MRA

MALTA RESOURCES AUTHORITY

Report on plans to achieve the set RES target of 10% by 2020.

14th January 2010

INDEX:

1. Introduction

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 Malta has the obligation of achieving a 10% target for share of energy from renewable sources in gross final consumption of energy by 2020. This includes energy consumed in transport, electricity, heating and cooling.

The same Directive has set also an Indicative Trajectory for each Member State as a measure to monitor the progress over the 10 years and as a means of review and reaction in time in case a Member State is falling short of the plans towards the set target. For Malta, the trajectory is shown in the table below:

Period	Share of renewable energy trajectory targets
Starting case (2010)	0%
2011-2012	2.0%
2013-2014	3.0%
2015-2016	4.5%
2017-2018	6.5%
2019-2020	10.0%

Table 1 : Trajectory and Final RES targets.

Article 4 of the Directive defines the requirement that each Member State shall adopt a National Renewable Action Plan (NREAP) indicating the local measures for energy from renewable energy sources as well as energy efficiencies strategies and any other measures required including cooperation with other Member States in joint projects, statistical transfers, joint support schemes as well as joint projects with third countries.

The same Article 4 also requires that the NREAP of each Member State is to be notified to the Commission by 30 June 2010, and as per Article 22, on 31 December 2011 and every 2 years thereafter.

Article 4(3) also requests that each Member State notifies to Commission, six months before the NREAP is due, a forecast document indicating:

- its estimated excess production of energy from renewable sources compared to the indicative trajectory which could be transferred to other Member States as well as its estimated potential for joint projects until 2020;
- its estimated demand for energy from renewable sources to be satisfied by means other than domestic production until 2020;

The following report addressing such request is based on an optimistic scenario of the renewable energy sources potential as a share of the estimated energy consumption in the next decade in the country of Malta. The projections are built on planned major developments and estimated uptake of RES technologies. These are subjective to risks and constraints which may be higher than anticipated following further studies yet to be commissioned.

2. Action at Policy level

The first draft of the National Energy Policy was issued for consultation in 2006. The policy document was based upon the following three objectives all pursued in a balanced way towards a sustainable energy supply:

- security of supply,
- environmental protection; and
- the social dimension , affordability and competitiveness

The draft energy policy of 2006 was recently reviewed to reflect among others the conclusion of the EU climate change and energy package in December 2008. In particular, the revised energy policy takes into account the EU mandatory target for Malta of 10% share of renewable energy mix by 2020 including 10% in the transport sector.

The policy proposal includes a series of measures and actions to reach the various objectives including measures to tap Malta's renewable energy sources potential.

A consultation process was launched in April 2009 on the revised Energy Policy. The outcome of the consultation is being analysed and concurrently the Strategic Environment Assessment (SEA) process on this policy was initiated.

In 2008, the Ministry for Resources and Rural Affairs (MRRA) appointed the National Climate Change Committee, an interdisciplinary committee consisting of senior players from appropriate public entities and the private sector, to draw up a strategy that will enable Malta to cohesively and coherently take measures to address Climate Change and specifically address one of the major harmful instigators of Climate Change: Greenhouse Gas emissions. In January 2009, this committee presented its Report entitled "National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse

Gas Emissions[1]". This report while being in synergy with the draft national energy policy also proposes measures to increase the uptake of renewable energy systems as part of the effort for climate change mitigation. Following a consultation process the report was reviewed and adopted by Parliament in September 2009.

An updated "Solid Waste Management Strategy for the Maltese Islands[2]" policy document was also launched for consultation in January 2009. The Energy from Waste strategy is in synergy with the other efforts being made by Malta to fight Climate change and increase the contribution from renewable energy sources.

3. Developments in the renewable energy sector

In 2008, a study[3] was commissioned to investigate the best and most likely options Malta should consider to meet its renewable energy targets, in line with the proposed Directive for the promotion of the use of energy from renewable sources. This study was concluded in January 2009. The report compares the technical and commercial aspects of various scenarios; local energy generation from renewable sources (RES), by wind and solar, joint projects in RES with other EU countries or through interconnection with non-EU Member States and the possibility of buying green certificates through statistical transfers.

The study recommended that the selection of the best option must asses the relative importance of the different benefits presented, in relation to costs, risks, environmental impacts, security of supply and generation of local jobs The study indicated that investing in a joint project such as an onshore wind energy project elsewhere in EU could be the most financially attractive option. If the strategic benefits of generating renewable energy within Malta are considered a priority, offshore wind would be a more feasible option as this would contribute a higher proportion of renewable energy than solar photo-voltaic (PV). The main reason behind this recommendation is the perceived lack of public acceptance of onshore wind farms and the limited availability of suitable onshore sites. It is however Government's intention not to exclude any option available, including onshore wind energy projects, before a detailed assessment, including public assessment, is conducted.

