Typical Meteorological Year generation service

Energogreen Renewable
Site: Villasor

Etienne Wey
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Outline

Introduction - methodology

Energogreen Renewable has requested a Typical Meteorological Year (TMY) P50 (median scenario) and P90 (pessimistic scenario) for their site located in Villasor, in Sardinia. They provide Transvalor with their ground station measurements for a prior calibration of the long term HelioClim-3v4 (HC-3v4) Global Horizontal Irradiation (GHI). This report synthesizes the TMY results for both the GHI and the Direct Normal Irradiation (DNI) components.

The method for the TMY (P50) generation exploits the HC-3v4 for the radiation data, and the MERRA reanalysis from NASA for the other meteorological parameters. This method has been developed and validated within the framework of the European research project named ENDORSE (funded by the Seventh Framework Programme (FP7) of the EU, number of agreement n°262892). A full description of the method is available at: http://www.endorse-fp7.eu/pre-market-services/tmy-generation/service.

Please note that the main outcome of this new service is the notion of "driver" which consists of taking into account in the month selection the solar technology for which the generated TMYs will be exploited. In this case, the Customer plans to install a Concentrated Solar Power (CSP) or a Fresnel system. This system is a 1-axis tracker which means that only part of the DNI radiation component is collected. The results concerning this "efficient part of the DNI radiation" (or, as a reminder, this "driver") are available in annex.

The first section gives a brief overview of the site description.

The second section ("Selected months for the P50 and P90 TMY") lists the months that have been selected by the method based on the driver.

The third and the fourth sections show respectively the results and illustrations for the GHI and the DNI components.

The fifth (and last) section is a summary of the major results of this TMY generation service.

Data description

Name of the location: Villasor
* *Latitude: 39.3872°*
* *Longitude: 8.8707°*
* *Altitude: 40.0 m*

Data: Driver DNI 1 axis
* *Sampling of the data: 60 min*
* *Unit of the data: Wh/m^2*

Long-term time series:
* *Begin date: 2005-01-01*
* *End date: 2013-12-31*
* *Nb years: 9*

Databases:
* *Radiation components: HelioClim-3v4*
* *Other meteorological parameters: MERRA (NASA)*

TMY time series:
* *Name of TMY method: Villasor_FS50_Driver DNI 1 axis_month*
* *Driver selected to compute the MY: 1 axis tracker DNI for CSP*

Output formats:
* *CSV compatible with the PVsyst software*
* *CSV compatible with the System Advisor Model (SAM, NREL)*

Selected months for the P50 and P90 TMY

Year chosen for:	P50	P90
Jan.	2013	2010
Feb.	2012	2013
Mar.	2010	2013
Apr.	2013	2009
May	2007	2010
Jun.	2005	2006
Jul.	2005	2013
Aug.	2006	2005
Sept.	2009	2008
Oct.	2013	2012
Nov.	2008	2007
Dec.	2011	2008

Results and illustrations for the GHI component, P50 and P90

The long term variability of the GHI component is represented as a "boxplot" graph for each month.

NB: Help to understand the monthly boxplot illustration
* The bottom horizontal line is the minimum monthly value
* The top horizontal line shows the maximum monthly value
* The orange box shows the extent from the 25 to 75 percentile values
* The circle in the orange box show the median value
* The horizontal line in the orange box shows the average value

