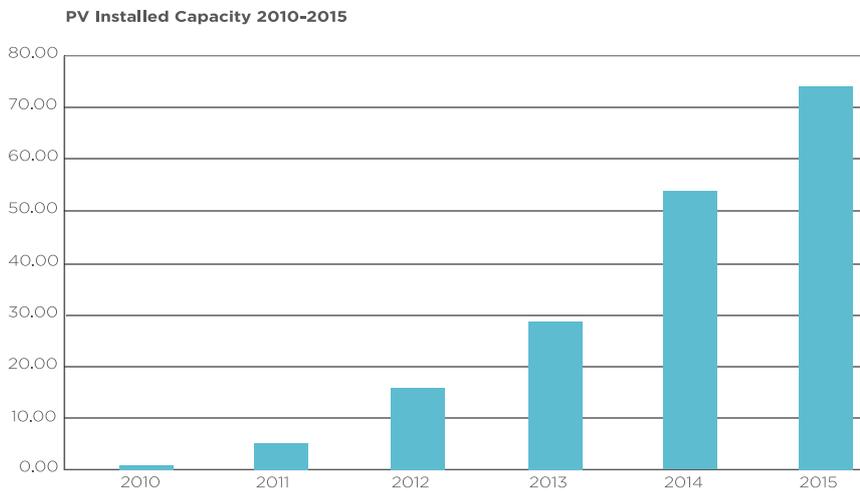


Figure 3 - PV Capacity Installed between 2010-2015

²² Figure is provisional and is subject to verification

Feed-in tariff for solar photovoltaic systems

The introduction of a feed-in tariff for solar photovoltaic systems has addressed a financial barrier holding back the further penetration of PV.

The Subsidiary Legislation 545.27 titled Feed-in tariffs scheme (Electricity generated from solar photovoltaic installations) Regulations (enacted in September 2010 by Legal Notice 422 of 2010) sets feed-in tariffs for the electricity generated by photovoltaic installations connected to the grid, including those systems benefitting from a capital grant. The new tariffs replaced the previous net-metering arrangement. The introduction of the feed-in tariff increased the potential for exploitation of the roof space, including that of premises with no consumption of electricity and hence with no incentive for net metering. New feed-in tariffs were published during 2013 (LN71/2013, LN253/2013, LN271/2013), 2014 (LN 7/2014, LN155/2014, LN416/2014) and 2015 (LN 171/2015, LN264/2015, LN365/2015, LN415/2015) and are revised regularly to ensure a reasonable return on investment and avoid overcompensation as market prices of new systems change.

PV in the Residential Sector

A major part of the uptake of the PVs on residential premises took place from 2009 onwards mainly as a direct result of EU-funded grant schemes enabling households to benefit from up to 50% of the initial capital investment, capped at €3,000. A similar scheme, but capped at €2,500, was launched in 2013 which had a take-up of a total of 8,443 applications resulting in a total PV capacity of 23.4MWp. On 19th June 2015, a new scheme was launched, capped at 50% of eligible costs up to a maximum of €2,300 per system and €757 per kWp. The scheme was fully subscribed and subsequently closed on 1st September 2015 through Government Notice 837. An identical scheme was launched again in 2016.

PV in the non-residential Sector

In the non-residential sector, support schemes were initially part-funded under the ERDF program managed by Malta Enterprise. These schemes catered for the generation of electricity from renewable sources or efficiency measures in the industrial/commercial sector. Applicants could benefit from a grant of up to 50% on the initial investment, capped at €100,000. Three grant schemes of this type were launched between 2009 and 2010.

Further support schemes were made available to the agricultural and tourism sectors, while other similar schemes were launched for renewable energy-related projects for education, non-governmental organizations (NGOs), religious institutions and local councils. As with the domestic sector, there was an increase in PV capacity uptake by the commercial and industrial sector from 2009 onwards in response to the EU-funded grant schemes managed by Malta Enterprise. The uptake in the commercial and industrial sectors is shown in Figure 4. Subsequently support for

deployment of PV in the non-residential sector was shifted from a system of grants towards a feed-in tariff mechanism.

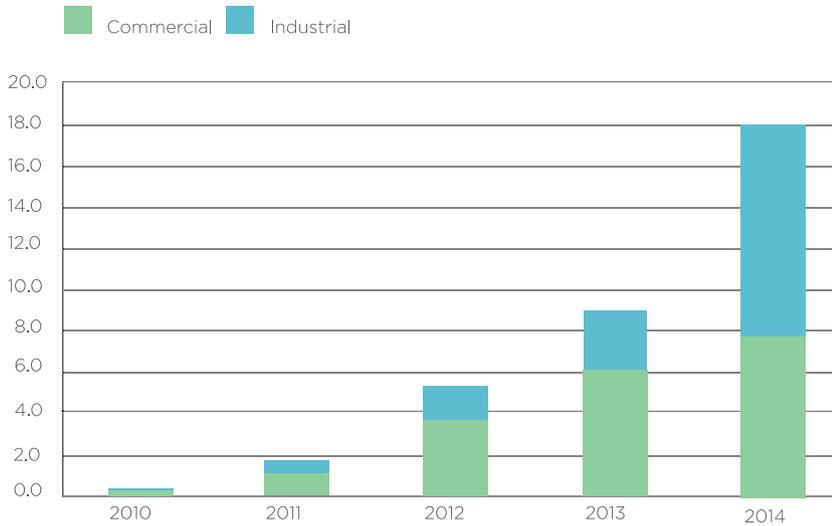


Figure 4 – Commercial and Industrial PV Installations

Permitting and Authorization of PV Installations

The SPED encourages RES use in the design of buildings (Policy Thematic Objective 9.3). In November 2015, the Planning Authority issued a new set of guidelines where one of its objectives was to further support the uptake of solar technologies within the curtilage of buildings. These new guidelines (superseding the Development Control Policy and Design Guidance²³ published in 2007) encourage the introduction of PV and SWHs at ground level within backyards, within the building fabric, in surface car parks and other open spaces particularly those within non-residential development. The requirement to set back PV and SWH units from the front and back edge of rooftops has been removed. Subject to compliance with the guidelines, no specific planning permits are required. Photovoltaic installations that fall outside the scope of these guidelines require a planning permit.

A system of fast track permitting was also adopted by the Regulator for Energy and Water Services (REWS) for PVs not larger than 16 Amps per phase to facilitate the installation of these systems and their connection to the grid.

Larger PV systems (greater than 16 Amps per phase) still require authorisation by the Regulator prior to construction and, once commissioned, a 'licence to operate' is required before connection to the

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grid. These systems may also require a grid connection study to be carried out by Enemalta to make sure they integrate seamlessly with the network

Enemalta plc (the Distribution System Operator (DSO) in Malta) has published its “Process Flow for the processing of applications for grid connections of distributed renewable energy sources”²⁴ applicable to generators of capacity greater than 16 Amps per phase.

5.3.2 The way forward

Projected growth in PV capacity to 2020

Figure 5 shows the actual cumulative installed PV capacity from 2010 up to December 2015, and projections for the following years.

It is estimated that between 38MWp and 48MWp of additional new PV capacity is to be installed on domestic, commercial and industrial rooftops between 2016 and 2019. Rooftop installations shall continue to be given priority.

Further to the above, it is being projected that around 7MWp will be installed on public property, around 8.4 MWp on disused landfills, 14.6 MWp within the airport perimeter and another 50MWp on brown field sites. Altogether, these should contribute to reach the targeted PV share.

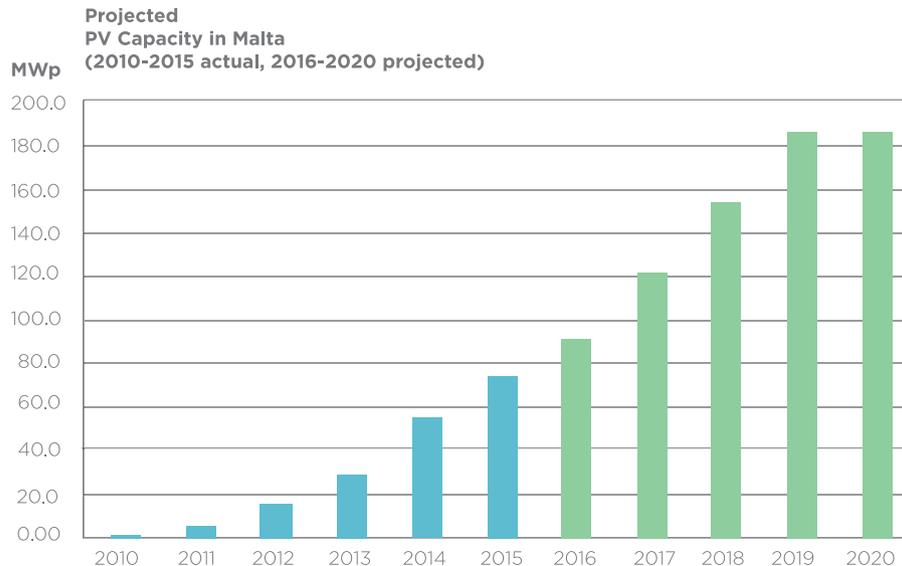


Figure 5 - Projected PV Capacity in Malta

²³ <https://www.mepa.org.mt/LpDocumentDetails?syskey=%20655>

²⁴ The guide is accessible at <http://www.enemalta.com.mt/enemaltastorage/images/files/miscellaneous/process%20flow%20for%20grid%20connection%20evaluations%20v2.1.pdf>

Further domestic potential

The domestic rooftop sector reached 34MWp of installed capacity by the end of 2014. In June 2015, the government announced its intention to propose additional incentives to help families install RES in houses. These tap EU funds available under PA4 (2014-2020 Operational Programme) and should exploit the remaining potential estimated at around 20MWp.

Further industrial rooftop potential

Malta Industrial Parks (MIP) is promoting the use of roofs in industrial zones for the installation of PV systems. Current estimates, including private industrial premises, are that between 15MWp and 20MWp of PV systems can be installed. Timeframes are 2015 to 2018. These systems shall be supported through feed-in tariffs guaranteed for 20 years and which will reflect the declining trend in system costs. Moreover, the Operational Programme 2014-2020 allows for the support of such investments through financial instruments.

New systems on brown field sites

Through the Solar Farm Policy, the Planning Authority shall determine which areas in Malta can be utilized for PV farms, utilizing areas which have already been committed for other forms of development such as spent quarries.

The response to the Solar Farm Policy Objective public consultation and a request for information (RFI) published to assess the interest in the development of quarries, commercial and industrial rooftops and car parks yielded a total of 72 submissions. Among those showing potential to be fully developed into PV farms, the maximum installable capacity reached approximately 50MWp. Whilst it is appreciated that not all of these will be eventually developed into solar farms, the estimate is based on those which have submitted feedback during the consultation and RFI process and does not include all appropriate sites. This uncertainty is reflected by using a lower-end projected figure of 30MWp.

There are a number of disused landfills which can potentially be developed into PV farms. It is estimated that their effective potential would be circa 8.4MWp.

Furthermore other areas such as grounds within the perimeter of the Malta International Airport could potentially host around 14.6MWp of PVs, although part of this is located on sub-critical zones close to the airstrip. For projections purposes, a range between 10MWp and 14.6MWp is assumed.

Other Specific Government-sponsored Projects

Rooftops on public buildings were measured and assessed for their potential to host PV installations. Based on a study performed by the Institute of Sustainable Energy, rooftop potential on public buildings could reach a theoretical maximum of 22.9MWp. However, shading and other factors is expected to limit potential to about 7MWp. This includes rooftops on public schools, hospitals, government department buildings and reservoirs. Reservoirs are owned by Water Services Corporation which is a state-owned utility.

The government shall be promoting the deployment of PV systems on government premises through appropriate financial mechanisms and through the establishment of public-private partnerships. Part of these developments will be reserved for families who do not have access to suitable roof space and wish to invest in PV to reduce their electricity bill.

Support for Large PV installations

Whilst PV systems smaller than 1MWp are supported through the present framework of feed-in tariffs, larger systems, equal or larger than 1MWp would need to be subject to a different support mechanism based on a competitive process in line with the EEAG (Energy and Environmental State Aid Guidelines). A new scheme developed within this framework has been approved by the European Commission and is expected to be in place by the end of 2016.

Research and Development

Government will continue to support research and development of more efficient and cost-effective PV systems, and their adoption by industry through incentive schemes if necessary. The University of Malta, through the Institute for Sustainable Energy, is already investing in this line of research.

Summary of expected PV systems installed by 2020

The expected PV deployment is not only based on a sectoral assessment of the technical potential, but also on a defined support strategy which should ensure a staggered deployment. Table 3 provides a summary by category of projected PV capacity to be installed by the end of 2019.

A parallel assessment of Malta's RES potential was performed as part of a study "An Energy Roadmap - Towards Achieving Decarbonization for the Maltese Islands", which is expected to be completed in the coming months. This assessment projects the cumulative deployment of around 170MWp of PV over a longer timeframe, basing itself on less aggressive support measures. Both assessments foresee that deployment of photovoltaic installations shall reach a saturation point at around 200MWp. Figures presented in Section 13.2 are based on a mid-growth scenario with a PV capacity of 184MWp in 2020.

Summary of expected PV systems to be in operation by 2020		
	MWp	Timeframe
Connected by end 2015	73.3	
<i>Other systems projected to 2020</i>		
Further domestic & commercial rooftop potential	23 - 28	2015-2018
Further industrial rooftop potential	15 - 20	2016-2019
Rooftops of public buildings	7	2015-2019
Ground mounted/brown field sites		
- Quarries, water reservoirs, and car parks	30-50	
- Disused landfills	8.4	
- Others	10-14.6	
Total	166.7-201.3	

Table 3 – Summary of expected PV installed capacity by category

5.3.3 Financial Impact

Although over the past few years the price of PV panels and the development of best practices in their deployment drove the Levelized Cost of Electricity (LCOE) generated by PV downwards, this is still significantly higher than the marginal cost of electricity produced from conventional sources. So whilst the level of support necessary to make a financially sound investment in PV has dropped, the generation cost gap is still pronounced. Price trends clearly show that the projected increase of PV from the present level to that envisaged for 2020 will not happen unless support for their deployment is sustained. This is bound to have an appreciable impact on government budget. More so, when one takes into account the fact that support is often provided in the form of operating aid guaranteed for 20 years, leading to a cumulative effect as overall installed capacity increases. This is expected to peak during 2018.

It is important to note that should the marginal cost of electricity (for Enemalta) turn out to be even lower than projected, the budget impact would increase as the government would need to bridge a larger cost gap.

5.3.4 Effect on Climate Change

Photovoltaic technology is planned to produce nearly half (4.7% equivalent to circa 277GWh) of Malta's projected renewable energy share required to meet the country's 2020 target. Based on the 2020 projections of energy demand of 2.6TWh, a total of around 800 thousand tonnes of CO₂ per annum are expected to be emitted by conventional power generation. This projection is based on a dispatch model which takes into account the planned upgrades in Malta's electricity infrastructure, including the switch from heavy fuel oil to natural gas and the interconnector. The model is based on the cost of fuel and carbon and Italy's national single (PUN) prices for the year 2013.

The results show that by 2020, generation by PV will displace close to 30,000 tonnes of CO₂-equivalent. The projected local savings are effectively much lower than the actual net CO₂ savings because most of the impact will be on non-indigenous generation. In fact, renewable energy generated by PV is expected to mainly displace electricity imports over the interconnector, which so far has no bearing on Malta's CO₂ inventory (Figure 6).

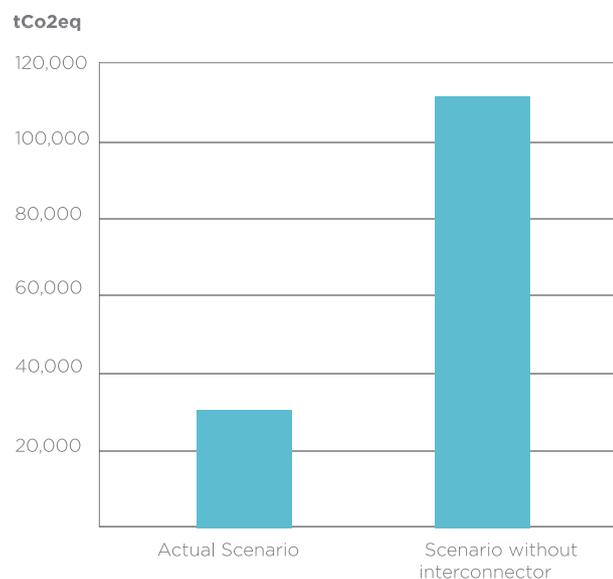


Figure 6 - Effects on CO₂

5.3.5 Lifecycle of PV

Although CO₂ is not released during energy generation by photovoltaic panels, emissions are still associated with the lifecycle of a PV system, mainly during their production, but also at their end-of-life. Unlike conventional energy plants, most of the lifecycle CO₂ is associated with the manufacturing (mainly silicon production), transport and installation of a PV plant. PV is estimated to release around 40 grams of CO₂ per kWh²⁵, which is much lower than other conventional technologies running on fossil fuels such as natural gas (12 times less) and coal (24 times less)²⁶. However, the CO₂/kWh emitted by PV varies given that it is based on indirect emissions which originate from fossil fuel-based power plants.

As from 2012, the Waste Electrical and Electronic Equipment Directive (WEEE Directive), which regulates the appropriate treatment of products which reach end-of-life, covers the disposal of PV panels. The WEEE Directive also applies to Malta, whereby the producer (which as defined in the Directive, will in Malta's case be the importer) will be required to recycle PV panels. It is very likely that local importers will delegate their responsibility to collect and recycle these installations to a compliance scheme which handles end-of-life WEEE products.

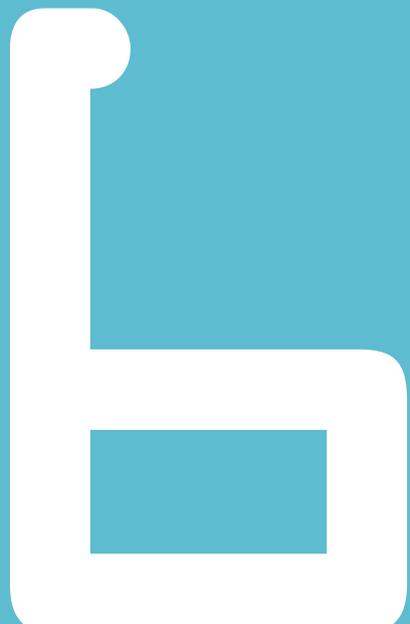
PV panels are mainly made up of a metal frame and glass, both of which can be recycled by means of relatively simple processes. Wafer recycling tends to be more complicated. The recycling cost of PV panels depends on various factors including volumes available for recycling, dismantling, type of panel and transportation costs, amongst others. Malta's installed base of PV panels shall always be deemed to be small relative to those attained in larger countries, and so it could probably make more economic sense to perform much of the recycling in centralized facilities abroad.

The market cost of metals used for the structure of a PV system is expected to continue to increase, and since the recycling process involves merely melting the scrap and removal of its impurities, it is far less energy intensive than its extraction from the ore. With the new EU binding targets²⁷, most of the PV panel glass would now need to be reused or recycled. Both metal and glass are heavy materials and so the transport monetary and energy costs have to be taken into account when selecting the location of a recycling plant. Due to the high energy cost to produce solar grade silicon, it is economically viable and environmentally desirable to recycle spent solar modules by either re-processing the same module or extracting the pure silicon and using it as a feedstock for new mono or poly-crystalline wafers. It is difficult to predict whether this will still be viable in 20-30 years' time. Mass volumes of PV systems requiring decommissioning and recycling are expected only in around 20 to 25 years. Thus, this gives Malta ample time in which to define the most economically feasible solution for the end-of-life for each component of a PV plant. It is expected that up to 800,000 panels will eventually reach their end of life over this time window.

²⁵ <http://www.nrel.gov/docs/fy13osti/56487.pdf>

²⁶ <https://www.euronuclear.org/e-news/e-news-21/greenhouse-gas-emissions-print.htm>

²⁷ http://ec.europa.eu/environment/waste/target_review.htm



THE
CONTRIBUTING
TECHNOLOGIES

-

SOLAR
WATER
HEATING



6.1. INTRODUCTION

Favoured by the high solar intensity prevalent in Malta, solar water heaters (SWHs) are estimated to contribute 0.92% of the 10% national RES target by 2020. They eliminate a good percentage of the energy consumption that otherwise goes for heating water in households and in some types of commercial establishments. Unfortunately, being designed to cope with conditions in winter when hot water demand is higher and the SWH yield is at its minimum, SWHs are underutilised for that part of the year when the ambient temperature is high.

6.2. SWH TECHNOLOGY FROM MALTA'S PERSPECTIVE

6.2.1 The technology

SWH technology is simple, established and by now very mature and reliable. Currently, it is the only form of cheap, sizeable and practical renewable energy storage technology, especially for the domestic sector.

The conversion efficiency of SWHs is around 40% and based on a standardised methodology it is estimated that a typical domestic solar water heating system in Malta generates 2007.5kWh_e per year.

6.2.2 Compatibility with energy policy

SWH systems are generally compatible with energy policy objectives.

Cost issues

The effective cost of heat harvested from SWH is difficult to quantify, since it depends on utilisation. For irregular patterns of hot water consumption, SWH effectiveness is handicapped by demand-supply matching characteristics.

Though there has been a significant reduction in the price of SWH systems over the years, driven by greater mass production, their capital cost is quite high compared to a conventional electric or gas water heater. Incentives are still required to induce the general consumer to install SWHs.

The decrease in price of PV systems and the relevant feed-in tariff offered has shifted consumer interest away from SWH. PV systems are also competing against SWH installations for rooftop space, the former being perceived as a better investment in view of its versatility.

Visual impact

SWH on roofs are unsightly if visible from roads and other public spaces. Collectors are typically inclined at 40° to 50° and can be up to 1.9m high. Thus, the higher the uptake, the higher is the overall cumulative impact on the urban landscape.

6.2.3 Job Creation

Marketing SWHs is ideally suited to Maltese SMEs. Many small retailers have entered the field, generating more competition and market penetration.

SWH systems are assembled on site and require no special engineering expertise for deployment. A short period of training is sufficient for installers to achieve the required level of competence. The Regulator for Energy and Water Services manages the certification scheme and maintains a list of certified installers. Sixteen installers had been certified as at August 2015²⁸. Certification is valid for five years and an installer would need to attend a refresher course to maintain his certified status. The Regulator is also responsible for monitoring and inspecting installations and addressing customer complaints.

6.3 SWH PROMOTION AND INSTALLATIONS IN MALTA

6.3.1 History of incentive schemes and grants

Since 2005, the Government has launched a number of grant schemes to promote the use of solar water heaters for households (see Table 4). The first scheme was launched in 2005 and offered a rebate of 20% on the purchase price (capped at a maximum of €116.48). Uptake was rather low.

In 2006, the maximum rebate was doubled to €232.94 and the uptake of SWHs tripled with an average of 1,700 SWH per year. This scheme was continued until 15 February 2009.

Subsequently, in 2009, the Government increased the rebate further to 66% of eligible costs up to a maximum of €460.

In 2010, a fourth scheme for SWHs was launched giving a 40% rebate up to a maximum of €560 on eligible costs on approved systems and installations, but was restricted to specific households, mainly those who meet certain social assistance criteria.

Two new schemes were launched in 2011, one funded through 85% ERDF funds and 15% national funds and the other totally from national funds. The latter scheme was extended until 31 December 2016 by government notice 1272 of 2015.

²⁸ <http://www.rews.org.mt/#/en/a/81-providers-res-and-energy-audits>



Year of scheme launch	Rebate/ Maximum	Maximum	Uptake per scheme	Remarks
2005	20%	€116.48	Low	100% national funds
2006		€232.94	2,536	100% national funds
2009	66%	€460.00	2,966	100% national funds
2010	40%	€560.00	533	Restricted eligibility criteria, ERDF funded
2011	40%	€560.00	37	Restricted eligibility criteria changed, ERDF funded
2011	40%	€400.00	2,690 ²⁹	100% national funds (Scheme still open)

Table 4 – Grant Schemes for Solar Water Heaters

The penetration of solar water heaters for households as at the end of 2014 was estimated at 17,845 installations with a calculated solar heat capture of 35.8GWh.

The government also issued a number of capital grant schemes, managed by Malta Enterprise, for the non-residential sector. The first scheme for industry was launched in December 2008. The scheme allocated €20 million for Industry and could fund investments in eco-innovative solutions under the environment section. A number of enterprises benefitted from these funds through four calls between 2009 and 2012. Another separate €10 million fund was allocated for ERDF Energy Grant Scheme. The scheme funded 50% on capital investment between €25,000 and €200,000 for investment in alternative energy sources and/or energy saving measures. Three calls were issued, two in 2009 and one in 2010. A number of solar water heaters were supported through these grants.

6.3.2 Permitting of solar installations

MEPA permits the installation of solar water heaters installed within the curtilage of a building as long as these are compliant with the general requirements of the Development Control Design Policy, Guidance and Standards 2015 (DC15) document. SWH applications that fall outside the scope of these guidelines still require a planning permit.

