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# ENERGY, TRANSPORT AND WASTE MANAGEMENT: A REVIEW OF MALTESE POLICIES TO COMBAT CLIMATE CHANGE

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## Abstract

As the year 2020 draws closer, European Member States strive harder to reach their individual mandatory targets for the share of renewable energy in their total final energy consumption. Malta has joined the European Union in May 2004 and has since then, worked towards achieving the required compliance of national energy policies to the relevant EU Directives. Malta has also prepared a number of documents dealing with the main three sectors affecting climate change namely, energy, transport and waste management. Besides, Malta has to achieve 10% share of renewable energy in the final energy consumption by 2020, as well as 10% share of bio fuels in the transport sector. Moreover, Malta should also reduce its electricity consumption in public buildings by 9% by 2016. Within the scope of climate change, Malta has no obligations within the Kyoto Protocol but this could change when Malta applies to become an Annex 1 Member at the Conference of Parties meeting in December 2009 in Copenhagen. Meanwhile, within the European Union Emission Trading System (EU-ETS), only the emissions from Malta's two power stations fall under this system. The Commission has decided that Malta's emissions for the period 2008-2012 should not exceed 2.1 Million tonnes of Carbon Dioxide (European Allowance Units EAUs) per year. This is already proving to be a hard challenge to meet, given the projected increase in electricity demand.

This paper outlines the current efforts that would contribute towards achieving the renewable energy targets and curbing of carbon dioxide emissions, mainly focusing on energy, transport and waste management. Three different scenarios are also presented for the plausible contribution of different renewable energy sources in the energy mix. It is noted that a number of important plans and policies have been drafted during 2009 and have still to be transposed to national legislation. However, the race against time has already started and it would clearly require a strong political will to drive Malta towards a cleaner energy mix, achieve the RE binding targets and avoid paying non-compliance penalties.

## Keywords

Malta, energy efficiency, renewable energy, transport, waste.

## 1. Overview

Malta is a small EU island-state in the centre of the Mediterranean Sea, with a total area of 316 $km^2$ and a population of 410,000. Malta's electricity generation profile fulfils the definition of a 'small, isolated electricity system' as understood in the context of the EU Directive 2003/54/EC, since the level of electricity generation had not exceeded the 3,000 GWh/annum for the base year of 1996 and so far it is not connected to the European electricity network. Since its accession to the EU in May 2004, Malta has moved relatively faster than ever before, in its plans for the development of energy efficiency and renewable energy policies and incentives. The targets set by the relevant EU Directives for Malta are as follows:

- Energy Efficiency in Buildings: 9% by 2016;
- Renewable Energy Target: 10% of final energy consumption by 2020;
- Bio-fuel contribution in the fuel mix: 10% of final energy consumption of fuels by 2020.

During the past few years, a number of reports have been published or drafted as follows:

1. The State of the Environment Report (SOER 2005) and State of the Environment Indicators (2007)
2. A "Draft" National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions (2009);
3. A "Draft" Solid Waste Management for the Maltese Islands (2009);
4. The National Energy Efficiency Action Plan (2008);
5. The "Draft" Malta Energy Policy (2006 and 2009) and the Draft National Renewable Energy Policies (2006);
6. The Energy Performance of Buildings Regulations (2008).

## 2. The Political Energy Structure

The Central Government is the sole policy maker and therefore energy planning is carried out on a National level only. The Malta Resources Authority (MRA) – which was set up in 2001 and currently falls under the Ministry for Resources and Rural Affairs – has the role of regulating, implementing and monitoring the energy, water and mineral resources policies. Within the MRA, the Directorate for Energy Resources takes up the responsibility for regulating all activities related to generation,

transmission, distribution, supply and use of all energy sources including renewables, as well as issuing of relevant licenses to operators and electrical tradesmen [1].

Meanwhile the sole energy operator Enemalta Corporation (EMC) falls under the Ministry for Infrastructure, Transport and Communications. Up to a few years ago, EMC had the monopoly in electricity generation, transmission and distribution, however, the Legal Notice 511 of 2004, as amended by Legal Notices 17 and 426 of 2007, and 234 of 2008, which has transposed the EU Directive 2003/54/EC concerning common rules for the internal market of electricity to local legislation, has divested EMC from sole control of generation but retained its monopoly on transmission and distribution [2]. This comes following the acceptance of the European Commission to grant Malta a special derogation due to its small isolated situation. However, this may change when Malta's grid is interconnected with the EU in 2015. The Commission has requested that the situation be regularly monitored and has kept the right of annulling the derogation in the future [3].

The Malta Environment and Planning Authority (MEPA) controls the sustainable development of land while protecting the environment [4]. Hence, all developments, including energy projects would need to be approved by the Authority beforehand. The only exceptions to this requirement are the installations of small photovoltaic systems and domestic solar water heaters, provided that they are installed according to the established norms and regulations [5]. More recently, MEPA has published a draft consultation document for the installation of micro-wind turbines in built-up areas and is now open for public consultation [6]. MEPA currently falls directly under the jurisdiction of the Office of the Prime Minister [7]. At the moment, it is undergoing major reform to improve its efficiency, consistency, accountability and enforcement.

The Malta Standards Authority is the National Competent Body for the European Eco-Label Scheme and the National Eco-Management and Audit Scheme (EMAS). It also works on implementing European standards in the local context, which includes energy-related standards and labelling schemes. It falls under the Ministry for Competitiveness and Communications [8].

Other Authorities that might have leverage for particular energy projects, especially with regards to offshore wind energy projects, are listed below:

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[1] Government of Malta website, accessed on 5th January 2009, http://www.gov.mt/frame.asp?l=2&url=http://www.doi.gov.mt/en/ministries_and_departments/portfolio08.asp.

[2] Ministry for Justice and Home Affairs, accessed on 5th January 2009, http://docs.justice.gov.mt/lom/Legislation/English/SubLeg/423/22.pdf

[3] Official Journal of the European Union No. L332/32 dated 30 November 2006, accessed on 8th January 2009, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:332:0032:0033:EN:PDF

[4] The Malta Environment and Planning Authority, Malta, accessed on 6th January 2009, http://www.mepa.org.mt

[5] Development Control Policy and Design Guidance 2007, Sections 13.3 – 13.5, MEPA 2007, www.mepa.org.mt/.../DC%202007%20_MEPA%20approved%2022.03.07_%20Printable%20version.pdf, ISBN 978-99932-83-68-3, accessed on 12th February 2009, http://www.mepa.org.mt/planning/planning_policy/policyanddesign2007/DC%202007%20_MEPA%20approved%2022.03.07_%20Printable%20version.pdf

[6] The Malta Environment and Planning Authority, Malta, Planning Guidance for Micro-wind turbines (Public Consultation Draft), http://www.mepa.org.mt/planning/planning_policy/wind_turbines/Policy%20Guidance%20on%20Micro%20Wind%20turbines%20Public%20Consultation%20Draft%20July%2009.pdf, ISBN 978-99957-26-01-0, accessed on 15 August 2009.

[7] Office of the Prime Minister, Malta, accessed on 18th February 2009, https://opm.gov.mt/awtoritajiet-upm?l=1

[8] The Malta Standards Authority, accessed on 11th December 2008, http://www.msa.org.mt

- The Malta Maritime Authority (effect on bunkering activities, approach to harbour and effect on marine environment);
- The Malta Communications Authority and the Armed Forces of Malta (with regards to aviation traffic, approach paths to the airport, radar interference and shielding);
- The Malta Tourism Authority (interference with diving sites);
- Oil Exploration Department (effect on potential oil drilling sites);
- The Malta Transport Authority (access and effect on vehicular traffic).

## 3. Strategic Planning

Since its accession to the EU in May 2004, Malta has moved relatively faster than ever before, in its plans for the development of energy efficiency and renewable energy policies and incentives. A number of interesting and valuable reports, policies and incentives have been produced. Here, a summary of each of them is provided.

### 3.1. The State of the Environment Report (SOER) and State of the Environment Indicators (2007)

The State of the Environment Report was first published in 1998, with updates in 2002 and 2005. Also, two updates were made for specific indicators in 2006 and 2007. The first reports had identified the main challenges for Malta, namely air quality, use of natural resources including water, biodiversity, waste management, marine and coastal hazards, land use and transport. Soon after joining the EU, the 2005 SOER report update showed that the Maltese population have by large, reached a sufficiently high level of comfort and that the demand for greater commodity is now putting pressure on the environment. Such pressures could be seen in many sectors but more specifically in electricity generation, transport and waste management [9].

#### 3.1.1. Electricity Generation

Malta has two power stations, one at Marsa (close to the Grand Harbour) and another at Delimara (in the south-east), with total installed capacity of 571 MW [10]. The plants use a mixture of steam turbines (for base loads) fuelled by 1% sulphur fuel oil and gas turbines (for peak loads and to relieve the old Marsa Power Plant) that burn 0.1% sulphur distillate fuel oil. The Marsa Power Station is expected to be phased out, in fulfilment of the European Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants. Instead, a new 140 MW combined cycle

[9] State of the Environment Report 2005, MEPA, January 2006, ISBN 99932-83-21-5, accessed on 18th February 2009, http://www.mepa.org.mt/Environment/index.htm?SOER/mainframe.htm&1.
[10] Enemalta Corporation, accessed on 3rd January 2009, http://www.enemalta.com.mt.

plant will be commissioned at Delimara starting 2011. Malta has secured a loan of 150 Million Euros from the European Investment Bank for this purpose and to make electricity generation more environmentally-friendly [11].