Wind Energy Plans

In 2009, Malta decided on three sites to be assessed further for the development of wind farm facilities. The sites include two onshore sites and one offshore site. The onshore sites are located at Bahrija and Hal Far and the estimated potential wind farm capacity is 10.2MW and 4.2MW respectively. The offshore site is Sikka l-Bajda with an estimated potential of 95MW located at the north of the Island around 1.5km from the coast. These

[1] The report submitted by the National Climate Change Committee can be found at www.mrra.gov.mt/cc_report.asp
[2] The Solid Waste Management Strategy for the Maltese Islands document can be found at www.mrra.gov.mt.
[3] Feasibility Study for Increasing Renewable Energy Credentials: January 2009

projects would come on line later than 2012 and would bring the wind energy generation capacity in Malta to 109.4MW with an estimated annual electricity generation of 254GWh.

The impact of the construction of large scale onshore wind generation facilities has been, from the outset, a source of concern. In particular, there are concerns linked with unacceptable visual and landscape impacts given the country's small superficial area and high population density.

The development of offshore wind farms using commercially available technologies is also limited by the bathymetry of the Maltese waters, since the 25 metre contour extends to just around 3km off the coast, which carries a high density of near-shore traffic and the approaches to the harbour. Additional constraints in locating offshore wind farm sites come from the heavy and conflicting use of the water. The Maltese economy is significantly dependent on marine and tourism activities.

Other concerns are the possible negative effects of the development of the wind energy facilities on the fauna and flora on the chosen sites in particular at Sikka l-Bajda.

The three sites will, therefore, be subject to all the necessary environmental assessment as required by the applicable directives and the local environment and planning regulations.

Wind data monitoring systems are being installed to enable a more accurate estimation of the wind energy yield from the three earmarked sites, and hence determine their economic feasibilities.

Another important factor is the impact on the stability of the electricity system of the integration of such intermittent generation sources. The current grid situation would not allow the connection of full 109MW wind farm capacity potential. A grid stability study has been carried out to determine the maximum wind farm capacity that could be integrated in the Maltese small isolated grid without jeopardizing continuity and reliability of supply. In addition, the studies have been further extended to determine the effects induced by the wind farm potential capacity on the grid, once the Malta-Sicily interconnection is in place.

Malta does not exclude the possibility of deep water offshore technologies once these have been proven.

Micro-generation (wind and solar photo-voltaic)

Malta has continued to adopt measures to increase the penetration of micro-generation from wind and solar photo-voltaic (PV).

Residential sector

The capital grant schemes for micro wind and solar photo-voltaic systems introduced in 2006 continued to be applied up to the end of 2008.

In 2009, the previous capital grant scheme for the residential sector was replaced by the following financial support mechanism:-

- Capital grants of 30% on the purchase price of micro-wind turbine generating systems for installation in residential premises (subject to a maximum grant of € 750).
- Capital grants of 50% on the purchase price of solar PV systems for installation in residential premises (subject to a maximum grant of € 3,000). An original fund of € 500,000 was allocated for this grant and has been further promoted through a fund of € 3,800,000 for the three year period 2010-2013.

A net metering mechanism exists for electricity generated from renewable energy sources with a spill tariff of € 0.069/kWh for any excess electricity fed into the grid.

Malta will continue to seek Community funds to provide financial assistance for micro-generation installations from renewable energy sources. An application for €9,000,000 in funds to be used for residential grant schemes was submitted to the EU Commission in 2008. This fund has subsequently been granted.

Public Sector

Malta is continuing to promote such micro-generation through the implementation of a number of Government projects. During the period 2006-2008 a number of PV systems (amounting to a capacity of 78.43kWp) were installed on public buildings including schools and ministries.

The Government has also issued a call for expression of interest to lease out roof space available on Government buildings to one or more commercial operators to design, build and operate and maintain PV systems as part of a concession for a number of years. The possibility of providing private investors with the opportunity to invest in PV systems and benefit from a return or a rebate in their utility bills is also being assessed.

A number of Government buildings were earmarked for an initial evaluation of the potential to house PV installation on their roofs. The buildings include Water Reservoirs, Government School, Hospitals and some Government Departments. The initial assessment of the roofs of these buildings indicates a potential to accommodate 5MWp of PV generation capacity in the first phase and an additional 5MWp capacity in the second phase.

Other projects at the University of Malta (550kWp) and at the Malta College of Arts Science and Technology (1.75MWp) are being evaluated.

Commercial and Industrial sector

Malta is further promoting micro-generation renewable energy technologies in the commercial and industrial sector. During 2008, Malta Enterprise, the Government entity dealing with industrial promotion, co-financed with the EU, three PV installations in these sectors amounting to a total capacity of 62.3kWp.

Another similar scheme under the European Regional Development Fund 2007-2013 programme was launched in 2009, to provide financial assistance to operators in these two sectors, who wish to implement renewable energy and energy efficiency projects. The funds available amount to €10,000,000 and participants in this scheme can benefit from a 50% grant (maximum grant being €100,000).

A first call for proposals of projects has already been issued. A total of 1MWp (1.5GWh/annum) PV capacity will be installed by 2010 as result of this first call. A second call is ongoing and applications for a cumulative capacity of a further 2MW are being assessed.