²⁹ Scheme is still open. Figures quoted as on April 2015.

6.4 WAY FORWARD

Government will continue to incentivise the installation of solar water heaters through the continuation of the schemes presently being administered by REWS.

6.4.1 Expected Uptake

It is difficult to predict the uptake of SWH. From past experience and the continuation of Government incentives, a conservative uptake of 400 units per year up to 2020 is being projected.

6.4.2 Trends

While the incentive schemes for domestic SWH installations have registered a positive outcome, a downward trend is still evident as the number of grants paid for SWH has dropped from a peak of 2,469 in 2009³⁰. Table 5 shows the number of grants paid towards SWH installations between 2008 and 2014.

Year	2008	2009	2010	2011	2012	2013	2014
Number of SWH	1,390	2,469	1,814	1,126	804	436	608

Table 5 - Number of domestic SWH installed per year (receiving a grant)

This negative trend can be attributed to two primary factors:

1. the consumer shift towards photovoltaic systems, which have significantly dropped in price;
2. saturation of the SWH domestic market at current levels of support.

There is also a trend in the building sector, which is seeing the re-development of single unit households into multi-dwellings where the installation of a SWH is deemed ineffective due to the height of the building as well as limited roof accessibility.

³⁰ Source: MRA.



6.4.3 Financial Impact

The uptake of solar water heaters in the residential sector in general has been on the decline in recent years, confirmed by the reduction in uptake of the more recent solar water heater schemes (Figure 7). Assuming that the present grant scheme remains in place (that is, a grant of up to €400 on the capital investment), the projected government budget to support the deployment of 400 SWH each year will reach €160,000 annually.

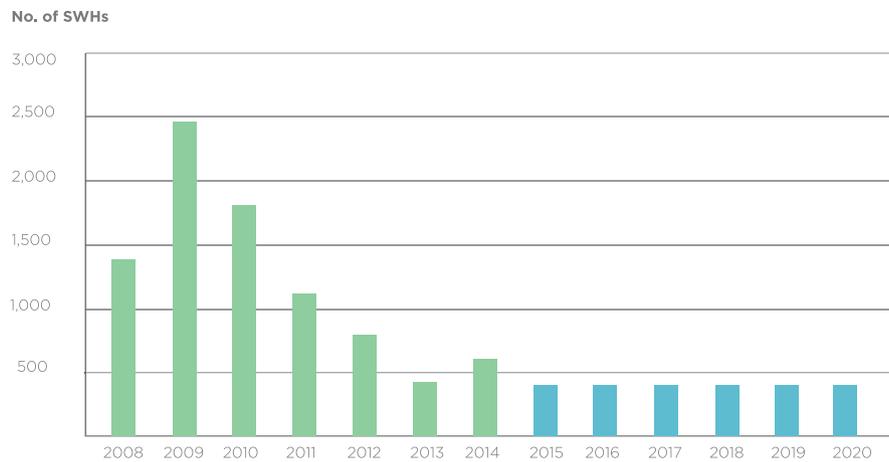
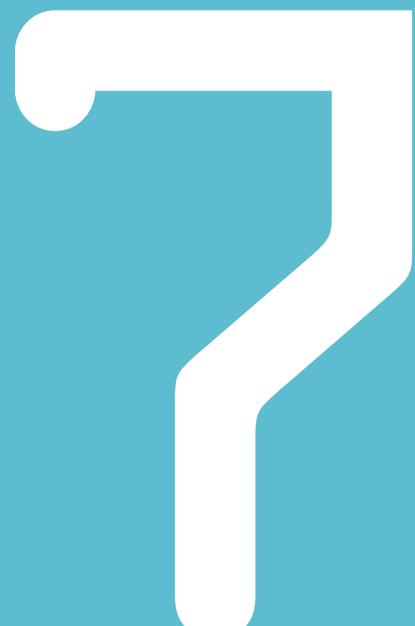


Figure 7 - Number of SWH installations per annum (Actual and projected)



THE
RESIDENTIAL
BUILDING
SECTOR IN THE
CONTEXT
OF HOSTING
PV AND SWH



This section summarises certain trends in the local residential building sector and explains the difficulty in expanding the penetration of domestic rooftop PV and SWH systems.

7.1. GENERAL OVERVIEW

As demonstrated through the recent work done in setting up the cost-optimal energy consumption levels³¹ for residential buildings as well as the work done to satisfy the requirements of the NEEAP³², both PV and SWH technology can have an important role in offsetting the carbon footprint of individual residential units. This is especially viable for those units having favourable characteristics such as adequate roof space and unobstructed access to solar radiation.

However, demographic factors, current building practices and land-use and planning policies have had, and will continue to have, an important and possibly decisive impact on the amount of renewable energy which can be obtained from such technology.

7.2 TRENDS IN OCCUPIED BUILDINGS DEMOGRAPHY

Malta has a total area of 316 km². It is the smallest country by landmass within the EU and has by far the highest population density. This and the fact that the local population has seen an increase of 20% over the last 30 years³³, have driven the building industry, specifically the residential sector, to shift from a predominant single-family house type building (e.g. terraced houses) to a more land resource efficient multi-family (storey) type building (e.g. apartments). In this context, Table 6 shows the shift in dwelling type considering only occupied buildings between 2005 and 2011³⁴.

This change in buildings' demography has an obvious and direct effect on the potential RES available, not only because of the average dwelling size and hence the roof space available, but also because of the way the very limited roof space is owned and can be shared and used in the case of multi-family buildings. In the case of most multi-family buildings, the ownership of the roof is retained by the original landowner for further development. The landowner more often has no interest in harvesting renewable energy.

Owing to this building demography, the drafting of the Nearly Zero-Energy Buildings (NZEB) Plan, which was made available for public consultation in 2015, has developed two components to define a NZEB: a mandatory component which is mostly due to the building fabric and efficient building services and a component of solar-based RES to be applied whenever possible.

³¹ 'Cost-optimal energy performance levels in new and existing residential buildings in Malta' pursuant to Directive 2010/31/EC on the Energy Performance of Buildings.

³² 'Malta's Long-Term Strategy for Mobilising Investment in the Renovation of the National Stock of Residential and Commercial Buildings' pursuant Energy Efficiency Directive 2012/27/EU: Article 4 - Building Renovation.

³³ National Statistics Office (2014), 'Census of Population and Housing 2011, Final Report', Floriana, Malta.

³⁴ National Statistics Office (2014), 'Census of Population and Housing 2011, Final Report', Floriana, Malta.

Type of Dwelling	Year: 2005	Percentage of Total: 2005	Year 2011	Percentage of Total: 2011	Difference 2005-2011
Terraced Houses	54,714	39.3	52,519	34.4	-4.0
Semi-Detached Houses	6,105	4.4	5,812	3.8	-4.8
Detached Houses	3,534	2.5	3,383	2.2	-4.3
Farmhouse	1,261	0.9	1,306	0.9	3.6
Sub-total single-family buildings ³⁵	65,614	47.1	63,020	41.3	-4.0
Maisonettes	40,160	28.9	44,145	28.9	9.9
Flats/ Penthouses	32,569	23.4	44,919	29.4	37.9
Sub-total multi-family buildings ³⁶	72,729	52.3	89,064	58.3	22.5
Other	835	0.6	686	0.4	-17.8
Total	139,178	100	152,770	100	9.8

Table 6 - Dwelling Type

7.3 SPACE CONSIDERATIONS

The average area of new apartments is 74m². Recent residential blocks within development zones, where apartments are normally permitted, is made up of an average of 4 units (including penthouse) on top of each other. The roof would have to accommodate water tanks, TV antennae/aerials and other building services, besides an access room. Space is also limited by shading. This means that in the case where each unit is granted permission to use the roof, each unit may technically have less than 18.5m² allocated to it, less the space for the services detailed above. In certain areas, buildings with up to nine floors are allowed by the existing building regulations, meaning that nine units would have to share the roof space. In practical terms such a space would hardly be enough for a 1 kWp photovoltaic installation. Thus in multi-family building units, specifically apartments, which constitute a significant share of the existing residential building stock (29.4%), the space available for installation of RES is very limited.

³⁵ Single-family housing is a housing classification where each building contains a separate housing unit for residential inhabitants.

³⁶ Multi-family housing is a housing classification where multiple separate housing units for residential inhabitants are contained within one building.



The change in building policies in 2006 allowing an additional habitable unit (penthouse) on top of existing buildings further reduces the area available for services and RES. The airspace on top of the penthouse is either sold with the penthouse or retained by the original owner/developer for further development should additional floors be permitted. Such property speculation hinders the deployment of RES on readily available space.

A similar situation applies to maisonette developments, with a ground floor and a first floor maisonette. The ground floor unit is usually allocated the back yard while the first floor maisonette enjoys the full roof, meaning that the ground floor maisonette is only allowed to install a water tank, a TV antenna and possibly a satellite dish on the roof. This means that half of the existing maisonettes, circa 22,000 units or 14.4% of all dwellings (potentially) do not have access or right to install photovoltaic panels or solar water heaters.

7.4 SOLAR RIGHTS

Single-family dwellings (terraced houses, detached and semi-detached houses) constitute 41.3% of all existing residential buildings. From the perspective of available roof area, in theory, their owners have fewer issues to install photovoltaic panels or solar water heaters. One hurdle faced in this instance is the lack of protected solar rights.

Terraced houses are located within development zones, where other development types (including multi-floor residential buildings) are permitted. Such developments, if and when they happen, create a situation where multi-floor residential buildings are adjacent to terraced houses in a predominant side by side narrow rectangular plot matrix, which creates instances of potentially severe over-shading.

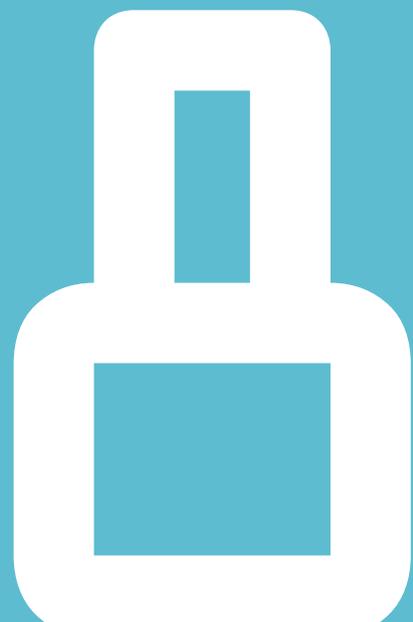
In the absence of any regulations protecting solar rights (or regulated compensation), it is becoming more common for owners of terraced houses to encounter problems with their photovoltaic or solar water heater installation, due to the over-shading of adjacent buildings. Such problems, arising in the course of the system lifetime, may be so acute as to downgrade the performance of already installed RES systems appreciably.

7.5 PLOT SIZE, SHAPE AND ORIENTATION

It is a very rare occurrence that dwellings are designed having a different orientation other than that dictated by the size and shape of the building plot. Plots in Malta are characteristically narrow and long, with a front and back façade of just 6m wide. This oblong configuration leaves little scope for manipulation in the orientation of the building to promote certain passive technologies or indeed to maximise RES output. The orientation is determined by the plot shape and its alignment with the road, whose alignment was not fixed on solar orientation criteria. Factoring in planning restrictions, it is often very difficult to allocate the right 'sunny' South-facing space for photovoltaic or solar water heating installations.

7.6 CONFLICTING USE OF ROOF SPACE

As previously discussed, Malta is a country with very limited open spaces in urban areas where the population density is even greater than the already high average density. Flat roofs provide much needed outdoor space. Such space, where accessible, is very much valued by the building owner for clothes airing and drying, which is in itself a beneficial practice to be encouraged, but also for family relaxation and entertainment.



ENERGY FROM WASTE



Deriving energy from waste is an important aspect of waste management. In fact, this has been reflected in Malta's Waste Management Plan adopted in January, 2014. Malta's Waste Management Plan represents the Government's approach towards the efficient use of resources and thus sets out a strategic direction for the waste sector. The core aim of the plan is that of moving waste management in Malta up the waste hierarchy through increased prevention, re-use, recycling and recovery, and minimize disposal. Energy recovery can therefore be an effective measure to process residual waste and further reduce land-filling especially if a significant share of the recovered energy is considered as renewable. This however, depends on a transformation of a variety of characteristics not least current population habits, waste volumes generated, waste collection practices, waste infrastructure and output markets. Malta's high population density, limited land space and lack of economies of scale coupled with the effects of its climatic conditions, proves challenging to achieve this aim. This plan is intended to be reviewed every three years in order to keep up with ongoing developments and ensure its full implementation.

One of the aspects for the implementation of Malta's Waste Management Plan includes the possibility to consider the development of a facility for waste treatment to reduce the quantity of waste deposited in engineered landfills, with the potential scope of Malta generating renewable energy from waste treatment. To determine the feasibility of such a consideration, the Maltese authorities are therefore coordinating a project to study the development of a waste to energy facility. This study is expected to take into account, inter alia, the characteristics of our local context and any relevant waste projections as well as a financial and economic analysis for the prospective development of a facility. Given the ongoing study and the nature of a project to develop a facility on the Maltese islands, such a potential source for renewable energy cannot be considered within the 2015-2020 timeframe.

Current waste assets with the potential to generate renewable energy in Malta and identified in Malta's Waste Management Plan include:

- Landfills at Għallis and Żwejra operated by WasteServ Ltd are equipped with gas extraction systems;
- The biological treatment plant (MBT) at the Sant Antnin Solid Waste Treatment Facility also operated by WasteServ Ltd;
- CHP plant at Ta' Barkat sewage treatment plant (STP) operated by Water Services Corporation.

8.1 AVAILABLE OPTIONS FOR ENERGY HARVESTING IN NATIONAL WASTE MANAGEMENT

The current Waste Management Plan (2014) outlines the following projects that could be adopted in the future, singly or in combination, for the energy harvesting from waste. These include:

- Expansion of Sant Antnin Waste Treatment Plant from the currently permitted capacity of 71,000 tonnes to 100,000 tonnes per annum to ensure that there is enough organic throughput to ensure that the digester can work at its maximum design capacity (this will entail a revision of the permitted capacity of the plant since the plant design caters for a larger capacity than that actually permitted for). Retrieval of gas for energy generation is expected to increase proportionately.

Although such an expansion is an option, variations to the Integrated Pollution Prevention and Control (IPPC) permit are required while an increase in operating/maintenance hours and man hours as well as major modifications to the dry MTP would be required.

- Construction of a Mechanical Biological Treatment Plant (MTP - AD) for the North of Malta for treatment of Municipal Solid Waste (MSW) and a biological treatment plant for animal manure which has already been permitted, and for which EU co-financing has been secured.

At this facility waste is processed to have the organic fraction and the Refuse Derived Fuel (RDF) extracted from the remaining waste which shall be directed away from the landfill. The digestion plant treats the organic fraction resulting from MSW and will also include a potential for the treatment of the animal manure not managed directly by farmers.

- Further treatment of RDF to improve its quality and allow for the recovery of embedded energy. This could potentially also be handled by the private sector should it view such an operation as a niche market and can be economically sustained.

The second option has been completed and is operational. The development of the above mentioned technologies would necessitate further treatment options to deal with waste generated from such facilities and the remaining non-recyclable/non-recoverable waste not directed to these facilities. The latter waste streams, which will mainly consist of refuse derived fuel (RDF), rejects from MBT plants, residual MSW and other non-recyclable/non-recoverable wastes, may be managed in any one or a combination of the following options:

- Local energy recovery (this would entail the development of an energy-from-waste processing facility);
- Export of this fraction for energy recovery;
- Land-filling.



These options are to be re-assessed in more detail in the light of the proposed capacity expansion and new facilities listed above, including through a cost benefit analysis, to determine the financial feasibility of the options considered.

Once the reassessment is completed and a policy direction decided, the Government will be in a better position to assess the potential for energy from waste.

8.2 BIOGAS FOR ELECTRICITY AND HEAT IN THE ANIMAL HUSBANDRY INDUSTRY

Biogas produced from farm waste such as animal manure can be used to generate electricity and/or heat, contributing towards both the renewable energy target as well as Malta's several other environmental obligations. Whilst a centralised management of waste stream offers advantages brought about by economies of scale, localized, small-scale plants intended to process animal manure produced on site may also be attractive for many reasons including:

- reduces the need for waste transportation and related emissions and odours;
- reduces contamination of groundwater from leaching nitrates and other substances;
- enables the agricultural sector to be more sustainable and environmentally friendly;
- can offer the possibility of an additional revenue stream for farmers.

Provided sufficient waste of suitable quality is available for processing, small-scale biogas plants, often coupled with CHP units to produce electricity and heat, can contribute towards a better environment.

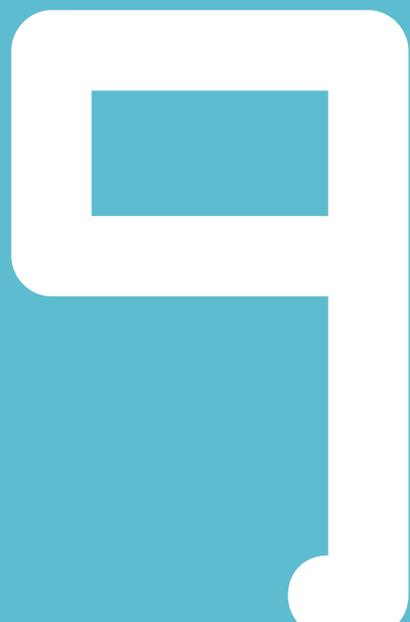
Government is committed to identify the appropriate funding mechanism so as to make projects to generate renewable energy from manure financially viable. For this purpose funds are being sought through Theme 4 of the Rural Development Programme 2014-2020 which has been approved by the EC in November 2015.

Under Focus Area 5C of the Rural Development Programme 2014-2020, around €8.5m (public expenditure) will be used to encourage the utilisation of renewable sources of energy and to invest in new technology to reduce and recycle wastes and other residues. Almost 90% of the resources will be available to encourage investment in equipment using Measure 4, while support for co-operation in renewable energy planning and management (e.g. for biogas plants using manures and crop residues) will help ensure its effective use. Because of the generally high capital cost of these kinds of investment, it is estimated that this focus area may reach around 300-400 farms.

Photovoltaic panels have been identified by farmers as a potential means of reducing operating costs. PV panels and biogas production are increasingly seen as opportunities for Malta, but both require development support. Biogas (produced by anaerobic digesters) will require cooperation among a number of livestock/pig farms to become economically efficient, while PV panels are increasingly attractive to both arable and livestock/pig farms (Measures 4, 16).

8.3 CURRENT PLANS TO 2020

WasteServ Malta's Waste to Energy Contribution (Updated September 2015)											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Electrical (GWh)											
<i>Landfill Gas</i>	0.00	0.00	0.58	1.29	1.24	1.30	1.30	2.0	2.0	2.70	2.70
<i>SAWTP MBT*</i>	0.00	1.55	2.50	0.27	0.42	1.80	1.80	1.80	1.80	1.80	1.80
<i>Malta North MBT</i>	0.00	0.00	0.00	0.00	0.00	0.00	3.00	6.00	6.00	6.00	6.00
Heat (GWh)											
<i>Landfill Gas</i>	1.80	2.18	2.47	1.31	1.88	1.30	1.30	1.30	1.30	1.30	1.30
<i>SAWTP MBT</i>	0.00	1.39	2.20	0.24	0.40	1.50	1.50	1.50	1.50	1.50	1.50
<i>Malta North MBT</i>	0.00	0.00	0.00	0.00	0.00	0.00	1.30	2.50	2.50	2.50	2.50
<i>Marsa Thermal Treatment Facility**</i>	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.50	3.50	3.50	3.50
Note: 2010-2014 is actual data											
* Reduced electricity generation in 2013 and 2014 due to fault in hydrolyser tank											
** Taking into consideration the tallow to be used as a renewable fuel											



RENEWABLE
ENERGY
IN
TRANSPORT

9.1 RENEWABLE ENERGY IN TRANSPORT

The transport sector is today almost fully dependent on fossil fuels. It accounts for the largest share of the total conventional energy consumed in Malta, equivalent to around 74% of the fuel used in the inland market, excluding that used in international aviation and power stations. Transport therefore is an important sector to be tackled in this National Renewable Energy Action Plan.

By its nature transport is the sector that is the most difficult to decarbonise. A separate target of 10% renewable energy penetration in road transport by 2020 has been set by EU directive 2009/28/EC to drive progress in this area.

This national target is expected to be reached mainly through the use of biofuels, with a minor contribution by electric vehicles which would be partially powered by renewable electricity. In Malta, there is no rail or other form of mass transport that can be electrified. Rail has so far been considered as not financially viable in view of the small population and potential patronage, though the viability of small networks in very busy areas is being discussed in the context of the Transport policy.

In 2014, the fuel mix used in transport (in terms of energy contents) was made up of EN228 petrol (42.5%), EN 590 automotive diesel (55.0%) and 2.5% biodiesel. Should Malta continue on this path and increase the biodiesel component to reach the overall RES-T target set for 2020, a biodiesel blend of circa 10%³⁸ would be necessary. Such a blend would be out of current fuel standard for diesel (EN 590) and therefore alternative solutions to meet the 2020 RES-T target have been assessed.

Apart from biodiesel, two further biofuel blends are being considered for the scope of presenting potential scenarios for meeting the RES-T target. These are Bio-ETBE processed from bio-ethanol for petrol and hydrotreated vegetable oil (HVO) for diesel.

9.2 BIOFUELS

9.2.1 Characteristics of biofuels

Biofuels are a green energy source that can replace some conventional fossil fuel. They are produced from non-petroleum, renewable resources. They are bio-degradable, non-toxic and safe to handle. They emit less greenhouse gases and other pollutants than fossil fuels (except nitrogen oxides emissions by a small percentage). For the purpose of GHG accounting under the Effort Sharing Decision, biofuels which satisfy the sustainability criteria are considered to have zero GHG emissions and so the savings would be 3.1KgCO₂/Kgfuel consumed in the case of petrol and 3.2KgCO₂/Kgfuel in the case of diesel³⁹.

³⁸ It is assumed that all biodiesel is eligible for double counting towards the RES-T target and that the diesel-to-petrol ratio consumed by the transport sector remains unchanged until 2020.

³⁹ Source: IPCC Guidelines 1996, 2006.

The major bio components used to blend with road transport fuels in Europe are biodiesel and bio-ethanol. Their calorific value (33 MJ/l for biodiesel and 21MJ/l for bio-ethanol) is less than that of their mineral counterpart. Both are also more expensive by energy contents.

9.2.2 Sustainability

Biofuels are only beneficial from an environment perspective if they are produced in a sustainable manner – without inducing food scarcity and without interfering unduly with the wider environment. Malta requires that biofuel placed on the market in Malta fulfils the necessary sustainable criteria, and requires compliance with EU directives and local legislation. REWS is the competent authority for fuel quality and ensuring adherence to sustainability criteria. The RES directive defines two sets of sustainability criteria which are GHG emission savings and land-use requirements.

9.2.3 Local production

Crops grown for the purpose of producing biofuel⁴⁰ require large expanses of land, fertile soil and an abundant supply of water. Malta has none of these and so no biofuel crops can be cultivated domestically.

As at 2015, a portion of the biofuel used for blending with EN590 diesel is manufactured in Malta, through the processing of used cooking oil (UCO) and animal fats as feedstock. Local production of UCO biodiesel has been on-going for the past 10 years. This offers the opportunity to recycle used cooking oil waste streams and has the added advantage of reducing possible damage to liquid waste collection systems and disposal costs. It also reduces import of fuel, in proportion to the amount produced.

The full potential of used cooking oil, if all is collected and converted to biodiesel would still fall short of the volumes required to meet the 2020 target. It could potentially produce sufficient biodiesel to replace circa 2% of diesel consumption⁴¹ (by energy), but which would, pursuant to Art 21(2) of Directive 2009/28/EC, count double towards the RE transport target. In 2014, 5,557 tons of biodiesel were consumed, of which 1,633 tons were produced locally and the rest imported. Biodiesel is readily available and traded on international markets.

⁴⁰ The term 'biofuels' refers to liquid or gaseous fuel for transport produced from biomass.

⁴¹ Based on diesel consumed during 2010, and an annual feedstock availability of 7kg/capita.

⁴² Biodiesel is technically referred to as Fatty Acid Methyl Ester (FAME). FAME is produced from either vegetable sources (1st generation) or from other various products such as waste sources such as Used Cooking Oil, or Animal Fats, or the inedible part of plants (2nd generation).

9.3 BIOFUEL OPTIONS FOR MALTA

9.3.1 Biodiesel

As at 2015⁴², biodiesel is the only biofuel available on the market in Malta. There is a general market acceptance of this product, at least up to a certain blend composition.

Biodiesel blend standards

Diesel blended with up to 7% fatty acid methyl ester (FAME), more widely known as biodiesel, is within the parameters of EN 590 standard for diesel fuel. This percentage limit in the EN Standard was raised from 5% to 7% following Directive 2009/30/EC. So far higher blends such as 20% (B20), may be considered for niche markets, such as public transport or heavy vehicles.