It is also envisaged that a new 200 MW submarine inter-connector costing around 130 million Euros will link Malta with the European grid through Sicily, Italy by 2012 [12]. The Italian electrical network operator TERNA has been appointed to make the required feasibility studies. Funds are being sought from the European Commission but so far, only 20 million Euros have been allocated for Energy Projects, to be shared between Malta and Cyprus [13].

Studies are also being prepared to evaluate the feasibility of replacing fuel oil by natural gas for electricity generation, as of 2015. This could be supplied by a pipeline from Sicily, which would cost around 150 million Euros to construct [14].

Malta will also become the first smart grid island, when it replaces all water and electricity meters with smart meters by 2012 at a cost of 40 million Euros. IBM and SAP have been contracted to fulfil this project [15]. A pilot project targeting specific areas has already been instated.

The need for more electricity generation is required not only to replace the ageing Marsa Power Station and satisfy a growing need for commodities, but also due to large development projects that have or will be operational within the next decade. These include the new Mater Dei Hospital, which started operation late 2007, and is planned to expand further by the addition of a new oncology block. Other projects such as the 300 million Euro ICT and Media Centre – Smart City, the new tourist and residential developments at Tigné Point and Manuel Island valued at 530 million Euros and the proposed developments for the regeneration of the whole Grand Harbour area and the Three Cities will create a significant increase in electricity demand.

Figure 1 shows the history of electricity generation in Malta for selected years since 1992 [16, 17]. The data shows that electricity demand has been on the increase throughout the years and across all months, with the exception of the late autumn and winter periods of the Year 2008 (circled). This is arguably the direct result of increasing the electricity rates in October 2008, which lead the domestic sector to shift from heating with electrical appliances to heating with bottled liquefied petroleum gas (LPG), since the latter was relatively cheaper. However, this trend could change again in future, following the removal of subsidies that resulted in doubling the prices to reach €0.88/kg [18]. On the other hand, the summer demand continues to increase as more and more air-conditioning units are installed

[11] Enemalta Blog, accessed on 12th February 2009, http://eneinfo.blogspot.com/2008/12/enemalta-granted-150-million-loan-by.html, of 16th December 2008
[12] Enemalta News, accessed on 12th February 2009, http://www.enemalta.com.mt/page.asp?n=newsdetailssearch&i=1675
[13] European Commission Press Release IP/09/142 of 28 January 2009, accessed on 5th February 2009, http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/142&format=HTML&aged=0&language= EN&guiLanguage=en
[14] The Times of Malta Newspaper of 17th January 2009, accessed on 31st January 2009, http://www.timesofmalta.com
[15] Department of Information Press Commentary of 4th March 2009, accessed on 10th March 2009, http://doi.gov.mt/en/commentaries/2009/02/ind11.asp
[16] National Statistic Office News Release No.195/2007 of 11th December 2007, accessed on 12th January 2009, http://www.nso.gov.mt/statdoc/document_file.aspx?id=2127
[17] National Statistics Office, official request for specific statistics on electricity generation in 2008
[18] The Times of Malta Newspaper of 31st March 2009, Enemalta Announces sharp LPG increases, accessed on 31st March 2009, http://www.timesofmalta.com/articles/view/20090331/local/enemalta-announces-lpg-price-increases

for space cooling. The total electricity generation in 2008 has reached 2,313 GWh, an increase of 0.69% over 2007. On the other hand, data for the first 6 months of 2009 have showed that the monthly peak load has dropped by an average of 5% and the total generated units of electricity has decreased by 10% across all months, which shows that consumers may have taken measures to reduce their electricity consumption. However, it is too early to conclude whether this trend will persist in the future or is a result of a short-term price shock.

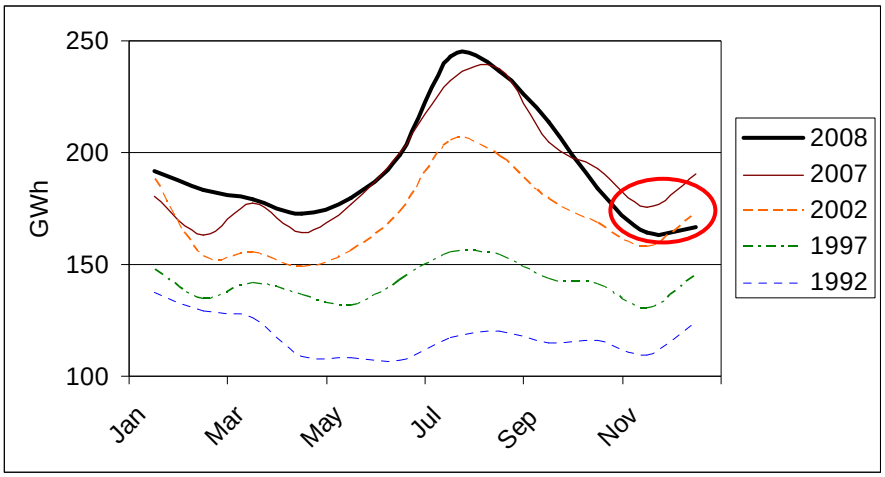


Figure 1: Smoothed curves depicting the monthly electricity generation in Malta, for selected years.

Figure 2 shows the peak loads attained for the same years. It is clear that that the peak loads are now occurring in summer rather than in winter, when compared to a few years back.

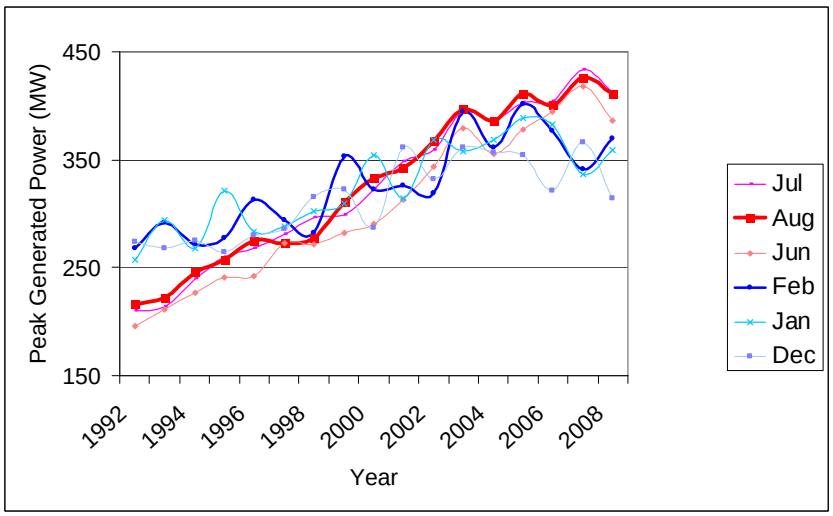


Figure 2: Peak power generation in Malta (1992-2008).

Another observation may be made with regards to the summer peak, which has exceeded the winter peak since 2003, with the gap constantly increasing thereafter. This phenomenon could be frustrating to the grid operator, since the demand could peak for only a few hours during the day. This would require bringing the gas turbines on line, which are more expensive to operate and maintain. Moreover, the over-loading of district sub-stations that would be operating at elevated temperatures during the summer afternoons, while trying to cope with the added demand, reduces transmission efficiency and risks major breakdowns. All these factors reduce the overall annual efficiency of power generation in Malta to below 30%.

Figure 3 shows the seasonal average monthly electricity generation. It becomes clear that the most effective energy efficiency measures should target the summer season energy demand, which is largely caused by air-conditioning.

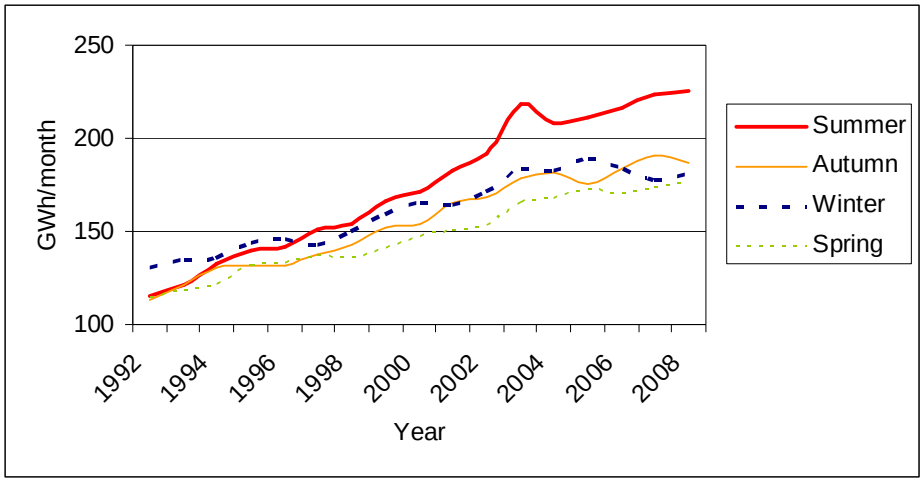


Figure 3: Average monthly electricity production in MWh for the four seasons in Malta.

