SOLAR RESOUCE ASSESSMENT WITH MSG DATA

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ABSTRACT

Despite their recognized benefits solar energy resources are not fully exploited at the moment. In order to establish appropriate instruments and strategies for the market introduction of solar energy resources and to allow international and national policy maker to establish appropriate framework conditions for their expansion, well founded information on demand and resources, technologies and applications is essential. As a first step, an in-depth analysis of the available solar resources is needed (e.g. maps of annual solar irradiance). Successively, the level of the available resources can be used to calculate where these technologies become economically viable, in order to determine their economic potential. This number shows which technologies are feasible to contribute to the national energy system at an economic level. This selection of suitable technologies is the first important step in strategy development. In other words, high quality resource assessments are the base for successful deployment of renewable energy sources. Their availability will lower the investors' uncertainty and risk about the availability of solar radiation and policymakers designing market introduction policies can better assess the level of necessary support in the beginning of market introduction.

The amount of incident solar radiation significantly determines the electricity produced by PV systems. The primary solar radiation data are measured at a limited number of climatic ground stations and to get maps, interpolation techniques are used. Methods of calculating solar irradiance from meteorological geostationary satellites (e.g., Meteosat Second Generation, GOES) are rapidly developing [1]-[5]. In general, processing of satellite data provides less accurate values for the location (compared with ground measurements), but the advantage is data coverage over vast territories at high spatial resolution and temporal resolutions. Hence, solar surface irradiance assessment from geostationary satellites constitutes a powerful alternative to meteorological ground network for climatological data and is the primary source of information in regions where ground based measurements are sparse (e.g. Ocean, Africa).

Within this context, the Photovoltaic Geographic Information System (PVGIS) has been developed at the Joint Research Centre (JRC), starting in 2001 (http://re.jrc.ec.europa.eu/pvgis/). This web-based knowledge distribution

system combines long-term expertise from technology research, testing, and monitoring with geographic knowledge with an aim to:

—support EU, state, and regional policies;

—contribute to research, education, and to assist the industry;

—increase public awareness of solar energy.

In synthesis, PVGIS is a web service for global radiation in Europe and Africa. PVGIS currently provides PV estimates with a resolution of 100m, based on calculating the effects of terrain shadowing. It brings an easy to use Google maps type interface. The user can select a site of interest by moving through the maps. The user can select which solar radiation components he is interested in (global or diffuse irradiation). Further, solar electricity potential in Europe has been analyzed assuming fixed-mounted and 2-axis tracking flat-plate PV systems, for several technical and economic options, assuming performance degradation factors such as temperature and reflectivity [6] (see Fig.1).

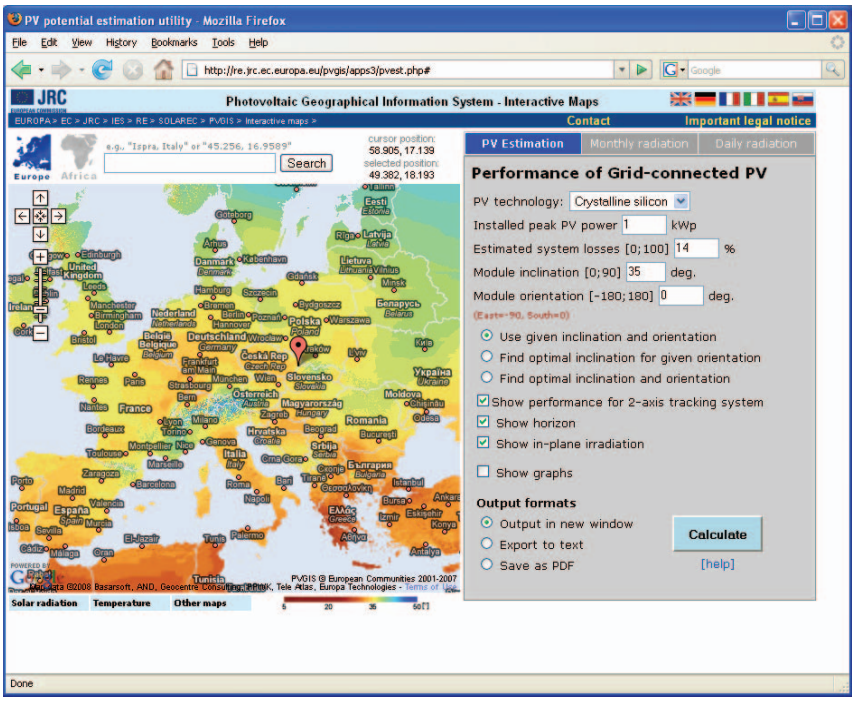

Fig.1: PVGIS website: Raster maps are integrated within the Google Maps Application Programming Interface which links the geodatabase with the assessment tools.

The PVGIS solar radiation database is based on meteorological data from 566 stations that are located in Europe and neighbouring regions. These measurements have been collected and harmonised within the European Solar Radiation Atlas [7], and they represent period 1981-1990. At present, a satellite-based pre-operational calculation scheme for solar irradiance is in the validation-phase to further be integrated into a new version of

PVGIS solar radiation database for Europe and Africa. The algorithm to derive solar irradiance form geostationary satellite data is based on the approach proposed by J. Verdebout [8].

One of the most important novelties will be the availability of estimates for the Direct normal irradiance component (DNI). As a matter of fact, the global irradiance is the important parameter for non-concentrating photovoltaic systems and flat plate collectors, while the direct normal irradiance, which is the amount of solar radiation arriving directly from the sun (ignoring radiation from the rest of the sky), and falling onto a plane perpendicular to the direction of the sun [9], can be used for electricity generation via concentrating solar thermal power plants or concentrating PV.

The potential of the integration of solar irradiance estimations form geostationary satellite data in the PVGIS web application will be shown at the conference.

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