With the inclusion of a feed in tariff, which is being considered namely for larger installations, private entrepreneurs are showing interest in developing PV parks integrated in areas already utilised for other scope.

The Climate Change Committee report "National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions"[4] recommends a set target of 4% of electricity generation to derive from solar technologies.

As regards to micro-wind generation, the Malta Environment and Planning Authority has issued a draft "Planning guidance for Micro Wind turbines below 20kW capacity" which is in the process of reviewing following the consultation period. The guidance is addressed to installations in rural areas, also as a first step for pilot projects, to determine the criteria and impacts on future installations intended in urban areas.

Electricity generation from biomass waste

In the report submitted to the EU Commission in 2005 Malta indicated that the 3% electricity generated from waste is only achievable through the construction of a waste combustion plant. Furthermore, it was stated that in line with the Solid Waste Strategy published in 2001, a final decision for the construction of such a facility had to be deferred in order to exploit to the maximum the possibilities of waste recycling and

[4] The report submitted by the National Climate Change Committee can be found at www.mrra.gov.mt/cc_report.asp

composting facilities on the volume of biodegradable wastes and to be able to benefit from further advances in waste treatment technologies.

"A Solid Waste Management Strategy for the Maltese Islands[5]" was published for consultation in 2009. This document intends to update the 2001 strategy and the following options are considered as the most favoured configuration

- The construction of three biological treatment plants (MBT) all equipped with energy recovery;
- The development of a waste to energy plant for the treatment of the residual fraction of waste, including RDF derived from the mechanical separation of MSW and rejects from the sorting of dry recyclables at the MRF.

The first mechanical biological treatment plant (MBT) in Malta is expected to start treating and receiving waste this year. In addition to this plant, two further MBTs are planned to be constructed by 2013 and, when operational, would generate more than 30GWh of electricity annually.

Previous projections that had been made regarding the potential of energy production from the installation of the gas extraction system at the Maghtab landfill have proved to be too optimistic since the gas quality resulted to be poor and unfit for electricity generation. However, Malta is actively pursuing the production of biogas from the Ta' Żwejra and Għallis engineered landfills and figures have been reviewed to include the latter sites in the recent estimates.

Electricity generation from sewage sludge

The potential of energy recovery from sewage sludge and the waste resulting from animal husbandry is not yet established. Co-digestion of various waste streams with solid waste is being considered for this type of waste.

Malta is presently implementing the required sewage treatment infrastructure, namely the construction of three new sewage treatment plants, one in Gozo and two in Malta. The Gozo plant (40,000 population equivalent capacity) started operation in November 2007 whereas the Malta North plant (45,000 population equivalent capacity) was commissioned in March 2009. The largest plant in the South with an anticipated treatment capacity of 500,000 population equivalent will be equipped with anaerobic sludge digestion facilities generating enough biogas to supply 32% of the plant's electrical power requirements. It is estimated that the plant will have an electricity generating capacity of 900kW and 1400kW in heat. The construction of this plant started in January 2009.

[5] http://www.mrra.gov.mt/wastestrategy.asp

Renewable energy for heating: RES-H

Solar Water Heaters

Malta is in the middle of the Mediterranean and thus it is endowed with sunshine for most of the year. The abundance of solar radiation provides favourable conditions for the exploitation of solar energy on the island. This contributes to a high level of performance from solar water heaters. On average a solar water heater system of collector area 2.5m^2 will save 1500 kWh/year[6]. Solar thermal applications (mostly used for the production of domestic hot water) are by far the most diffuse renewable energy applications in the country.

Residential sector

Malta has been implementing financial incentives to promote the use of renewable energy in the domestic sector, namely solar water heaters (SWH). The first grant scheme on SWH was announced by the Government in 2005 and the maximum grant available was €116.48. The maximum grant allowed was doubled in 2006 to €232.94. In 2009, the grant was increased from 25% to 66% of the capital costs of these products with a capping of €460. A budget of €2million was allocated. Government has recently announced that from 2010 there is an allocation of a further €4.2 million for solar water heater grants to be used over the next 3 years, the maximum grant allowed will be further increased to €560.

In addition, in the case of Solar Water Heaters installed in new households, Enemalta Corporation is waiving €163 from the connection fee for new electricity supply connections.

The total installed capacity of solar water heaters in the residential sector in 2008 was estimated at 25,451kWth and equivalent to 64kWth/1,000 capita.

Commercial and industrial sector

In the first call for applications for funds under the ERDF 2007-2013 scheme, operators in the non-residential sectors submitted projects involving the installation of a solar thermal system. The savings from these projects are estimated to amount to 2,330,850kWh/yr. A second call is ongoing and

[6] Recommended value by the Institute of Sustainable Energy

- applications for installation of solar thermal technology amounting to a saving of 1,355,314kWh/yr are currently being assessed.

