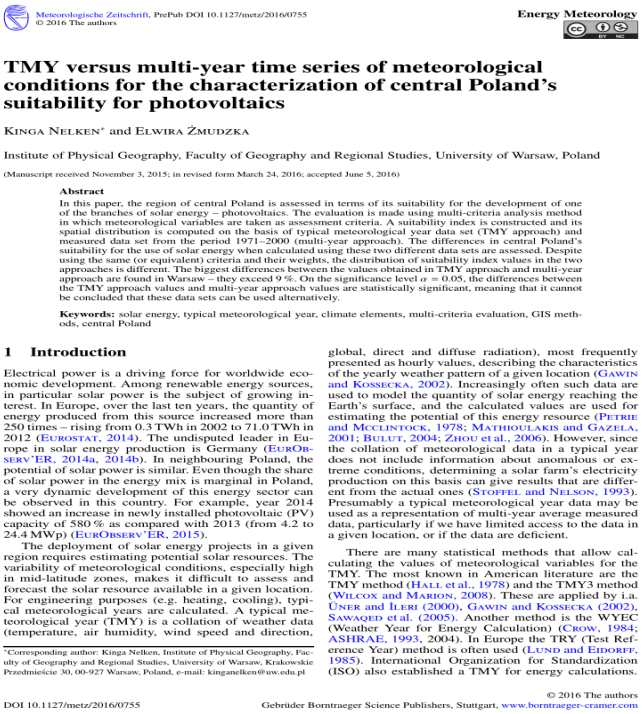
International Weather for Energy Calculations (IWEC)



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Energy Meteorology

TMY versus multi-year time series of meteorological conditions for the characterization of central Poland's suitability for photovoltaics

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Abstract

In this paper, the region of central Poland is assessed in terms of its suitability for the development of one of the branches of solar energy – photovoltaics. The evaluation is made using multi-criteria analysis method in which meteorological variables are taken as assessment criteria. A suitability index is constructed and its spatial distribution is computed on the basis of typical meteorological year data set (TMY approach) and measured data set from the period 1971–2000 (multi-year approach). The differences in central Poland's suitability for the use of solar energy when calculated using these two different data sets are assessed. Despite using the same (or equivalent) criteria and their weights, the distribution of suitability index values in the two approaches is different. The biggest differences between the values obtained in TMY approach and multi-year approach are found in Warsaw – they exceed 9 %. On the significance level $\alpha = 0.05$, the differences between the TMY approach values and multi-year approach values are statistically significant, meaning that it cannot be concluded that these data sets can be used alternatively.

Keywords: solar energy, typical meteorological year, climate elements, multi-criteria evaluation, GIS methods, central Poland

1 Introduction

Electrical power is a driving force for worldwide economic development. Among renewable energy sources, in particular solar power is the subject of growing interest. In Europe, over the last ten years, the quantity of energy produced from this source increased more than 250 times – rising from 0.3 TWh in 2002 to 71.0 TWh in 2012 (Eurostat, 2014). The undisputed leader in Europe in solar energy production is Germany (EurObserv'ER, 2014a, 2014b). In neighbouring Poland, the potential of solar power is similar. Even though the share of solar power in the energy mix is marginal in Poland, a very dynamic development of this energy sector can be observed in this country. For example, year 2014 showed an increase in newly installed photovoltaic (PV) capacity of 580 % as compared with 2013 (from 4.2 to 24.4 MWp) (EurObserv'ER, 2015).

The deployment of solar energy projects in a given region requires estimating potential solar resources. The variability of meteorological conditions, especially high in mid-latitude zones, makes it difficult to assess and forecast the solar resource available in a given location. For engineering purposes (e.g. heating, cooling), typical meteorological years are calculated. A typical meteorological year (TMY) is a collation of weather data (temperature, air humidity, wind speed and direction, global, direct and diffuse radiation), most frequently presented as hourly values, describing the characteristics of the yearly weather pattern of a given location (Gawin and Kossecka, 2002). Increasingly often such data are used to model the quantity of solar energy reaching the Earth's surface, and the calculated values are used for estimating the potential of this energy resource (Petrie and Mcclintock, 1978; Mathioulakis and Gazela, 2001; Bulut, 2004; Zhou et al., 2006). However, since the collation of meteorological data in a typical year does not include information about anomalous or extreme conditions, determining a solar farm's electricity production on this basis can give results that are different from the actual ones (Stoffel and Nelson, 1993). Presumably a typical meteorological year data may be used as a representation of multi-year average measured data, particularly if we have limited access to the data in a given location, or if the data are deficient.