### 3.1.2. Transport

According to data published by the National Statistics Office, it can be confirmed that there are 7 vehicles for every 10 citizens in Malta[19]. At the end of 2008, the total registered cars stood at 294,658 – an increase of 2.6% over 2007. Two main features are worth noting. First, the percentage of imported 'used' cars has now reached almost 50% of the total fleet of newly licensed cars, compared to 40% in 2007. The main reason for this increase is the relatively cheaper price and lower registration tax of second-hand cars. Second, the number of new electric cars has dropped from 11 in 2007 to only 4 in 2008, albeit Government's incentive (since 2006) to subsidise their capital cost, in a bid to reduce pollution on the roads.

[19] National Statistics Office News Release No. 016/2009 dated 28th Jan. 2009, accessed on 5th February 2009, http://www.nso.gov.mt/statdoc/document_file.aspx?id=2414

A number of measures have already been implemented to curb pollution resulting from the increased use of private transport. This included the replacement of leaded petrol with an alternative Lead Replacement Petrol (LRP) in January 2003 [20], supplying bio-diesel since 2005, which has reached a share of 1.08% of total petrol and diesel sales of 2007 [21], shifting to low-sulphur diesel EN590 standard in 2002 [22], introducing a new system of car taxation and road license that factors in the car's age, size, engine capacity, and emissions test results as of January 2009 [23], increasing the number of routes served by public transport and offering subsidies to alternative means of transport, including electric cars (subsidy of 15.25% up to a maximum of €1,164.69, since 2005) [24] and bicycles (subsidy of 15.25% as of 2009) [25]. But these measures alone will not be sufficient to effectively reduce greenhouse gases from transport, until the current efforts to reform the public transport sector are completed and seriously implemented.

### 3.1.3. Waste Management

Since 2001, when Malta published its first strategy document [26], several positive steps have been fulfilled, favouring the control and optimum use of waste material. Some of the achievements made were [27]:

1. Setting up of the Company, Wasteserv Malta Ltd. in 2002, to oversee all activities in the field of waste management.
2. The closure of the *Maghtab* (Malta) landfill in 2004 and the initialisation of a rehabilitation project for the site as well as for the older *Wied Fulija* landfill. Simultaneously the *Qortin* (Gozo) landfill has also been closed down and is currently being used as a transfer station for domestic waste, before it is sent to Malta for treatment. It is also in the process of being rehabilitated.
3. Building of temporary engineered landfills known as *ta' Zwejra* and *Ghallis*, with the scope of collecting domestic waste and using it to generate biogas and electricity.

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[20] Enemalta Corporation, accessed on 12th January 2009, http://www.enemalta.com.mt/page.asp?p=958&l=1

[21] Ministry of Resources and Rural Affairs, Malta's Annual Report for 2007 submitted to fulfil requirements of Article 4 of Directive 2003/30/EC on the promotion of bio-fuels and other renewable fuels for transport, 28th August 2008, accessed on 12th December 2008, http://ec.europa.eu/energy/res/legislation/doc/biofuels/member_states/2008_rapports/malta_en.pdf

[22] Enemalta Corporation Press Release of 20th June 2002, accessed on 16th January 2009, http://www.enemalta.com.mt/page.asp?i=1191&l=1&n=newsdetailssearch

[23] Malta Transport Authority, Registration Tax and Annual Circulation Licence Fees Guidelines, Version 6, Effective January 2009, accessed on 1st March 2009, http://www.maltatransport.com/en/uplatest/rt.pdf

[24] Government of Malta Notice No. GN203/2005 on a Once-Only Grant on the Purchase of Electric-powered Cars and Solar Heating Energy Savers for Domestic Use, The Malta Government Gazette No. 17,734 of 1st March 2005, pp. 2598-2610, Department of Information, accessed on 1st March 2009, http://www.doi.gov.mt/EN/gazetteonline/2005/03/gazts/GG%201.3.pdf

[25] Government of Malta Notice No. GN1095/2008 on a Once-only Grant on the Purchase of a Bicycle, The Malta Government Gazette No. of 9 December 2008, pp. 12,107-12,113, Department of Information, accessed on 2nd March 2009, http://www.doi.gov.mt/EN/gazetteonline/2008/12/gazts/GG%209.12.pdf

[26] Malta Environment and Planning Authority, A Solid Waste Management Strategy for the Maltese Islands October 2001, accessed on 12th November 2008, http://www.mepa.org.mt/Environment/waste/national_waste_register/documents/A%20SOLID%20WASTE%20MANAGEMENT%20STRATEGY%20FOR%20THE%20MALTESE%20ISLANDS.%85.pdf

[27] Ministry for Resources and Rural Affairs, A Solid Waste Management Strategy for the Maltese Islands, First Update, Consultation Document, January 2009, accessed on 28th January 2009, http://www.mrra.gov.mt/htdocs/docs/wastestrategyconsultationdocument.pdf

4. Upgrading of *San Antnin* waste treatment facility to become not only a waste separation centre but also to treat organic waste, generate biogas and use it to generate electricity. When completed, the fully enclosed facility will treat one-third of Malta's waste.
5. Proposals to build two new municipal and agricultural waste treatment plants, one in Malta and another in Gozo, as well as an incinerator at Delimara (to treat the remaining 20% of waste that cannot be recycled). The scope is to fully treat waste to generate electricity (33,000 MWh per annum) and avoid any further need for new landfills.
6. Earmarking old quarries to receive construction and inert waste.
7. Establishing a number of bring-in sites for waste separation and civic amenities centre for the deposit of bulky refuse. Most of the separated waste is currently being exported to China [28]. Also, house to house service known as 'Recycle Tuesday' has been established to collect mixed recyclable waste (paper, plastic and metal) from homes.
8. Introduction of a scheme to collect used cooking oil from establishments to be converted into bio-diesel.
9. Introduction of eco-contribution tax on many products including plastic bags and establishment of a packaging waste management scheme, following on the principle of the 'polluter pays'.
10. Building of a state-of-the-art abattoir facility to incinerate clinical and slaughterhouse waste, as well as refuse from the airport, sea ports and other hazardous waste.

Now the 2001 Strategy is being updated and the first public consultation exercise has been initiated in January 2009.

### 3.2. "Draft" National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions (2009)

During the 1988 United Nations' General Assembly, Malta was the first to propose the concept of "conserving the climate as part of the common concern of mankind". This led to the initiation of discussions in 1990, which formed the basis of the United Nations Framework Convention on Climate Change (UNFCCC), which Malta has ratified as a non-Annex 1 Party in 1994, as well as the Kyoto Protocol in 2001. However, following Malta's membership in the European Union, it was deemed fit to change Malta's status to Annex 1 Party. A formal application to amend Annex 1 will be presented at the Conference of the Parties (COP) 15 of the United Nations Climate Change Convention next December 2009, in Copenhagen [29]. A possible scenario would be to integrate Malta in Annex 1 Party in 2012, when the Kyoto Protocol enters its second phase.

[28] The Sunday Times Newspaper of 1st February 2009, An Interview with the Minister for Rural Affairs and the Environment, 'The Heat is On', by Caroline Muscat, accessed on 23rd February 2009, http://www.dinlarthelwa.org/index2.php?option=com_content&do_pdf=1&id=487

[29] Department of Information Press Release No. 1971 of 11 December 2008, accessed on 3rd March 2009, http://www.doi.gov.mt/EN/press_releases/2008/12/pr1971.asp

Following this announcement last December 2008, a consultation report on the National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions, was published for public consultation in January 2009 [30].

The 87 recommendations of this report all focus on measures to reduce greenhouse gases, in order to meet the urgent need for Malta to curb its emissions, following a 45% increase between 1990 and 2006, to 3.2 million metric tons of carbon dioxide equivalent. The main sectors that contributed to these emissions were energy industries, transport and waste treatment, as shown in Figure 4 [31]. This is projected to reach 3.5 million metric tons by 2010.

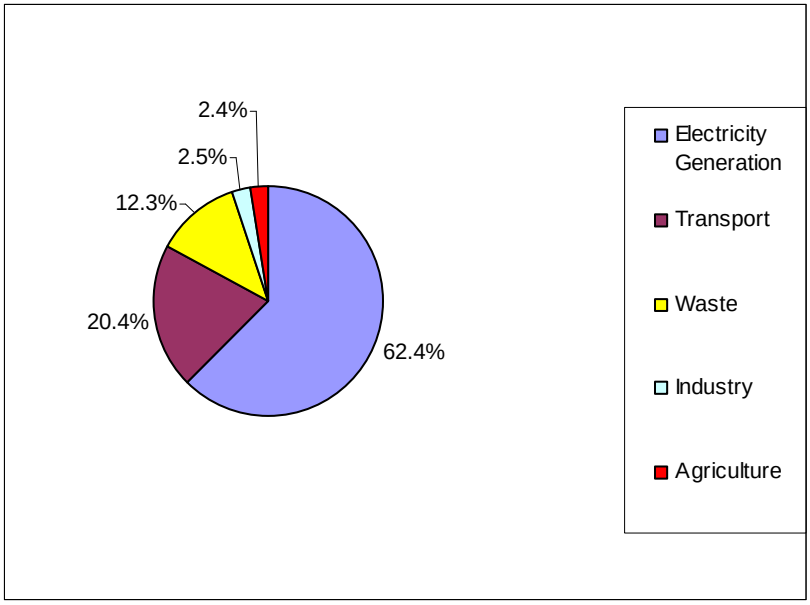


Figure 4: Greenhouse gas emissions by sector for Malta (2006).