Co-generation

A Feasibility Study produced in June 2009[7] on the use of combined heat and power has also been submitted. With respect to Directive 2009/28/EC and the NREAP, such technology will help in the reduction of the gross consumption due to its increased efficiency with respect to conventional electricity and heat generation and due to the offsets of electricity distribution losses through decentralisation and power station self consumption. However if renewable fuels are to be used in such technology, as biomass or bio-fuels, the share of the output related to the renewable source part will also contribute directly to the RES target. It is estimated that a 10% blend of bio-diesel will contribute to 0.17% of the final target.

Bio fuels in transport.

Malta has continued to implement fiscal measures to promote the use of bio-fuels - mainly the biomass content of bio-diesel is exempt from excise duty. It is estimated that approximately 1.5 million litres of bio-diesel were sold in 2007 compared to the 0.616 million litres sold in 2006. In the local market, bio-diesel is mainly produced from waste vegetable oil. However in order to achieve the required levels, bio-diesel may need to be imported.

A legislation setting the obligation of the use of bio-fuels as a share of the fuel supplies is currently being drafted. This will ensure the use of bio-fuels in the transport sector.

[7] http://www.mra.org.mt/library_publications.shtml Analysis of the potential for co-generation in Malta

4. Energy consumption data

Electricity demand projections

The sent-out figures of electricity till 2020 quoted by studies commissioned by the MRA[8] are also harmonised with other reports related to the Energy Package and the Climate Change Committee report of January 2009, Chapter 5 [9].

The self consumption figures of both Marsa power station and Delimara power station have been calculated based on data provided by Enemalta Corporation and further projections were based on MRA studies[10] calculated on the estimated generation of the respective power plant and type of fuel used. The estimated[11] interconnection cable losses have also been included.

The electricity distribution losses are being estimated to improve to a level of 5% [12]due to the reinforcement requirements on the local grid to integrate the electricity interconnection between Malta and Sicily, as well as through the introduction of smart metering.

End Use Energy efficiency measures

Malta has published its National Energy Efficiency Action Plan in 2008 (NEEAP), aimed to achieve 9% savings by 2016, and most of the measures are being implemented and ongoing with an effect on the gross final consumption. The net reduction in consumption projected per sector by the NEEAP are being assumed and extrapolated till 2020 in the projections for the calculations of the gross final consumption figures.

In this exercise however, the inclusion of micro-generation of electricity from RES and solar water heating, then being included as energy efficiency measures, have been removed and displaced as figures in the statistics of renewable energy sources, so as not to have double counting related to RES-E and RES-H. Only the gains derived from the elimination of the distribution and generation losses required otherwise to deliver power to the same applications have been considered as energy efficiency measures for such cases.

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[8] Lahmeyer International: Energy Interconnection Malta-Europe, July 2009

[9] The report submitted by the National Climate Change Committee can be found at www.mrra.gov.mt/cc_report.asp

[10] IDEM

[11] Information provided by Enemalta Corporation.

[12] Information supplied by Enemalta corporation 'Tackling Inefficiencies in 2009"

LPG market

Liquid petroleum gas, a fossil fuel derivative, is widely used for cooking and heating purposes. Past estimates have projected domestic heating would shift to LPG due to its favoured subsidised price in respect to the electricity alternative. Since the commercialisation and liberalisation of the LPG market and subsequent removal of subsidies, in 2009, the price has increased. As the local liberalised market is still in the initial phase and the fluctuations in the fossil oil prices do affect price projections, the shift to gas could be unpredictable. However, when comparing the energy required from LPG and electricity[13] for the same energy application, the net gross consumption equivalent is almost the same for both sources. This makes such shift between electricity and LPG ineffective for this particular exercise.

Transport consumption figures

The estimations on the use of petrol and diesel in transport are based on data projections derived from the local transport authority, ADT. The public transport reform is expected to have a positive effect on the fuel consumption of road transport through a shift of private car use to public commuting.

Electricity use in transport is also a measure being investigated. However, since no trains and tube systems exist in Malta, electricity use in transport will be addressing individual vehicle systems. The type of charging power and the respective emissions will be a function of the electricity mix supplied over the grid.

As already mentioned for bio-fuels, Substitution Obligation legislation will also necessitate a mix of bio-fuels in the use of transport fuels.

[13] Directive 2009/28/EC is not based on primary energy sources for the generation of electricity, hence plant generation efficiency is not being considered in this comparison.

Other options being considered

Heat-Pumps (Air-conditioners) for heating purposes

The Directive 2009/28/EC specifies that the use of aero-thermal heat pumps is also considered as a means of renewable energy source, once the driving energy is deducted. However the same Directive, in Annex VII, states that guidelines still need to be issued by January 2013 on the eligibility criteria of these technologies. In the case of Malta, such benefits will be only reaped from the use of air conditioners for heating purposes. Data is not yet available in order to determine whether there will be substantial potential. Plans to collect this data are being laid.