Biodiesel consumption

Biodiesel was introduced in Malta in 2003. Biodiesel consumption saw a steady increase until 2007, which can be mainly attributed to a higher availability from fuel stations and its lower price at the pump. However, consumption declined between 2007 and 2010 despite the increase in the prices of petroleum products (See Figure 8). In a report published by MRA⁴³, the factors which could have led to this decline in consumption include the difficulty in accessing pre-blended biofuel and concerns on the quality of biofuel, amongst others. It must be noted that during this period, fuel stations were only allowed to store and sell B100 biodiesel, with the fuel being effectively blended during refuelling. Eventually two of the three local producers of biodiesel closed down.

In order to reverse this trend, Legal notice 68/2011 was published in 2011 to boost the use of biofuels. This introduced a 'substitution obligation'⁴⁴ for importers and wholesalers of automotive fuels whereby market players were now obliged to place on the market a minimum amount of biofuel content calculated as a percentage of the total EN228 petrol and EN590 diesel imported or wholesaled. The percentage was set at 1.5% for 2011, and is expected to reach 10% by 2020 (see Figure 9). Nevertheless, these figures may be reviewed to reflect market availabilities and technical progress.

As at 2014, local importers and wholesalers of petrol and diesel are meeting the substitution obligations by blending EN14214 biodiesel with EN 590 diesel, prior to supplying the fuel stations. The blend ratio varies from one supplier to another depending on the fuel mix placed on the market.

⁴³ MRA, *Biofuel in Transport (2010)* <http://mra.org.mt/wp-content/uploads/2012/08/7.Bio-Fuel-in-Transport.pdf>

⁴⁴ L.N. 68 of 2011 amending the Petroleum for the Inland (Wholesale) Fuel Market (Amendment) Regulations, 2011, (LN 278 of 2007).

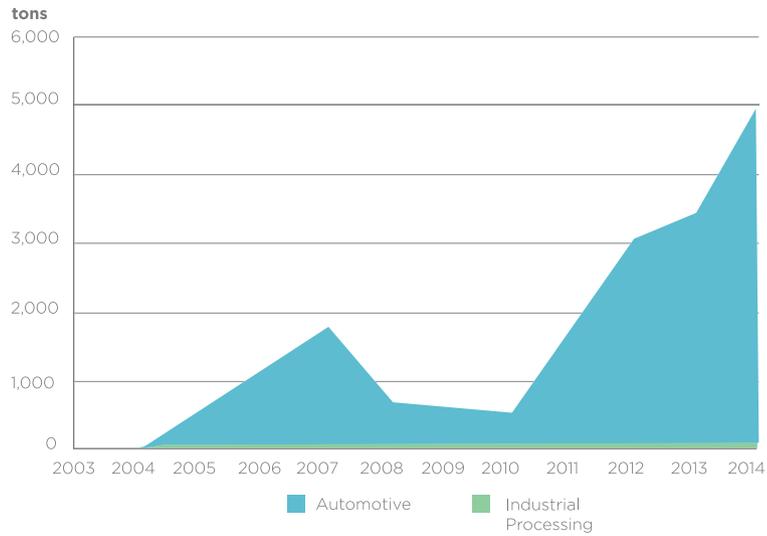


Figure 8 - Biodiesel Consumption in Malta 2003-2014 (Source: MRA)

Year	Minimum biofuel content as a percentage (%) of the total energy content petroleum placed on the market by an authorised provider who is authorised to carry out the activity of an importer and/or wholesaler of petroleum
2011	1.5%
2012	2.5%
2013	3.5%
2014	4.5%
2015	5.5%
2016	6.5%
2017	7.5%
2018	8.5%
2019	9.5%
2020	10.0%

Figure 9 - Substitution Obligation as per LN 68 of 2011

Niche applications

Large fuel stations can offer the possibility to supply more than one biodiesel blend, thus catering for the needs of specific diesel engine fleet users. Niche sectors such as public transport buses, coaches and heavy vehicles may choose to adopt biodiesel with higher biofuel content than B7 envisaged in the EN590 standard under controlled conditions. However, the lack of an EU standard for B20, higher cost of blended fuel, as well as lack of data on the impact on the current fleets in terms of compatibility and emissions, act as barriers for the adoption of higher biodiesel blends.

As at 2014, the share of energy consumption for national marine navigation stood at 2.9% of the final energy consumption of conventional fuels. Locally, the main fuel used for marine navigation is gasoil and although this provides an opportunity for biofuel blending, there are still concerns as regards certain technical aspects mainly related to lack of large-scale proof of principle in the sector⁴⁵. A major setback is the lack of an international standard for biodiesel use in marine applications.

Cost

Low biodiesel blends coupled with a relatively small market means that the amount of biofuel consumed in Malta is comparatively very small⁴⁶. Malta cannot take advantage of economies of scale in procurement and shipping and so the landed cost is generally higher than for larger markets, impinging on the price of the end product for the consumer and on the country's competitiveness.

Increase in demand by EU countries to meet their renewable energy transport targets may further increase the price of biodiesel especially UCO biodiesel, which counts twice towards the target.

9.3.2 Hydro-treated Vegetable Oil

Hydro-treated Vegetable Oil (HVO) is being considered as an option to supplement diesel blending. Hydro-treating of vegetable oils and animal fats is based on modern refining processes distinct from esterification, which is the process through which these feedstocks are converted to FAME biodiesel.

HVO offers several advantages over FAME biodiesel. It has a higher energy content and good solvency when blending, without any temperature issues. Furthermore, HVO parameters are all within EN 590 specifications, except for a lower density, which is not a barrier when blending with heavier diesel or even FAME biodiesel. The pricing of HVO is generally slightly higher than that of UCO biodiesel and may count

⁴⁵ http://www.ecofys.com/files/files/ecofys_2012_potential_of_biofuels_in_shipping_02.pdf

⁴⁶ It is estimated that the amount of UCO biodiesel required in 2020 will be around 7,800 tonnes.

as double towards the RES-T target if appropriate feedstock is used in the production process.

HVO meets CEN Technical Specification TS 15940:2012 for paraffinic diesel fuels. As the next step the Technical Specification will be updated to a formal EN 15940 standard⁴⁷. EN 590:2013 allows HVO components without limit in addition to the maximum 7% of biodiesel (by volume).

9.3.3 Bio-ethanol

While Bio-ethanol⁴⁸ is widely available on the global fuel market, and is the preferred green fuel to replace petrol, it is not available for consumption in Malta. It is prone to technical difficulties, mainly stemming from the hot Maltese summer climate and it is difficult to see it being adopted for general consumption. Below are some considerations relative to the use of bio-ethanol.

- Local bio-ethanol production is subject to the same constraints as for biodiesel and so cannot take place locally unless the feedstock is imported;
- Addition of bio-ethanol to petrol increases the vapour pressure of the fuel blend and so the possibility of emissions of benzene and volatile organic compounds will increase. This is exacerbated by the high ambient temperatures associated with summer in Malta. The vapour pressure of bio-ethanol-petrol would exceed the limit determined by EN 228;
- Bio-ethanol, as quoted on the international market, is more expensive than mineral petrol (in energy terms). It has a low calorific value (21 MJ/l) compared to petrol (31 MJ/l). Even if technical difficulties were overcome, consumers would be faced with a higher price for the blended product;
- Bio-ethanol suffers from storage and blending difficulties. It has to be blended at the wholesaling site prior to loading on fuel tankers due to its hygroscopic nature;
- So far, local fuel importers were unable to procure 'off the shelf' reformulated EN 228 petrol with a lower Reid Vapour Pressure (better than Class A) and so are precluded from blending bio-ethanol.;
- Noting the age of Malta's vehicle stock, a blend exceeding 3% may not be fully compatible with a significant number of vehicles. Vehicle owners need to consult with their respective car distributor to certify that the available fuel is appropriate and compatible with their vehicle engine.

⁴⁷ https://www.neste.com/sites/default/files/attachments/hvo_handbook_original_2014.pdf

⁴⁸ Bioethanol in petrol is blended either with neat ethanol or with Ethyl Tertiary Butyl Ether (ETBE) which is produced from ethanol and isobutylene in a catalytic reaction. Bio-ethanol is also segregated in between 1st and 2nd generation biofuels. 2nd generation bio-alcohols are made from straw and various waste and lignocellulosic materials.

9.3.4 **Bio-ETBE**

Bio-ETBE is not available for consumption in Malta as yet. Local importers are exploring the possibility of introducing Bio-ETBE⁴⁹ which does not exhibit the disadvantages of Bio-ethanol when blended with petrol.

Below are some considerations relative to Bio-ETBE as an adequate renewable fuel substitute for petrol:

- ETBE is a mature fuel and is regularly used as an octane booster at the refinery stage. Bio-ETBE is partially of renewable origin, and is typically imported pre-blended at the refinery;
- The pre-2009 Bio-ETBE standard allowed up to a 15% blend, broadly equivalent to E7 (7% ethanol);
- Following Directive 30 of 2009, the allowable percentage blend was increased from 15% to 22%. Vehicles manufactured from and around that period should, by specification, be able to run on Bio-ETBE at 22%;
- Like other biofuels, Bio-ETBE emits less greenhouse gasses (lifecycle CO₂ emissions) and other pollutants (except nitrogen oxides emissions) than fossil fuels;
- Currently Bio-ETBE uses first generation bio-ethanol as feedstock and so is not eligible for double counting towards the RES-T target. Its production process is such that only 37% of the energy contents of Bio-ETBE counts as renewable;
- Unlike direct bio-ethanol blending which can increase the vapour pressure of the resulting blend, blending Bio-ETBE would result in a lower overall vapour pressure which helps reduce evaporative VOC emissions from the vehicles' fuel system;
- The reduced impact of Bio-ETBE on the blend's vapour pressure also reduces the probability of engine performance difficulties during some hot summer days;
- Owners of vehicles have to be careful that the fuel they are using is appropriate and compatible with their vehicles;

⁴⁹ Ethyl Tertiary Butyl Ether (ETBE) which is produced from ethanol and isobutylene in a catalytic reaction.

⁵⁰ During 2013, 43.6% of newly registered vehicles were new. The rest were imported second hand vehicles - Source NSQ.

⁵¹ http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Tokyo_Japan_6-30-2014.pdf

- Malta's vehicle fleet composition is unique in that around half of the newly registered vehicles are used vehicles, mainly imported from the UK and Japan. Fuel compatibility therefore also depends on the standards enforced in Japan over the past 10 years or so, apart from the current standards being enforced at EU level. The Government of Japan has permitted sales of E10 gasoline and vehicles sold on the Japanese market are designed to use E10 or ETBE22 fuels as from April 2012. However second hand car imports would typically be pre-2012 models and may not be suitable to run on the higher blends;
- Bio-ETBE is generally more expensive than petrol (as quoted on international markets) when considering energy content. High percentage blends are required to meet target. This will impinge on the fuel retail price.

9.4 COMPATIBILITY WITH THE VEHICLE STOCK IN MALTA

The average age of passenger vehicles as at end of 2014 was 15 years, with over 46% being older than 15 years. This is significantly higher than the EU average (8.2yrs in 2009)⁵² and has to be factored in when introducing biofuel products which, in certain cases, may not be fully compatible with older vehicle models. The vehicle age distribution (as at 2014) is shown in Figure 10.

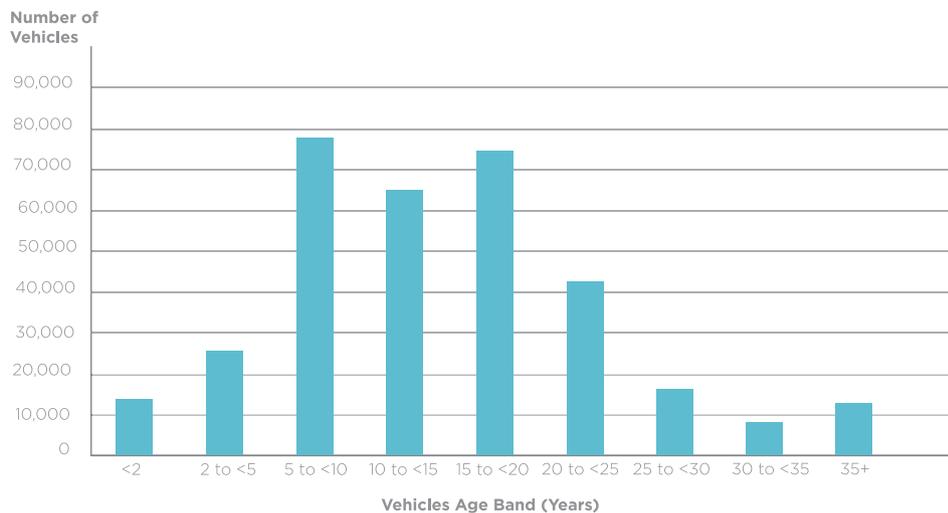


Figure 10 – Vehicle Age Distribution (as at end 2014) - Data Source: NSO

⁵² <http://www.eea.europa.eu/data-and-maps/indicators/average-age-of-the-vehicle-fleet/average-age-of-the-vehicle-3>

9.5 ILUC (Indirect Land Use Change) Proposal and Cooperation Mechanism

Although several fuels/technologies are available on the international market, concerns remain. These mostly relate to the availability of a suitable type of biofuel, the compatibility of the fuel with the vehicle fleet, and prices of the fuel/technology. The situation is fluid and warrants constant monitoring and review. These difficulties have prompted Malta to propose to the European Commission to extend the 'cooperation mechanisms' for reaching the overall RES target to apply also to the RES-T target. This proposal has been adopted by Directive (EU) 2015/1513 which includes a number of amendments to the RES Directive as follows:

- A maximum cap of 7% crop-based biofuels that can count for the target;
- A 0.5% non-binding sub-target for advanced biofuels. Advanced biofuels will be double counted towards the 10% renewable energy in transport;
- Electric vehicles count five times; electric rail counts 2.5x;
- Cooperation mechanisms available also to reach the transport target.

9.6 OTHER MEASURES TO REDUCE THE IMPACT OF TRANSPORT ON CLIMATE CHANGE

9.6.1 Energy Efficiency in Road Transport

The technical difficulty to reach the sectoral target for RES penetration in transport is well known. Hence efficiency in energy use assumes greater relevance as a parallel route to achieve the over-arching Climate Change targets and facilitates the achievement of the relevant RES-T target in the sector. The measures that are being taken⁵³ to improve transport efficiency are summarised below.

- Development of a National Transport Strategy and Transport Master Plan covering all modes of transport for the short, medium and long term, and which takes due consideration of energy efficiency and renewable energy use in transport.
- Improving EE in the public transport service
 - New bus fleet with Euro VI Diesel engines. Hybrid Electric Buses are also deployed as part of the service;
 - Rationalization of public transport routes;
 - Intensified use of inter-harbour ferry services to relieve congested roads along the perimeter of the Grand Harbour;
 - Upgrade of road infrastructure to reduce congestion;
 - Deployment of an Intelligent Traffic Management System;
 - Education campaign highlighting the positive aspects of public transport.

⁵³ Described in detail in the NEEAP.

- Increasing the attractiveness of public transport services
 - The over-arching objective of the Public Transport Reform is to shift the preferred mode of individual transportation from personal vehicles to public transport. Malta Public Transport announced the new tal-linja card in May 2015, which is a new smartcard-based electronic ticketing system aimed at simplifying the purchase of bus tickets and making the system more efficient. By July, it was reported that more than 60,000 bus trips are being made daily using the new tal-linja bus card⁵⁴. Further reforms of the service are aimed at improving punctuality and also convenience through providing tools (such as smartphone apps) for easier journey planning and real time information to commuters;
 - Park and ride facilities;
 - Bus lanes for public transport services and priority lanes.

- Increasing the efficiency of private transport
 - Scrappage schemes designed to incentivise owners to scrap old, high fuel-consuming vehicles, and replace them with new Euro Vb / EURO VIb vehicles having low CO2 emissions. The first scrappage scheme for private cars was introduced in November 2010 to encourage the scrapping of old polluting cars. This led to the scrapping of 5,195 cars (older than 10 years) over the period Nov 2010 - Dec 2012. Two more schemes were launched in 2013 and 2014. Another scheme was launched in 2015, with the scheme being extended following the uptake of the first, within two months.

 - A fiscal regime that taxes vehicles at first registration based on size and CO2 emissions has in fact resulted in smaller, more efficient vehicles appearing on the road. However, this is, to some extent, undermined by the EU free market rules that have seen a significantly greater increase in larger, older used vehicles also registered in Malta;

 - A registration tax for commercial vehicles, depending on their Euro engine class, with the aim of reducing the number of older, more polluting vehicles on the road.

 - Upgrading of roads and junctions to ease traffic flow, reduce congestion and shorten journey times such as improving accessibility into the capital city, Valletta, and the upgrade of the busy Kappara junction which is also part of the EU TEN-T network.

⁵⁴ <http://www.timesofmalta.com/articles/view/20150722/local/bus-card-usage-grows-refund-period-extended.577665>

- Promotion of eco-driving, car-sharing, public education campaigns and similar measures.
- Better planning tools for Transport Malta
- The development of a national transport model to support strategy development.

9.6.2 Renewable Electricity for Transport: Electric Vehicles

General situation in Malta

In Malta there were only 136 electric and 432 hybrid vehicles out of 275,380 licensed passenger cars by the end of Q4/2015⁵⁵ (equivalent to 0.05% and 0.16% respectively), notwithstanding incentives in their favour by Government. At current price levels, it is unlikely that significant take-up of EV shall occur in the next few years.

Targets

The Malta National Electromobility Action Plan (2013) highlights the need for Malta to make transport more environmentally friendly, with electrification of transport seen as one of the solutions to this achievement. The government is committed to ensure that sufficient technical infrastructure to support electric vehicle uptake (e.g. accessible and intelligent charging points, as well as servicing facilities) are in place. In this context an EU-funded LIFE+ project (DemoEV)⁵⁶ and an Italia-Malta project (Port PVEV)⁵⁷ have/are supporting the development of the necessary infrastructure and increase the public confidence in EVs.

Government incentives

Government has been promoting the purchase of electric cars for personal use through grant schemes since 2008. Under the scheme launched in 2015, consumers buying electric vehicles benefit from a government grant of up to €4,000 towards the initial cost and a heavily reduced vehicle registration tax and circulation tax. The grant value increases to €5,000 if the person registering the electric vehicle also de-registers a car which is at least 10 years old. Those registering an electric quadricycle benefit from a grant of €1,500. The grants are applicable to individuals as well as to enterprises and NGOs and beneficiaries can also opt to buy second hand electric vehicles⁵⁸.

⁵⁵ https://nso.gov.mt/en/News_Releases/View_by_Unit/Unit_B3/Environment_Energy_Transport_and_Agriculture_Statistics/Documents/2016/News2016_008.pdf

⁵⁶ <http://www.electricvehiclesmalta.eu/>

⁵⁷ http://www.portpvev.eu/index.php?id_sezione=0&id_lingua=2

⁵⁸ <http://www.transport.gov.mt/news/grant-scheme-on-the-purchase-of-electric-vehicles-to-include-registered-ngos-an>. Second hand electric vehicles should not exceed 12,000 km on the odometer and would not be more than 24 months old.

The National Electromobility Action Plan recommends other financial incentives as well as soft measures in line with the local requirements, and which would need to be reviewed over time depending on the uptake of EV.

Real benefit of EV

The real contribution of EV to increased penetration of RES in Malta is marginal at best. Their contribution lies more in achieving zero tailpipe emissions, as the effective reduction in GHG emissions depends on the efficiency of the generation and distribution sector and their fuel source. Electric vehicles are, in general, more environmentally friendly than conventional vehicles when the electricity is produced from high efficiency plants or decarbonised sources.

Low uptake of EVs

Indicative projections being carried out as part of the ongoing study An Energy Roadmap: Towards Achieving Decarbonisation for the Maltese Islands, show that the penetration level of electric vehicles until 2020 is expected to remain marginal with respect to the total private car fleet.

The Maltese market for EV is minute by any standard and Malta is a technology taker. It will therefore not influence the development of EVs or their marketing. The low uptake of EVs is mainly attributed to the relatively high capital cost compared to internal combustion engine (ICE) vehicles having similar specifications. A typical EV costs around twice as much as a comparable ICE vehicle and the government incentives in the form of grants have so far been unable to bridge this price gap.

Battery life is rather limited compared to what the public perceives to be an acceptable life of vehicles in Malta. Replacement cost is relatively high. The business model whereby the vehicle owner leases the battery has recently been introduced in Malta to soften the initial capital outlay. Its success will much depend on the comparative costs of the monthly fuel savings and the battery lease, as well as the expected additional cost which would be incurred after the battery lease agreement expires.

The choice in EVs is still relatively limited. There is also a perceived limited mileage range between battery charges and also the fact that the battery could need replacement after 8-10 years. This has to be assessed from the local perspective, where the average age of the vehicle stock is 15 years.

Electric vehicles are expected to play a more important part post-2020 as the greening of the generation sector would translate into lower transport-related GHG emissions. Electric vehicles are in line with the 'Challenge 2050' vision to reduce GHG emissions because it appears easier to decarbonise bulk electricity generation rather than fossil fuel-driven road transport.

9.6.3 Use of cleaner fuels

The use of cleaner fuels, such as autogas instead of other fossil fuels, also facilitates the achievement of the sectoral RES targets in the transport sector.

Autogas is the commonly used name for liquified petroleum gas (LPG) when used as a fuel in ICE and thus is not a renewable source of energy. Nevertheless, it is cleaner than diesel/petrol and burns efficiently. It replaces petrol and diesel in the transport fuel mix and is available at the prescribed standard EN 589.

Government is promoting the conversion of existing petrol-driven vehicle engines to run on autogas. REWS has published all relevant codes of practice and has a register of licensed retrofitters. Petroleum stations that can meet the relevant codes of practice, including space requirements, can retail their product. As at 2014⁵⁹, there were four fuel service stations retailing this fuel.

The Government has launched a grant scheme in conjunction with Transport Malta to incentivise conversions to autogas. Subject to certain conditions, beneficiaries can benefit from a grant of €200 when converting their M1 motor vehicle to run on autogas. Conversion to autogas is particularly useful for older, less efficient vehicles. Emissions will decrease without sacrificing the performance of the vehicle. It is intended that this scheme continues.

9.7 MEETING THE 2020 RES TRANSPORT TARGET UNDER DIFFERENT SCENARIOS

The various measures implemented so far as well as further policy measures planned for the period 2015-2020 should ensure that Malta meets its 10% target in 2020. However in order to assess the expected demand on biofuels, a number of scenarios for consumption of transport fuels for the 2015-2020 period were modelled based on present and projected fleet composition, transport demand and energy efficiency policies⁶⁰.

A sensitivity analysis was carried out by varying the age distribution of stock of newly licensed passenger vehicles, the results of which are shown in Figure 11 (petrol) and Figure 12 (diesel). Subsequent financial estimates and biofuel options are based on the business-as-usual (BAU) scenario⁶¹. Fuel demand by non-passenger vehicles was assumed to remain fixed for the period modelled

⁵⁹ <http://mra.org.mt/wp-content/uploads/2013/07/4302/List-of-Autogas-Authorised-Providers-update-till-03-10-2014.pdf>

⁶⁰ The scenarios were based on a demand growth (activity) of 2.2%, which is in turn based on the average growth rate for the period 2010-2014. It was further assumed that the current policy scenario in terms of new licensed vehicles and scrapped vehicles remains as for 2013/2014 with an increase of around 8,900 of newly registered and 3,600 deregistered petrol vehicles, and 5,400 newly registered and 1,100 deregistered diesel vehicles per year. Newly registered vehicles include both new and used imported vehicles.

⁶¹ The BAU scenario includes all present measures as well as measures included in the National Energy Efficiency Action Plan (NEEAP).

Taking the BAU scenario (see Figure 13), Malta will need to place 750 TJ of biofuels on the market in 2020. As at 2015, only one operator imports petrol, which given the petrol to diesel share placed on the market, cannot meet the 10% target through the exclusive use of biodiesel (which is limited to a maximum of 7% by volume content) even if UCO biodiesel is used. Other operators who import only diesel should not have any difficulty meeting their 2020 target if they blend UCO biodiesel. Thus, other biofuels need to be considered by the operator importing petrol for blending with diesel or petrol in order for him to meet the substitution obligation and for Malta to reach the RES-T target.

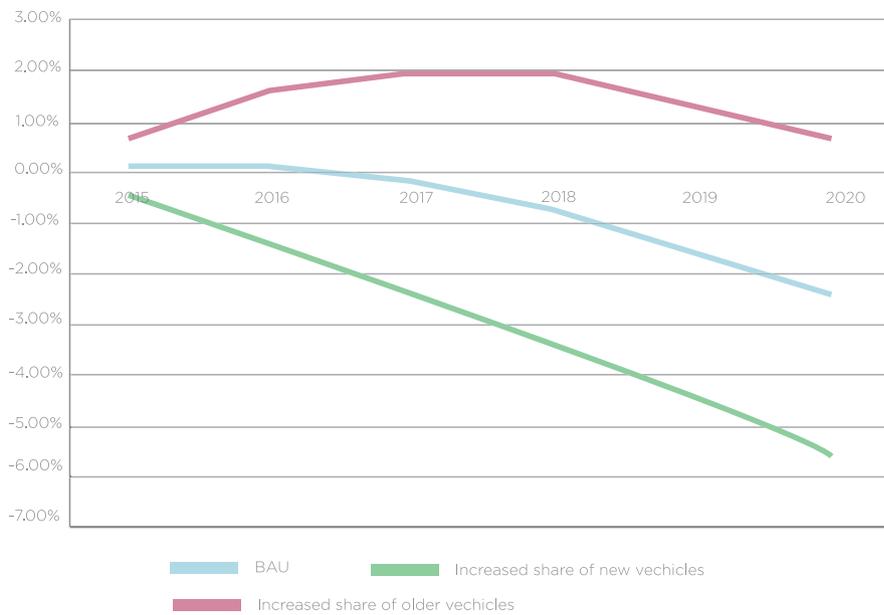


Figure 11 - Sensitivity analysis of petrol used by 2020

Heavy duty diesel engines may be modified to run on higher percentage biodiesel blends, such as B20. Such a measure implemented on the entire public transport fleet could increase the use of biodiesel and possibly reduce the requirement for alternative biofuel options.

