DOMESTIC SOLAR WATER HEATING: POTENTIAL & CHALLENGES IN MALTA

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SOLAR ENERGY MARKETS: MALTESE AND GERMAN EXPERIENCES TOWARDS 2020
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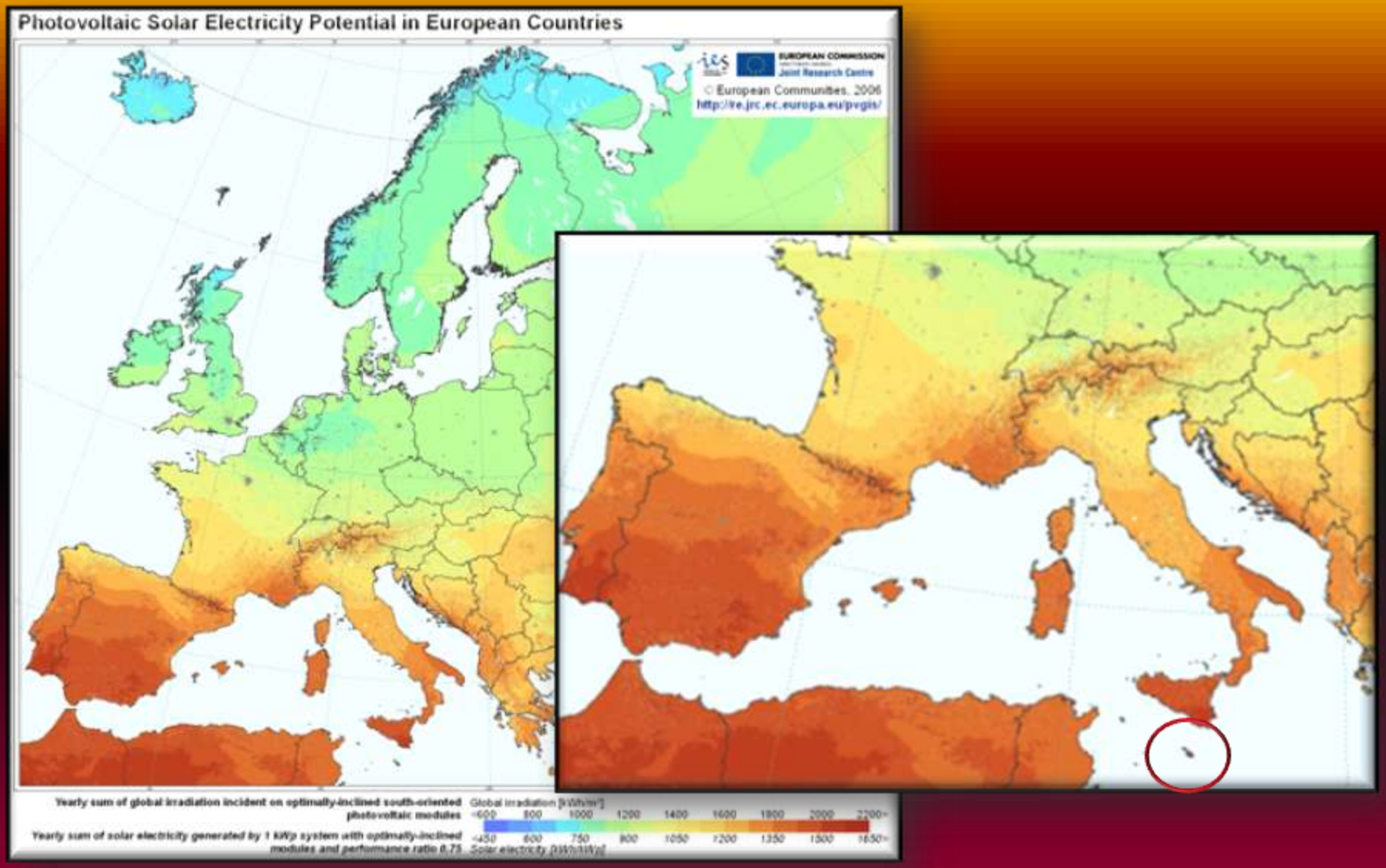
Background

- The Maltese islands depend almost entirely on fossil-fuel generated electricity;
- Malta must meet 10% of its total energy consumption from RE sources by the year 2020. Trajectory targets have been established – 2% to be reached by the year 2012*;
- The majority of households on the islands still utilise electric water boilers (geysers) for their domestic hot water requirements.