Wave energy technology:

Wave technology has a lot to offer, though it is a relatively new technology. There are a number of ideas and designs for wave energy devices. It cannot as yet be established whether such technology will eventually be a viable source of clean electricity for Malta, and if so, when; hence it is unknown how much wave energy, if any, could contribute to Malta's 2020 renewable energy target. A report by Scott Wilson for the Malta Maritime Authority[14] gives an indication of the wave resource around Malta. A wave energy company which contacted MIEMA (Malta Intelligent Energy Management Agency) has shown interest in Malta and its surrounding sea. If wave technology starts to develop in the Mediterranean region it could be an important step towards renewable energy development, and Malta might eventually be able to benefit from it.

Deep sea wind farms:

Extensive areas of the Maltese sea bed cannot lend itself for the installation of current off-shore wind turbine installations, as these normally require depths not exceeding 30m. The local sea bed falls off to greater depths quite close to the coast.

However Malta will continue to monitor the advances in the market and will eventually investigate possibilities of new technologies addressing wind farms in deep seas. Indeed, this technology would avoid the more serious objection to wind farms – visual impact and environmental issues.

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[14] Scott Wilson [UK] – Malta Significant Wave Height Study.

In 2007, Malta issued a call for expression of interest from firms capable and willing to construct an offshore wind farm in Maltese territorial waters. The results obtained clearly indicated that the technology was then immature and not likely to be of interest in the near future. Given the depth of the sea around Malta, it was likely to be expensive and that more cost-effective technologies were likely to be available.

Accordingly, the project was shelved but the development in the technology is being followed. The Government is interested particularly in pilot demonstration projects that would capitalise on the island's strategic position as a demonstration centre in the central Mediterranean, particularly the North African coast.

Solar concentration:

Solar concentration for thermal or photo-voltaic plants installations present a footprint concern, due to Malta's limited land area creating conflicts in land use, the high visual impact in the limited countryside and effects on local flora and fauna. However, the use of solar concentration for smaller applications, as for example solar cooling, is an option being considered.

Geo-Thermal:

The geothermal potential is low grade and may be utilised for geothermal heat-pumps. Enthalpy distribution maps for Europe show that Malta lies in a region of low enthalpy, suggesting exploitation can only be obtained on a small scale.

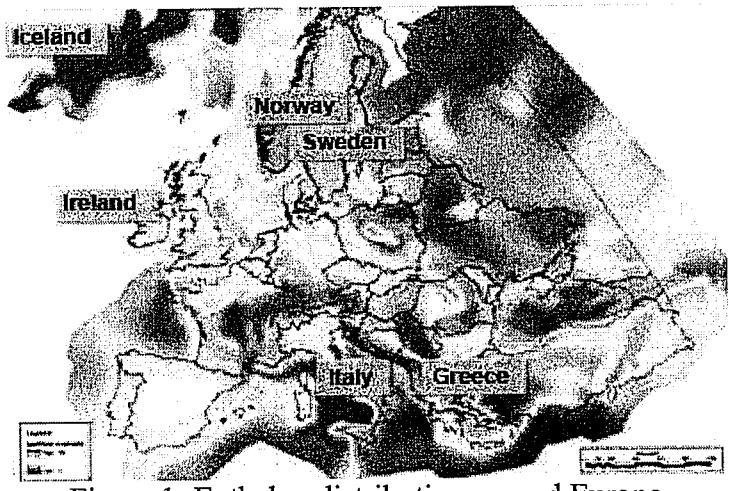

Figure 1: Enthalpy distribution around Europe,

Given the importance but extreme fragility of the local aquifers in a region of high water stress the Malta Resources Authority has initiated a consultation process on the use of groundwater for heating and cooling purposes with the aim of educating users into

acceptance of a national policy that safeguards this resource while benefiting from the geothermal policy.

5. Assumptions, Risks and Concerns

The data used in the calculations for the projections has been based on data made available to the Malta Resources Authority. Some calculated assumptions had to be taken where information was lacking. Assumptions were based on historical information and experiences, and have been addressed in such a way that their variation would only influence minimally the final results.

It is further assumed that the planned projected capacities and schedules submitted to the Malta Resources Authority will be developed and commissioned as planned.

Improvements on electricity distribution losses

Figures supplied by Enemalta Corporation for the power plants' self consumption (Generated units less Sent-out units) and for the Losses in the Distribution (Sent_out units less Billed units, thus including technical losses and unaccounted for consumption of electricity) are shown in the table below.

Year	Percentage Self Consumption	Percentage Losses in Distribution
2000/01	6.1	13.9
2001/02	6.0	16.5
2002/03	5.7	17.8
2003/04	5.8	17.5
2004/05	5.8	15.8
2005/06	5.8	13.0
2006/07	5.9	13.1

Table 2: Power station self consumption and losses

In studies carried out by Lahmeyer International, estimates of the self consumption of each generation plant with respect to average loading and fuel used have been made and these have been used for the expected generation mix planned till 2020. There is an improvement trend due to the inclusion of new plants and the phasing out of the old power plants. For the Malta Sicily electricity interconnection losses, a study provided by Enemalta Corporation has been used.