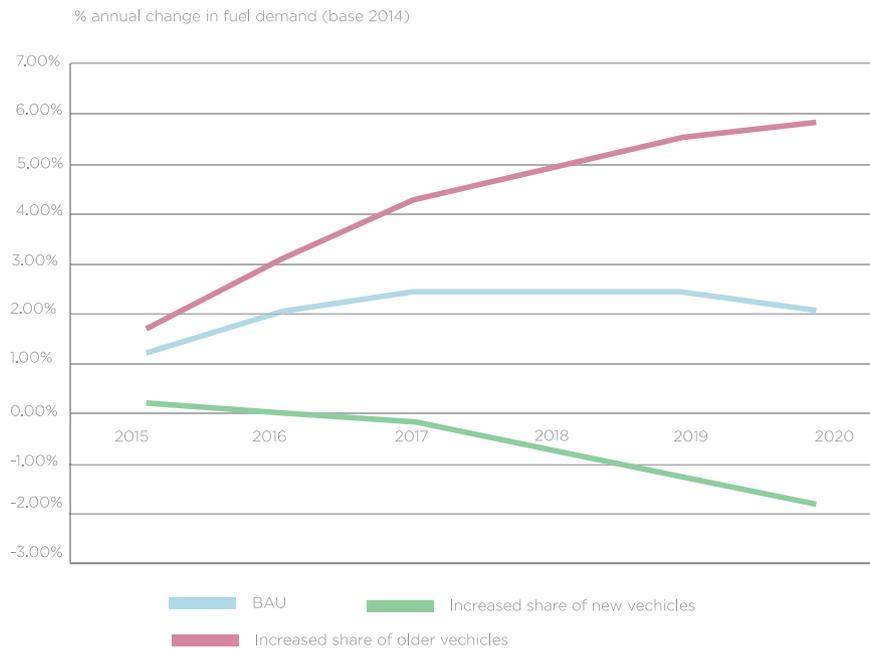


Figure 12 - Sensitivity analysis of Diesel used by 2020

However, such a measure might require ad-hoc cost allocation or subsidies so as not to transfer the additional costs associated with biofuel blending from private to public transport. One would need to explore ways to support the additional cost of B20 either directly or else through a lower excise tax. This would have a budget impact and may need clearance by the EU Commission for possible state aid implications.

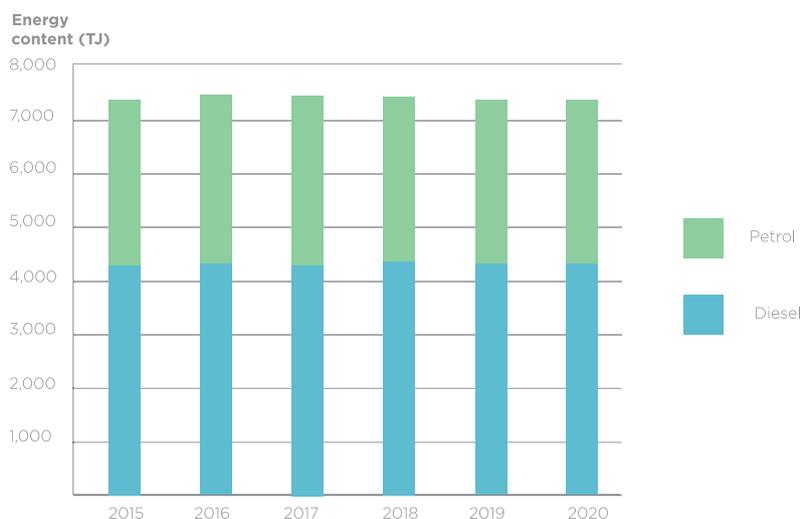


Figure 13 - Projected petrol and diesel demand for road transport

Furthermore B20 needs acceptance by the private operator of public transport. This may be an issue especially during the present ongoing reform.

Different scenarios have been prepared in order to assess the best way forward in this sector. The following considerations were taken:

- Biodiesel produced from UCO, which is currently being used by local importers of petroleum to meet the substitution obligation, has been given priority over other biofuels in view of the fact that it is already being produced locally and imported as well as its double counting effect on the RES-T share;
- Once the maximum limit of 7% volume of biodiesel is reached, other biofuels were considered, namely HVO and Bio-ETBE.
- All importers will blend a maximum of 7% UCO biodiesel. In practice importers who supply only diesel may limit blending to 5% UCO biodiesel as this would be sufficient for them to meet their 2020 target.

Figure 14 and Figure 15 portray the blends of HVO⁶² or Bio-ETBE that would be required to fulfil the substitution obligation.

⁶² It is hereby being assumed that HVO is not eligible for double counting towards the RES-T Target.

Double-counted biodiesel alone would still be insufficient to reach the 10% RES-T. If HVO is blended with diesel and biodiesel, around 5 million litres of HVO would be needed. On the other hand, if Bio-ETBE is used as the alternative fuel after pushing the biodiesel share to the limit (7%), a volume four times higher (than with HVO) would have to be blended with petrol. Apart from the lower energy content of Bio-ETBE when compared to HVO, only 37% of its energy is considered as being renewable, thus a higher volume is required. In either case, HVO or Bio-ETBE would need to be blended as from 2018 or earlier, given that in Malta, so far, only one operator supplies petrol for the local market and is therefore bound to reach the 7% blending limit of biodiesel as early as 2015.

In the case when HVO is considered as the second alternative biofuel, the resultant volume ratio of the diesel blend at 2020 would be around 89% fossil-diesel, 7% bio-diesel and 4% HVO.

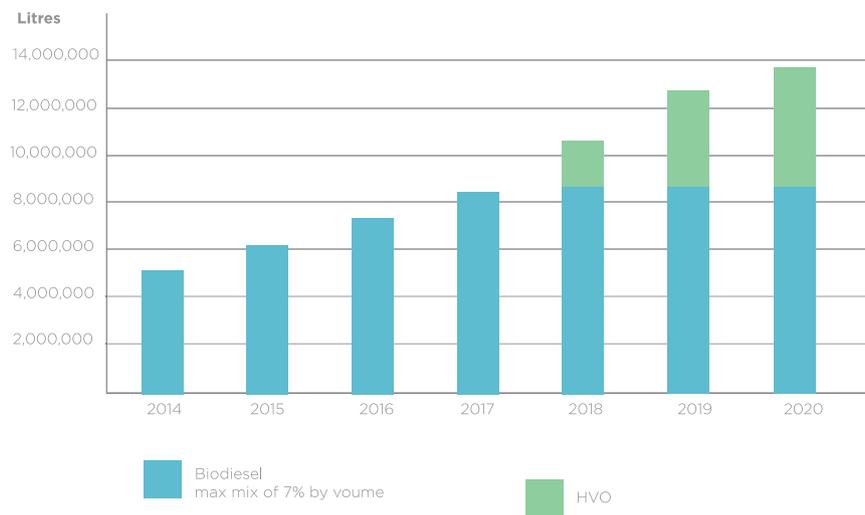


Figure 14 - Biodiesel and HVO scenario

Based on 2014 prices, the overall cost difference between HVO and biodiesel in absolute terms would depend on whether HVO placed on the market would be eligible for double counting. For single-counted HVO, the price gap would be significant. This difference is more accentuated in the case of Bio-ETBE given that only 37% is counted towards the RES-T target. Figure 15 represents a scenario whereby the 10% RES-T target is met through blending of Bio-ETBE with petrol along with B7 diesel fuel. It is estimated that a 20% blend of Bio-ETBE in petrol would be required. It is unclear whether Malta's vehicle fleet would be able to handle such high blends of bio-ETBE in petrol.

In both substitution scenarios presented above, the ratio of biofuel requirements is increased gradually in line with interim targets set by SL423.28 (LN 68/2011) which also reflects the overall RES trajectory. This approach is in line with legal notice 68 of 2011 and the scope is to minimise the additional financial burden on the end consumer in implementing these plans to reach the annual targets.

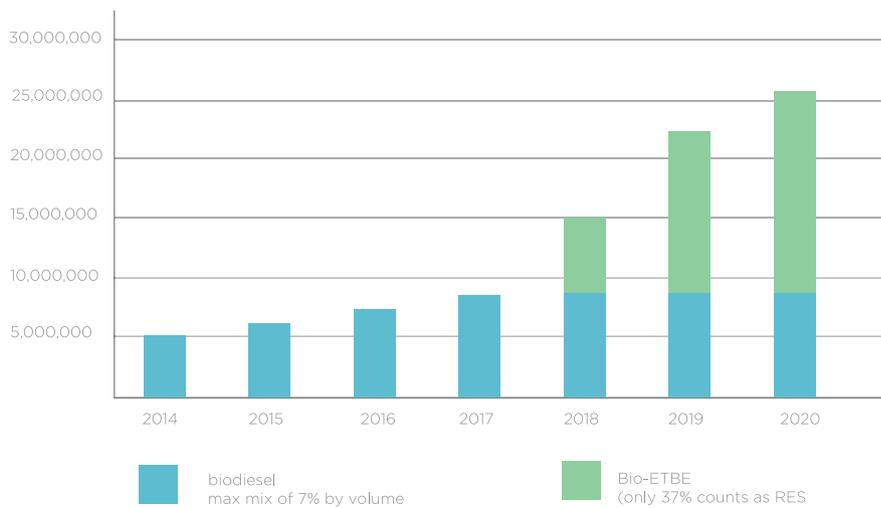


Figure 15 - Biodiesel and Bio-ETBE scenario

In practice, the actual amount of HVO/Bio-ETBE required to meet the target will be somewhat higher because importers who only supply diesel will only blend up to 5% UCO biodiesel and the deficit will have to be made good for by the petrol importer/s.

9.8 FINANCIAL IMPACT

Biofuel Blending

In Malta, biodiesel is already being blended with diesel fuel in the transportation and industry sectors and is subject to the same excise tax imposed on the mineral counterpart. The CIF (Cost, Insurance and Freight) price of biofuels is typically higher than that of diesel, and this leads to a higher price for the blended product when compared to the mineral fuel.

There is however also a price difference between different biofuels. For instance, based on international market prices, the cost of blending bio-ETBE to meet the Substitution Obligation, would typically cost consumers more than three times as much as HVO blending.

The cost estimates are based on a fixed price difference between biofuels and their fossil counterpart market prices (as at 2015). The resulting difference is shown in Figure 16.

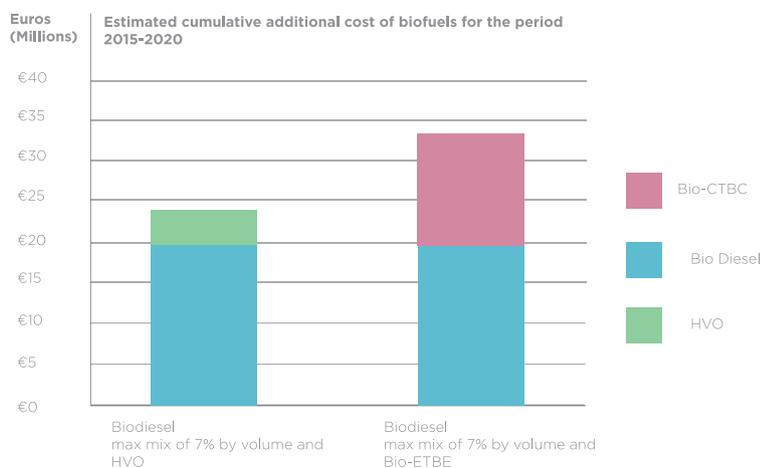


Figure 16 - Cumulative additional cost of biofuel substitution for the period 2015-2020

Biofuels also contribute towards the overall renewable energy target. Increasing their share can lead to a lower support requirement for other RES technologies such as PV. In this context, the financial impact of HVO is compared to the support granted on photovoltaic panel systems. It is however important to distinguish between the budget impact of support mechanisms for PV such as the feed-in tariff or capital grants, both of which are typically financed through taxation, as opposed to the polluter-pays principle as applied in the case of biofuel consumption. Assuming that the domestic biofuel blending mix remains based on double-counted biodiesel, the only constraint on HVO (first generation) blending is the 7% cap proposed in ILUC on crop-based fuels, unless HVO based on feedstocks not specifically excluded⁶³ in the proposal is sourced.

Electric Vehicles

Reaching the 10% renewable energy target in the transport sector is mainly based on biofuel blending with transport fuel.

⁶³ The ILUC proposal places a cap of 7% on biofuels produced from cereal and other starch-rich crops, sugars and oil crops and from crops grown as main crops primarily for energy purposes on agricultural land.

The possibility of offsetting a significant part of this target with electric vehicles is highly unlikely (due to reasons outlined in previous sections), even though the use of electric vehicles is counted five times towards the transport target. Considering that almost €24 million (scenario biodiesel and HVO blending) would be needed to meet the 10% transport target, these funds could be used to fund 5,750 electric vehicles through a grant of €4,000 to cover part of their capital cost. This translates to less than 1% of the RES-T share.

The Government is providing grants for individuals, enterprises and NGOs who purchase electric vehicles (EVs). Statistics on the number of registered EVs show a slow uptake. In 2014, only 12 applicants benefitted from the scheme which had a budget allocation of €300,000 over a period of 2 years (and which could potentially support 75 electric cars at €4,000 per vehicle).

Autogas

Autogas is a cleaner fuel and is promoted at EU level albeit not on the same level as biofuels. It does not count towards the country’s overall RES target but can have a minor contribution towards the transport sector target in that its consumption is excluded from the gross consumption of fuel. By end 2014, there were over 450 licensed autogas vehicles in Malta⁶⁴. Government launched the first autogas conversion scheme in 2013, which was then re-opened in 2014 and in 2015. Considering a continuation of the scheme an annual budget of €50,000 would be required.

9.9 IMPACT ON GHG SAVINGS

In terms of GHG savings, the savings for the two biofuel blending scenarios are estimated at around 24 ktCO₂ for both. Figure 17 refers.

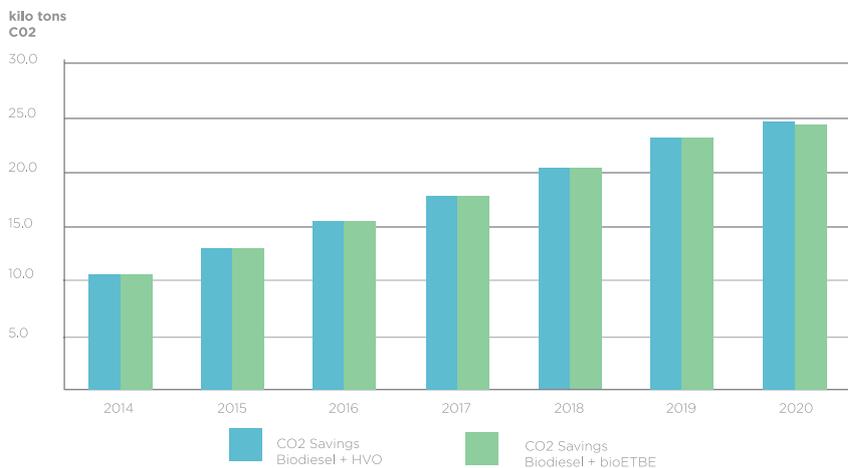


Figure 17 - CO2 savings

⁶⁴ Data source: NSO Motor Vehicles reports



9.10 **WAY FORWARD**

Biofuels, Electric Vehicles and the use of Autogas are expected to contribute to different extents towards Malta's 10% RES-T, and all three provide additional benefits such as lower noxious emissions. However, given that the relative contribution from Autogas and the use of EV is expected to be marginal by 2020, the legal substitution obligation remains the central policy tool to drive the necessary uptake of biofuels.

This assessment highlights technical and financial relative advantages of readily available biofuels. It is however within the remit of the individual fuel operators to determine their optimal strategy to meet their individual obligations. The Government, on its part, will continue to ensure that fuels compatible with the existing fleet remain available on the local market for a reasonable length of time.

10

HEAT PUMPS FOR HEATING PURPOSES

10.1 BACKGROUND

Heat pumps for space heating are based on well-established technology, which is now being promoted for water heating as well. In heating mode, heat pumps are more efficient than any fossil fuelled-heater because they utilise a portion of ambient heat energy to raise the temperature of the heated space.

The major application of heat pumps in Malta as a country with a Mediterranean climate has traditionally been in cooling. Average monthly temperature in Malta is shown in Figure 18. The lack of extreme cold temperatures and hot peaks reached during summer mean that cooling, rather than heating, is a priority, and this has led to a number of buildings being fitted with reversible air conditioners primarily intended for cooling.

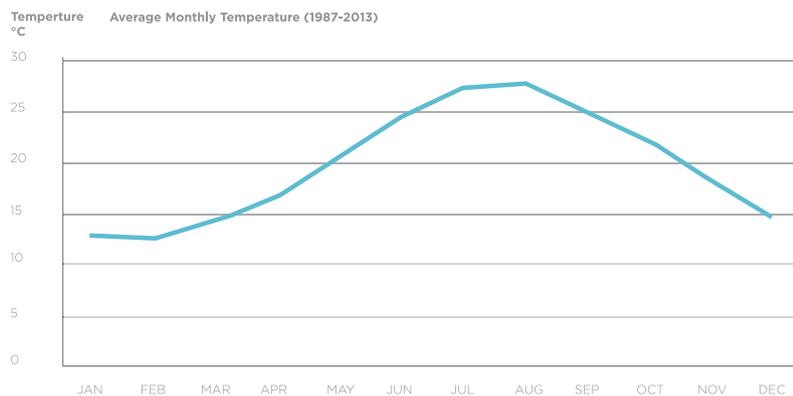


Figure 18 - Average monthly temperature (Source: Maltaweather.com)

The NSO Census 2011 found that out of a total of 152,770 occupied dwellings, 79,624 (52.1%⁶⁵) had at least one air conditioner installed. Through an ad hoc survey carried out within the domestic sector, it was estimated that by September 2014 a total of 164,654 air conditioners were installed⁶⁶.

Until recently the preferred technology for space heating was LPG heaters and electric filament heaters, with some wood-fuelled fire places. This was driven by the capital cost of the hardware, the perceived differential between the price of electricity and LPG in favour of the latter and also by the fact that air conditioners were traditionally installed in bedrooms and so could not be used for heating common areas such as the living room or kitchen. No official data that indicates the relative shares of the heating and cooling modes is as yet available.

⁶⁵ Census 2011 was carried out by the National Statistics Office.

⁶⁶ Survey carried out during September 2014. Practically all air conditioners installed in Malta are of the air-to-air reversible type.

Malta does not have any district heating networks. Preliminary results of the study 'An Energy Roadmap: Towards Achieving Decarbonisation for the Maltese Islands', commissioned by the Energy and Water Agency, shows that district heating networks are not cost-effective in Malta given the type of climate and the capital cost of these networks. Climatic conditions in Malta would result in low utilisation factors for the heating equipment and distribution network making investment economically unfeasible. Furthermore, Malta possesses no sustainable sources of biomass, and there are no sources of industrial waste heat with adequate energy that can be integrated and utilised for a district heating network. Besides, Solar Water Heating is already a widespread method for heating water both in the domestic and services sectors whereas heat pumps are widely used for space cooling and should be actively promoted for space heating as well.

It must be noted that heat pumps are an electricity consuming technology. An increase in the number and capacity of heat pumps would automatically result in an increase in the electrical demand when they are used for cooling. This further raises the summer electricity peak demand. However, comfort standards must be sustained and the electrification of the efficient heating and cooling sector may prove to be congruent with Malta's policy and investments for the uptake of RES from PVs.

10.2 CONTRIBUTION TOWARDS THE RES TARGET

Directive 2009/28/EC considers ambient heat absorbed by a heat pump for heating purposes as renewable energy, provided the heat pump has a minimum net seasonal coefficient of performance (SCOPnet) in active mode of at least 2.5 (for electrically driven heat pumps).

The European Commission decision 2013/114/EU⁶⁷ establishing the guidelines for the calculation of the amount of renewable energy harvested through heat pumps, provides a useful methodology for calculating the eligible potential of aero-thermal heat-pumps. High efficiency space and water heating using heat pumps is expected to play an important role in the EU's policy to increase the overall share of renewable energy. This renewable energy source had not previously been taken into account in calculating Malta's RES potential due to lack of local market information.

Small to medium capacity air-conditioning (AC) units are generally of the split unit type based on reversible heat pump technology and they can be used for both heating and cooling. Relatively recently, the advent of more efficient hardware and the relative changes in the price of electricity and LPG, supported by awareness campaigns, has resulted in this type of heat pump being increasingly used for space heating in households, commercial buildings, offices and hotel rooms in winter.

⁶⁷ Vide also Corrigendum to Commission Decision 2013/114/EU of 1 March 2013 published on the 11/01/2014 L 8/32.

It is likely that the utilisation of heat pumps for heating will increase significantly once consumers become more aware of the benefits they offer. To ensure that good quality systems are demanded by the public, even to replace the older energy-inefficient units, more focussed information campaigns are necessary. The recent revision in utility tariffs, which were reduced by an average of 25%, further promotes the utilization of air-conditioners for space heating (Figure 19) and the move away from fossil fuel based heating.

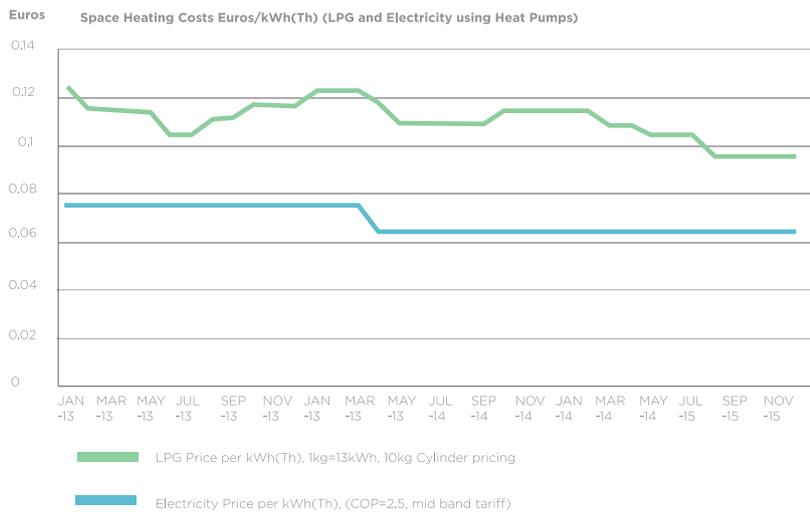


Figure 19 Space Heating Costs Euros/kWh(Th) (LPG and Electricity using Heat Pumps)

The Maltese Government incentivized high efficient air conditioners (using heat pump technology) through a scheme launched in 2007 whereby households purchasing a Class 'A' unit would benefit from a refund of €58.23 against their purchase price. This had multiple positive effects, as it not only encouraged the installation of air conditioners within the domestic sector, but also increased public awareness of the benefits of efficient hardware (as indicated by the labelling system) which drove the market away from lower efficiency heat pumps.

Assuming default values established by Commission Decision 2013/114/EU, and based on the results of a survey carried out in 2014, it is estimated that the RES contribution by air conditioners installed within the domestic and small commercial/ industrial⁶⁸ sectors during 2014 was 64GWh⁶⁹, equivalent to the electricity generated by around 41MWp of PVs.

⁶⁸ Data was collected through two surveys carried out amongst the domestic sector and the non-residential sectors employing not more than 50 employees.

⁶⁹ The figures presented in Malta's progress report as required by Article 22 of the RES directive were estimates based on preliminary surveys performed by the Institute for Sustainable Energy of the University of Malta. As from 2013, the results will be obtained from surveys and using the methodology established by Commission Decision 2013/114/EU.

The calculated figure would be higher were it to include the heat pumps installed in companies employing more than 50 persons and within government-owned buildings, which have not yet been covered by past surveys. An exercise is ongoing to estimate this potential.

Furthermore, other data collection methods are being assessed in order to gather more detailed information on the number, type and typical use of heat pumps within the commercial/industrial sectors and to monitor stock changes and improvements over the years.