Overview of the Technical Potential:

Resources - Technologies - Applications -

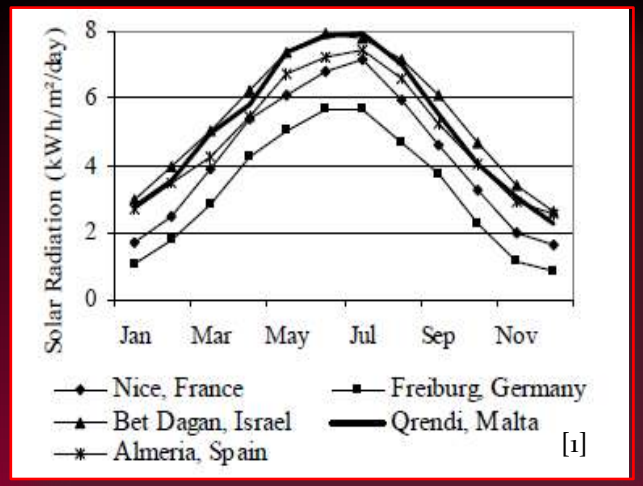
Solar Resources



http://re.jrc.ec.europa.eu/pvgis/countries/europe/EU-Glob_opta_presentation.png

Solar Resources

- Solar radiation monitored by the Institute for Sustainable Energy since 1993;
- Total annual global solar irradiation on a horizontal surface at circa 1,825 kWh/m² (± 3%) [1];
- Maximum radiation in summer (almost 8 kWh/m²/day) and minimum in winter (2.5 kWh/m²/day) [1].
- A typical solar water heating system could save an equivalent of 1,650 kWh_{th} (equivalent to 0.142 toe) per year [2], offsetting ≈ 2,200 kWh_e (consumed by an electric water boiler used in Maltese home [3].



[1] G. Oña Quecedo, C. Yousif and J. Bilbao Santos, Comparison of Solar Radiation in Marsaxlokk, Malta and Valladolid, Spain, World Renewable Energy Congress, XI, Abu Dhabi, U.A.E., 25-30 September 2010.

[2] 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

[3] S. Morentin Gutiérrez, C. Yousif, R N Farrugia (2010), Testing of an Air Source Heat Pump Water Heater in Malta, World Renewable Energy Congress XI, Abu Dhabi, U.A.E., 25-30 September 2010.

Technologies

Solar Water Heating (SWH) systems installed locally generally consist of a collector and storage tank installed close together.

Systems encountered vary in terms of collector type:

- **Flat plate collector with glazing;**
- **Evacuated tube type: water tubes, heat pipes.**

Some Batch type systems have also been installed.

Technologies

SWH for X persons

- **Bathroom 1**
- **Bathroom 2**
- **Bathroom 3**

KITCHEN:

- **Sink**
- **Dishwasher**
- **Washing Machine**

Why Promote SWH? – Part 1

Malta's 2012, 2% trajectory target (equivalent to 9.2 ktoe or 107 GWh) may, for argument's sake, be attained by:

- Installing about 71 MWp of solar photovoltaic systems; OR
- Installing wind capacity (assuming a 25% capacity factor) of about 49 MW; OR
- The contribution from some 64,900 domestic solar water heaters.

Technology Status

Status of SWH in Malta [1]:

- **Approximately 10,000 solar water heaters installed prior to 2008;**
- **The Government's grants schemes encouraged the installation of 2,600 between January and February 2008;**
- **In 2009, Government allocated funds for SWH costs up to a maximum of €460 for 4,500 units. Over 2,688 grant applications were received under this scheme;**
- **In 2010, the grant was increased to 40% (up to a maximum of €560) subject to a means test i.e. scheme only applicable to low income families or to Gozo residents.**

Achieving the RES 2020 target, Malta Resources Authority, 18 February 2011

Technology Status

Dwellings by Building Type	No.	
Terraced Houses	54,714	
Semi-detached houses	6,105	
Fully detached houses	3,534	
Ground-floor tenements having their own airspace	9,266	
Farmhouses	1,261	74,880 (54 % of building stock)
Maisonettes	30,894	
Apartment/Penthouse	32,569	Assume that 50% have roof access and space
Suite of rooms forming part of a housing unit	447	
Other	388	
Totals	**139,178**	

Census of Population and Housing 2005, Volume 2: Dwellings. Valletta: National Statistics Office, 2007. xxi, 197p. ISBN: 978-99909-73-52-5

Circa 106,600 households

Prospects for SWH Systems

One can assume that circa 106,600 (or 76% of all Maltese households) have access to a rooftop that could be available for the installation of a solar water heater. This magic value assumes that rooftops are structurally sound, not shaded, etc.

This would mean a potential total of 106,600 solar heating systems, equivalent to an installed capacity of:

- 223,860 kW_{th} *,

OR

- 540 kW_{th} per 1000 capita (413 thousand in 2009)**.

* Based on an average panel area of 3 m^2 (where 1 m^2 of panel area is equivalent to 0.7 kW_{th}).

** http://www.nso.gov.mt/: Demographic Review 2009

Prospects for SWH Systems

It can thus be concluded that domestic solar heating could provide a RE contribution (savings) of up to 176 GWh_{th} annually*, with the total expected energy savings amounting to 15,000 toe/year.