As the gross final consumption in electricity is represented by the Sent-out units and the generation plant self consumption, the losses in distribution are already being accounted for. However, distribution technical losses are being considered as savings by decentralised generation and energy efficiency measures. The actual figure of the

required technical losses is not available, but as predicted through the introduction of smart meters, the above quoted figures should reduce to around 5%. It is further assumed that Enemalta Corporation through smart metering, and through enforcement requirements in the integration of the electricity interconnection with Sicily and the large scale RES projects, will have improvements to a 4% figure[15]. The overall RES target is however not that sensitive to such estimated figures as these will only affect a small share of the electrical gross consumption figures.

Below is a table of the projected self consumption figures and the estimated technical losses:

Year	Estimated percentage Self Consumption	Estimated percentage Technical Distribution Losses
2010	5.48	5
2011	5.49	4.9
2012	4.86	4.8
2013	4.59	4.7
2014	4.39	4.6
2015	4.2	4.5
2016	4.07	4.4
2017	4.09	4.3
2018	4.04	4.2
2019	3.87	4.1
2020	3.83	4.0

Table 3: Power station projected self consumption and technical losses

Thermal energy equivalent from SWH

The thermal energy generated by an average solar water heater has always been in discussion. A paper named "Performance Analysis of Water-in-Glass Evacuated Tube Solar Heating Systems in Malta, October 2008, C Yousif, C.Fernandez, V.Buhagiar" defines this at 1650kWh annually. The NEEAP assumes a 5kWh saving for 210 days, giving a result of 1050kWh. "Renewable Energy Potential of the Maltese Islands, R.N.Farrugia, M.Fsadni, C.Yousif (Xjenza 2005)" projects a 5kWh/m^2 radiation figure per day. However in practice it is the actual consumption of hot water which otherwise would have been heated through other means, such as LPG, heating fuel or electricity, which must be considered. The Institute for Sustainable Energy (ISE) has suggested a figure of 1500kWh annual savings for an average family size of 4 persons, this being considered the average size for which a solar water heater would be purchased.

[15] Hon. Minister,s comment – In-Nazzjon 30th October "Vantaggi ghall-konsumatur bl-ismart meters"

Bio-fuels use in transport

The alternative renewable energy sources to conventional fuel used in transport are either bio-diesel for diesel powered vehicles, or bio-ethanol for petrol driven vehicles.

However, climate conditions in Malta make the blending of bio-ethanol environmentally harmful unless certain product specific measures are taken beforehand. Due to local temperatures, relatively higher than other EU countries, bio-ethanol will increase the content of airborne volatile organic compounds and Malta stands at a technical disadvantage in using this alternative. Further information is being sought in addressing this hurdle.

The potential hence mainly lies in bio-diesels. The estimated data based on projected fuel needs by the Transport Authority, ADT, have been calculated on the assumption that bio-diesel will have a substitution obligation according to suggested future EN590 standard of 7% FAME by volume. The share of bio-diesel derived from waste oils compared to other kinds of bio-diesel, has been estimated based on the possibilities of local suppliers producing bio-diesel from waste oils. The remaining balance is assumed to be imported.

However the expected price increase of diesel due to the inclusion of a relatively higher cost of bio-diesels, may distort the market, and a shift to petrol may occur in the future, thus reducing further the potential use of bio-diesel.

Risks on projects proposed.

The target figure is highly dependent on the strategy, funding and possibility of major projects, the development of legal framework in case of obligations related to renewable sources of energy use and the successes of incentive measures, promotion and public acceptance.

The risks related to major projects may be categorised in:

- Over estimation (detailed actual data prove otherwise);
- Scale of project may render the project non-economically feasible.
- Environmental impacts, health issues and public non-acceptance,
- Lack of interested developers and lack of financing possibilities,

Waste to Energy

The waste to energy projects represent risks as defined above. The emissions of gases or calorific values from the waste mixture may be optimistically estimated. Projects in this category also have a risk of environmental concerns. For instance a waste to energy plant for the treatment of the residual fraction of waste is a highly emotional issue which is dependent on public opinion.

Wind Farms

The planning stage for a wind energy generation development involves a number of risks which could lead to the failure of such a project. Some risks may not materialise but others could lead to abandoning the project. Reasons for such failure could be related to cost, time and/or revenue caused by, but not limited to, natural potential. The risks discussed are related to the large scale wind energy developments.

There are generally a number of uncertainties at the initial stages of development of a wind farm. On-site wind measurement is very important to make estimates of the annual energy yield from a prospective wind farm. Wind measuring campaigns at the three proposed wind farm sites will allow for such energy estimates. A few months worth of data must be gathered until the first energy estimates can be made.

Another risk is related to environment. Before an environmental assessment (Appropriate Assessment or EIA) is carried out at the three sites, the potential impact on local flora and fauna on-site will not be known – at least not in detail. The wind farm site at Hal Far is in an industrial estate hence the impact is minimised. The one at Wied Rini and the offshore site need to be assessed.

The condition of the seabed at the offshore site is another risk issue. Surveys need to be carried out to evaluate the characteristics of the seabed and its nature. This is important to determine the type of foundation that the wind turbines will need and to plan the route of the export cable to shore.