10.3 COMMUNAL HEATING SYSTEMS, INCLUDING COUPLING TO GROUND OR SEAWATER AS THE HEAT SINK

In the absence of district heating and cooling systems, large establishments such as hotels, factories and large scale residential complexes have adopted centralised communal systems based on heat pumps (chillers running in reverse mode), thereby avoiding the use of central heating boilers and small independent split AC units. Combined with sophisticated Building Management Systems (BMSs), they constitute a highly efficient arrangement.

To further extend the efficiency of these systems, sea water from shore wells along the coast (where possible), or from groundwater in exceptional circumstances, is used as the heat sink medium instead of ambient air. This arrangement can provide a heat transfer process (heat rejection) which is more efficient than using the ambient air as the heat sink medium through auxiliaries such as roof top air-cooled condensers. Temperature in aquifers is generally stable and cooler. Hence it delivers higher system COPs. The added cost to the system due to the heat sink arrangement would be offset by lower running costs.

The impacts of heat rejection in the aquatic environment give rise to concerns unless well managed. Technical expertise in monitoring (and defining any corrective action that may be necessary) together with permitting and supervision by the relevant regulators is required.

In the case of using groundwater as the heat sink, the interaction with the aquifer is critical and must be carefully monitored and strictly regulated. The freshwater aquifers in Malta are fragile. They have an important role in the provision of drinking water and so need to be protected. Monitoring and expert hydrological regulation is therefore compulsory to adopt such systems.

Groundwater moves at an extremely low velocity and the heat discharged to the aquifer remains around the discharge point increasing the local temperature significantly and hence reducing the efficiency of the system in the event of recirculation. Malta's aquifers are small and locally fractured, favouring recirculation from discharge to intake.

From a water quality perspective, discharges of hot water deep in the aquifer create local convection currents causing saline water to move to the top (freshwater) parts of the aquifers, therefore severely affecting the quality of the aquifer system.

Open loop groundwater systems are not allowed, a reflection of the scarcity of groundwater resources. In the case of seawater, discharge water at a higher temperature than the receiving sea temperature will impact biodiversity and marine eco-systems in the immediate vicinity.

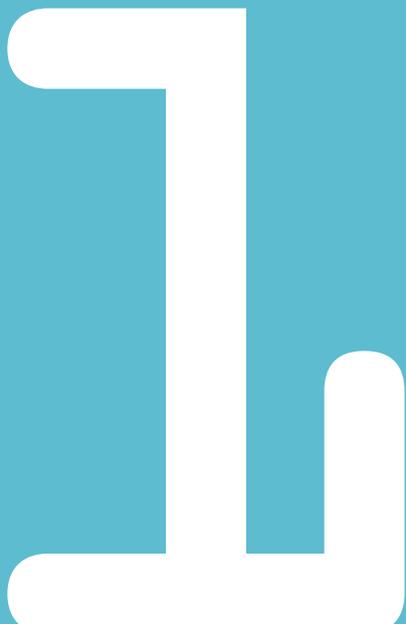
10.4 HEAT PUMP WATER HEATERS

Similar to space heating, heat pump water heaters (HPWHs) can be useful for water heating especially in the hospitality industry and in the domestic sector when solar water heaters are insufficient or impractical to be used. They can be two to three times more energy efficient than conventional electric water heaters.

HPWHs require more space than traditional water heaters because of their additional height, weight, air volume and clearance requirements. The additional weight of the unit, particularly larger capacity models, may require reinforcement of the floor to ensure structural soundness. The capital cost is deemed to be a major barrier for their wider use.

10.5 WAY FORWARD

The outcome of the study 'An Energy Roadmap: Towards Achieving Decarbonisation for the Maltese Islands' and an internal assessment of the financial and economic viability of various appliances shall form the basis for future support of energy efficient technologies.



COOPERATION MECHANISMS



The Renewable energy directive 2009/28/EC provides for the possibility of using cooperation mechanisms⁷⁰ aimed at helping Member States to achieve their RES targets in a cost-effective manner through cooperation with other Member States and third countries.

Malta is fully stretched in its endeavours to meet its national 2020 RES targets because of its geophysical constraints. While every effort is being made to exploit all effective indigenous RES, cooperation mechanisms are considered as a backup option to make up for any shortfall that may result in the planned exploitation of these resources.

Cooperation mechanisms have not yet taken off⁷¹ in Europe. The market for them is expected to accelerate as the economic potential in most countries is developed and more RES is needed to cope with climate change.

A project⁷² was initiated in 2011 under the European Union's Intelligent Energy - Europe Programme and sponsored by the Executive Agency for Competitiveness and Innovation (EACI) to develop a roadmap to a cost effective deployment of RES in the period up to 2020 and 2030 by making use of cross-border cooperation mechanisms, as described in the Renewable Energy Directive. It is foreseen that the number of cooperation mechanisms for the period up to 2020 shall be limited.

Another project⁷³ (2013/2014) aimed to provide a practice-oriented analysis for the implementation and relevant design of cooperation mechanisms, established by the Renewable Energy Directive 2009/28/EC. The project identified the barriers for a broader application of cooperation mechanisms and potential remedies to overcome these barriers. Furthermore, it provided concrete design options for the implementation of cooperation mechanisms, addressing Member State preferences, estimation of costs and benefits, and assessing the impact on the European energy market.

⁷⁰ *The possibility of utilizing RES produced in one country to satisfy the obligations of another is favourable from the optimum spatial development perspective, on a European and on a global basis, as investors will tap the best potential for RES maximisation (e.g. investment in PV's is much more rewarding in North Africa than in Northern Europe).*

⁷¹ *Market regulation rules still need to be defined. New and potentially complex cross-border support frameworks need to be negotiated. The price of RES from flexible mechanisms and the robustness of the market are uncertain. Price regulation guaranteeing price transparency is required, otherwise public acceptance problems could arise. No official system of registration of renewable energy surplus in Member States exists as yet.*

⁷² *www.res4less.eu, Full report available for download at: <http://www.ecn.nl/docs/library/report/2013/o13005.pdf>*

⁷³ *www.res-cooperation.eu*

11.1 MALTA'S PERSPECTIVE

The three main forms of cooperation mechanisms as identified within the Renewable Energy Directive 2009/28/EC are:

1. Statistical Transfers
2. Flexible Mechanisms
3. Joint Projects

Malta is in a position to cooperate on all the three types of mechanisms as above. This is in line with the Government's strategy of promoting Malta as an energy hub in the Mediterranean between Europe and Africa.

Although the way the market will develop in the context of cooperation mechanisms is yet not clear, it is evident that each mechanism has its own characteristics that make it more suitable for particular circumstances.

11.1.1 Statistical transfers

Malta prefers to meet its RES obligations through indigenous production and is working towards this objective. However, as outlined earlier, Malta's geographic constraints mean that Malta shall be fully stretched to meet its 10% RES target. Malta's renewable energy mix includes various technologies each delivering a small portion, except for solar PV technology which is carrying a relatively large share. The Renewable Energy Directive provides additional flexibility through the possibility of having statistical transfers between Member States which could be useful as a contingency in the case of unforeseen circumstances. In 2015, Luxembourg and Lithuania signed a Memorandum of Understanding, whereby the former has committed to buy energy generation by renewable energy sources in the form of a statistical transfer over the period 2016 to 2020⁷⁴.

11.1.2 Joint projects between member states and third countries

This type of flexible mechanism provides opportunities for foreign investment in the RES sector for Maltese businesses and serves as a catalyst to initiate such a foreign investment.

Neighbouring countries in North Africa, could, in the future once they achieve social and political stability, provide the right characteristics to attract efficient and large investment in RES. They have the solar energy intensity and space to host large projects.

⁷⁴ <http://www.chronicle.lu/categoriesluxembourgathome/item/12430-luxembourg-and-lithuania-agree-renewable-energy-deal>



The attractiveness of North Africa as a potential gigantic solar power station has already been realised and investigated (e.g. Mediterranean Solar Plan and Desertec). Cooperative mechanisms provide the opportunity to develop additional RES potentials in countries which would otherwise remain undeveloped (e.g. utilisation of vast desert spaces in North Africa).

Malta has always supported projects and initiatives particularly in the Mediterranean area. Coupled with the strategic alliances being forged by Government, this could provide flexible mechanism opportunities for Malta.

11.1.3 **Joint support schemes**⁷⁵

Malta has looked at the possibility of tapping this mechanism, but no specific area of cooperation has been identified as yet.

11.2 WAY FORWARD

In view of these issues and possible opportunities, Malta has commissioned a study, co-financed through ERDF, to evaluate the potential of all options offered by flexible mechanisms and to determine the availability of the renewable energy surplus potential within European Member States and outside the EU. Prices, direct and indirect benefits were analysed.

As confirmed by the study “An Energy Roadmap – Towards Achieving Decarbonization for the Maltese Islands”, Malta has very little potential for further RES deployment post 2020 (until 2030). It is yet unclear as to how cooperation mechanisms will develop post 2020. However, given the limited use of these mechanisms so far, a review of their design may be in order so as to ensure that all participating parties benefit from the agreement. This is particularly important in view of the drive towards regional cooperation being promoted by the European Commission as part of the design of the Governance System, an essential element of the 2030 Climate and Energy Policy Framework and ultimately the Energy Union.

The use of flexible mechanisms as envisaged by the Renewable Energy Directive is not excluded in principle; however priority will be given to developing indigenous sources where cost-effective. During the effective period of this plan, flexible mechanisms will be considered as a fallback position should Malta register a shortfall in the planned renewable energy production.

⁷⁵ Two or more Member States may decide to coordinate their national support schemes. This shall allow a certain amount of energy from renewable sources produced in one Member State to count towards the national targets of another, either through a statistical transfer or through an agreed distribution rule allocating contributions accordingly. Joint support Schemes have the potential to pave the way to a more coordinated and potentially harmonized EU support framework.

12

RES
TECHNOLOGIES
NOT INCLUDED IN
THE FINAL MIX

This section reports on other technologies that have been considered in the course of preparing the NREAP, but which for various reasons could not be included in the final technology mix to reach the 2020 10% target.

These technologies could not be supported either because the available resource intensity is not yet known or sufficient to make them cost-effective or indeed possible at the current level of development of the technology, or because they are as yet immature, or because they have a negative collateral impact on the environment and on other indispensable activities. These technologies include the following:

- Wind energy
- Deep geothermal
- Wave and tidal
- Hydro power
- Biomass energy crops

12.1 WIND ENERGY

12.1.1 Previous targets and way forward

Malta's NREAP (2010), in line with one of the options detailed in the Energy Policy published in December 2012, projected a total contribution of 254.49GWh from wind energy to Malta's target of 10% RES in its gross final energy consumption by 2020.

RES	MW	GWh	Percentage share of the 10% target
Onshore Wind	14.45	38.12	0.6%
Offshore Wind	95.00	216.37	3.5%
Total Combined	109.45	254.49	4.1%

Table 7 - Wind energy

These targets were based on three main wind farm proposals:

- Hal Far Onshore Wind Farm with a capacity of 4.25MW which had to be constructed by 2013;
- Wied Rini Onshore Wind Farm with a capacity of 10.2MW which had to be constructed by 2015;

Sikka I-Bajda Offshore Wind Farm with a capacity of 95MW which had to be constructed by 2016.

MRA's Mott MacDonald report Strategy for Renewable Energy Exploitation in Malta (Volume 1)⁷⁶ characterises the renewable energy resource of the Maltese islands and considers barriers to such technology. These three wind farms were selected based on the preliminary assessment of the feasibility of such projects.

It is to be noted that international market prices of renewable energy technologies have changed significantly from the figures reported in the Mott MacDonald study. In fact, prices for PV systems have gone down considerably from 2005, driven by lower cost of modules. This pushed down the Levelized Cost of Electricity (LCOE) of PV at a much faster rate than for Wind Farms.

12.1.2 Offshore Wind farms

Sikka I-Bajda Offshore Wind Farm

A large scale offshore wind farm at Sikka I-Bajda was, until some time ago, planned to be the major potential contributor towards meeting the RES target (equivalent to 3.5% of the overall RES target). A wind farm consisting of up to 19 turbines, having a maximum of 95MW capacity was proposed. Sikka I-Bajda is the only offshore shallow site large enough to host a modest size farm based on current commercial technology.

A Project Description Statement (PDS) was submitted to MEPA in April 2009 by the then Ministry for Resources and Rural Affairs. In relation to this submission, measurement of the wind resource was carried out over a two-year period by means of an 80 meter wind mast at L-Aħrax tal-Mellieħa and an Environmental Impact Assessment (EIA) was commissioned.

The conclusions of the EIA for the Sikka I-Bajda wind farm were that on the basis of existing knowledge, it could not be guaranteed that the environmental impacts of the project were acceptable or could likely be mitigated through sustainable measures.

The EIA consultants identified probable impact on the important bird colony of shearwaters within two Special Areas of Conservation (SAC) and Special Protection Areas (SPAs) of EU importance. The proposed development was not far from a known rafting area for Cory's and Yelkouan shearwaters and is close to the birds' nesting sites. Malta hosts some 10% of the seabird's world population.

⁷⁶ July 2015

The Cory's shearwater is listed as SPEC 2 species vulnerable under the European Threatened Species category. Both species are an Annex I species under the Birds Directive and both are listed species for the Rdum il-Madonna SPA. The area in question is also used by nocturnal migrants as it is on their migratory route. MEPA's Environmental Protection Directorate agreed with the consultants' concerns that these impacts cannot be realistically mitigated to the point of non-significance, and so the precautionary principle applies.

In February 2015, the outline development application was rejected by MEPA given that the detrimental effects on the environment, specifically on avifauna and marine ecology, were considered to override the benefits that were to be achieved through the wind energy generation from the proposed project.⁷⁷

12.1.3 Onshore Wind farms

The onshore wind farm sites which, based on the Mott Macdonald report⁷⁸ were considered to be promising, are located at Hal-Far and Wied Rini, (limits of Bahrija). A number of turbines with a total capacity of 4.2 MW and 10 MW for the respective sites were proposed.

Hal Far Onshore Wind Farm

A PDS for the development of an onshore wind farm at Hal Far, with a capacity of 4.25MW, was submitted in 2009, following which MEPA requested an Appropriate Assessment (AA). These studies were carried out, and dealt mainly with the project's effect on birds and bats. The AA was submitted in August 2013 and is currently being reviewed by the Planning Authority. In addition, the technical studies listed below were requested and submitted along with the AA:

- Noise
- Health and Safety (including Shadow Flicker)
- Landscape and Visual Amenity assessment
- Aviation (Civil and Military)
- Communication (Civil and Military)
- Geotechnical study
- Impact on Industry
- Impacts on recreational activity
- Waste Management
- Impacts on cultural heritage

Of main concern is the Aviation Safety Assessment by Osprey Consulting Services Ltd carried out with respect to Air Traffic Services and operations in the vicinity of Malta International Airport (Luqa).

⁷⁷ MEPA, *Sikka l-Bajda wind farm project given thumbs down*. [Online]. Available: <http://www.mepa.org.mt/news-details?id=989>

⁷⁸ MRA, *Mott MacDonald report Strategy for Renewable Energy Exploitation in Malta (Volume 1)*

The assessment has shown that building the Hal-Far wind farm could potentially pose a hazard to aircrafts. This constitutes an unacceptable increase in risk to the safety of air operations in the vicinity of the development. Osprey would not recommend developing the five turbine Hal-Far site in light of the results of this Safety Assessment. Their recommendation on the maximum height and number of turbines for this site is for a single turbine development with a maximum tip height of 68 metres. The location of the turbine within the site must be carefully selected to ensure that the tips of the turbine remain below 115m above mean sea level to avoid breaching the Inner Horizontal Obstacle Limitation Surface.

In view of these recommendations, it is likely that the Hal Far site will not be considered further.

Wied Rini Onshore Wind Farm

A PDS was submitted to MEPA in 2009 for the development of an onshore wind farm at Wied Rini. MEPA requested an Environmental Impact Statement (EIS) which is to include:

- A Coordinated Assessment Report;
- Appendix containing all original survey reports as prepared by individual consultants for specific topics;
- Appropriate Assessment report;
- Non-Technical Summary.

The requested reports have been completed and are being assessed by the planning authority.



Figure 20 Photomontage of development as seen from Mdina. Source: EIA Second Draft

The possible impacts of the Wied Rini wind farm on the environment and its surrounding are of particular concern. The EIS indicates that the area under consideration is partly an Area of High Landscape Value. Such development is fully visible from Mdina, Rabat, Dingli, Mtarfa and Baħrija creating large concern on visual impact on neighbouring villages. Such development doesn't allow much in terms of mitigation measures mainly due to the size of the structures which if developed, would dominate and dwarf the surrounding landscape.

The proposed wind farm is of a particular concern to the nearby community as the area under consideration is mainly an agricultural site currently utilized by both part-time and full-time farmers who depend on this land for their livelihood.

The EIS also highlighted the limitation of the access route which would be a major problem during construction due to the irreversibility of the necessary ancillary developments.

In view of the above in relation to their small contribution, and the current status of their planning application, it was decided not to include any contribution from onshore wind farms towards Malta's RES target for 2020.

Deep Offshore Technology

In view of the fact that the bathymetry around Malta is characterized by deep seas, deep offshore technology was also investigated but has been found to be technically immature and expensive.

The current position is that deep offshore technology is as yet in the development stage and is not likely to be of active interest prior to 2020. Nevertheless, the Government will continue to closely monitor the development of this technology for possible application if and when appropriate.

This interest is mainly motivated by:

- Projects based on this technology would not suffer from the environmental concerns of near-shore prospects, and at the same time benefit from a possibly better resource;
- Larger scale projects may be possible, and that would fit in with the 'challenge 2050' targets and concepts;
- The competence and current research initiatives being undertaken by the University of Malta, which augur well for Maltese involvement with the technology;

- Wide international research and development which looks likely to deliver lower costs in the medium to long term future.

Micro-Wind

Micro-wind technology has not been completely excluded from the technology mix, however its contribution is deemed to be negligible.

In 2010, MEPA published a planning guidance for micro wind turbines, with an energy generating capacity of up to 20kW. The guidelines look favourably upon the installation of micro-wind turbines in industrial areas, on the roofs of large buildings or within large buildings surrounded by large grounds situated in ODZ areas, but adopt a more conservative approach to the installation of micro wind turbines in urban areas.

Micro-wind turbines installed on rooftops are considered to cause nuisance to surrounding receptors and create unacceptable impacts within the confined local urban environment. These impacts could be exacerbated by the cumulative impact of multiple turbine installations and include:

- visual impact on the flat Maltese rooftops especially in village cores;
- acoustic, including vibrations and flicker, which lead to complaints being lodged by neighbours considering that Maltese houses are kept open for the greater part of the day for some eight months of the year.

MEPA has so far declined to grant permits for rooftop micro wind, except for a very small number for research purposes.

12.2 EXPLOITATION OF GEOTHERMAL ENERGY

So far, geothermal energy has not been considered as a contributor to the national RES mix for Malta. This situation has been reassessed in view of technological developments in this field.

An initial desk-based preliminary assessment of the potential of geothermal energy exploitation in Malta has been done. A basic heat-flow map for the Maltese Islands and the surrounding areas was constructed on the basis of temperatures recorded in deep oil exploration wells in Malta and on published information for the region. The heat-flow map clearly shows one geothermal province in the South, associated with the active Pantelleria-Linosa-Malta Rift Complex, that is characterized by medium and high heat flow values (>65mWm⁻²). Although this area is offshore, the technology for the exploitation of offshore geothermal resources exists and the possibility of such exploitation in Malta in the future cannot be excluded. However more robust and more site-specific studies from an economics and technical perspective shall be required.

A working group is being set up to create the right policy framework for interested parties to be able to develop the geothermal industry in Malta should this become viable. Given the uncertainties and expected time frame for investigation and possible exploitation, geothermal technology cannot be considered as a viable source of renewable energy, at least before 2020.

12.3 WAVE ENERGY POTENTIAL

The ocean energy sector was highlighted in the Commission's Blue Growth Strategy COM(2012) 494 dated 13.09.2012 as one of five developing areas in the 'blue economy' that could help drive job creation in coastal areas. The long-term goal for wave energy is to become cost effective and to provide an alternative to other RES and conventional energy sources as a reliable energy technology feeding to the European Energy system. However, it is acknowledged that wave technology in Malta is not expected to make any significant contribution towards meeting the RES 2020 targets. This section records the efforts made so far to evaluate this technology, including research by the University of Malta with other partners and EU funding.

Earlier assessments

In December 2003, Scott Wilson prepared a report titled 'Malta Significant Wave Height Study' for the Malta Maritime Authority.

In summary, the findings were the following. The significant wave height data for both annual and summer periods is very similar for all the offshore locations. As would be expected the significant wave heights are milder for the summer period when compared to the annual period of operation. The offshore significant wave height that is exceeded for less than 10% of the time is around 2.1m annually and 1.75m for the summer period of operation. Offshore significant wave height does not exceed 4.5m on an annual basis, or 3.5m in summer. The predominant wave direction is from the north-west. Waves from the south-east are also relatively frequent.

The Mott MacDonald 'Strategy for Renewable Electricity Exploitation in Malta, Volume 1: Renewable Electricity Target', final Report of July 2005 for the Malta Resources Authority distinguishes between Shoreline wave power and Offshore wave. The former resource is likely to be very limited and much of the exposed coastline that may be suitable for such devices is protected under national and international environmental designations. Even for the oscillating water column technology, it is unlikely that there are either sites or suitable resources for this in Malta.

In the case of the Maltese Islands, the limited land mass is compensated by the highest ratio (»12) amongst European nations of available marine space with respect to land territory, when taking into account territorial waters up to 12 nautical miles. It is even much higher if one takes into account the Exclusive Economic Zone. However, the opportunities for offshore wave energy are currently limited by the present level of development of the associated technology. Diverse options are being researched to

convert the captured wave energy into utilizable form and to transport it to the point of use and future developments may enable operation even at Malta's lower wave heights. The majority of the concepts developed will be anchored to the seabed by using mooring lines for floating Wave energy converters (WEC) and foundation systems for bottom-standing devices. Challenges emanating from wave energy technologies, as well as the consistency and stability of the power quality, grid connection and environmental issues must be considered, confirmed by recent due diligence investigations of experienced players in the global offshore business.

Sea depths around Malta also pose a challenge for wave technology. The deep water off the west coast of Malta (the likely area of wave energy potential) may pose severe but manageable engineering issues with regards to anchorage, collection and transport of the power to the shoreline. No installation has so far taken place beyond 5 km from shore and in water depths of more than 75 m (Corsatea & Magagna, 2013). Mott MacDonald concludes that it is not likely that the technology will be available before 2020.

In terms of Maritime Spatial Planning, offshore renewable energy generation would have to be concentrated within designated areas well away from busy sea lane routes. Future Potential will be subject to development in other areas such as licensing, ocean space regulations and conflicts of use, as well as environmental impact assessment and performance standards.

The Blue Ocean Energy project

The BLUE OCEAN ENERGY® (BOE) project kicked off on January 2011 and was completed in April 2012. The scope of this study was to understand the sea wave conditions around Malta and estimate the wave energy resource, providing the baseline information to potential projects for feasibility assessments and the identification of the best sites for energy extraction. A Dexawave converter was installed at sea off northwest Gozo. This zone shows good potential for generating energy from waves. Here the maximum significant wave heights can exceed 7m in winter⁷⁹, even in close proximity to the coast, and with a seasonal mean of 1.92m as determined from direct measurements. The annual mean wave power transport is found to be 7.0 kWm⁻¹.

The field data collected on waves as part of this MCST-funded project complemented previous computer-based wave models conducted by the University of Malta's Physical Oceanography Unit (PO-Unit). The unit had run two nested wave models, the Malta MARIA WAM model and embedded Malta SWAN model over a span of five years since 2007.

With the right energy extraction technology, but which is not yet available, even though there is strong seasonal and inter-annual variability, the average annual wave power is still useful and wave energy can be considered as a supplementary source of renewable energy in the future depending on the cost-effectiveness of machines that might be developed.

⁷⁹ This is somewhat higher than that reported in the Scott Wilson Report.

The study also delved into the most productive machine suitable for local waves. A point absorber type of converter was found to be a more efficient system than a WAB (wave

activated bodies) converter since this can utilise directly the full wave height. It was decided to design a linear synchronous generator with permanent magnets in order to be able to convert the power absorbed by the mechanical structure at the low speeds present. Results from such a machine should yield the highest potential of power generation throughout the year.

However, one cannot ignore the huge challenges that need to be addressed before exploitation of wave power is made economically viable:

- Wave energy converters (WECs) still at the prototype stage;
- During storms, waves may contain enough energy to destroy some types of wave power systems;
- Wave direction changes, and is mixed in some cases (wind power is simple as the wind only blows in one direction at one time);
- Bringing the electricity onshore is expensive;
- Conflict with other uses in the marine space;
- Strict environmental requirements must be met.

These challenges are being addressed in the draft strategy prepared by the Ocean Energy Forum (which had been created by the EU in 2014 to help get promising ocean energy technologies off the ground).

The Ocean Energy Forum published its Draft Strategic Roadmap in October 2015. The Roadmap will set out the challenges faced by the industry and the proposed solutions (key recommendations) to overcome these challenges. The Forum Steering Committees are currently developing the key recommendations into action (implementation) plans. The Roadmap will set out the challenges faced by the industry and the proposed solutions (key recommendations) to overcome these challenges. The final version of the Strategic Roadmap will be presented in early November 2016.