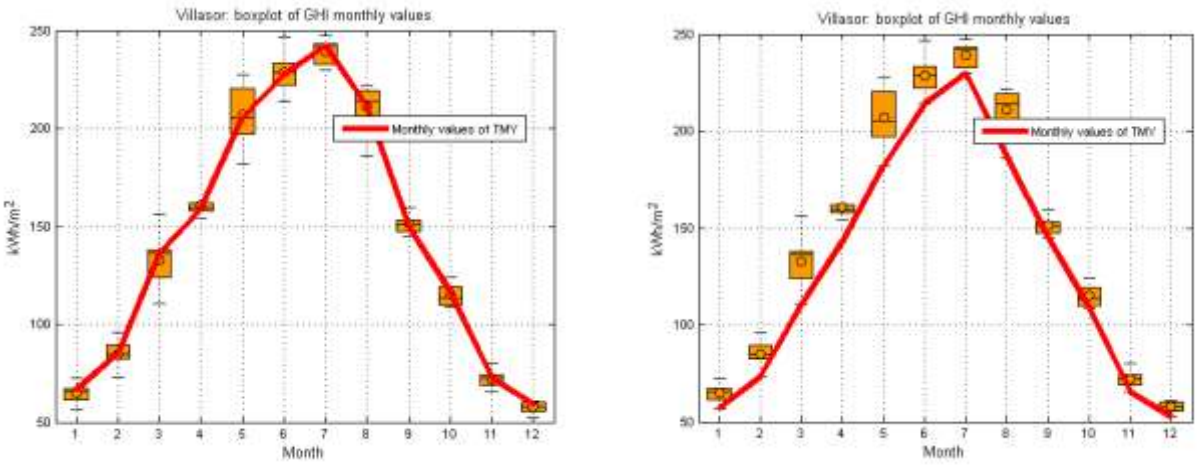

Figure 1: monthly boxplot for the GHI component.
(P50 on the left hand side, P90 on the right hand side)

The monthly GHI values of the TMYs are:

	P50 (in KWh/m²)	P90 (in KWh/m²)
Jan.	67	57
Feb.	85	73
Mar.	136	111
Apr.	159	143
May	205	182
Jun.	227	214
Jul.	242	230
Aug.	211	186
Sept.	150	145
Oct.	117	109
Nov.	72	66
Dec.	59	53
YEARLY	**1730**	**1567**

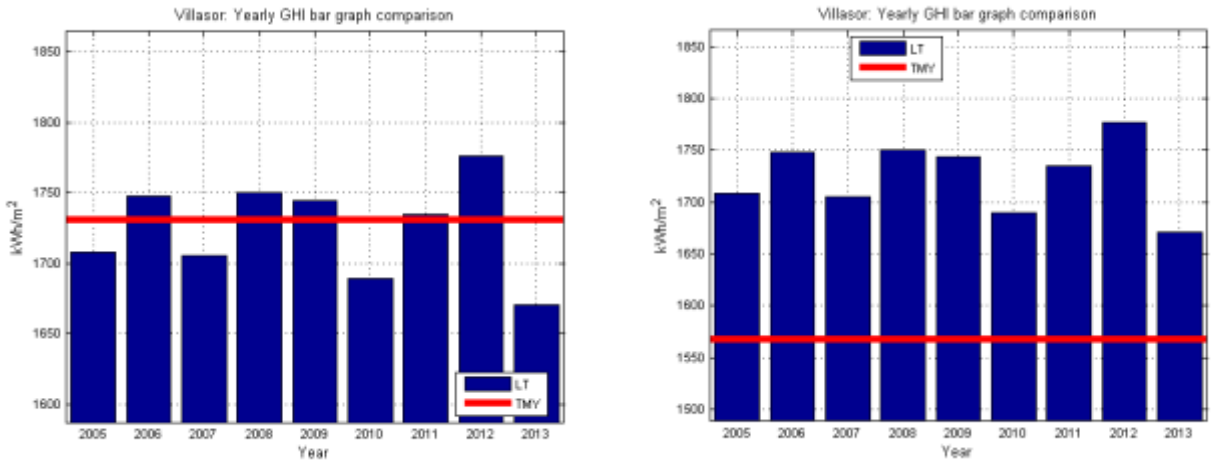

Figure 2: yearly GHI bar graph comparison
(P50 on the left hand side, P90 on the right hand side)