Other risks could be related to procurement (supply chain), delays and vessel hire (for offshore project). As data gathered accumulates, better and better estimates of cost and project viability will be made, thereby reducing risk and enabling final decisions to be taken.

Photo-voltaic Installations

The uptake of photo-voltaic technology has been and will be promoted through grant schemes or through other incentive mechanisms. However this plan includes a number of major installations. A tender has already been issued for a 1.7MW system at the Malta College of Arts Science and Technology and a further tender for 550KW system will be issued by the University of Malta. Government intends to issue a tender for the coverage of circa 67,263m^2 of public space to be allocated to photo-voltaic systems – there is interest from private parties to install photo-voltaic installation of relatively large capacities. This latter case represents a higher risk and will substantially influence the projections for such technology in case the project is not carried out.

Thermal energy through Solar Water Heater

In this report, it is being projected that the solar water heating scheme for domestic applications will be fully taken up. The projections also assume that uptake of solar water heaters will continue in the future.

In the past years, there has been a huge increase in the number of apartments throughout the island. Since April 2005 many of these apartments and any three storey buildings were allowed to apply for a permit to construct a penthouse on the topmost floor. This has led to a situation where most apartment residents have no acess to the roof, and hence have no adequate roof space to install SWH. The irregular building patterns also mean that the sun's rays are often shielded by higher neighbouring buildings. Additionally the number of vacant dwellings in Malta is far larger than most other EU states, the latest census[16] shows that 43,108 properties are completely vacant all year round – excluding the 10,028 holiday homes which are occupied for some time of the year. One in every five dwellings in Malta and more than one in every three in Gozo are empty all year round.

Grid stability issues on integrated large scale RES (electrical) generators.

Though the Malta Resources Authority has already commissioned a study to investigate the concerns related to the integration of large scale RES (electrical) into the grid, and this study is in its final stages, the projects may either be delayed due to the required grid infrastructure upgrading, or might require the diminishing of operational capacities during specific conditions.

Delay in securing of construction vehicles

It is to be kept in mind that there is a high demand for renewable technologies installations especially for wind farms. There is also a lack of construction supporting vehicles especially for off-shore wind farms. The projects planned for Malta are relatively smaller and do not benefit from economies of scale. Furthermore, any developer would prioritize larger projects and Malta's projects may be given less priority and consequently may be delayed.

Density of population for integrating on-shore wind technologies:

The installation of on-shore wind farm technologies presents an issue due to the high population density and due to the fact that any rural area may be quite possibly populated by a number of families inside the required buffer space. Hence the selection of a site having the appropriate requisites for grid connection, access and environmental impacts

for an on-shore wind farm is quite limited. The plan to install a first farm in an industrial park in Hal Far also envisages this installation to serve to educate public opinion and foster public acceptance.

6. The Resultant Projections

The projections are being reported in similar tables as requested by the National Renewable Action Plan (NREAP)

Based on the currently available information and forecasts, Malta estimates to meet all the interim targets and will also meet the final 2020 target through cooperation mechanisms such as joint projects, statistical transfers and joint support schemes to cover 0.81% of its 10% binding target. Malta shall be exploring ways of exploiting such cooperation mechanisms.

As regards to the transport targets, the technical issues regarding the petrol vehicle fleet places a handicap on the use of bio-fuels. The target estimate which may be possibly reached is of 4.78%. The following tables indicate the estimated projections in the NREAP template format.

As Part B of Annex I to the Directive		2011-2012	2013-2014	2015-2016	2017-2018		2020
RES minimum trajectory		2.00%	3.00%	4.50%	6.50%		10.00%
RES minimum trajectory (ktoe)		9.08	14.23	22.26	33.33		53.67

Table 4: National 2020 target and estimated trajectory targets

%	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
RES-H&C	8.0%	8.7%	9.4%	9.1%	8.8%	8.5%	8.2%	7.9%	7.3%	7.1%	6.7%
RES-E	0.6%	1.2%	1.6%	3.8%	7.9%	8.0%	10.5%	15.7%	15.4%	15.1%	14.7%
RES-T	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	1.2%	1.7%	2.1%	2.9%
Overall RES share	1.4%	1.9%	2.2%	3.3%	5.3%	5.3%	6.6%	9.3%	9.2%	9.1%	9.2%
Of which required from cooperation mechanism											0.81%
Surplus for possible cooperation mechanism			0.06%		1.30%		1.43%		2.72%		

Table 5: Estimated trajectory of energy from renewable sources in heating and cooling, electricity and transport

ktoe	2010		2011		2012		2013		2014	
	reference scenario	additional energy efficiency	reference scenario	additional energy efficiency	reference scenario	additional energy efficiency	reference scenario	additional energy efficiency	reference scenario	additional energy efficiency
1.Heating and Cooling	45.99	**44.83**	56.15	**54.69**	58.57	**56.82**	60.86	**58.82**	63.19	**60.85**
2.Electricity	225.44	**215.28**	230.65	**219.56**	237.52	**225.59**	244.14	**231.32**	250.61	**236.90**
3. Transport as in Art 3(4)a	151.25	**151.25**	153.18	**153.15**	155.12	**155.05**	157.06	**156.95**	158.99	**158.85**
4.Gross Final energy consumption	516.38	**505.06**	533.68	**521.11**	544.92	**531.16**	555.75	**540.79**	566.49	**550.31**
	The following calculation is needed since final energy consumption for aviation is expected to be higher than 4,12%									
Final Consumption in Aviation		93.70		93.70		93.70		93.70		93.70
Reduced for aviation limit Art 5(6)		20.81		21.47		21.88		22.28		22.67
Total Consumption after reduction for aviation limit		432.17		448.88		459.35		469.37		479.28