Current outlook

Currently, the available technology is deemed not viable for deployment in the Maltese waters and therefore cannot make any contribution towards the 2020 targets. The Draft Ocean Energy Strategic Roadmap envisages that full scale wave energy converter prototypes should be deployed by 2020, with larger demonstration projects rolled out by the mid-2020s. Should more efficient and flexible wave energy converters harvesting wave power be developed, wave power may be revisited as an additional energy source in the future. This is further emphasised within the Blue Energy COM(2014) 8 final, i.e. 'Action needed to deliver on the potential of ocean energy in European seas and oceans by 2020 and beyond', which states that 'The ocean energy sector can become an important part of the blue economy, fuelling economic growth in coastal regions, as well as inland.'

Moreover, and as part of the BLUEMED Strategic Research and Innovation Agenda, the EU's research and innovation programme, Horizon 2020, will aim to address important societal challenges including clean energy and marine research. As such, it is a powerful new tool that can be harnessed to drive the ocean energy sector towards industrialisation, creating new jobs and economic growth.

Unfortunately the slow growth of the sector and delays in the development of the market have forced key developers and Original Equipment Manufacturers, (OEMs) to either downsize or withdraw their interest in developing ocean energy technology. (Source: "2014 JRC Ocean Energy Status Report Technology, market and economic aspects of ocean energy in Europe", Magagna & Uihlein, 2015).

With respect to industry and potential job creation, the impact of the wave energy industry on the job market may be of particular note, given Malta's traditional link with the marine industry.

12.4 OTHER TECHNOLOGIES

Hydropower

Feasibility of hydropower requires the availability of a water reservoir at some height such that its embodied potential energy can be harnessed. The highest peak in Malta is only around 250 metres above sea level, there are no surface water areas (such as lakes) and water resource is scarce.

Tidal

There are no tides of any significance in Malta which could be exploited with the current technology. The currents around Malta are too weak to sustain generation of energy from tidal movement, both for the traditional technology (capturing the rise and fall of tides) and for tidal stream technology (exploiting marine currents).

Biomass energy crops

Malta does not have the land area required to cultivate biomass energy crops to any practical extent. Besides, the fertility of the soil is low and water is scarce. Together with Cyprus, Malta has the highest water stress index in Europe, and among the highest in the world⁸⁰. Furthermore, Malta's heating demand is limited and current policy is to promote high efficiency electricity-based heating utilizing heat pump technology where applicable, which achieves the highest overall fuel efficiency whilst taking advantage of the decarbonisation of the generation sector. Promoting the importation of biomass for heating purposes would defy all this.

⁸⁰ <http://www.wri.org/blog/2013/12/world%E2%80%99s-36-most-water-stressed-countries>

13

“MEETING
THE RES
TARGET”
IN NUMBERS

This section reports on the estimated compliance with the national 10% target for RES penetration up to 2020.

The tables that follow are based on templates set by the Commission for each Member State's National Renewable Energy Action Plan.

13.1 EXPECTED FINAL ENERGY CONSUMPTION 2010-2020

The gross final energy consumption includes all types of energy (from both renewable and conventional sources), overall and for each sector, in the period up to 2020⁸¹.

The estimates reported in this Section take into account the expected effects of energy efficiency and energy saving measures to be introduced during the period.

Under the heading 'reference scenario' a scenario has been presented taking into account the following:-

- Includes only the energy efficiency and savings measures adopted before 2009;
- A medium growth scenario was assumed for electricity demand;
- Fuel demand used for private vehicles grows at a steady rate corresponding to the average growth in transport activity over the period 2010-2014.

Under the heading 'additional energy efficiency scenario' a scenario has been presented taking into account all measures that were or are still to be adopted from 2009. The elaboration of the other parts of the NREAP is based on this additional energy efficiency scenario.

The term 'consumption for heating and cooling' is defined as the final energy consumption excluding electricity in all sectors other than transport.

According to Article 5(6) of Directive 2009/28/EC, for the purpose of measuring compliance with the 2020 target and the interim trajectory, the amount of energy consumed in aviation in Malta is to be considered to be no more than 4.12% of the Member State's gross final energy consumption. The appropriate adjustments have been made in the table.

⁸¹ COMMISSION DECISION of 30.6.2009 establishing a template for National Renewable Energy Action Plans under Directive 2009/28/EC.

ktoe	2010		2011		2012		2013		2014	
		Actual								
1. Heating and Cooling		62.85		50.79		60.67		76.60		81.77
2. Electricity		181.76		187.32		197.27		193.49		193.05
3. Transport as in Art 3(4)a		169.05		166.36		166.49		168.06		174.29
4. Gross Final energy consumption		526.58		520.03		536.53		554.38		570.72
The following calculation is needed since final energy consumption for aviation is expected to be higher than 4.12%										
Final Consumption in Aviation		101.95		105.73		100.92		106.14		112.23
Reduced for aviation limit Art 5(6)		21.70		21.43		22.10		22.84		23.53
Total Consumption after reduction for aviation limit		446.33		435.73		457.71		471.08		482.02

ktoe	2015		2016		2017		2018		2019		2020	
	reference scenario	with additional energy efficiency										
1. Heating and Cooling	83.34	82.46	85.12	81.23	87.03	81.47	88.69	81.41	90.34	81.32	91.99	81.83
2. Electricity	199.69	198.12	205.64	202.29	209.47	205.60	214.35	210.40	219.70	215.67	222.62	218.51
3. Transport as in Art 3(4)a	175.45	175.45	175.25	175.25	175.04	175.04	174.55	174.55	173.77	173.77	172.95	172.95
4. Gross Final energy consumption	574.53	572.08	582.51	575.27	588.20	578.78	594.46	583.24	600.97	587.93	604.91	590.65
The following calculation is needed since final energy consumption for aviation is expected to be higher than 4.12%												
Final Consumption in Aviation		106.43		106.43		106.43		106.43		106.43		106.43
Reduced for aviation limit Art 5(6)		23.57		23.70		23.84		24.02		24.22		24.33
Total Consumption after reduction for aviation limit		489.22		492.54		496.19		500.83		505.72		508.55

Table 8 - Expected gross final energy consumption of Malta in heating and cooling, electricity and transport up to 2020 taking into account the effects of energy efficiency and energy saving measures 2010-2020 (ktoe)

A. Share of energy from renewable sources in gross final consumption of energy in 2005 (S_2005) (%)	0.00%
B. Target of energy from renewable sources in gross final consumption of energy in 2020 (S_2020) (%)	10.00%
C. Expected total adjusted energy consumption in 2020 (from Table 5, last cell) (ktoe)	508.55
D. Expected amount of energy from renewable sources corresponding to the 2020 target (calculated as B x C) (ktoe)	50.86

Table 9 - National overall target for the share of energy from renewable sources in gross final consumption of energy in 2005 and 2020 (figures to be transcribed from Annex I, Part A to Directive 2009/28/EC)

13.2 SECTORAL TARGETS AND TRAJECTORIES

Table 10 below gives the national 2020 target and estimated trajectory of energy from renewable sources in heating and cooling, electricity and transport as required by Article 4(1) of Directive 2009/28/EC.

The total of the three sectoral targets, translated into expected volumes (ktoe) including the planned use of flexibility measures, has to be at least as high as the expected amount of energy from renewable sources that corresponds to the Member State's 2020 target (as reported in the last cell of Table 9).

The transport target, in addition, has to be compatible with the requirements of Article 3(4) of Directive 2009/28/EC for a 10 % share of renewable energy in transport. It should, however, be noted that the calculation of compliance with the target in Article 3(4) differs from the calculation of transport's contribution to the Member State's overall national target for renewable energy.

For the transport target, and not for the overall target:

- Only petrol and diesel from among petroleum products used in all modes of transport count towards the calculation of the total energy consumption in transport;
- Biofuels used in road and rail transport sourced from wastes, residues, non-food cellulosic material and ligno-cellulosic material count double towards the transport renewable energy target;
- Electricity from renewable sources used in road vehicles counts 2.5 times towards the numerator and the denominator. These multipliers shall be updated once the ILUC Directive is transposed into local legislation.

According to Article 3(4)(c) of Directive 2009/28/EC to calculate the contribution of electricity produced from renewable sources and consumed in electric vehicles, Member States may choose to use either the average share of electricity from renewable energy sources in the Community, or the share of electricity from renewable energy sources in their own country, as measured two years before the year in question. Malta has chosen the former option.

As well as setting sectoral targets for 2020, Member States must also describe the trajectory that they expect the growth of renewable energy use in each sector to follow between 2010 and 2020. The sectoral renewable targets in electricity and heating and cooling and the sectoral trajectories assume that the full estimated potential is exploited.

	2013	2014	2015	2016	2017	2018	2019	2020
RES-H&C	14.71%	14.37%	14.75%	15.74%	16.61%	17.23%	17.85%	18.33%
RES-E	1.57%	3.34%	4.68%	5.83%	7.36%	9.13%	10.85%	11.58%
RES-T	3.79%	5.03%	5.46%	6.47%	7.46%	8.50%	9.54%	10.07%
Overall RES share	3.71%	4.68%	5.36%	6.14%	7.09%	8.27%	9.46%	10.04%
Of which required from cooperation mechanism	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Surplus for cooperation mechanism	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

As Part B of Annex I to the Directive	2013-2014	2015-2016	2017-2018	2020
RES minimum trajectory	0.030	0.045	0.065	0.100
RES minimum trajectory (ktoe)	14.30	22.09	32.40	50.86

Table 10 National 2020 target and estimated trajectory of energy from renewable sources in heating and cooling, electricity and transport

ktoe	2013	2014	2015	2016	2017	2018	2019	2020
(A) Expected gross final consumption of RES for heating and cooling	11.25	11.75	12.16	12.78	13.53	14.02	14.51	15.00
(B) Expected gross final consumption of electricity from RES	3.05	6.44	9.27	11.80	15.14	19.22	23.41	25.30
(C) Expected final consumption of energy from RES in transport	3.18	4.38	4.79	5.66	6.53	8.18	9.92	10.74
(D) Expected total RES Consumption	17.48	22.57	26.22	30.24	35.19	41.42	47.84	51.04
(E) Expected transfer of RES to other MS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(F) Expected transfer of RES from other MS & 3rd countries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(G) Expected RES consumption adjusted for target (D) - (E) + (F)	17.48	22.57	26.22	30.24	35.19	41.42	47.84	51.04

Table 11 Calculation table for the renewable energy contribution of each sector to final energy consumption

ktoe	2013	2014	2015	2016	2017	2018	2019	2020
(C) Expected final consumption of energy from RES in transport	3.18	4.38	4.79	5.66	6.53	8.18	9.92	10.74
(H) Expected additional part RES Electricity in road transport	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05
(I) Expected additional part consumption of bio-fuels from waste, residues, non-food cellulosic and lingo-cellulosic material in transport	3.18	4.38	4.78	5.64	6.50	6.61	6.61	6.60
(J) Expected RES contribution to transport for the RES-T target (C) + (2,5-1) x (H) + (2-1) x (I)	6.37	8.77	9.58	11.33	13.06	14.83	16.58	17.42

Table 12 Calculation table for the renewable energy in transport share

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TABLE OF MEASURES

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
1.	GENERAL		
1.1	Policy, Regulatory and Planning Framework		
	Develop the legal and policy framework to support RES sector to achieve success. In the interest of stability and investor confidence, due consultation and advance notice of proposed changes will be given to stakeholders.	Ministry responsible for Energy through the Energy and Water Agency.	Regularly updated legal and policy framework that reflects changes in local and international decisions and policies, in technology, in market conditions and in progress towards targets. Certainty encourages investment.
	Ensure that there is a stable transparent regulatory framework.	Regulator for Energy and Water Services, PA, Transport Malta and other Regulators.	Stable, predictable and robust legal and regulatory framework that encourages investment.
	Ensure a knowledge-based planning environment where synergy and consultation between relevant learned institutions is ongoing in a structured fashion and statistics, reports and information are disseminated and used by as many involved parties as possible.	Ministry responsible for Energy through The Energy and Water Agency.	More accurate, detailed and successful planning that delivers best results.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
	Establish a record-keeping and analysis system covering schemes and RES-related hardware that is deployed, especially those supported through public funding in whole or in part.	Ministry responsible for Energy through The Energy and Water Agency. Regulator for Energy and Water Services.	Maximum benefit from invested funds, confirmation as to what extent actual performance matches projections, future funding schemes are designed on the basis of knowledge and best information, that priorities are correctly established and that lessons learnt from one circumstance are applied to others.
	Ensure an adequate share of EU funding for RES and EE projects	Ministry responsible for Energy, The Energy and Water Agency, other energy relevant entities, eligible stakeholders, PPCD.	Assistance towards sufficient and timely development of the RES sector
	Ensure that all proposals for RES projects are investigated and considered from the perspective of a holistic energy policy	Ministry responsible for Energy through The Energy and Water Agency.	All favourable opportunities are exploited, including expansion of the green economy and increased participation by the private sector.
	Ensure the timely implementation of the measures in the NREAP and take corrective actions where necessary to meet targets.	Ministry responsible for Energy through The Energy and Water Agency.	Good governance, achievement of targets and avoidance of penalties.
	Ensure the necessary planning policies are in place to ensure seamless integration of RES within the built and other environment and on suitable sites.	The Energy and Water Agency, PA.	Avoidance of problems associated with RES hardware, including visual, acoustic and other impacts on the quality of life of citizens.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
1.2	Implementation of measures		
	Keep all measures under constant review, including their cost-benefit, as circumstances change. This also covers externalities, new technologies and contingency options.	Ministry responsible for Energy through The Energy and Water Agency.	Optimised return on investment.
	Government to lead by example.	All Government and public entities.	Motivation and good leadership to the private sector (domestic, commercial and industrial).
	Keep methodologies of permitting, authorisation and applications of funding for RES systems meaningful but as streamlined as possible.	All Government and public entities.	Avoidable bureaucracy eliminated, thereby avoiding costs and disillusioned investors, while ensuring good governance.
	Promote self-consumption of energy produced through RES in private establishments.	The Energy and Water Agency.	
1.3	Supporting measures		
	Conduct public information and awareness campaigns, including media campaigns and house visits intended to raise citizens' appreciation of the implications of climate change, their obligations towards present effort-sharing and rights of future generations and hence facilitating RES penetration.	The Energy and Water Agency and other entities according to their competence	A more co-operative, informed and receptive consumer and general public, willing to invest in clean energy.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
	Actively facilitate access to finance and support innovative financing mechanisms to facilitate worthy RES projects.	The Energy and Water Agency, financial institutions, Malta Enterprise.	Maximised investment and hence the contribution of RES to the environment and the economy.
	Increased research on the adaption of technologies and ideas to the local market.	Various ministries, MCST, University of Malta.	Maximum local benefit out of new emerging technologies and ideas customising them where necessary to local circumstances.
	Organise the gathering of information/ knowledge on the status of RES technologies, whether established, emerging or at inception stage.	The Energy and Water Agency through the Institute of Sustainable Energy.	More options to consider for implementation or research, possibly identifying better technologies and solutions.
	Utilise smart meters to optimize management of distributed RES.	Enemalta plc, The Energy and Water Agency.	Integration of RES with holistic energy management in Malta
2.	Photovoltaic systems		
2.1	Exploiting the remaining rooftop potential		Efficient use of rooftops reducing the pressure to utilise virgin land.
	Ensure that the remaining domestic rooftop potential is exploited. Continue grant schemes for PV installation in the domestic sector	The Energy and Water Agency (Administered by REWS), PPCD.	Appropriate incentives including deployment of ERDF funding where applicable.
	Ensure that the remaining industrial rooftop potential is exploited.	The Energy and Water Agency (Administered by REWS), Malta Industrial Parks.	Appropriate incentives including deployment of ERDF funding where applicable.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
	Ensure the development of PV systems on the rooftops of public buildings using appropriate financial and governance mechanisms.	The Energy and Water Agency with the cooperation of the Lands Department and the occupiers of buildings.	Government leading by example.
2.2	Other PV projects		
	Finalise the exercise to identify brown field sites that can be used for PV farms, such as spent quarries, disused landfills, car parks, rooftops of private industrial buildings, etc. and promote investment to maximise their potential.	PA The Energy and Water Agency.	Reduced pressure to utilise virgin land. Disused quarries are expected to host around 50MWp of PV installations, whereas disused landfills and car parks are estimated to host another 16MWp.
	Exploit space within Malta International Airport.	MIA.	Circa 20 MWp of PV panels.
	Organise communal medium scale PV project/s specifically designed for households who do not have roof access or space.	The Energy and Water Agency with the cooperation of a financial institution to be decided.	Opportunity to invest and participate in the national RES effort given to those with no roof access or space in their homes.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
2.3	Promotion and incentives		
	Continue in principle existing schemes to provide the minimum incentive necessary to achieve the target penetration of PV systems, but modify the terms from time to time to reflect changes in circumstances such as in capital cost.	The Energy and Water Agency, administered by REWS.	The target penetration of RES is achieved at least cost to the taxpayer.
	Ensure that FITs are revised regularly in response to changing conditions and that at any time they are sufficient but not excessive to meet objectives.	The Energy and Water Agency.	The objectives of schemes are achieved at least cost to the taxpayer.
	Auxiliary support		
	Promote and support research in technologies and RES issues relevant to Malta, covering more efficient and cost effective systems that perform best in the Maltese environment, and in development (technical and governance) to meet Malta's specific needs. This with the collaboration and participation of industry and relevant entities.	The Energy and Water Agency, University of Malta, Private industry and other interested stakeholders.	Most efficient customised technology deployed in Malta. Benefit and upgrading of industry. Better understanding and innovative leadership and governance of the sector. Motivates and enhances the profile of research institutions, such as the University of Malta.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
	Use the full potential of Smart meters to fine-tune FIT, maximising the benefit of PV systems.	Ministry responsible for Energy, The Energy and Water Agency, REWS, Enemalta Plc.	Integration of RES with holistic energy management, through, but not limited to, sophisticated tariff systems facilitating demand-side management.
3.	Solar Water Heaters		
	Continue the grant scheme for SWH installation in the domestic sector.	The Energy and Water Agency, REWS.	Incentive to consumers to adopt SWHs sufficient to reach the projected 300 SWH installed annually to 2020.
	Encourage the use of SWH in industry and promote new hybrid technologies such as solar-assisted air conditioners.	The Energy and Water Agency, REWS.	Incentive to industrial and commercial consumers to adopt EE measures and RES to enhance their competitiveness while reducing their carbon footprint.
4.	Waste to Energy		
	Further evaluation by expert consultants of waste to energy options and implementation of selected options.	MSDEC.	In-depth analysis and perspectives of the relevant issues leading to the informed choice of the best/ preferred options for energy harvesting from waste, and their implementation.
	Promote plants producing biogas to heat or electricity of appropriate capacity	MSDEC (Department of Agriculture), MEAIM.	Facilities to process animal manure on site avoiding its transport and disposal in sewage systems, generating environmental benefits including protection of the groundwater aquifers, more sustainable agriculture and additional revenue streams for farmers.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
5.	RES in Transport		
5.1	Biofuels		
	General		
	Ensure a robust regulatory regime for biofuels.	REWS.	<ul style="list-style-type: none"> - Imported biofuels produced according to sustainability criteria. - Locally produced biofuel that is compliant with quality standards. - Monitoring of market operations from import/ production to retail, including fair pricing, in the interest of consumers. - Increased substitution of fossil fuel.
	Biodiesel B7 to B20		
	Set the biofuel content level in imported fuels up to the maximum allowed by EN Standards by 2020 and monitor compliance.	The Energy and Water Agency.	Maximum use of RES in transport, thereby contributing towards non-ETS target and interim RES target.
	Engage in consultations to increase the share of biodiesel beyond the 7% limit for public transport vehicles, if feasible.	Ministry responsible for Energy through The Energy and Water Agency.	A higher contribution towards Climate Change and RES targets by public transport vehicles. Main stakeholders: Ministry responsible for Transport, Transport Malta and Company running Public Transport.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
	Endeavour to maximise biofuel use by Gozo Channel and other substantial marine enterprises, subject to availability of an international standard.	Ministry responsible for Energy through The Energy and Water Agency.	Similar to above, but by Gozo Channel and other marine enterprises. Main stakeholders: Ministry for Gozo, Ministry responsible for Transport, Transport Malta.
	Assess and where advisable implement market incentive options to encourage the use of biodiesel, especially in niche and captive sectors.	Ministry responsible for Energy through The Energy and Water Agency	Secure the relatively higher contribution to biofuel penetration that niche captive sectors can make. Main stakeholders: Ministry responsible for Transport and Transport Malta.
5.2	Efficiency in Transport		
	Ensure (through regulatory means) that the public transport operator provides a fuel efficient service.	MTI.	Less fuel to meet public transport needs, minimising GHG emissions and reducing the burden required to meet targets.
5.3	Electric Vehicles		
	Promotion of Electrical Vehicles through continuation of schemes generally as that existing, but which may be modified periodically.	MTI through the Malta's National Electromobility Platform.	Part of transport target shifted on to power station, (or other electricity generated by RES) where it can be met more easily.
	Set up directly and promote the setting up by the private sector of essential ancillary services (e.g. charging points)	Transport Malta through Malta's National Electromobility Platform.	Support to uptake of electric vehicles, removing avoidable negative perceptions.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
	Implementation of the electromobility plan	Transport Malta through Malta's National Electromobility Platform.	A more holistic development of the transport sector, including furthering the penetration of electric vehicles in Malta
5.4	Auto-gas		
	Promote the use of Auto-gas in transport through information programs and the continuation of the current incentive schemes.	Transport Malta.	Support Auto-gas as a cleaner vehicle fuel option
6.	Heat Pumps for heating		
	Collaborate with the National Statistics Office to obtain a quantitative understanding of the heating habits and patterns in Maltese households, preferably as part of a wider study of energy consumption.	The Energy and Water Agency, MRA (Climate Change Unit), NSO.	Quantitative knowledge that allows the best promotion of the most appropriate means of water and space heating, including through the use of heat pumps for heating where they are beneficial.
	Undertake an information campaign to inform the general public and managers of commercial establishments of the wise use and relative merits of heat pump technology to meet their heating needs.	The Energy and Water Agency.	Informed consumers that are likely to make correct decisions regarding the hardware to satisfy their heating needs.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
	Incentivise the purchase of modern high efficiency hardware and products for heating, including heat pumps for heating water where it is established that they are cost- effective.	The Energy and Water Agency.	Assist consumers to cover part of the capital cost of the most efficient hardware to satisfy their heating needs, which cost is generally higher than that for traditional appliances available on the market.
	Promote the switch from fuel-based space heating to heat pump technology within the domestic sector.	The Energy and Water Agency.	Increase public awareness about the effective heating costs and other benefits associated with different heating technologies.
	Tighten the permitting /authorisation procedures by regulators to ensure that the use of the groundwater aquifer and seawater cooling systems do not have undue negative environmental impact.	MRA/ERA,PA.	Better management of the environmental impacts of process heat rejection, while benefitting from the RES element, especially in the case of the groundwater aquifer so as not to detract from its primary role of providing drinking water.
7.	Flexible Mechanisms		
	Identify business opportunities in EU member states and third countries for investment in joint large scale RES projects.	The Energy and Water Agency.	New investment opportunities and investor support.
	Participate actively in the development of the market at international level, particularly at EU fora.	The Energy and Water Agency.	National interests taken into account in developing EU policy and regulations.

Measure number	Measures	Entity Responsible for Implementation	Outcome/s
	Commission the necessary studies to evaluate the opportunities and potential of all options offered by flexible mechanisms in the short, medium and long term, including the purchase of green certificates under the 'statistical transfer arrangement' should they be required to meet 2020 target and trajectory or prove to provide significant net benefits to the economy.	The Energy and Water Agency.	A tool for decision making – optimising the benefits that can accrue to Malta from these mechanisms.
8.	Wind (Large/medium scale)		
	Monitor, through the Institute of Sustainable Energy of the University of Malta, the progress of deep offshore floating wind technology from both technical and financial/ economic and strategic perspective.	The Energy and Water Agency, Institute of Sustainable Energy of the University of Malta.	Up-to-date comprehensive information on large/ medium scale wind technology so as to ensure that a possible opportunity is not missed. Specialist competence at the University is preserved and enhanced.
9.	Wave		
	Note and act upon any progress in suitable wave exploitation technology as may be recommended by experts.	The Energy and Water Agency.	Up-to-date comprehensive information on applicable wave technology so as to ensure that a possible opportunity is not missed. Competence at the University is preserved and enhanced.

ANNEXES

Annex I

Economic considerations

1. PROJECTING TOTAL ENERGY CONSUMPTION AND IMPACT OF RES

Meaningful determination of targets and the roadmap to reach them requires the quantification of the energy needed to be sourced from RES to satisfy the national target of 10% of the final energy consumption by 2020, which in turn requires the best projection of the final energy consumption to 2020. This projection was obtained through holistic mathematical models of energy consumption and generation.

This section gives a short account of the main economic parameters that were integrated in these models to show consistency in the national economic and energy planning. It also shows the impact of 10% RES in final consumption by 2020 on the security of supply, cost and affordability of local energy generation including conventional energy.