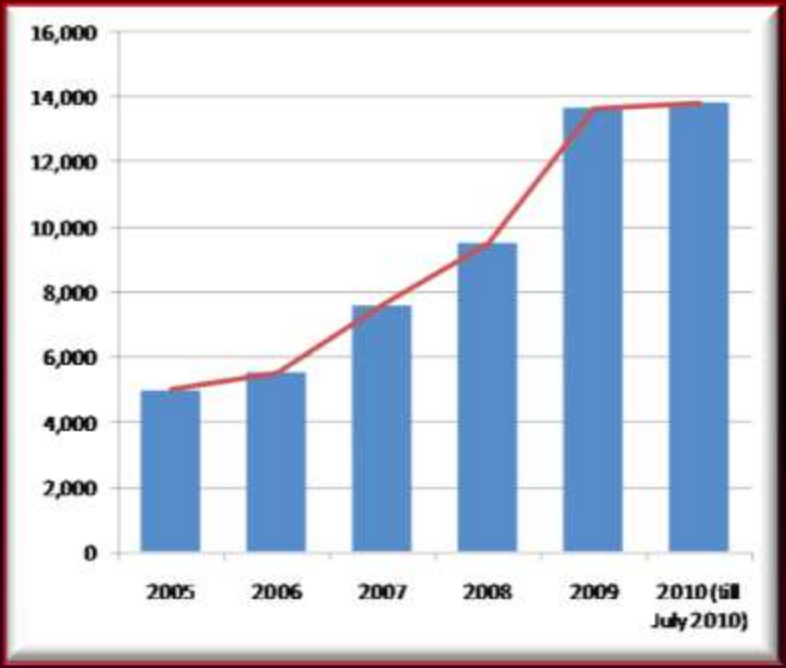
The RE savings would be equivalent to approximately 2.8% of the required 10% complement in 2020.**

* Based on a contribution of 1,650 kWh_{th} from a SWH system;

** Based on the forecasted gross energy consumption in 2020 (equal to 534,494 toe) as per Malta's National Renewable Energy Action Plan, 6th July 2010.

Technology Status

Setting this theoretical maximum potential at some 106,600 systems and assuming that there are currently about 15,500 systems installed, clearly indicates that, as rough as the values may be, the domestic SWH potential in Malta is still relatively untapped.



Barriers: Competition with other rooftop services and activities

- Competing for roof space with water tanks, satellite dishes, air conditioners, PV systems, micro-wind turbines;
- Competing with other rooftop activities such as drying the washing, BBQ areas, other leisure activities;
- Shading by other structures/roof structures;
- Limited, inaccessible roof area or no roof ownership.

Challenges

OBJECTIVE: The ultimate goal is to increase the number of SWH systems and to meet and surpass intermediate trajectory and 2020 targets

- **Striving towards quality products, good installations and aftersales services;**
- **Supplying systems that suit local operational conditions;**
- **Meeting changing building sector and end-user trends;**
- **Targeting market sectors that are currently untapped;**
- **Is there a need for national support schemes to accomplish this goal?**

Challenges: Quality & Reliability

To improve the quality and reliability of the systems on the market:

- **MRA [1] requested that systems registered with the Authority be compliant with MSA EN12975 or MSA EN12976 or have the solar key-mark certification;**
- **ISE has carried out two runs of a course for SWH system installers. This is now being developed as a full certification MRA-approved course that will be launched later on today;**
- **ISE performs visits to homeowners who wish to have their SWH and usage patterns vetted. Over 100 systems have been visited to date.**
- **Other initiatives by other entities are also underway.**

[1] *Achieving the RES 2020 target, Malta Resources Authority, 18 February 2011*

Challenges: Meeting Changing Buildings Sector Trends

- Current trend in the building industry to demolish villas, terraced houses and maisonettes in favour of multi-storey apartment blocks continues.
- While reducing the buildings' footprints, the roof area available per apartment occupant is also being significantly reduced.

Challenges: Meeting Changes in Building Trends

- Installing individual SWH on available roof areas to meet the apartment occupants' hot water needs?
- Installing large communal SWH systems to meet the hot water requirements of apartment occupants?
- Integration into the Building Envelope in other ways?

Challenges: Improving System Performance

Images: C. Yousif

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Challenges: Improving Installations

Images: C. Yousif

Piping and pipework

Neat pipework does not necessarily mean better performance. Too many bends will restrict the thermosiphon effect and increase frictional losses, etc.

Images: C. Yousif

Collector Inclination

Images: C. Yousif

Other Afflictions

Images: C. Yousif

Challenges: Are Grants a Solution?

- The grant schemes over the past few years have varied, and so too have the numbers of SWH systems installed.
- Should the grant limit cover the cost of a SWH or should it cover other infrastructure necessary to install the system? Hidden costs such as structural support on roofs that have stone slabs (*xorok*), new pipework, bathroom tiles, etc. in older buildings all constitute barriers to the installation of new SWHs .
- Will other mechanisms, such as the compulsory installation of SWH systems in new or retrofitted buildings, see more systems installed?
- Could tax rebates for contractors and owners choosing to build low energy buildings be another solution?

Why Promote SWH? – Part 2

Solar heating is 3 to 5 times more efficient than PVs (depending on the technology used);

Contributes more RE per unit area of rooftop utilised than PVs.

Cost of investment per unit of energy is at least 2.5 times cheaper than for a PV system.

One should not encourage the installation of PV systems without giving similar, or better support to SWH systems;

Heating water with SWH systems is more efficient than generating PV electricity, and then operating a geyser for domestic hot water requirements.

Strategy should be: To install a SWH <u>first</u>, then to install a PV or other RE systems.

THANK YOU