The strategy also stresses on the need to strengthen and improve the greenhouse gas inventory system. In a recent report by the European Environment Agency (EEA) on the greenhouse gas emission trends and projection in Europe 2008 [32], it was mentioned that Malta needs to devise methodologies to provide data and carry out projections more accurately. Malta has requested funding from the United Nations Development Programme (UNDP) to the value of $405,000, and is now preparing the necessary tools, which will improve data gathering and help prepare a more complete report of the Second National Communication to the UNFCCC.

[30] Ministry for Resources and Rural Affairs, National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions, Consultation Report, January 2009, accessed on 22nd February 2009, http://www.mrra.gov.mt/htdocs/docs/climatechange_eng.pdf

[31] Malta Environment and Planning Authority, State of the Environment Report Indicators 2007, accessed on 18th January 2009, http://www.mepa.org.mt/Environment/SOER/SOEI%202007/pdfs/Separate%20Pdfs/CC1_Greenhouse_gas_emissions_by_sector.pdf

[32] Greenhouse Gases Trends and Projections in Europe, Greenhouse Gas Country Profiles 1990-2020, October 2008, accessed on 10th December 2008, http://www.eea.europa.eu/themes/climate/ghg-country-profiles/extended-country-profiles/malta-greenhouse-gas-extended-profile.pdf

Within the European Union Emission Trading System (EU-ETS), only the emissions from the two power stations fall under this system. The Commission has decided that Malta's emissions for the period 2008-2012 should not exceed 2.1 Million tonnes of Carbon Dioxide (European Allowance Units EAUs) [33]. Bearing in mind the projections for a greater need of electricity as explained earlier, Malta will need to generate its own Emission Reduction Units (ERUs) through Joint Implementation Projects or accumulate Certified Emission Reductions (CERs) through Clean Development Mechanism (CDM) Projects. Unfortunately, Malta had no planned or ongoing projects in these areas and therefore, the only remaining options would be either to cap electricity generation or buy carbon credits. The latter would probably be the only plausible way for the near future, although this would eventually cause a further increase in electricity rates. If this approach produces results, it would save Malta paying penalties that would burden the country's economy by an estimated 400 million Euros for the period 2008-2012 [34]. A Committee of experts has recently been set up to prioritise actions with regards to Malta's adaptation to the impact of climate change and its EU and subsequent UN commitments for the abatement of greenhouse gases [35].

### 3.3. A "Draft" Solid Waste Management for the Maltese Islands (2009)

The updated Waste Management Strategy document of January 2009 has been published for public consultation. It builds on the first strategy of 2001 and on what has already been achieved so far in this sector. Following on the new Waste Framework Directive 2008/98/EC [36], Malta has now published its plans with regards to waste recycling, waste minimisation and energy recovery. The EU Directive requires all Member States to avoid waste generation with the hope of getting closer to a 'recycling society' situation, where waste becomes a resource to the State, rather than a burden on the environment. The EU Directive further mandates that at least 50% of domestic paper, metal, plastic and glass waste is recycled by 2020. One of the new features of this updated Directive is the fact that incineration with heat and electricity recovery is now considered as contributing towards the EU Packaging Directive 2004/12/EC. This Directive requests that at least 55% of packaging should be recycled and at least 60% recovered. Moreover, the Landfill Directive 199/31/EC aims at reducing the dumping of biodegradable municipal waste (BMW) in landfills to 35% of the 1995 base year volume, by 2020.

A number of green initiatives have been initiated by the Office of the Prime Minister, the latest one being an energy efficiency awareness campaign 'Switch', featuring a number of local television celebrities. Perhaps, one of the most successful initiatives was the establishment of 'Green Leaders' in every Ministry back in January 2005, which has brought about major developments in greening public

[33] European Commission Press Release No. IP/06/1650, Brussels, 29 November 2006, on Emissions trading: Commission Decides on First Set of National Allocation Plans for the 2008-2012 Trading Period, accessed on 11th January 2009, http://europa.eu/rapid/pressReleasesAction.do?reference=IP/06/1650&format=HTML&aged=0&language=EN&guiLanguage=en

[34] The Times of Malta Newspaper of 7th September 2008, 'How Green is Smart City', by Ing. Marco Cremona, accessed on 3rd March 2009, http://www.dinlarthelwa.org/content/view/355/71

[35] The Times of Malta Newspaper, Committee to Prepare for Impact of Climate Change, 11th August 2009.

buildings [37]. Among their various duties, Green Leaders are expected to create environmental awareness within their Ministries and act as promoters of environmentally-friendly measures within their respective Ministries. They are coordinated by the Government Environmental Corporate Responsibility Office, within the Office of the Prime Minister [38]. These initiatives ranged from training, recycling, waste separation, energy auditing, water conservation and using energy efficient lighting to installation of solar photovoltaic systems, consideration of green features for all public procurements and using electric cars at Ministries to carry out short official day trips.

Other initiatives have also been taken, in particular that of offering electronic services to the public through an e-Government portal. It is also envisaged that during 2009 a National Green ICT Action Plan shall be produced to complement the other existing initiatives and plans, which together will fulfil the exigencies of the EU Directive 2006/32/EC [39].

However, the waste management strategy emphasizes that the current recycling measures have only succeeded in attracting 28% of the full potential of recyclable material. A number of proposals for all sectors have been made to achieve the required targets as stipulated by the different EU Directives.

The Document does not mention neither, specific targets to be reached by a certain intermediary year, nor methods for monitoring of such targets but this could change in the final version, as the report is still in the consultative stage.

### 3.4. The National Energy Efficiency Action Plan (2008)

In line with the EU Directive 2006/32/EC on energy end-use efficiency and energy services, Malta had submitted its 2008 update to the Commission [40]. The action plan is aiming at attaining a 3% reduction in energy consumption, when compared to the average annual consumption between 2001 and 2006. Ultimately, the goal is to reach 9% savings by 2016, or an equivalent of 378 GWh.

Some of these measures have been implemented, as shown in Table 1.

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[36] Official Journal of the European Union, Directive 2008/98/EC of the European Parliament and of the Council of 19th November 2008 on waste and repealing certain directives, on 4th March 2009, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:en:PDF

[37] Office of the Prime Minister, Malta, Green Initiatives, accessed on 18th January 2009, https://opm.gov.mt/green_initiatives?l=1, accessed 18th January 2009

[38] Office of the Prime Minister, Environmental Corporate Responsibility Office, accessed on 4th March 2009, http://www.greennetwork.gov.mt/index.asp

[39] Ministry for Infrastructure, Transport and Communications, Green ICT Working Document: Reducing the Environmental Impact of ICT, 30 January 2009, accessed on 12th February 2009, https://secure2.gov.mt/mitc/MediaCenter/PDFs/1_Green%20ICT%20Working%20document.pdf

[40] Malta Resources Authority, National Energy Efficiency Action Plan 2008, accessed on 22nd February 2009, http://www.mra.org.mt/Downloads/Publications/National%20Energy%20Efficiency%20Action%20Plan%202008.pdf

Table 1: Proposed measures to achieve the target of 3% energy saving by 2010.

| **Fiscal Incentives – Domestic Sector** | |
|---|---|
| **Application** | **Time Frame** |
| Energy Efficient Appliances - Class A [41] [42] | Implemented 2006-2008 |
| Solar Water Heaters [43, 44, 47] | Ongoing, since 2005, upgraded in 2006 and 2009 |
| Micro-wind Electricity Generation [45] | Ongoing, since 2006 |
| Photovoltaic Electricity Generation [46], [47] | Ongoing, since 2006, upgraded in 2009 |
| Insulation for roofs [45, 47] | Ongoing since 2006, upgraded in 2009 |
| Double-glazing [47] | Started 2009 |
| Compact fluorescent lights [48]. Free vouchers to interchange them with CFLs by October 2009 | Once only offer launched July 2009 |
| **Financial Grants – Industrial Sector** | |

[41] Government of Malta Notice No. GN1026/2006, of 5th December 2006, on the grant on the purchase of household appliances for domestic use certified as being efficient in the use and consumption of energy, The Malta Government Gazette No. 18,005 of 5th December 2006, pp. 10,770-10,779, Department of Information, accessed on 11th November 2008, http://www.doi.gov.mt/EN/gazetteonline/2006/12/gazts/GG%205.12.pdf

[42] Government of Malta Notice No. GN406/2008, of 20th May 2008, on the grant on the purchase of household appliances for domestic use certified as being efficient in the use and consumption of energy - termination of scheme, The Malta Government Gazette No. 18,250 of 20th May 2008, p. 6729, Department of Information, accessed on 11th November 2008, http://www.doi.gov.mt/EN/gazetteonline/2008/05/gazts/GG%2020.5.pdf

[43] Government of Malta Notice No. GN203/2005 on a Once-Only Grant on the Purchase of Electric-powered Cars and Solar Heating Energy Savers for Domestic Use, The Malta Government Gazette No. 17,734 of 1st March 2005, pp. 2598-2610, Department of Information, accessed on 1st March 2009, http://www.doi.gov.mt/EN/gazetteonline/2005/03/gazts/GG%201.3.pdf

[44] Government of Malta Notice No. GN55/2006 on a Once-only Grant on the Purchase of Solar Heating Energy Savers for Domestic Use, The Malta Government Gazette No. 17,867 of 17th January 2006, p.379, Department of Information, accessed on 30th December 2008, http://www.doi.gov.mt/EN/gazetteonline/2006/01/gazts/GG%2017.1.pdf