Job creation arising out of RES in the local economy is also discussed qualitatively. The above mentioned considerations, and where relevant conclusions, give comfort that the set RES targets are very likely to be met with the measures / projects proposed in the NREAP and that no problems with public acceptance on the basis of financial hardships or for any other economic reason should arise.

2. A SHORT ACCOUNT OF BASIC MACROECONOMIC FACTORS TO PROVIDE A CONTEXT FOR THE ESTIMATES OF ENERGY CONSUMPTION AND MOVEMENT

Gross value added (GVA) generated in Malta in 2014 stood at €7.1billion from €6.0billion in 2011⁸³. From a sectoral approach, over 60% of GVA in 2014 was generated from the Wholesale and Retail sector, transport, accommodation and food service (23%), Public Administration (19%), Manufacturing (12%) and Professional, technical, administrative and support activities (12%). Figure 1 illustrates the sectoral distribution of economic activity in 2014.

⁸³ http://nso.gov.mt/en/News_Releases/View_by_Unit/Unit_A1/National_Accounts/Documents/2015/News2015_224.pdf

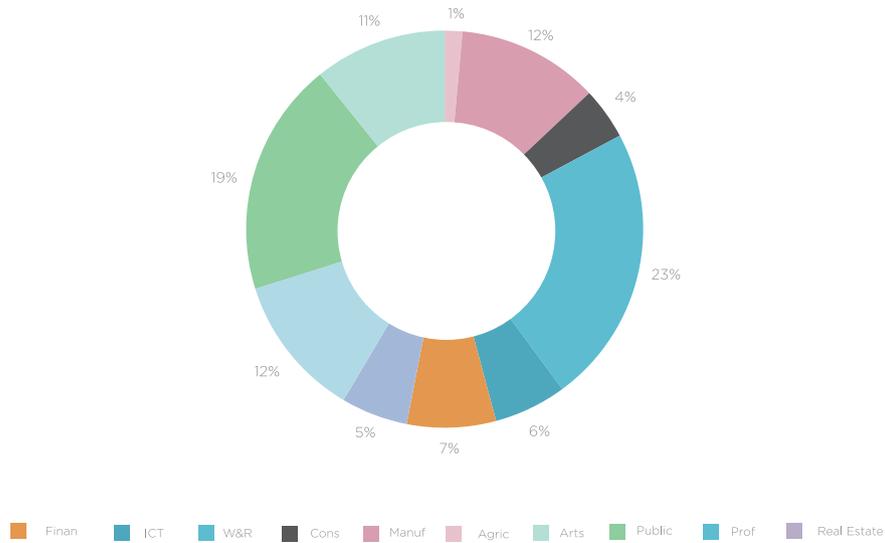


Figure 1 - Sectoral Distribution of Economic activity in 2014 (Source: NSO)

Over the previous four-year period, growth in GVA resulted in the main from the professional, technical, administrative and support activities as well as arts and recreation, which increased their share to GVA by 2.4 p.p and 1.4 p.p, respectively. On the contrary, a drop in GVA resulted from the manufacturing sector, causing a decline in the contribution to GVA by 2.8p.p.

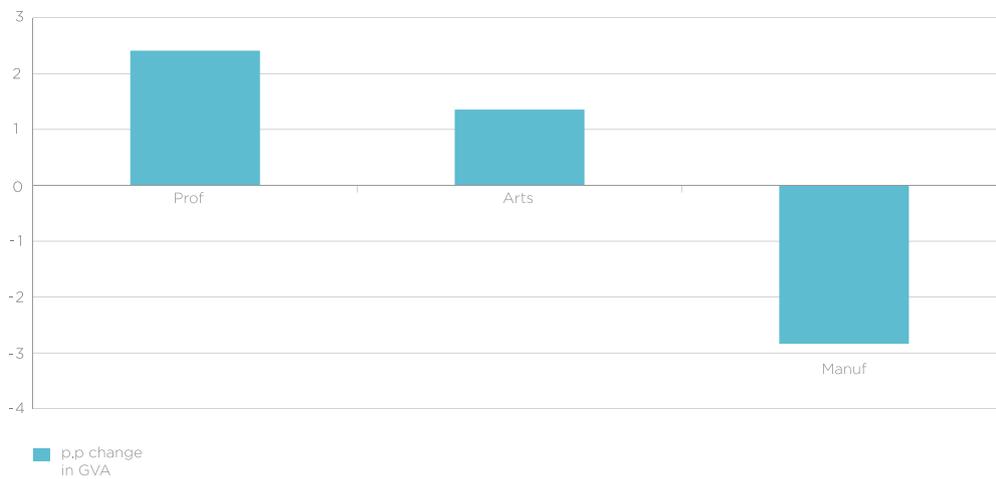


Figure 2 - Contribution to GVA: Growth/decline over the period 2011-2014 (Source: NSO)

From an expenditure approach, the domestic sector's contribution to Gross Domestic Product (GDP) was underpinned mainly by private consumption (77%) followed by government expenditure (21%), investment (17%) and net exports (6%).

Over the previous four-year period, the share of Government expenditure increased by 1p.p. due to significant growth in absolute terms. This increase was partly offset by a decline in investment, exports and consumption as a proportion of GDP, by 1.5 p.p, 3.5 p.p and 1.4 p.p respectively, due to slower growth in absolute terms. The contribution of imports to GDP declined as well by 6.2 p.p.

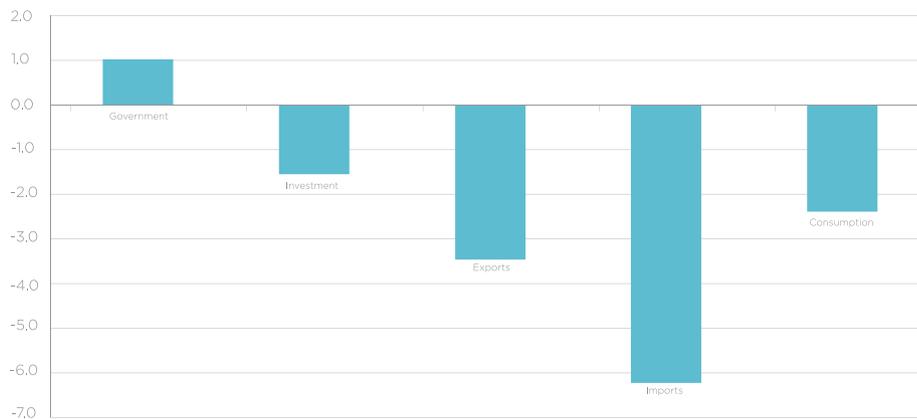


Figure 3 - Contribution to GDP: Growth/decline over the period 2011-2014 (Source: NSO National Accounts)

In terms of employment, the gainfully occupied population in Malta in FTE⁸⁴ in 2014 stood at 186,026 persons⁸⁵. From a sectoral approach, over 50% of employment in 2014 was generated from the Wholesale and Retail sector (28%) and Public Administration (26%). Figure 4 illustrates the sectoral distribution of the gainfully occupied population in 2014.

⁸⁴ Full time equivalent.

⁸⁵ http://nso.gov.mt/statdoc/document_file.aspx?id=4041

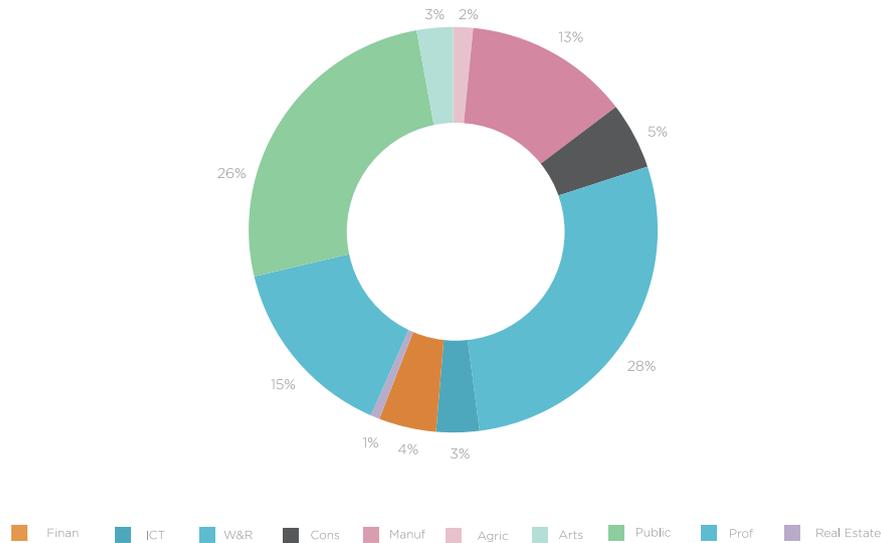


Figure 4 - Sectoral Distribution of Gainfully occupied population in 2014 (Source: NSO Gainfully Occupied Population).

As illustrated in Figure 5, over the previous four-year period, employment within the professional, technical, administrative and support activities and public administration categories increased as a proportion of total employment, by 2.1 p.p. and 2.3 p.p. respectively. On the contrary, the share of employment in construction, manufacturing and wholesale and retail declined.

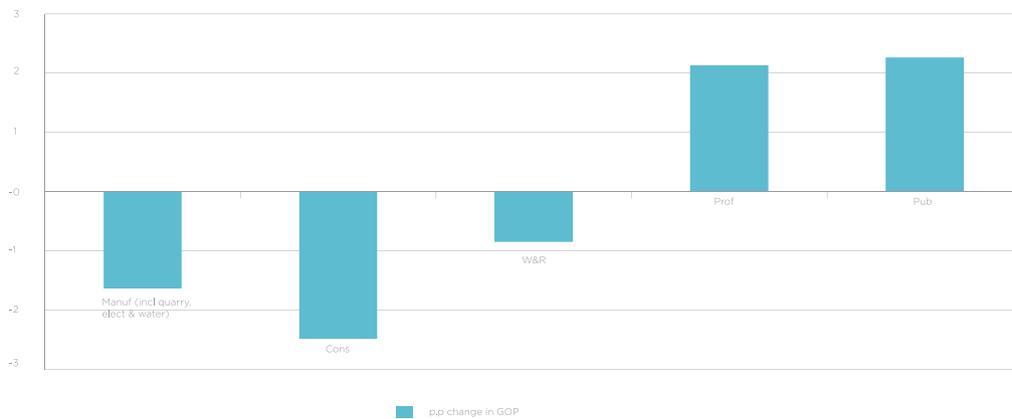


Figure 5 - Contribution to Gainfully Occupied Population: Growth/decline over the period 2011-2014 (Source: NSO, Gainfully Occupied Population)

3. THE EXPECTED GDP IN 2020 TAKEN INTO ACCOUNT IN SETTING THE NATIONAL TARGET FOR 2020

According to the European Commission Spring forecast, GDP growth for 2015 and 2016 is estimated at 3.6% and 3.2%, respectively⁸⁶. Economic activity expansion in the short term is expected to be driven by investment, benefitting from a number of large-scale construction and energy projects and EU fund absorption (mostly in 2015), and private consumption, on the back of increasing disposable incomes and favourable consumer sentiment. Falling interest rates, bringing about a reduction in the cost of financing for firms, are expected to ease access to finance for firms, in particular for micro and small enterprises.

The 2012 Fiscal Sustainability Report⁸⁷ presents the key macro-economic assumptions for 2014-2020 for actual and potential real GDP growth as follows:

	2017	2018	2019	2020
GDP growth (real) potential	2%	1.9%	1.9%	1.9%
GDP growth (real) actual	1.9%	1.9%	1.9%	1.9%

The forecast for economic growth up to 2020 is driven by changes in total labour input and its productivity. The figure for 2020 is confirmed in the 2015 Ageing Report⁸⁸.

The 2015 Budget Speech⁸⁹ presents GDP figures in nominal terms for the years 2017 and 2018 in absolute figures. Nominal growth rates are estimated at 5% for 2017 and 4.8% for 2018, which can be translated to 3% and 2.8% in real times, which are more optimistic than the Commission forecast presented above.

This overall economic scenario provides the inputs into a specific model aimed at forecasting the demand for energy from various economic sectors and for a number of uses. It provides an overview of the fuel use in different sectors of the economy and its responsiveness to changes in economic activity. In this model, the various economic sectors are aggregated into five categories as specified hereunder:

- Category 1: Agriculture (NACE A)
- Category 2: Mining and quarrying, Manufacturing, Electricity and Water and Construction (NACE B-F)
- Category 3: Wholesale and Retail, Transport and Accommodation (NACE G-I)
- Category 4: ICT, financial services and real estate (NACE J-L)

⁸⁶ http://ec.europa.eu/economy_finance/eu/forecasts/2015_spring/mt_en.pdf

⁸⁷ 2012 Fiscal Sustainability report, European Commission http://ec.europa.eu/economy_finance/publications/european_economy/2012/pdf/ee-2012-8_en.pdf

⁸⁸ http://ec.europa.eu/economy_finance/publications/european_economy/2015/ee3_en.htm

⁸⁹ https://mf.gov.mt/en/The-Budget/Documents/The_Budget_2016/Diskors_Bagit_2016.pdf

- Category 5: Professional and scientific activities, Administration and support activities, Public Administration, Education, Human Health, Arts, Households activities and other services (NACE M-T)
- Category 6: Household Sector (Total Fuels Used in the Non-Economic Sectors)

The sectors are categorised according to the ‘Nomenclature generale des Activites economiques dans les Communautés europeennes’ or otherwise known as NACEs90 which is an industrial classification used by Eurostat.

The model estimates the use of fuel which is translated into energy demand, measured in Terajoules, for various activities under the different economic sectors which are taken as a function of output. The model estimates the percentage change in fuel use or demand for energy in TJ as a result of changes in economic activity. The scope is to measure the responsiveness or the elasticity of fuel use to change in output based on historical data provided by the Regulator for Water and Energy Services (REWS) and processed by the MRA and the Energy and Water Agency.

Historical data, from 1990 to 2014, shows that the biggest user of energy is the transport sector followed by the accommodation services and manufacturing sectors; mainly for automotive and industrial processing activities. The most widely used types of fuel in the economic sectors are diesel and gasoil. Note that data for Transport (incl. automotive, national navigation, domestic and international aviation) and electricity generation activities is subtracted from each individual economic sector to be analysed separately under the transport and electricity sectors.

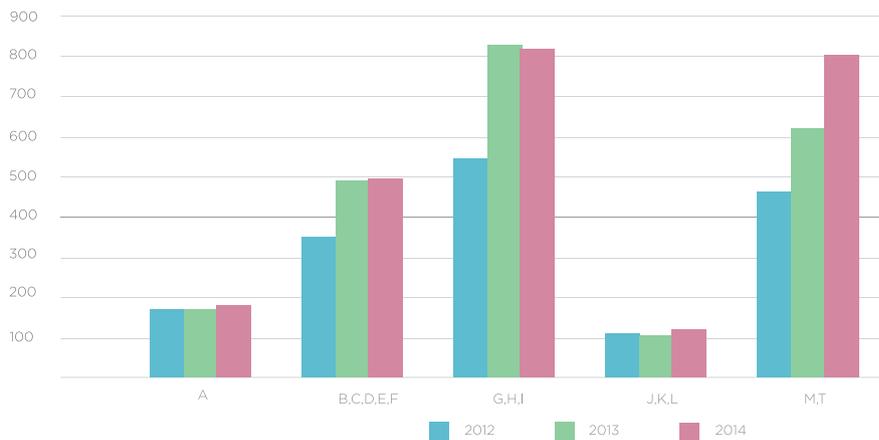


Figure 6: Energy Use (TJ) between 2012 and 2014 (Source: MRA)

⁹⁰ http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=NACE_REV2

Energy - Agriculture

As depicted by figure 6, the agricultural sector used an annual average of 174 TJ during the years 2012-2014. Data for these years shows that energy demand from the agricultural sector has increased by 6% in 2014 when compared to the 1% increase in 2013, driven mainly by an increase in energy use for automotive activities. To note that in the case of the Agriculture sector, fuel use for automotive activities is not classified under the Transport sector as this is used by non-road transport. In 2014 the energy use by the agricultural sector amounted to 182 TJ. The output elasticity for this sector is low at 0.795 implying that the responsiveness of energy demand to changes in output is low. This means that a 1% change in agricultural output will result in a 0.795% increase in energy demand.

Energy - Manufacturing and Construction

This category is larger than agriculture in terms of energy demand given that it includes five sectors two of which are major consumers including manufacturing and construction. Excluding automotive activities and electricity generation activities, in 2014, energy use for the industry sector amounted to 495 TJ. The demand for energy in this category is mainly used for industrial processing with the electricity, gas, steam and air conditioning supply sector consuming only 7 TJ of energy in 2014. Data shows a drastic increase between 2012 and 2013 of about 39% to fall back to 1% increase in 2014. This was mainly driven by a drastic increase in spatial heating and industrial processing for NACEs C (Manufacturing) and E (Water Supply; Sewerage, Waste Management and Remediation Activities). The elasticity for NACEs B to F is estimated at 0.73.

Energy - Wholesale and Retail, Transport and Accommodation

This category is the largest consumer of energy given that it captures the transport sector which is the largest user of energy, using an average of 729.73 TJ per year, over the period 2012-2014. Excluding automotive and electricity generation activities, this is mostly used for industrial processing and spatial heating in case of the accommodation sector. In 2014 the energy demand amounted to 817.9 TJ excluding the above mentioned activities. This category also recorded a drastic increase between 2012 and 2013. In 2013 it registered double the amount of energy used in 2012 driven mainly by an increase in energy use for industrial processing, for transport, and for spatial heating in the accommodation sector. This was followed by a negative growth of 1% in 2014. The output elasticity for this sector is 0.884, which is also inelastic.

Energy - ICT, financial services and real estate

In 2014 the three sectors identified within this category used 122.16 TJ (excl. the automotive and electricity generation activities). The responsiveness to changes in output is by far less than in the other categories.

Energy – Professional and scientific activities, Administration and support activities, Public Administration, Education, Human Health, Arts, Households activities and other services

In 2014 the energy use excluding the automotive and electricity generation activities was of 806.91 TJ, an increase of 155.88 TJ from the previous year. This sector registered an increase of 30% and 34% in 2013 and 2014 respectively. With an output elasticity of 0.792 the responsiveness of energy use to changes in output is inelastic.

Household Sector

When compared to the economic sectors, the household sector is a large consumer of energy. In 2014 the energy use amounted to 708 TJ representing an 8% increase over the previous year when compared to the 6% increase in 2013.

4. THE IMPACT (SECURITY OF SUPPLY, COST AND AFFORDABILITY) OF RES ON THE LOCAL ENERGY GENERATION SCENARIOS IN 2020.

This section describes the impact in terms of security of supply, cost and affordability of RES. With specific reference to affordability of renewable energy, undue hardship is not expected on the local population, although renewable fuels are expected to have a non-insignificant impact on the price of automotive fuels in the future. In terms of security of supply, RES will entail power generation through PV in addition to reduced output from LNG and more significantly from the interconnector. The presence of RES does not only increase the average cost through higher costs of generation in itself, but also leads to higher costs by displacing potential imports over the interconnector.

Estimates regarding the total average variable cost per kWh of electricity generation in Malta have been produced under two scenarios. One of these involves the production of electricity through RES as indicated in this document, whilst the other features no generation through RES. Under the RES scenario, the average variable cost per kWh is estimated to be higher in comparison to the alternative (no RES) scenario even though the premium (above the marginal cost) is not included in the computation of the variable cost. This is the result of a reduction in the optimization of the dispatch order, whereby PV generation would often displace electricity purchased from the interconnector.

In terms of affordability, it must be highlighted that electricity consumption bills of a residential and domestic nature have been reduced by 25% since April 1, 2014 due to the new investment in the LNG facilities as well as the development of the Malta-Sicily interconnector, which replaced ageing facilities operating at significantly lower efficiency rates. This takes place through the interplay of tariff rates and eco-reduction, leading to an average effective 25% overall reduction in electricity consumption bills. Furthermore, the premium paid for electricity generated from PV is financed through central Government budget and is not included in the electricity tariff structure. Overall, therefore, Maltese households have experienced a significant improvement in the affordability of electricity.

It is interesting to note that this development followed a period where significant increases in energy prices internationally had led to concerns on the sustainability and affordability of electricity prices in Malta. The then Malta Resources Authority (now REWS) had estimated that for modal households the expenditure on water and electricity rates averaged 4.1% of disposable income between 2008 and 2010, ranging between 3.7% in 2009 and 4.4% in 2008. Viewed by number of persons, the average expenditure in the three years ranged between 3.3% in the case of 3-person households to 5.5% in the case of 1-person households.

In terms of the most vulnerable households, the expenditure on water and electricity between 2008 and 2010 averaged at 3.0% of disposable income. The level of expenditure is in this case being restrained by the social benefits discussed above, especially the energy benefit, as shown in Table 1.

Analysis by Most Frequent Households											
Number of persons	Disposable Income Bracket (€, 2008)	Average Disposable Income (€, 2008)	Number of Households	Net Annual Expenditure (€)				Net Annual Expenditure as % of Disposable Income			
				2010 tariffs	2009 tariffs	2008 tariffs	2008-2010 average	2010 tariffs	2009 tariffs	2008 tariffs	2008-2010 average
1	6000-14000	8533	18152	488.8	422.3	509.4	473.5	5.7%	4.9%	6.0%	5.5%
2	6000-14000	9895	18525	372.6	363.2	430.7	388.8	3.8%	3.7%	4.4%	3.9%
3	14000-22000	18085	10193	564.9	556.4	665.0	595.4	3.1%	3.1%	3.7%	3.3%
4	14000+	28945	25743	1241.0	1083.1	1283.7	1202.6	4.3%	3.7%	4.4%	4.2%
5+	14000+	31692	14372	1331.0	1156.0	1358.3	1281.8	4.2%	3.6%	4.3%	4.0%
Average		19810		834.7	742.2	880.3	819.1	4.2%	3.7%	4.4%	4.1%

Analysis by Most Vulnerable Households											
Number of persons	Disposable Income Bracket (€, 2008)	Average Disposable Income (€, 2008)	Number of Households	Net Annual Expenditure (€)				Net Annual Expenditure as % of Disposable Income			
				2010 tariffs	2009 tariffs	2008 tariffs	2008-2010 average	2010 tariffs	2009 tariffs	2008 tariffs	2008-2010 average
1	0-6000	3819	7014	74.1	58.7	72.7	68.5	1.9%	1.5%	1.9%	1.8%
2	0-6000	4333	3050	102.3	67.8	82.4	84.2	2.4%	1.6%	1.9%	1.9%
3	6000-14000	11326	5838	306.6	325.5	382.0	338.0	2.7%	2.9%	3.4%	3.0%
4	6000-14000	11117	5505	381.2	401.4	475.0	419.2	3.4%	3.6%	4.3%	3.8%
5+	6000-14000	11295	1318	331.5	361.4	422.4	371.8	2.9%	3.2%	3.7%	3.3%
Average		8018		226.9	229.0	271.2	242.4	2.8%	2.9%	3.4%	3.0%

Table 1 - The Impact of Water and Electricity Bills on Household Disposable Income (Most Frequent Households and Most Vulnerable Households)

Malta has nowadays one of the lowest residential electricity prices (€12.5 per 100 kWh) in the EU (Figure 7) when compared to the EU-average of €20.8 per 100 kWh⁹¹. The countries registering the highest electricity prices across the EU include Germany (€29.7 per 100 kWh) and Denmark (€30.4 per 100 kWh). Malta was one of the countries with the most noticeable decrease in electricity prices, of -26.6%, between the second half of 2013 and the second half of 2014 together with Czech Republic, Hungary, Netherlands, Slovakia and Belgium.

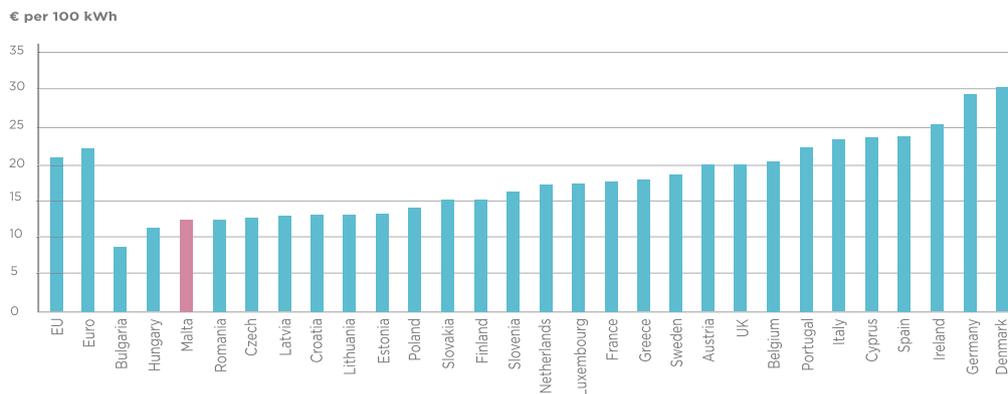


Figure 7: Electricity Prices for the 2nd half of 2014 (Source: Eurostat)

However, on average in the EU, almost a third (32%) of household electricity prices are taxes and levies. The share of taxes and levies in total household electricity prices varies significantly between Member States, ranging from more than 50% in Denmark (57%) and Germany (52%) to 5% in both Malta and the United Kingdom in the second half of 2014. Further adding to the discussion on affordability of electricity as a consequence of the introduction of RES in Malta is the fact that the REWS (formerly MRA) administers various capital grant and feed-in tariff schemes to enhance the affordability of renewable energy. Incentives are partly funded under the European Regional Development Fund and/or from national funds.