Results and illustrations for the DNI component, P50 and P90

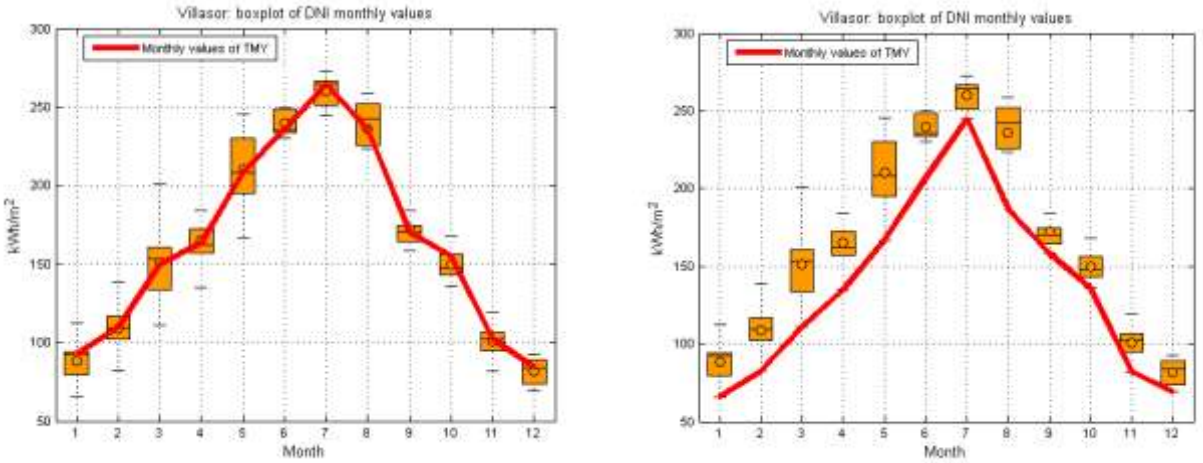

Figure 3: monthly boxplot for the DNI component
(P50 on the left hand side, P90 on the right hand side)

The monthly DNI values of the TMYs are:

	P50 (in KWh/m²)	P90 (in KWh/m²)
Jan.	93	66
Feb.	110	82
Mar.	150	111
Apr.	163	135
May	208	167
Jun.	235	207
Jul.	264	244

Aug.	236	186
Sept.	170	158
Oct.	155	136
Nov.	102	82
Dec.	84	69
YEARLY	**1971**	**1644**

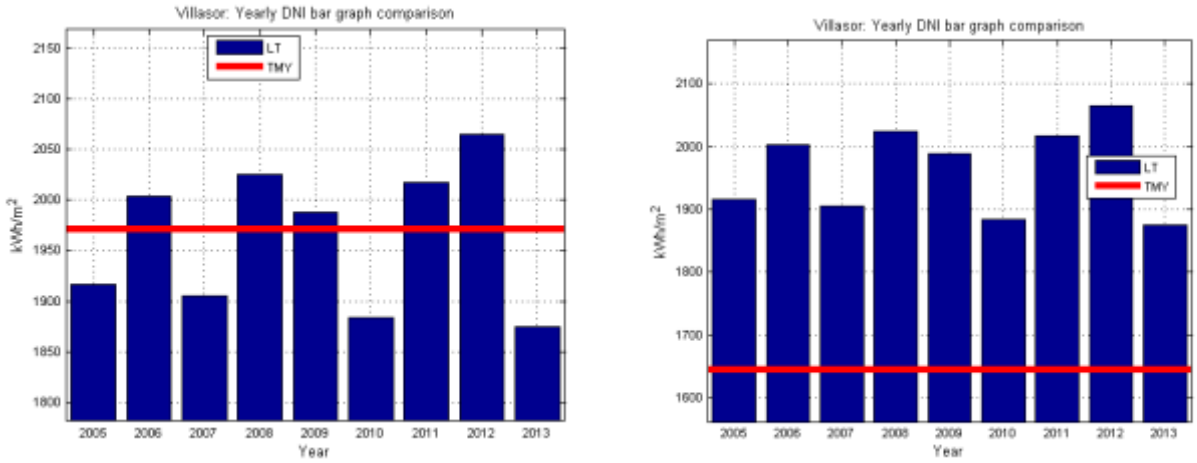

Figure 4: yearly DNI bar graph comparison
(P50 on the left hand side, P90 on the right hand side)

Conclusion – interpretation of the results

The major results of this TMY analysis are:

- GHI P50 yearly average irradiation value: 1730 kWh/m²
- GHI P90 yearly average irradiation value: 1567 kWh/m²
- DNI P50 yearly average irradiation value: 1971 kWh/m²
- DNI P90 yearly average irradiation value: 1644 kWh/m²

Annex: results for the effective part of the radiation P50 and P90 ("driver")

