Applet for Open CourseWare production of Photovoltaic Solar Energy Systems

Sources:


Method used to calculate flux at tilt:
(Obtained from the first article by S. A. Klein and J. C. Theilacker listed above)
The calculation attempts to predict the total irradiation on a tilted panel by approximating and summing the individual contributions of the direct, diffuse, and reflected solar radiation. The first step in the algorithm is to calculate the theoretical daily irradiation on a horizontal panel located outside the Earth’s atmosphere, given a specific latitude and average day of a specified month. Then, a “clearness index” index is calculated by taking the ratio of the measured monthly average daily irradiation for the specific site and this theoretical calculation. The clearness index is used to estimate the relative contributions of the direct and the diffuse irradiation based on the tilt of the panel and a relationship proposed by J. K. Page. Then the contribution of the reflected irradiation is estimated based on the tilt angle and a reflectivity coefficient of 0.3. These three values sum to a single factor that directly relates the monthly average daily total radiation on an inclined surface to the monthly average daily radiation on a horizontal at the Earth’s surface. This method is simply repeated for each month of the year, and then tabulated and plotted for the user to see and understand more clearly.
How to add new site data:

The data is located in the file FixedData.java. It is organized in 4 separate string arrays and divided by country and then city. These arrays are: `location_country`, `location_city`, `location_latitude`, and `location_irradiation`.

The first array simply contains a list of the countries:

```java
String location_country[] = { "USA", "Australia" };
```

The three remaining arrays are all 2 or 3 dimensional with the first dimension then being the country. In other words, if one were to add a site in a new country, s/he would also need to add new list items to the first dimension of each of the remaining arrays.

For example:

```java
String location_city[][] = {
  { "Albany NY", "Atlanta GA", ... }, // USA
  { "Adelaide SA", "Albany WA", ... }, // Australia
  { "new site", ... }                 // new country
};
```

If one is not adding a new country, it is as simple as adding a new city name and the associated data onto the end of the current data in the arrays. One should keep in mind that the location (the indices) of the site’s name in the `location_city` array will be used by the applet to retrieve the latitude and irradiation values for the site as well; therefore, they must match up. A good rule of thumb would be to just follow the current formatting and check the curly braces.

One of the shortcomings of the current code design is that the specific site data is contained within the code itself and must be recompiled if one wants to add more sites. This could be fixed in the future by having the applet parse in an external text file with comma delimited site information.