Schemes administered by the REWS have evolved since Feed-in Tariffs were first introduced in 2010. A non-exhaustive list of schemes offered for residential PV Systems installed in Malta or Gozo which benefit from a grant of not more than 50% of the initial capital investment is given below:

1. Feed-in tariff approved between the 10th September 2010 and the 31st December 2012, applicable tariff is 25c/kWh for eight years;
2. Feed-in tariff approved between the 1st January 2013 and the 30th April 2015, applicable tariff is 22c/kWh for six years;
3. Feed-in tariff approved between the 13th July 2015 and the 30th June 2016, applicable tariff is 16.5c/kWh for six years.

The most recent scheme, announced on the 15th June 2015 and relaunched in 2016, includes a grant scheme and a feed-in tariff which offer an attractive rate of return on investment, albeit to a somewhat lesser extent than in previous years. On average it is estimated that the government will spend around €9 million annually to support PV development. The projected annual PV budget is expected to peak in 2018. Other schemes in operation include subsidies on solar water heaters and on roof thermal insulation and double glazing installations.

A number of Maltese banks⁹² also offer competitive rates and conditions for Green or Eco-loans for investments in renewable energy. The aim of these eco personal loans is to support domestic home owners in financing their investment in photovoltaic equipment and solar water heaters, empowering customers to manage their utility bills in a sustainable manner whilst helping in the safeguard of the environment for the benefit of society at large.

It is estimated that the biofuel substitution obligation will drive energy prices up by 3% (per unit of energy) by 2020 . Using this estimate and applying it to the weight of fuels and lubricants for personal transport equipment which amounts to 5.2%⁹⁴ implies an increase in the cost of living of 0.156%. This contrasts with the reduction in electricity tariffs of 25% effected in April 2014 which has a weight of 2.6% in the HICP, and is equivalent to a drop in the cost of living of 0.7%.

⁹¹ <http://ec.europa.eu/eurostat/documents/2995521/6849826/8-27052015-AP-EN.pdf/4f9f295f-bb31-4962-a7a9-b6c4365a5deb>

It can therefore be expected that the increase in the price of liquid fuel could have some limited impact on affordability which may be compounded by knock-on effects on consumer prices arising from the use of fuel as intermediate input in production.

In conclusion, Maltese households have experienced a significant improvement in the affordability of electricity due to the reduction in electricity tariffs which came into force in 2014. From a macro perspective, the presence of RES in power generation often leads to a higher cost of purchases from the interconnector, by replacing imports which could have been done at a lower cost. From a household perspective, RES is not expected to cause undue hardship on the local population due to a number of schemes in place by REWS as well as eco loans provided by local banks.

5. JOB CREATION

Literature reviews suggest that renewable energy development uses local energy resources to improve the local economies, create skilled jobs whilst reducing the dangers of global warming and air pollution.

A study entitled 'The impact of renewable energy policy on economic growth and employment in the European Union'⁹⁴ concludes that the high positive economic impacts of RES can be increased in the future through support policies that encourage innovation. It also highlights that security of supply and environmental sustainability should be pursued however it is doubly beneficial if increasing the share of RES not only does no harm to the economy, but can even contribute to it in a positive way by creating jobs and increasing GDP.

To this end, availability of an adequate knowledgeable and skilled human resource base is fundamental for the attainment of benefits obtained from the meaningful adoption of RES and green employment. The Maltese Government has strengthened institutional capacities in education and training such as investment in local production of components and systems, and in the training and certification of installers.

The European Employment Observatory Review entitled 'Promoting green jobs throughout the crisis, 2013'⁹⁵ states that as with every other structural change the success of the transition to a green economy lies on the availability of technical skills and entrepreneurial ability to match new investment and job requirements across all the sectors of the economy.

The study also presents a table with a list of occupations with potential to benefit from the low-carbon transition, by sector (Table 2).

⁹² <https://www.bov.com/news/bov-eco-personal-loan--grtu-special-scheme-renewed>; <http://www.apsbank.com.mt/en/eco-plus>

⁹³ http://www.nso.gov.mt/statdoc/document_file.aspx?id=2833

Occupations With Potential To Benefit From The Low-Carbon Transition, By Sector						
	R&D	Manufacture & Installation/Engineering	Operation & Maintenance	Management	Administration	Sales
Renewable Energy	✓	✓	✓	✓	✓	✓
Conventional Power Generation			✓	✓	✓	
Cement		✓				
CCS	✓	✓	✓			✓
Iron & Steel	✓		✓	✓		
Machinery & Electrical equipment	✓	✓		✓		
Construction	✓	✓		✓	✓	✓
Transportation			✓	✓	✓	

Table 2:

The study also highlights that for Malta, green employment promotion strategies must be implemented within economic development planning through several measures. Similarly, Malta's National Environmental Policy⁹⁶ mentions the preparation of a Green Jobs Strategy by 2013 and a Green Jobs Training Strategy by 2014. One of the measures contemplated in the Policy is a commitment to create more than 2,000 new green jobs.

A report entitled 'Green Jobs: Towards decent work in a sustainable, low carbon world' highlights that as the move toward a low-carbon and more sustainable economy gathers momentum, growing numbers of green jobs will be created. Although winners are likely to far outnumber losers, some workers may be hurt in the economic restructuring toward sustainability.

The report also presents the question as to what extent specific communities, regions, or countries benefit most from green employment. Green jobs span a wide array of skills, educational backgrounds and occupational profiles ranging from R&D, professional fields and blue-collar areas such as low-wage installers of solar panels. It is likely that blue-collar workers transform into green-collar workers in countries and regions where R&D and innovation are lacking and where most materials are imported.

⁹⁴ http://ec.europa.eu/energy/renewables/studies/doc/renewables/2009_employ_res_report.pdf
⁹⁵ <http://www.eu-employment-observatory.net/resources/reviews/Malta-EEO-GJH-2013.pdf>

The report also mentions the share of revenues captured by local producers as opposed to middlemen and globally-operating companies, and whether the necessary industrial and knowledge base, as well as infrastructure, exist in a particular country, region or other locality.

Furthermore, the report puts forward the fact that companies and regions that become leaders in green innovation, design and technology development are more likely to retain and create new green jobs which require human resources with a high level of qualifications and skills, contributing to a higher value added earning higher wages in return.

Countries that become leaders in green products, services, and technology development will want to press their advantage and capture export markets in addition to serving their own domestic markets. Indeed, countries like Germany and Japan see the environment as a key dimension of their future economic strategy. This implies that the bulk of green business revenues and jobs in R&D and manufacturing operations accrues to a relatively small group of countries, at least until other countries catch up. By contrast, jobs in operations and maintenance tend to be created in or near the location where wind turbines, solar panels, efficient windows, etc. are installed and used; they cannot be easily outsourced.

With specific reference to Malta, the study entitled 'A Civil Society Perspective of Sustainable Energy Policy and Green Jobs in Malta as a Small EU State'⁹⁷ shows that the representatives of Maltese civil society are aware of and knowledgeable about the shift towards sustainable energy use and its potential of creating green jobs. They also acknowledge that it may lead to some jobs losses in particular sectors but still believe that benefits, which this shift can bring about, outweigh these negative repercussions. This strong belief is however tempered with a serious concern about uneven developments within the green job market, which may create skill mismatches and give rise to precarious employment. There seems to be a wide degree of consensus among the key players of Maltese civil society that the smooth implementation of a green sustainable policy depends heavily on a holistic and inclusive approach characterised by consultation and decentralisation, and finding the ideal mix of macro and micro policies. Through innovative policy making and exploitation of Malta's geographical position and its natural and human resources, the shift to a green sustainable economy can be successfully implemented despite smallness. The supportive role of civil society augurs well for the future prospects of green jobs in Malta. Consciousness on the green job potential exists within civil society in Malta which in itself augurs well for the myriad of challenges and opportunities which Maltese society is likely to encounter in relation to sustainable energy use.

⁹⁶ <https://environment.gov.mt/en/decc/Pages/environment/natenvpol.aspx>

⁹⁷ http://gef.eu/uploads/media/Green_jobs_from_a_small_state_perspective.pdf

Jobs in the green economy in Malta are focused in the main within the operations and maintenance categories. There is a high import content within the renewable energy sector due to Malta's small size and inability to reap economies of scale, coupled by the fact that R&D within this field is still at a nascent stage. This places Malta at a relative disadvantage in the creation of green jobs in comparison to countries that are producers of green products. To this end, the National Research Strategy for Manufacturing in Malta⁹⁸ highlights that in the medium term Malta has a high potential for carrying out Research and Development activities that are geared exclusively towards Photovoltaic Systems. This is of particular relevance to Malta since the National Reform Programme 2015 outlines that Government is prioritising solar photovoltaic systems and solar water heating in order to achieve its committed renewable energy 2020 target.

In the 2014-2020 Partnership Agreement for Malta⁹⁹ which sets the strategy for optimal use of ESI Funds, it is stated that there is scope for further investment in renewable energy in Malta, taking into account the geographical realities of the country. Increasing the share of electricity generated by renewable energy sources will also help reduce the total electricity demand that has to be met by conventional sources which will also contribute towards energy security as well as climate change mitigation. Government shall also seek to utilise waste as a resource contributing towards green energy.

This is expected to contribute towards the green economy including the creation of green jobs and green businesses. Furthermore, Government will also explore the possibility of supporting interventions aimed towards creating the necessary skills base required by industry including investment targeting the development of green jobs. Complementary capacity building interventions are also envisaged to strengthen the knowledge and skills in the low carbon economy.

To this end, job creation related to RES falls under Funding Priorities 2 and 3 of the Partnership Agreement namely sustaining an environmentally friendly and resource efficient economy as well as Creating Opportunities through investment in human capital and improving health and well-being.

In particular, Operational Programme II for the 2014-2020 period refers to Education and training measures to support increased knowledge and skills in the low carbon economy to foster the creation of green jobs, complemented with ERDF related investment to sustain a more resource efficient economy which is in turn translated into specific effects on job creation (direct and indirect).

⁹⁸ [http://www.manufacturingresearch.eu/documents/Research%20Manufacturing%20Strategy%20Final\(3\).pdf](http://www.manufacturingresearch.eu/documents/Research%20Manufacturing%20Strategy%20Final(3).pdf)

⁹⁹ <https://eufunds.gov.mt/en/Information/Documents/MT%20PA%20-%20October%202014.pdf>

Annex II

RENEWABLE ENERGY EXPLOITATION IN NATIONAL POLICIES, STRATEGIES AND PLANS

It is recognised that exploitation of RES is an important element in the efforts to contain climate change and in enhancing environmental management in general and that there is urgency in making rapid progress in these areas.

Accordingly, RES exploitation and clean energy feature in the more important national policies, strategies and programmes dealing with development, budgeting, energy and the environment. Deployment of RES has absorbed substantial funds and effort along the years, demonstrating the difficulty inherent in its development and penetration in Malta's circumstances.

The following notes point out the relevance of RES to some of the more important national policies, strategies and programmes. Neither the list nor the content is meant to be exhaustive.

Partnership Agreement 2014 - 2020

The Partnership Agreement is the strategic document which paved the way for the preparation of the Operational Programmes related to the European Regional Development Fund (ERDF), the Cohesion Fund (CF), the European Social Fund (ESF), the European Agricultural Fund for Rural Development (EAFRD) and the European Maritime and Fisheries Fund (EMFF).

During the period 2007-2013, extensive investment was undertaken in the field of energy efficiency in various sectors of the economy and in the generation of energy through renewable sources. The Partnership Agreement 2014 - 2020 continues on the same lines.

This investment, incorporating substantial EU funding, has spurred businesses and agricultural holdings to contribute towards these objectives. There is scope for further investment in renewable energy in Malta, taking into account the geographical realities of the country.

Operational Programme I 2014 - 2020

The Operational Programme I 2014 - 2020 was published in March 2015. Priority Axis 4: Shifting towards a low carbon economy considers the implementation of measures to move towards resource-efficiency, low-carbon economy and sustainable growth, thereby addressing the local energy-related environmental challenges such as the high reliance on imported fossil fuel oil for energy generation, the carbon emissions footprint of industry and enterprises and low energy performance in buildings. This Operational Programme builds upon the progress achieved in the previous Operational Programme (2007 - 2013) which noted that RES as a practical alternative was still in its infancy and needed to be developed.

The investment priorities (IPs) under the Priority Axis 4 include:

IP 1 - Promoting the production and distribution of energy derived from renewable sources in households

This measure seeks to promote the use of RES within the domestic sector and increase the number of households investing in RES so as to address the rise in energy demand and mitigate the impact of this on the environment. Interventions include financial incentives for RES systems in households, such as installations of PV systems on house rooftops. This approach enables the country to exploit low-value spaces and so eliminates avoidable recourse to uncommitted land.

IP 2 - Promoting energy efficiency and renewable energy use in enterprises

The support towards the installation of PV units through earlier ERDF funds and other schemes has increased the amount of clean energy generated in commercial enterprises very significantly. This aid also leveraged over €3.5 million of private investment. However, energy generated from RES remains low and suggests that more investment is necessary over the next few years to harvest more of the existing potential. In order to sustain the competitiveness of the private sector, efforts are also required to increase energy efficiency in operations and in buildings. In this respect, investment in energy efficiency resulting in increased energy savings and reduced energy costs is necessary to support the business community to achieve cost effectiveness.

IP 3 - Supporting energy efficiency, smart energy management and renewable energy use in public infrastructure, including in public buildings, and in the housing sector

This priority seeks to minimise energy use in public infrastructures and in the (social) housing sector through a holistic strategic approach that integrates EE and RES technologies. The overall objective remains that of decarbonising Malta's economy and secure sustainable energy. Government will aim to increase the generation of energy from RES in public infrastructure thus ensuring the maximisation of rooftop usage of government and public buildings. In order to enhance energy savings, Government will also aim to improve energy efficiency in public property and in the housing sector. The upgrading and conversion of already existing buildings (such as housing and historical buildings) will be encouraged.

The transport sector falls under Priority Axis 7 - Shifting towards a more low-carbon transport sector, which considers the development and improvement of environmentally-friendly (including low noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links and airport infrastructure, in order to promote sustainable regional and local mobility.

National Reform Programme under the Europe 2020 Strategy

Malta's Country Report 2015, recommends that Malta should "Diversify the energy mix in the economy, including by increasing the share of energy produced from renewable sources."¹⁰⁰

¹⁰⁰ http://ec.europa.eu/europe2020/pdf/csr2015/cr2015_malta_en.pdf

Malta's National Reform Programme under the 2020 strategy advises that a review of Malta's NREAP is under way and explains the main findings of this document and the underlying reasoning behind the new choices being made in order to meet the 2020 RES target.

Strategic Plan for the Environment and Development (SPED)

The SPED was approved by Parliament in July 2015 and is the official document which addresses the spatial issues for the Maltese Islands in the coming years. The SPED, which has replaced the 1990 Structure Plan for the Maltese Islands, is based on an integrated planning system that regulates the sustainable use and management of land and sea resources. This shift in the way strategic planning is carried out in the Maltese Islands from traditional land use planning to a more holistic spatial planning approach emerges from the Environment and Development Planning Act (EDPA) of 2010. The Plan provides a strategic spatial policy framework for both the environment and development up to 2020, complementing Government's social, economic and environmental objectives direction for the same period.

Thematic Objective 9 of the SPED tackles climate change. It aims to control GHG emissions and enhance Malta's capacity to adapt to climate change by promoting renewable energy sources and low carbon modes for transport, directing large scale solar farms to areas as identified in the proposed Solar Farm Policy and promoting energy efficiency in the design of buildings.

The Energy Policy (2012)

In addressing the Malta's energy challenge the nation's energy policy is significantly influenced by a number of EU energy and environmental policies. The policy document is based on five fundamental principles:

- Efficiency and Affordability
- Security of Supply
- Diversification
- Flexibility
- Sustainability¹⁰¹

This policy document identifies six key policy areas to attain the stated policy objectives. These are: energy efficiency, reduction in reliance on imported fuels, stability in energy supply, improvement in our carbon footprint, efficient and effective delivery of energy and finally policy support to the energy sector.¹⁰²

The Energy Policy sets the following main policy statement with regard to renewable energy sources: "Government will support the sustainable development of renewable energy sources." Government accepts its obligation to participate in the international

¹⁰¹ *The National Energy Policy for the Maltese Islands, 2012.*

¹⁰² *Energy Policy for Malta, MRA, 2009*

efforts to mitigate climate change while recognising that RES on its own merits is objectively beneficial to Malta in terms of security of supply, reduction in the country's dependence on foreign energy sources and the potential for job creation.”¹⁰³

The Energy Policy document of 2012 was produced at a time of rapid changes in the RES landscape both in Malta and abroad. “While placing an emphasis on the development of PV technologies in the immediate term, Government is keeping all options open with respect to the best mix of renewable energy sources to optimise the country's energy performance over the medium to long term.”¹⁰⁴

Accordingly, the policy document set out the four options that could have been followed in the development of RES in Malta, whilst additional studies were being pursued.. The main concern was the doability of large wind energy projects and in the event of negative conclusion of the studies being undertaken, their replacement by PV projects. Decisions on this matter have now been taken and are reflected in this updated NREAP. The measures, projects and actions proposed in the 2012 Energy Policy in so far as RES is concerned have been reviewed and updated, for inclusion in this new Action Plan.

Third National Energy Efficiency Action Plan (2014)

In 2014, the government published the third National Energy Efficiency Action Plan setting indicative energy efficiency targets to 2020. This is the latest major update of the first NEEAP published in 2008 and the first plan under the new Energy Efficiency Directive.

Energy efficiency is complementary to clean energy generation in reaching the overarching objective of reducing the impact of energy consumption on climate change. The NEEAP, although focussed on energy efficiency also considers some applications of RES, particularly in buildings, recognising that energy consumption to maintain a comfortable climate inside buildings is significant.

Nearly-Zero Energy Buildings Plan for Malta: 2015

The National Plan to promote Nearly Zero-Energy Buildings outlines the Maltese strategy and actions necessary for achieving nearly zero-energy buildings after the end of 2018 for buildings occupied by public authorities and by the end of 2020 for all buildings respectively.

As defined in Directive 2010/31 and transposed by Legal Notice 376 of 2012, “nearly zero-energy building means a building that has a very high energy performance, as determined in accordance with Schedule I. The nearly zero or very low amount of energy required shall be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby.”

¹⁰³ *The National Energy Policy for the Maltese Islands, 2012*

¹⁰⁴ *The National Energy Policy for the Maltese Islands, 2012.*

The potential of RES, such as PV, solar water heaters and reversible heat pumps to reduce the energy consumption in buildings in Malta is emphatically demonstrated in the cost-optimal levels of heat consumption calculated for various categories of buildings that make up the national building stock.

Solar Farm Policy

The Solar Farm Policy (still in draft form at time of writing) was published for public consultation in December 2014. The proposed policy document sets out the fundamental criteria which the authority deems appropriate to guide the planning and design of solar farm development. The policy furthermore, encourages solar farm development which achieves dual or multiple uses of land, mainly due to land availability restrictions in Malta, to ensure that urban areas are exploited in a more efficient manner. It also provides for solar farms development with a priority given to large scale rooftops, car parks, industrial areas and quarries.

Draft Green Economy Strategy and Action Plan

The Strategy and Action Plan, published in October 2015 for public consultation, includes a list of actions that promote investment towards the green economy; education, jobs and resource sustainability within various economic sectors including waste, water, energy, transport, tourism, agriculture, construction and industry.

National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions: 2009

The National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions (National Strategy for Climate Change Mitigation) presents a multi-pronged approach to the implementation of energy efficiency in Malta as a vehicle directed to enable Malta to meet its GHG reduction target of 20% CO₂e reduction on the 1990 base line.¹⁰⁵

The document deals with establishing the most appropriate way forward for the stimulation and penetration of RES as part of the reduction of GHG emissions. As stated in the document, “The Government re-affirms its recommendation that Malta’s approach to RES is to be a mix of the most applicable technologies that are most suited for Malta – and in doing so it will seek within such a mix a balance of all types of technologies available today and in the future.”

A Sustainable Development Strategy for the Maltese Islands: 2007-2016

The main objective set out for the Sustainable Development Strategy for the Maltese Islands (SDSMI) is to “build upon and harmonise the various sectoral, economic, social and environmental policies and plans that are operating in the country and to ensure socially responsible economic development while protecting the resource base and the environment for the benefit of future generations”.¹⁰⁶ In the consultation process leading to the development of the Strategy, several environmental challenges were identified, amongst which:

¹⁰⁵ Pg 119, *Ibid.*

¹⁰⁶ *Agenda 21, Chapter 8, paragraph 8.7 cited in SDSMI pg. 5*

- Air quality and climate change
- Energy efficiency and RES
- Transport

Malta signed the Millennium Declaration and agreed on the Millennium Development Goals. The Sustainable Development Strategy complements the Millennium Development Goals in that it seeks the integration of the principles of sustainable development into country policies and programmes and reverses the loss of environment resources (Millennium Development Goal 7). The SDSMI identifies the environment to be one of the five main pillars which are considered as warranting foremost attention for the attainment of sustainable goals in Malta.

The Strategy identifies 20 priority areas. The RES Action Plan impacts very directly two of these priority strategic directions under the heading of 'The Environment', which are as follows:

- Climate change: "Take steps to reduce greenhouse gas emissions through transport policy and an energy policy that seeks to promote environmental protection, competitiveness and security of supplies and, as a result, decouple the rate of growth of GHG emissions from economic growth."¹⁰⁷
- Air Quality: Take remedial action to control emissions of air pollutants (ambient levels of particulate matter, sulphur dioxide, carbon monoxide, benzene, lead, ozone, heavy metals and nitrogen oxides) as well as achieve compliance with European Standards.

Other areas are impacted though not as directly or significantly – land use, employment and spatial development.

The strategy underlines that energy efficiency and the use of renewable energy sources (RES) can be economically and environmentally advantageous. The NREAP presented in this document is a more detailed presentation of the measures being contemplated to maximise the cost-effective deployment of RES.

National Environment Policy (2012)

The National Environment Policy incorporates six environmental objectives which are directed to achieve a high level of environmental quality in the Maltese Islands. While most of the set objectives incorporate horizontal measures that concern RES, RES is a major issue in Objective 6 which addresses 'Climate change and energy' as a long term sustainability issue.

The NEP recognises that the climate change and energy sectors have well-developed policy frameworks which align national policy objectives with the UN Framework Convention on Climate Change and the EU Climate and Energy Package.

¹⁰⁷ Pg 7, A Sustainable Development Strategy for the Maltese Islands: 2007-2016, National Commission for Sustainable Development, 20th December 2006.

It emphasises the need of periodical review of existing policies and plans to ensure relevance and achievement of targets. It endorses the National Renewable Energy Action Plan (of 2010) as sufficient to meet the national RES targets.

The NREAP presented in this document is a revision and update of the 2010 action plan that takes changes in policies and circumstances of the energy sector into account.

EcoGozo Strategy

The eco-strategy for Gozo is a holistic vision covering all aspects of development in Gozo. It places the generation of energy as a central issue to the Eco-Gozo vision. This is re-iterated in subsequent initiatives building upon the original concept e.g. 'Eco-Gozo: Gozo A Better Gozo' Action 2010-2012 and A Vision for an Eco-Island, August 2012.

The Strategy proposes a high degree of public participation through consultation. Accordingly, inputs include:

- Production of a master plan, quantitative determination of the carbon footprint of selected categories of energy consumers and activities;
- Horizontal measures, e.g. PPP (including small-scale energy generation, government leading by example, information and consultation availability, R&D);
- Technology-specific issues.

National Strategy for the Introduction of Electromobility in Malta & Gozo (2012) and National Electromobility Action Plan (2013)

The main aim of this Strategy is to recommend a number of measures that could be adopted by Government to surmount barriers currently impeding the uptake of electric and hybrid vehicles as an alternative to fossil fuel-powered cars; while decoupling increased transportation requirements from vehicle generated harmful emissions. Malta is obliged to increase its share of cleaner transportation, both with respect to the reduction of air pollution required by the Air Quality Framework Directive as well as the reduction in greenhouse gas emissions under the Climate and Energy Package.

Waste Management Plan for the Maltese Islands - A Resource Management Approach 2014-2020

The core aim of this Plan is that of moving waste management in Malta up the waste hierarchy through increased prevention, re-use, recycling and recovery. This depends on a transformation of a variety of characteristics, not least current population habits, waste volumes generated, waste collection practices, waste infrastructure and output markets.

Policies and Measures and Projected Greenhouse Gas Emissions (PAMs Report)

This document reflects implemented or planned measures employed by the government to reduce greenhouse gas emissions and thus includes measures outlined in the Energy Policy document, NREAP and NEEAP. The latest version of the report was published in 2015

