INTERNATIONAL JOURNAL OF HYDROGEN ENERGY 33 (2008) 4235–4246

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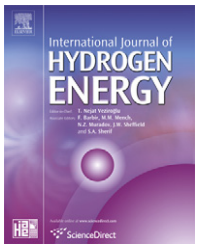

# Energy scenarios for Malta☆

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ARTICLE INFO

*Article history:*
Received 17 October 2007
Received in revised form 9 May 2008
Accepted 7 June 2008
Available online 12 August 2008

*Keywords:*
$H_2$RES
Malta
Hydrogen scenario
Renewables
Financial analysis
Energy scenarios
Renewable energy
Wind energy
Solar energy
Hydrogen
Load

ABSTRACT

Many island power systems are powered by diesel generators or long underwater cables, which result in greater operating costs or losses than stand-alone systems. It is therefore desirable to integrate renewable energy (RE) sources into these mini grids.

The main objective of the paper is to describe, analyse and present a more unified approach for assessing the technical feasibility/potential of different energy scenarios for the islands of Malta. In this study, three different scenarios are analysed. Integrating RE sources (RES) in energy systems reduces losses, cuts fossil fuel consumption whilst maintaining system stability and increasing job opportunities. Hydrogen conversion and storage methods are also analysed as a method for greenhouse gas (GHG) reduction in the transport sector and as a way to reduce excess electricity produced from RE.



## 1. Introduction

As discussed in the Kyoto Protocol, different nations agreed and ratified the protocol in order to reduce the GHG emissions. The European Community undertook to cut its GHG emissions by 8% of 1990 levels over the first Kyoto Protocol (KP) commitment period (2008–2012) [1]. Different ways exist to achieve this, amongst these are the efficiency improvement of fossil fuelled generating plants and the introduction of energy form renewable sources. Malta ratified the Kyoto Protocol and has to abide to the Directive on the Promotion of Renewable Energy (2001/77/EC). Malta's stated target under this directive is to generate 5% of its electricity from RE sources by 2010 [1].

Malta's situation is quite particular with a high population density, limited available land space and an ever increasing electricity demand. Aiming to provide 100% electrical energy from renewable sources is difficult to achieve and too costly. However, attention to generation technology, transmission and end use efficiency will greatly attribute to a sustainable environment apart from fulfilling our international obligations. In order for this to be achieved, there has to be a broad understanding of what the mechanisms for addressing it entail, continuously backed up by political will and scientific

☆ A paper presented at the "4th Dubrovnik Conference on Sustainable Development of Energy, Water and Environment Systems", June 4th–8th, Dubrovnik, Croatia.

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doi:10.1016/j.ijhydene.2008.06.010

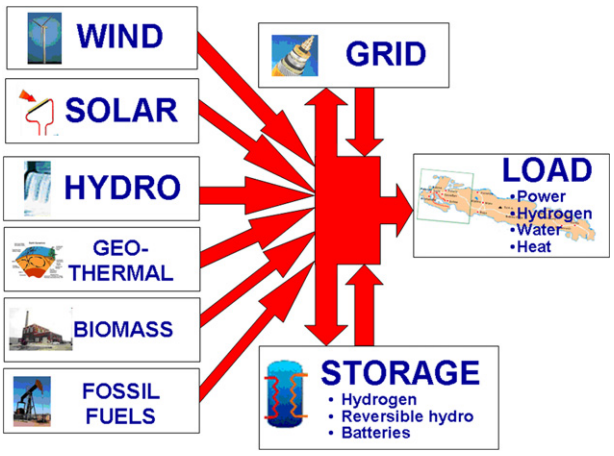


**Fig. 1 – $H_2$RES model v 2.6.**

findings. In its Green paper on efficiency, *Doing more with less* [2], the European Commission together with the Directorate-General for Energy and transport stresses the importance that ''An energy-efficiency initiative has wider implications'', one that ''constitutes a major contribution to reduction of our energy dependency on third countries''.

## 2. $H_2$RES model

The $H_2$RES model (Fig. 1) [3] is designed for balancing between hourly time series of water, electricity, heat and hydrogen demand, appropriate storages and supply (wind, solar, hydro, geothermal, biomass, fossil fuels or grid).