[45] Government of Malta Notice No. GN136/2006 on a Once-Only Grant on the Purchase of Wind Energy Systems for Domestic Use, The Malta Government Gazette No. 17,878 of 9th February 2006, pp. 1208-1214, Department of Information, accessed on 12th February 2009, http://www.doi.gov.mt/EN/gazetteonline/2006/02/gazts/GG%209.2.pdf

[46] Government of Malta Notice No. GN135/2006 on a Once-Only Grant on the Purchase of Photovoltaic Systems for Domestic Use and on the Purchase of Thermal Roof Insulation Materials for Roofs of Domestic Residences, The Malta Government Gazette No. 17,878 of 9th February 2006, pp. 1190-1207, Department of Information, accessed on 4th March 2009, http://www.doi.gov.mt/EN/gazetteonline/2006/02/gazts/GG%209.2.pdf

[47] Government of Malta Notice No. GN81/2009 on a Grant on the Purchase of Systems for Domestic Use that Reduce the Use of Energy, or Use Renewable Sources of Energy, The Malta Government Gazette No. 18,372 of 27 January 2009, pp. 757-791, Department of Information, accessed on 12th February 2009, http://www.doi.gov.mt/EN/gazetteonline/2009/01/gazts/GG%2027.1extra.pdf

[48] Government of Malta Notice No. GN200/2009 on a Scheme to Promote the Domestic Use of Compact Fluorescent Lamps, the Malta Government Gazette No.18,388 of 11th March 2009, pp. 2237-2253, Department of Information, accessed on 12th March 2009, http://www.doi.gov.mt/EN/gazetteonline/2009/03/gazts/GG%2011.3.pdf

| | |
|---|---|
| Co-financing of the European Regional Development Fund-Operational Programme 1 (ERDF-OP1), aimed at supporting energy audits, environmental consultations and acquisition of environmental certification, licences and new more efficient machinery [49]. | Calls started in 2009, to continue till 2013 |
| EU-ERDF grant to acquire Renewable Energy Installations and carry out energy audits [50]. | Calls started in 2008 to continue till 2013 |
| **Fiscal Measures - Transport** | |
| Capital grants for the purchase of electric cars [51] | Ongoing since 2005 |
| Excise tax on fuel to fund Alternative Energy Schemes (6.3 million Euros/annum )[52] | Ongoing since November 2008 |
| Rebates on purchase of bicycles [53] | Started 2009 |
| **Energy Efficiency in Buildings** | |
| Implementation of the Legislation of the Minimum Requirements for the Energy Performance of Buildings Regulations, 2006 in line with EU Directive 2006/32/EC [54]. | 2nd Jan. 2009 |
| **Voluntary Actions** | |
| The Housing Authority decision to follow a policy of building more environmentally-friendly social housing projects [55]. | Ongoing since 2003 |
| Public Procurement Green Initiatives to reduce energy consumption in public buildings and install photovoltaic grid-connected systems [56]. | Ongoing since 2006 |
| **Other Specific Grants** | |

[49] The Malta Enterprise, , European Regional Development Fund, Innovation Actions Grant Scheme (Environment) Operational Programme 1 – Cohesion Funds 2007-2013, accessed on 19th February 2009, http://www.20millionforindustry.com

[50] The Malta Enterprise, European Regional Development Fund, Energy Grant and Energy Audit Schemes, accessed on 22nd February 2009, http://www.energy.maltaenterprise.com

[51] Government of Malta Notice No. GN203/2005 on a Once-Only Grant on the Purchase of Electric-powered Cars and Solar Heating Energy Savers for Domestic Use, The Malta Government Gazette No. 17,734 of 1st March 2005, pp. 2598-2610, Department of Information, accessed on 1st March 2009, http://www.doi.gov.mt/EN/gazetteonline/2005/03/gazts/GG%201.3.pdf

[52] The National Budget 2009, accessed on 12th January 2009, http://www.budget2009.com.mt/media/docs/Budget%20Speech.pdf, page 55.

[53] Government of Malta Notice No. GN1095/2008 on a Once-only Grant on the Purchase of a Bicycle, The Malta Government Gazette No. of 9 December 2008, pp. 12,107-12,113, Department of Information, accessed on 2nd March 2009, http://www.doi.gov.mt/EN/gazetteonline/2008/12/gazts/GG%209.12.pdf

[54] Government of Malta Notice No. LN261/2008, The Malta Government Gazette Supplement No. 18327 of 21st October 2008, pp. 3565-3612, accessed on 23rd December 2008, http://docs.justice.gov.mt/LegalPub/Legal_Publications%5CLegal_Notices%5CEnglish%5C2008%5C261%20-%202008%20-%20LN.pdf

[55] The Housing Authority Policies, accessed on 4th March 2009, http://www.housingauthority.com.mt/publications/Microsoft%20Word%20-%20the_policies%20-short%20version%20for%20web%20site%20Dec%202008.pdf

[56] Office of the Prime Minister, Green Initiatives, accessed on 3rd January 2009, https://opm.gov.mt/green_initiatives?l=1

| | |
|---|---|
| Call for Projects co-funded by the European Regional Development Fund (ERDF) 2007-2013, under Priority Axis 4: Energy: "Upgrading Services of General Economic Interest" of Operational Programme I "Investing in Competitiveness for a Better Quality of Life" for the Island of Gozo only (5 million Euros) [57]. | Launched May 2009 |

### 3.5. The "Draft" Malta Energy Policy (2006, 2009) and the Draft Renewable Energy Policy (2006)

In 2006 two proposals were published for public consultation, namely the Draft Energy Policy for Malta [58], and the Draft Renewable Energy Policy [59]. The Energy Policy closely followed the EU Energy Policy by focusing on three main pillars, those of security of supply, competitiveness and environment protection. Five areas were identified for achieving the above scopes, namely:

- Energy Efficiency;
- Reduced dependence on imported fossil fuels;
- Stability in energy supply;
- Delivering energy efficiently;
- Safeguarding future stability of this Energy Policy.

The Renewable Energy Policy was based on the reports made by the MRA's consultants Mott Macdonald (UK), on the Strategy for Renewable Electricity Exploitation in Malta [60] [61]. In essence, this policy had suggested that the maximum renewable energy target that could be achieved by 2010 would be 0.31% of the total electricity generated in 2010, or 1.37% if a land-based wind farm is installed, rather than the 5% indicative target of Malta's accession treaty to the EU [62]. This draft policy had to be ultimately revised, in light of the new European Union Energy Package of 2008, which has set a target of 10% renewables for Malta's final energy consumption, to be reached by 2020 [63].

[57] Office of the Prime Minister, Planning and Priorities Coordination Division (PPCD), http://www.ppcd.gov.mt
[58] Ministry for Resources and Infrastructure, A Proposal for a National Energy Policy, June 2006, accessed on 21st October 2008, http://www.mra.org.mt/Downloads/Consultations/energy%20policy060629%20public%20consultation.pdf
[59] Government of Malta Pre-Budget 2007, A Draft Renewable Energy Policy for Malta, August 2006, accessed on 1st October 2008, http://www.doi.gov.mt/en/archive/prebudget2007/Renewable%20Energy.pdf
[60] Malta Resources Authority, Mott MacDonald Report 1: Strategy for Renewable Electricity Exploitation in Malta: Volume 1- Renewable, August 2005, accessed on 16th November 2008, http://www.mra.org.mt/Downloads/Publications/MM%20Phase%201.pdf
[61] Malta Resources Authority, Mott MacDonald Report 2: Strategy for Renewable Electricity Exploitation in Malta: Volume 2 - Policy, August 2005, accessed on 16th November 2008, http://www.mra.org.mt/Downloads/Publications/MM%20Phase%20II%20.pdf
[62] European Commission Energy Directorate, Malta's 2006 Update to the European Commission on the Implementation of Directive 2001/77/EC on the promotion of electricity from renewable energy sources in the internal electricity market, Ministry for Resources and Rural Affairs, 15 May 2008, accessed on 4th March 2009, http://ec.europa.eu/energy/renewables/electricity/ms_report_directive_2001_77_en.htm, under the 2006 Member States Report
[63] European Commission: The EU in Malta News: Energy for a Changing World, 23rd January 2008, accessed on 23rd November 2008, http://ec.europa.eu/malta/news/climate_action_en.htm

In April 2009, a second draft of the Energy Policy has been produced for public consultation [64]. This new version builds on the previous one and adds new features to it such as policies to reduce emissions of the energy sector. It is worth noticing that a number of measures proposed by the policy have already been implemented, but the policy itself has not become a legal document so far.

### 3.6. Energy Performance of Buildings Regulations (2008)

The Legal Notice 261/2008 has set the grounds for the implementation of the legislation on the Minimum Requirement on the Energy Performance of Buildings Regulation. This is being applied to all new buildings and other constructions undergoing a substantial amount of renovation or alterations [65, 66]. This regulation transposes the EU Directive 2002/91/EC on the Energy Performance of Buildings, into the National Legislative Framework. It also repeals the older Legal Notice 238/2006, but keeps its supplementary Technical Guidance Document F as appearing in Government Notice 1002/2006 [67]. In this publication, valuable guidelines are given to a number of topics including thermal energy flow through walls, windows and roof, solar gains, heating and cooling, lighting and conservation of rain water.

