2.24 Measurement of Solar Radiation

太阳辐射的测量

In PV system design it is essential to know the amount of sunlight available at a particular location at a given time. The two common methods which characterise solar radiation are the solar radiance (or radiation) and solar insolation. The solar radiance is an instantaneous power density in units of kW/m2. The solar radiance varies throughout the day from 0 kW/m2 at night to a maximum of about 1 kW/m2. The solar radiance is strongly dependant on location and local weather. Solar radiance measurements consist of global and/or direct radiation measurements taken periodically throughout the day. The measurements are taken using either a pyranometer (measuring global radiation) and/or a pyrheliometer (measuring direct radiation). In well established locations, this data has been collected for more than twenty years.

对于光伏系统设计来说，知道某个地点特定时间可利用的太阳辐射是很重要的。两个常用于描述太阳辐射特征的方法是太阳辐射（或辐射）和日照度。太阳辐射是瞬时的功率密度，单位为千瓦每平方米。一天中，太阳辐射的值在夜间的 0 千瓦每平方米和日间的最大值约 1 千瓦每平方米之间变化。太阳辐射主要取决于观测点的位置和天气。周期性的太阳辐射的测量包括一天中总辐射和（或）直射分量的变化。测量工具为日射强度计（测量总辐射）或者太阳热力计（测量直射分量）。对于设施完善的地区，上述数据的记录时间超过 20 年之久。

The photograph at left shows equipment for solar irradiance measurements. (Photograph from David Pearsons) via NREL information exchange.

左图（译者注：原文中为左图，译文中为上图）中为测量太阳照度的设备。（图片来自大卫·皮尔森）

An alternative method of measuring solar radiation, which is less accurate but also less expensive, is using a sunshine recorder. These sunshine recorders (also known as Campbell-Stokes recorders), measure the number of hours in the day during which the sunshine is above a certain level (typically 200 mW/cm2). Data collected in this way can be used to determine the solar insolation by comparing the measured number of sunshine hours to those based on calculations and including several correction factors.

另一种测量太阳辐射的方法是使用日照计，这种方法精度较低，但其成本也较低。这种日照计（也称为坎贝尔-斯托克斯日照计）测量一天中日照强度高于某一水平（一般为 200 毫瓦每平方厘米）的小时数。将这种方法收集的日照小时数与基于计算和修正因子的得出的日照小时数进行比较，我们就可以得出日照度。

A final method to estimate solar insolation is cloud cover data taken from existing satellite images.

还有一种估计日照度的方法基于卫星图片中的云层覆盖信息。

While solar irradiance is most commonly measured, a more common form of radiation data used in system design is the solar insolation. The solar insolation is the total amount of solar energy received at a particular location during a specified time period, often in units of kWh/(m2 day). While the units of solar insolation and solar irradiance are both a power density (for solar insolation the "hours" in the numerator are a time measurement as is the "day" in the denominator), solar insolation is quite different than the solar irradiance as the solar insolation is the instantaneous solar irradiance averaged over a given time period. Solar insolation data is commonly used for simple PV system design while solar radiance is used in more complicated PV system performance which calculates the system performance at each point in the day. Solar insolation can also be expressed in units of MJ/m2 per year and other units and conversions are given in the units page.

尽管通常测量数据所得为太阳辐射，光伏系统设计中更常用的是日照度。日照度指的是特定地点一段时间内接收到的总太阳能量，它的单位一般为千瓦时每平方米每天。尽管日照和太阳辐射的单位都是功率密度（对于日照度来说，分子中的小时和分母中的天都是时间单位），日照度与太阳辐射还是有着很大的区别，因为日照是瞬时太阳辐射在一段时间内的平均值。对于简单的光伏系统设计，人们多采用日照度。而对于复杂的光伏系统，需要计算其在一天中不同时间点的表现，因此人们多采用太阳辐射。日照度也可以用兆焦耳每平方米每年来度量，“单位”页面中详细列出了它的其他的单位和相互转化。

Solar radiation for a particular location can be given in several ways including:

Typical mean year data for a particular location

Average daily, monthly or yearly solar insolation for a given location

Global isoflux contours either for a full year, a quarter year or a particular month

Sunshine hours data

Solar Insolation Based on Satellite Cloud-Cover Data

Calculations of Solar Radiation

特定地点的太阳辐射可以通过下列方式给出，包括：

特定地点的典型气象年数据

特定地点的日均、月均或年均日照度

一整年、一个季度或者特定月份的等辐照线

日照小时数

从卫星的云层覆盖数据得到的日照度

太阳辐射的计算