The main purpose of the model is energy planning of islands and isolated regions which operate as stand-alone systems, but it can also serve as a planning tool for single wind, hydro or solar power producers connected to bigger power systems. Wind velocity, solar radiation and precipitation data obtained from the nearest meteorological station are used in the $H_2$RES model. The wind module uses the wind velocity data at 10 m height, adjusts it to the wind turbine hub level and, for a given choice of wind turbines, converts the velocities into the output. The solar module converts the total radiation on the horizontal surface into the inclined surface, and then into the output. The hydro module takes into account precipitation data, typically from the nearest meteorological station, and water collection area and evaporation data based on the reservoir free surface to predict the water net inflow into the reservoir. The biomass module takes into account the feedstock information, the desired mix of feedstock, conversion processes (combustion, gasification and digestion) and desired output production (power, heat or

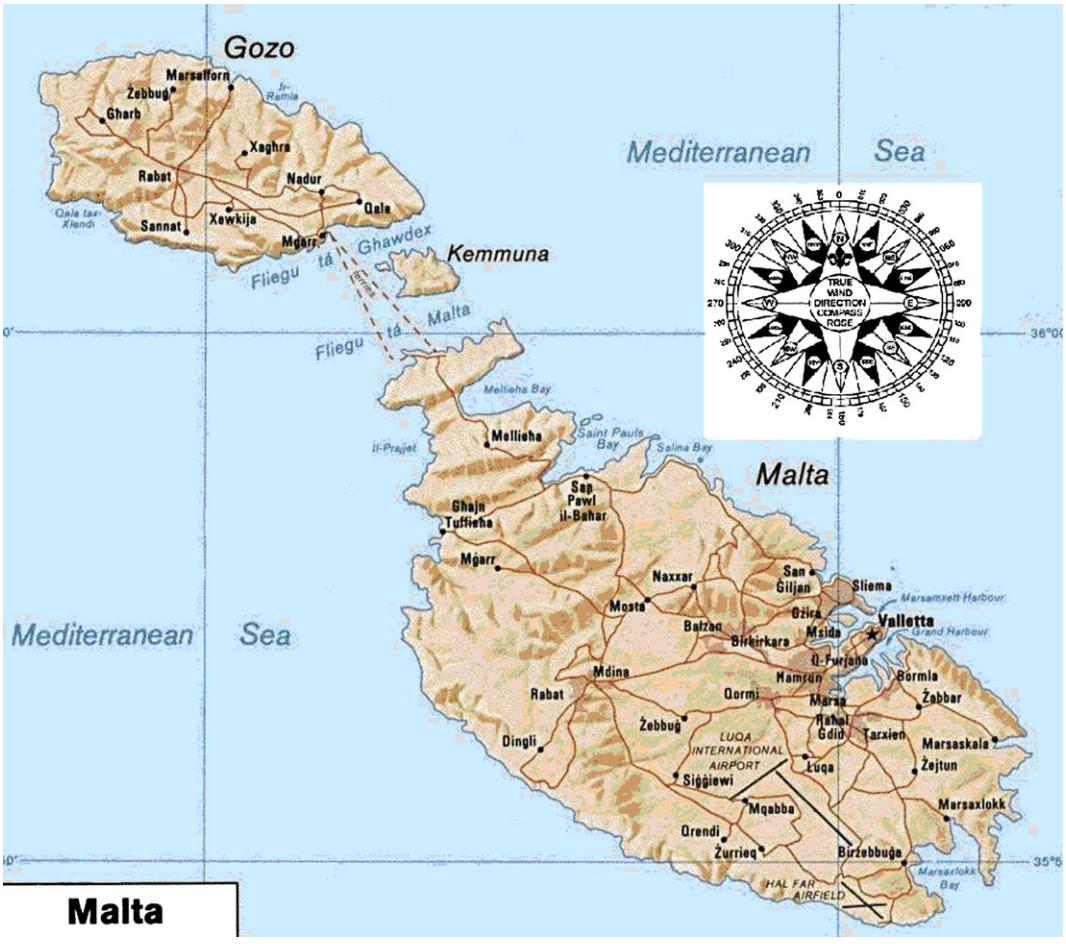


**Fig. 2 – Maltese archipelago main islands.**