There are many statistical methods that allow calculating the values of meteorological variables for the TMY. The most known in American literature are the TMY method (Hall et al., 1978) and the TMY3 method (Wilcox and Marion, 2008). These are applied by i.a. Ineer and Ileri (2000), Gawin and Kossecka (2002), Sawaqed et al. (2005). Another method is the WYEC (Weather Year for Energy Calculation) (Crow, 1984; ASHRAE, 1993, 2004). In Europe the TRY (Test Reference Year) method is often used (Lund and Eidorff, 1985). International Organization for Standardization (ISO) also established a TMY for energy calculations.

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International Weather for Energy Calculation (IWEC) files, which cover worldwide locations outside the United States and Canada, are now available for .International Weather for Energy Calculations (IWEC). The IWEC are the result of ASHRAE.There are many different weather data formats available. The International Weather for Energy Calculation (IWEC) files are derived from up to 18 years of.Buy International Weather for Energy Calculations (IWEC Weather Files) DVD on tektienen.com ? FREE SHIPPING on qualified orders.International Weather for Energy Calculations (IWEC) [American Society of Heating Refrigerating and Air-Conditioning Engineers] on tektienen.com *FREE* .ASHRAE International Weather Files For Energy Calculations. Also Titled. IWEC weather files. Creator. ASHRAE Technical Committee , Climactic Information.ASHRAE's International Weather for Energy Calculations (IWEC2) were completed in Dec. to provide "typical year" weather files of.Contains "typical" weather data in ASCII format, suitable for use with building energy simulation programs, for locations outside the USA and Canada.Canadian Weather for Energy Calculations (CWEC) and International Weather for Energy Calculations (IWEC) consists of 12 typical meteorological months.Source weather data for building energy simulation programs can be broken into two their Weather Year for Energy Calculations (WYEC) hourly weather files for 51 US IWEC also describes a data format, very similar to the TMY2 data format. . data for Kuwait International Airport and KISR's coastal weather station.The commonly used IWEC (International Weather for Energy Calculations) files direct radiation parameter was found to have a very strong negative bias of about .For the need of energy building simulation, ASHRAE developed in the IWEC (International Weather for Energy Calculations) weather files for Energy Efficiency and Renewable Energy's High Performance Building's Initiative . We .. (CSV) and International Weather for Energy Calculations (IWEC) [1].Frequently Asked Questions for ASHRAE IWEC2 weather data, including International Weather for Energy Calculations (IWEC Weather Files), Version annual heating and cooling degree days, and global (a) standardized IWEC weather files, (b) simulated Weather for Energy Calculations, IWEC (Thevenard .Where energy modeling has favored 'typical' weather years for the purpose of IWEC International Weather Year for Energy Calculation.Energy Procedia Volume 78, November , Pages International Weather for Energy Calculations (IWEC Weather Files) User Manual and CD-ROM; Identifying characteristic climate data for energy balance calculations. 1 . named International Weather for Energy Calculations (IWEC). This data is.demonstrate how several sets of international typical designed for use in building energy simulations, .. for Energy. Calculations (IWEC Weather Files) Users.J.-C. () 'A detailed weather data generator for building simulations', Energy () International Weather for Energy Calculations (IWEC Weather Files).Centre for Advanced Research in Building Science and Energy, CEPT . International Weather for Energy Calculations (IWEC Weather Files).General tab on Hourly Weather data Dialog. file (epw) from the ASHRAE

International Weather for Energy Calculations (IWEC) data for Havana, Cuba (CUB).