The Legal Notice concentrates on the main four issues pertaining to measuring and ensuring optimum energy usage within a building. These are:

1/ Devising a common procedure to calculate the energy performance of buildings;
2/ Setting minimum standards for new and renovated buildings;
3/ Energy certification of buildings;
4/ Inspection and evaluation of large heating and cooling equipment.

The Services Division within the Ministry for Resources and Infrastructure has been assigned the task of implementing this legislation. It has already identified a software programme to be implemented to issue energy certificates for domestic buildings. Training courses aimed at engineers and architects have started in May 2009, for energy performance in dwellings only. The next step would be to focus on other types of buildings such as factories and public entities. Other efforts are underway to start up the performance testing of large air-conditioning systems and boilers.

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[64] Ministry for Resources and Rural Affairs, A Proposal for a National Energy Policy 2009, http://www.mrra.gov.mt/htdocs/docs/Energy%20Policy%20for%20Malta.pdf, accessed 20th April 2009.
[65] Malta Government Legal Notice No. 238/2006, Minimum Requirements on the Energy Performance of Buildings Regulation, http://docs.justice.gov.mt/lom/Legislation/English/SubLeg/423/25.pdf, accessed on 12th July 2009.
[66] Malta Government Legal Notice No. 261/2008, Energy Performance of Buildings Regulations , Subsidiary Regulation 423.33, http://docs.justice.gov.mt/lom/Legislation/English/SubLeg/423/33.pdf, accessed on 12th July 2009.
[67] Malta Government Notice No. GN1002/06, Technical Guidance Document 'F' – Conservation of Fuel, Energy and Natural Resources (Minimum Requirements on the Energy Performance of Buildings Regulations 2006, The Services Division, Ministry for Resources and Infrastructure, The Malta Government Gazette No. 18,002 of 28 November 2006, p. 10,486, accessed on 7th November 2008, http://www.mra.org.mt/Downloads/Publications/TechGuid_F.pdf

## 4. Potential of Renewable Energy Sources

The renewable energy potential of the Maltese Islands has not been officially declared so far. A number of scenarios do appear in the Mott MacDonald reports [60, 61]. The conclusion was that it is not possible to achieve 5% share of renewable electricity by 2010. On the other hand, an independent scientific paper that was published in 2006 had set the maximum practical potential of renewable electricity at 24% based on the electricity generation figures of 2003. This is shared among the different RE technologies, as shown in Table 2 below [68]:

Table 2: Estimated "*practical*" potential of electricity production from different renewable energy technologies for Malta, based on an independent study.

| **Sector** | **Electric Energy $GWh_e$/year** |
|---|---|
| Photovoltaic systems on domestic rooftops | 165 |
| Photovoltaic systems in industrial zones | 35 |
| Photovoltaic systems in public and other buildings | 3.5 |
| Onshore wind farms | 110 |
| Offshore wind farms | 75 |
| Energy from waste | 120 |
| Domestic solar heating (savings) | 100 |

The Mott Macdonald report of 2005 is in agreement with this paper on the fact that the main renewable energy sources for Malta are solar and wind energies and energy from waste. However, it does not specify a practical potential but limits the evaluation to the maximum unconstrained potential of photovoltaic and wind energy applications as shown in Table 3 below.

[68] Farrugia R., Fsadni M., Mallia E. and Yousif C., The Renewable Energy Potential of Malta, Proceedings of the World Renewable Energy Congress – IX, 19th-25th August 2006, Florence, Italy

Table 3: Maximum "*unconstrained*" energy production from photovoltaic and wind energy applications in Malta, based on the Mott MacDonald study[60].

| Sector | Energy $GWh_e$/year |
|---|---|
| Total Photovoltaic systems (base year 2005) | 1,310 |
| Onshore wind farms (2 MW turbines) | 507 |
| Medium–scale onshore wind turbines (60 kW turbines) | 59 |
| Micro-scale rooftop wind turbines (1 kW turbines) | 155 |
| Offshore wind farms (3 MW turbines) | 259 |

To date the most popular applications have been domestic solar water heating, followed by small rooftop stationary grid-connected solar photovoltaic systems. A few small tracking photovoltaic systems have also been witnessed around Malta.

### 4.1. Solar Heating

Sales of domestic solar heating systems have recently picked up following the increase in electricity rates and the introduction of an attractive Government's grant on capital cost, whereby a maximum of 50% of capital or €460, whichever is smaller, is given to first-time domestic buyers of solar heaters. The majority of domestic users in Malta heat water by means of electric boilers, which made the shift to solar heating logical and economically feasible.

There is no established methodology to monitor the rate of diffusion of solar heating in Malta. The official Malta Census for 2005 has determined that there were 5,010 solar heating systems installed in homes [69]. The Malta 2006 update report on the EU Directive 2001/77/EC has estimated the total energy output of installed domestic solar heaters at 16,700 $kW_{th}$[62]. An estimate by ESTIF put the total installed area in 2007 at 29,360 $m^2$, equivalent to 20,552 $kW_{th}$ [70]. A scientific paper that was published recently has shown that a typical solar heater could save up to 1,650 $kWh_{th}$ per annum [71]. Coupling this value with a realistic estimate of the existence of 15,000 units by the end of 2008, one would conclude that the savings in electricity consumption due to the existence of solar heaters amount to 26 $GWh_e$, which is 1% of the 2,313 GWh generated by EMC in 2008 (0.7% of the total energy consumption of Malta in 1990 or 0.5% RE share of the projected total final energy consumption in 2020).

[69] National Statistics Office 2007, Census of Population and Houses (2005), Volume 2: Dwellings, p.142, accessed on 12th March 2009, http://www.nso.gov.mt/statdoc/document_file.aspx?id=2096

[70] ESTIF 2007, Solar Thermal Markets in Europe: Trends and Market Statistics 2007, June 2008, accessed on 10th January 2009, http://www.estif.org/fileadmin/estif/content/publications/downloads/Solar_thermal_markets_in_Europe_2007.pdf

[71] Yousif C., Fernandez Vazquez C. and Buhagiar V. (2008), Performance Analysis of Water-in-Glass Evacuated-Tube Solar Heating Systems in Malta, Proceedings of the 1st International Congress on Heating, Cooling and Buildings, EuroSun2008, 7-10 October 2008, Lisbon, Portugal, Ref. No. 244

So far, about 1,900 applications have been filed to benefit from the 2009 Government grant mechanism, however the grant has been abruptly halted recently, possibly due to financial constraints, until further notice. The prospects of widespread application of solar heating system still remain ambiguous, since grants are closely tied to national budgets and there are no long-term plans for any support mechanism and this projects an unstable state on the market and the potential buyer.

### 4.2. Solar Photovoltaics

The first solar photovoltaic grid-connected system was installed at the Institute for Energy Technology of the University of Malta in 1996 [72]. This was a demonstration project, which aimed at testing the performance of the system under local weather conditions. Following that, only few solar photovoltaic systems were installed, until Government decided to give financial grants on capital in 2006 [73]. This boosted the market with over 70 system suppliers [74]. The total installed capacity has reached about 230 kWp by end of 2008, out of which 115 kWp were installed in public buildings [75]. The electricity contribution of all systems stands at 0.01% of the total electricity production in 2008 (0.005% RE share of the projected total final energy consumption in 2020).

Government's grant in 2009 to subsidise the capital costs of 200 domestic PV systems by up to €3,000 Euros per kWp, had been over-subscribed. Due to the current global economic downturn, it is not expected that Government will continue subsidising such systems. Instead, power purchase agreements will be preferred, whereby the investor would install and maintain the solar PV system, while EMC buys the electrical power at an agreed price. This change is commended since the operator would be more knowledgeable and would ensure optimum performance and proper maintenance for all systems.

The Malta Resources Authority is the official entity that controls licences and monitors installations. It bases its calculations on actual data collected from electricity meters that are specifically installed with every renewable energy grid-tied system.

### 4.3. Wind Energy Systems

There are no large or medium wind installations in Malta, although Government is considering the feasibility of installing an offshore wind farm at *is-Sikka l-Bajda* reef, off the north-east coast. The reef is about 1.5 km away from land and measures approximately 7 $km^2$. An application for a building

[72] Yousif C. (2002), Recent Developments of Applying Solar Photovoltaic Technologies in Malta, Proceedings of the "Enemalta 25th Anniversary Conference on Energy Efficiency", Mediterranean Conference Centre, accessed on 22nd February 2009, http://staff.um.edu.mt/cisk1/pvhistory.pdf,
[73] Yousif C, PV Grid-connected Systems in Malta, accessed on 23rd February 2009, http://staff.um.edu.mt/cisk1/pvsystems.htm
[74] Malta Resources Authority, List of Registered Suppliers of Photovoltaic Systems, accessed on 5th March 2009, http://www.mra.org.mt/Downloads/Grants/2009%20Schemes/List%20of%20Registered%20Retailers-040309.pdf
[75] Office of the Prime Minister, Photovoltaic Cells on Government Buildings, accessed on 3rd March 2009, https://opm.gov.mt/pvc_blgs

permit has been submitted to MEPA for a temporary 80-metre wind monitoring mast at Ahrax Point for 2 years, which is the closest on-shore point to the reef.