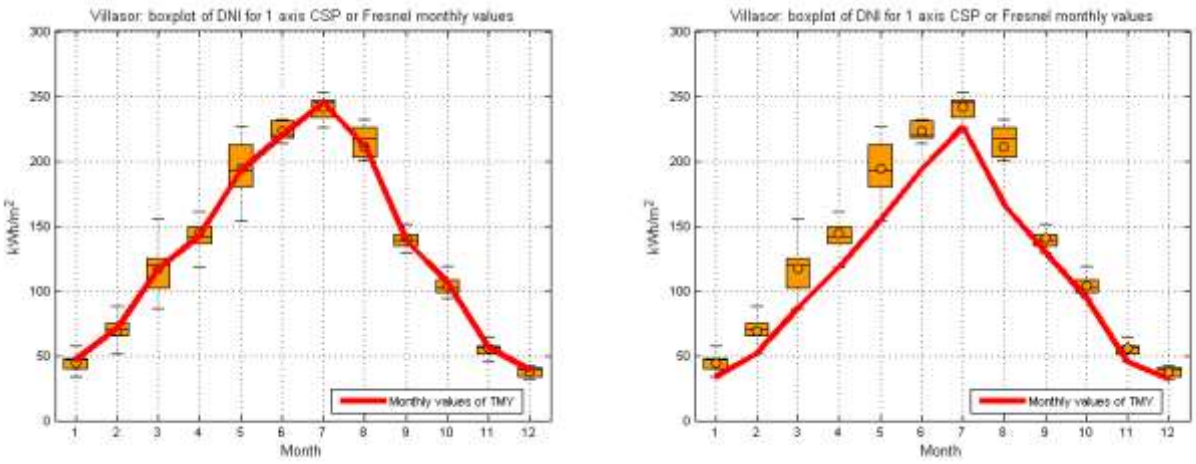

Figure 5: monthly boxplot for the driver component (1-axis tracking)
(P50 on the left hand side, P90 on the right hand side)

The monthly driver values (1-axis tracking) of the TMYs are:

	P50 (in kWh/m²)	P90 (in kWh/m²)
Jan.	47	33
Feb.	71	52
Mar.	117	86
Apr.	142	118
May	192	154
Jun.	220	193
Jul.	245	226
Aug.	211	166
Sept.	139	130
Oct.	107	94
Nov.	57	45
Dec.	39	32
YEARLY	**1586**	**1330**

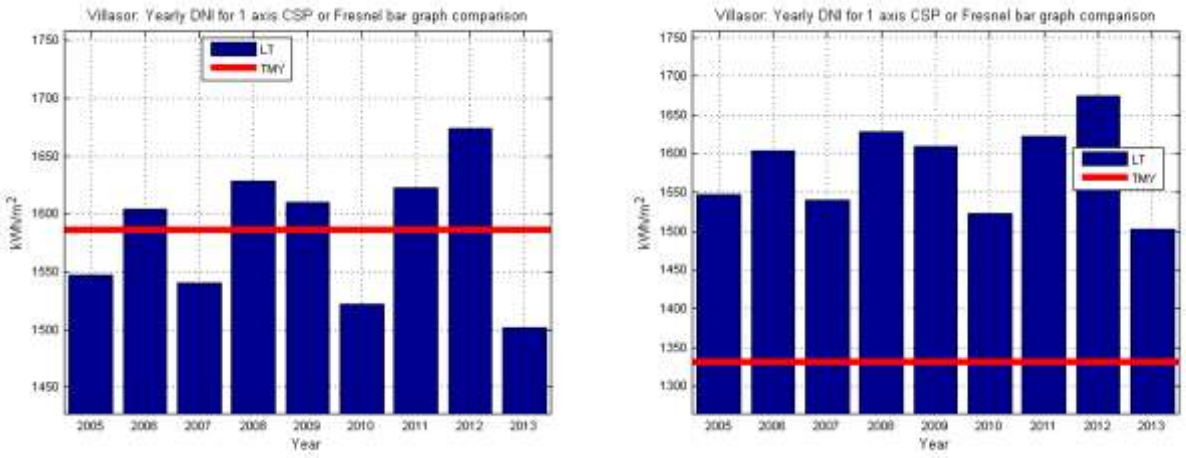

Figure 6: yearly driver bar graph comparison (1-axis tracking)
(P50 on the left hand side, P90 on the right hand side)

Table of illustrations