:oe	2015		2016		2017		2018		2019		2020	
	reference scenario	additional energy efficiency	reference scenario	additional energy efficiency	reference scenario	additional energy efficiency	reference scenario	additional energy efficiency	reference scenario	additional energy efficiency	reference scenario	additic energy efficie
Heating and ooling	66.06	**63.43**	68.26	**65.34**	70.69	**67.76**	72.64	**69.72**	74.59	**71.66**	76.05	**73**
Electricity	257.24	**242.65**	263.58	**248.10**	269.42	**252.69**	275.73	**257.76**	282.51	**263.33**	289.08	**268**
Transport s in Art 3(4)a	160.93	**160.75**	162.87	**162.65**	164.74	**164.49**	166.61	**166.32**	168.48	**168.16**	170.29	**169**
Gross Final nergy onsumption	577.93	**560.53**	588.40	**569.78**	598.55	**578.64**	608.68	**587.50**	619.28	**596.85**	629.12	**605**
	The following calculation is needed only since energy consumption for aviation is expected to be higher than 4,12%											
nal onsumption Aviation		93.70		93.70		93.70		93.70		93.70		**93**
educed for viation limit rt 5(6)		23.09		23.47		22.67		24.20		24.59		**24**
otal onsumption fter duction for viation limit		489.92		499.56		507.61		518.00		527.74		**536**

Table 6: Expected gross final consumption for 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	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
(A) Expected gross final consumption of RES for heating and cooling		3.6	4.8	5.4	5.4	5.4	5.4	5.4	5.4	5.1	5.1	4.9
(B) Expected gross final consumption of electricity from RES		1.3	2.5	3.5	8.8	18.7	19.3	26.0	39.8	39.6	39.6	39.5
(C) Expected final consumption of energy from RES in transport		1.2	1.3	1.3	1.3	1.3	1.3	1.3	2.0	2.8	3.5	5.0
(D) Expected total RES Consumption		6.1	8.6	10.2	15.5	25.4	26.0	32.7	47.2	47.5	48.3	49.3
(E) Expected transfer of RES to other MS												
(F) Expected transfer of RES from other MS & 3rd countries												
(G) Expected RES consumption adjusted for target (D) - (E) + (F)	0	6.1	8.6	10.2	15.5	25.4	26.0	32.7	47.2	47.5	48.3	49.3

Table 7: Calculation Table for the renewable energy contribution of each sector to final energy consumption

ktoe	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
(C) Expected final consumption of energy from RES in transport	0	1.2	1.3	1.3	1.3	1.3	1.3	1.3	2.0	2.8	3.5	5.0
(H) Expected additional part RES Electricity in road transport		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(I) Expected additional part consumption of bio-fuels from waste, residues, non-food cellulosic and lingo-cellulosic material in transport		1.2	1.3	1.3	1.3	1.3	1.3	1.3	2.0	2.8	3.2	3.2
(J) Expected RES contribution to transport for the RES-T target (C) +(2,5-1)x(H) +(2-1)x(I)	0	2.5	2.5	2.6	2.6	2.6	2.7	2.7	4.1	5.5	6.7	8.1

Table 8: Calculation table for the renewable energy in transport share

7. Nomenclature

ADT	– Malta Transport Authority
EC	– European Community
EIA	– Environmental Impact Assessment
EU	– European Union
ERDF	– European Regional Development Fund
FAME	– Fatty Acid Methyl Ester
GWh	– Giga Watt Hour (Energy)
ISE	- Institute for Sustainable Energy
kWh	– Kilo Watt Hour (Energy)
kWp	– Kilo Watt Peak (Power peak capacity)
LPG	– Liquid Petroleum Gas
MBT	– Mechanic Biological Treatment
MIEMA	– Malta Intelligent Energy Management Agency
MRA	- Malta Resources Authority
MRRA	- Ministry of Resources and Rural Affairs
MSW	– Municipal Solid Waste
MRF	– Municipal Recycling Facility
MW	– Mega Watt (Power)
MWp	– Mega Watt Peak (Power peak capacity)
NEEAP	– National Energy Efficiency Action Plan
NREAP	– National Renewable Action Plan
PV	- Photo- Voltaic
RDF	– Residual Derived Fuels
RES	– Renewable Energy Source
RES-E	– RES in electricity
RES-H	– RES in heating
RES-T	– RES in transport
SEA	– Strategic Environmental Assessment
SWH	– Solar water heater