The draft Energy Policy has shown reservations towards large on-shore wind farms and has recommended that no authorisation be given to such developments. On the other hand, it may consider the installation of a limited number of on-shore medium-sized turbines (less than 500 kW) [58]. In a press release on 28 April 2009, the Prime Minister together with the Minister for Resources and Infrastructure have announced that following initial technical studies, Government is now seriously considering a more detailed approach to enable Government to take a definitive decision with respect to the installation of offshore wind turbine at *Sikka l-Bajda* (95 MW), as well as two smaller on-shore projects at *Wied Rini* (10 MW) and *Halfar* (4 MW), which together would generate around 4.6% of Malta's electricity demand and cost up to a total of about 350 million Euros [76].

The number of small wind turbines for domestic use does not exceed a few tens, and it has been demonstrated that there could be strong opposition to widespread diffusion of such technologies by neighbours of would-be takers, mainly for fear of noise. MEPA has drafted a policy to regulate the installation of micro-wind turbines and has been presented to the MEPA Board for approval. The Board has called for research work on the extent of noise, visual and vibration impacts in the urban environment, before approving the policy.[77]. Meanwhile the proposed planning guidance document has been published for public consultation [78]. It is to be noted that up till now, while small solar photovoltaic installations do not require full development permit from MEPA, wind energy systems do.

### 4.4. Energy from Waste

Energy from Waste is still at its infancy, with only a small 300 kW installation at *Maghtab* landfill. According to the Draft Renewable Energy Policy, it is envisaged that by 2013, electricity generation from treatment of solid waste would amount to 2.1% of total electricity generation of 2010. Two 500 kW generators, one in 2010 and another in 2013, are envisaged to be installed to burn biogas generated at the existing landfills of *Ta' Zwejra* and *Ghallis* [59].

### 4.5. Bio-Fuels

Malta has transposed the EU Directive 2003/30/EC on the promotion of bio-fuels and other renewable fuels for transport in the Legal Notice 528/2004. Since then 3 private companies have been established to produce bio-diesel either from used cooking oil that is collected from households, hotels and other

[76] Department of Information, http://www.doi.gov.mt/EN/press_releases/2009/04/pr0716.asp, accessed 28th April 2009

[77] The Sunday Circle Magazine (of the Sunday Times Newspaper), Wind Energy: The Way Forward, or Just Hot Air?, Jo Caruana, pp. 35-36, January 2009, accessed on 12th January 2009, http://www.sundaycircle.com/sundaycircle/page.aspx?id=110845

[78] The Malta Environment and Planning Authority, Planning Guidance for Micro-Wind Turbines: A Public Consultation Draft, http://www.mepa.org.mt/planning/planning_policy/wind_turbines/Policy%20Guidance%20on%20Micro%20Wind%20turbines%20Public%20Consultation%20Draft%20July%2009.pdf, accessed on 11th August 2009.

catering establishments or by importing pure vegetable oil. The use of bio-fuels has been on the increase in Malta with the latest figures showing a market share of 1.08% in 2007 of all petrol and diesel used for transport [79]. The binding target for all EU Member States is to reach 10% share of bio-fuels used in transport by 2020. The promotion of bio-diesel has been mainly supported by the exemption of this fuel from excise duty. Table 4 shows a summary of the share of renewable energy in Malta to date:

Table 4: The share of renewable energy technologies in Malta.

| Sector | Percentage share |
|---|---|
| Photovoltaic systems | 0.01% of electricity generation of 2008 (estimate) or 0.005% of the projected final energy consumption of Malta in 2020 |
| Wind Energy systems | negligible |
| Domestic solar heating (savings) | 1% of electricity generation of 2008 (estimate) or 0.5% of the projected final energy consumption of Malta in 2020 |
| Bio-fuels in transport | 1.08% of petrol and diesel sales for transport of 2007 |

## 5. Scenario of Renewable Energy Deployment till 2020

In this section, three scenarios will be presented, based on the previous sections and the available information to date. The main three sources of energy are solar energy, wind energy and energy from waste besides bio-diesel for transport.

### 5.1. Scenario for Wind Energy

The three possibilities are as follows:

**Low Penetration:** Although the off-shore wind farm at *is-Sikka l-Bajda* promises to be the best option for Malta (230 GWh/year) [80], the procedures involved would be more complicated than land-based wind farms, especially with regards to permits. Hence, for the low penetration scenario, it would be

[79] Ministry for Resources and Rural Affairs, Malta's Annual Report for 2007 submitted to fulfil requirements of Article 4 of Directive 2003/30 EC on the promotion of bio-fuels and other renewable fuels for transport, 28 August 2008, accessed on 30th October 2008, http://ec.europa.eu/energy/res/legislation/doc/biofuels/member_states/2008_rapports/malta_en.pdf

more realistic to assume a land-based installation as a first step to greater penetration. The more realistic installations would be those at *Wied Rini* (30 GWh/year) [81] and *Hal-far (11 GWh/year)* [82]. Total electricity generated would amount to 41 $GWh_e$/year.

**Medium Penetration**: If the off-shore plant at *is-Sikka l-Bajda* comes on line in 2015, then it would, together with the land-based wind farms at *Wied Rini* and *Hal-far,* produce a total of 260 $GWh_e$/year.

**High Penetration:** The introduction of micro-wind in built-up areas up to a maximum equivalence of 1,000, 5 kW turbines by 2020 would add to the existing capacity of Medium Penetration and marginally increase the total electricity production to 265 $GWh_e$/year.

### 5.2. Scenario for Solar Heating

The three possibilities are as follows:

**Low Penetration:** Solar heating installed on 25% of domestic homes. Total electric energy saved from the power station would amount to 60 $GWh_e$/Year.

**Medium Penetration:** Solar heating installed for 50% of domestic homes. Total energy saved would amount to 120 $GWh_e$/year.

**High Penetration:** Solar heating installed for 80% of domestic homes, together with installations on major hospitals and hotels. Total energy saved would amount to 210 $GWh_e$/year.

Energy estimates are based on actual tests carried out on domestic systems in Malta [71].

### 5.3. Scenario for Solar Photovoltaic Electricity

The three possibilities are as follows:

**Low Penetration:** Solar photovoltaics installed in 5% of the domestic sector up to a maximum power of 2 kWp each. Total energy generated would amount to 19.5 $GWh_e$/year.

**Medium Penetration:** Solar photovoltaics installed in 10% of the domestic sector up to a maximum of 2 kWp each, together with centralised installations up to a maximum of 10 MWp. Total energy generated would amount to 54 $GWh_e$/year.

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[80] Ministry for Resources and Rural Affairs, A Proposal for an Offshore Wind farm at is-Sikka l-Bajda, Project Description Statement, http://www.mrra.gov.mt/htdocs/docs/sikkabajdaprojectdescription.pdf, April 2009.
[81] Ministry for Resources and Rural Affairs, A Proposal for a Land Based Wind Farm at Wied Rini L/O Bahrija, Project Description Statement, http://www.mrra.gov.mt/htdocs/docs/wiedriniprojectdescription.pdf, April 2009.
[82] Ministry for Resources and Rural Affairs, A Proposal for a Small Land Based Wind farm at Hal Far, Project Description Statement, http://www.mrra.gov.mt/htdocs/docs/halfarprojectdescription.pdf, April 2009.

**High Penetration:** Solar Photovoltaics installed in 20% of the domestic sector up to a maximum of 2 kWp each, together with centralised installations and other rooftop installations on public buildings up to a maximum of 20 MWp. Total energy generated would amount to 108 $GWh_e$/year.

Estimates on photovoltaic electrical outputs in Malta are based on technical studies carried out on the performance of solar photovoltaic systems in Malta [83].

### 5.4. Energy from Waste

The three possibilities are as follows:

**Low Penetration:** Biogas extraction from the Maghtab landfill which would produce a maximum of 1% of total electricity production in 2020 [59], that is 32.5 $GWh_e$/year.

**Medium Penetration:** This scenario would consider doubling the share of electricity up to 2% (65 $GWh_e$/year.

**High Penetration:** Maximum production estimated at 3% of total electricity production in 2020 (97.59 $GWh_e$/year).

### 5.5. Bio-fuel for transport

The three possibilities are as follows:

**Low Penetration:** As mentioned before in Section 4.5, Malta has already reached 1% of biodiesel of total fuels used for transport. In this scenario, it will be assumed that the increase in the use of bio-diesel can only be doubled due to limited resources. This translates to a saving of 3,780 toe/year.

**Medium Penetration:** Here, one would assume that 5% of the fuel used would come from biodiesel, which would save 9,450 toe/year.

**High Penetration:** It would be difficult for Malta to reach the required 10% biofuels by 2010, and hence this would be put in the high penetration scenario, which would save 18,900 toe/year.

Figure 6 shows the different scenarios for the year 2020. Some observations may be made:

a) Most of the RE sources have balanced contribution in the Low Penetration Scenario, but when this moves to the medium and high penetration scenarios, wind energy and solar heating play a more important role.

[83] Yousif, C. et. al., Upright, Optimally-inclined and Tracking Grid-connected PV Systems Performance in Malta, Proceedings of the 22nd European Photovoltaic Solar Energy Conference & Exhibition, Milan, Italy, 3-7 September, 2007, pp. 3205-3208.

b) It is seen that wind energy almost reaches its maximum contribution in the medium penetration scenario, while photovoltaics start to gain importance in the high penetration scenario. This implies that photovoltaics, being the more expensive option, could play a more prominent role at a later stage.

c) A simple analysis shows that the combination of medium penetration wind energy with high penetration solar heating could yield the required 10% RE target by 2020. These technologies are also the cheapest options to implement and therefore, they should be developed first. However, an aggressive plan for dissemination of both technologies would need to be put in place as soon as possible.

d) Although great hopes are placed on the most promising offshore wind site of *is-Sikka l-Bajda*, it will also have the greatest challenges to overcome, due to scarcity of long-term wind data, conflict of interest between different stakeholders (bunkering, fishing, diving) and lack of experience with large wind farms. Fortunately, it can be seen that should this project fail to materialise, the combined contribution of the other RE technologies in the high penetration scenario could substitute it.

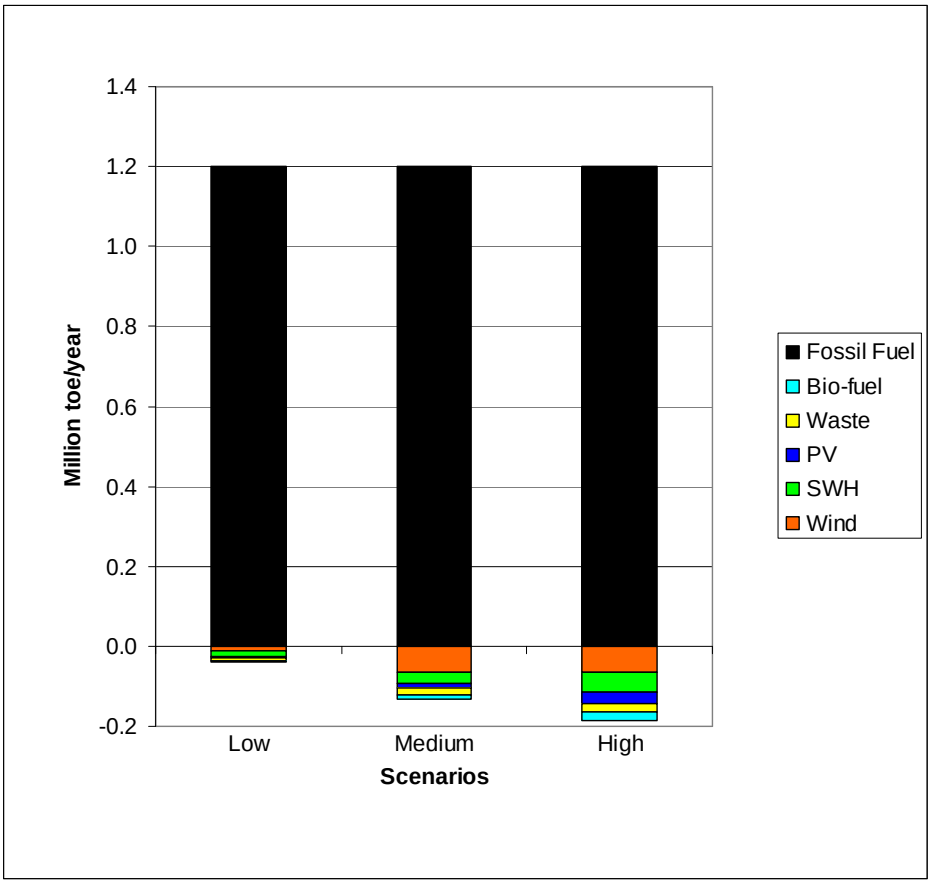


Figure 6: The Renewable Energy Scenarios in Malta for the year 2020.

Hence, the total contribution of RE technologies may be summarised as follows:

**Low Penetration:** 3.4% of total final energy consumption in 2020.

**Medium Penetration:** 10.8% of total final energy consumption in 2020.

**High Penetration:** 15.2% of total final energy consumption in 2020.

Figure 7 shows the percentage contribution of renewable energy in the total final energy consumption for the three different scenarios in 2020.

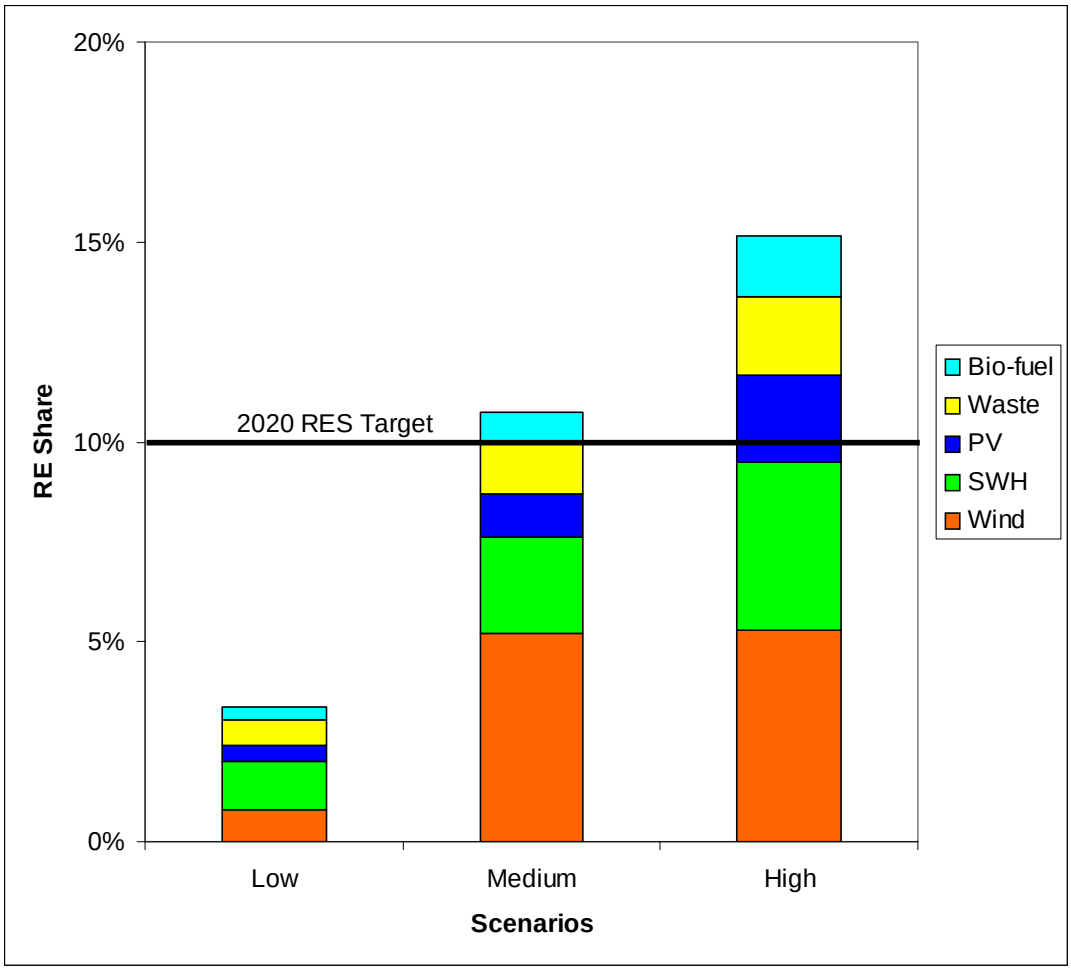


Figure 7: Percentage share of renewable energy sources for three different scenarios in 2020.

## 6. CONCLUSION

This paper examined the main policies that are in force or are being proposed for the rational use of energy, improvement in transport efficiency and waste management. Although great efforts have been put in the first five years of Malta's membership in the European Union, to bring the local policies in line EU legislations and directives, it is clear that Malta is still at the learning curve and therefore, developments would take longer than anticipated to be realised.

It has been shown that the major contributor towards increased electricity consumption is the increase in summer demand due to air-conditioning. Better control and enforcement of construction regulations for new buildings and more stringent regulations on the importation of new air-conditioners with respect to their efficiency could help to slow down the increase in electricity demand. Simultaneously, more attractive fiscal incentives for encouraging roof insulation in existing buildings, as well as a nation-wide campaign to use light-coloured paints for roofs, could bring down the current demand significantly.

While greater use of public transport could ease the pressure on polluting the environment in urban areas and reduce the country's fuel bill, it is still considered to be unreliable by many potential customers and would need a major facelift to make it more efficient, user-friendly and time saving. The Government has started a programme of privatisation that could promise to bring about the required change.

The paper showed that a number of positive steps have been undertaken to reduce waste and convert it to an energy resource. The experience showed that resistance to change from the general public could be hard and painful, but the results could be rewarding. The success of this sector could be directly attributed to the fact that Government had set up a dedicated company to manage waste. To date however, the major costs incurred to treat waste and municipal waste is fully borne by Government, which could become unsustainable in the long term.

Notwithstanding the fact that a number of initiatives have been implemented to improve energy end-use efficiency and conservation of energy, as well as measures and incentives to increase the penetration of renewable energy applications, Malta is still running the risk of missing its RE target of 10% by 2020. Transposing the draft Energy Policy and other policies into legal legislation should be given priority. The low penetration scenario, which reflects the possible short-term development of RE technologies in Malta, would only contribute to 3.4%. Extraordinary efforts need to be urgently put in place to secure a more aggressive programme that would bring the RE energy production closer to the 10% target. The fact that the two cheapest technologies of wind energy and solar heating systems have the potential of achieving the 2020 RE target, should be given priority. More expensive RE options should nevertheless be exploited in the long-term to prepare Malta for the years beyond.