

# Solar Resource Assessment For Pre-Feasibility and Feasibility Studies

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## Introduction

This is a guide to performing a very basic solar resource assessment for a pre-feasibility study at a given site. Please complete these steps to find the information required to produce a pre-feasibility study.

This was written for SIBAT (Sibol ng Agham at Teknolohiya), an NGO based in the Philippines and working on small scale community based renewable energy systems.

**Note:** Please email the author ([matt@re-innovation.co.uk](mailto:matt@re-innovation.co.uk)) if you have any comments and suggestions.

## Background information

The solar resource at a given site is measured in kilo-watt hours per square meter per day (kWh/m<sup>2</sup>/day). This is a measurement of the total energy falling onto one square meter. Obviously this will vary throughout the day as clouds pass and the sun rises and sets, but the average amount tells us the useful solar energy available.

Luckily some form of solar resource is available everywhere, the problem at present with solar photovoltaic panels ('PV' panels that create electricity) is their cost. Usually there is no problem for the installation of solar PV panels (basically they just have to point at the sun). The main problem is their high cost per unit of power installed. If another renewable energy resource is available locally then usually that would be a cheaper option.

Solar photovoltaic panels convert the sunlight falling onto the panel into electrical power. The output voltage is relatively constant no matter how much sunlight falls on the panel but the output current will vary almost linearly with the solar irradiance. The conversion efficiency of modern solar panels is in the region of 10 to 15%.

The panels should be mounted at an angle roughly corresponding to the latitude of your location (i.e. in the Philippines at between 5 to 15°), although mounting within ±10° would not seriously affect the energy captured. Mounting horizontally is an option in the Philippines, if it simplifies the mounting structure. In the northern hemisphere (e.g. the Philippines) the panels should face due south.

## Pre-FS solar resource assessment procedure

### *Initial data required*

The **longitude** and **latitude** of the potential site (as accurately as possible) is required in order to perform a pre-FS solar resource assessment.

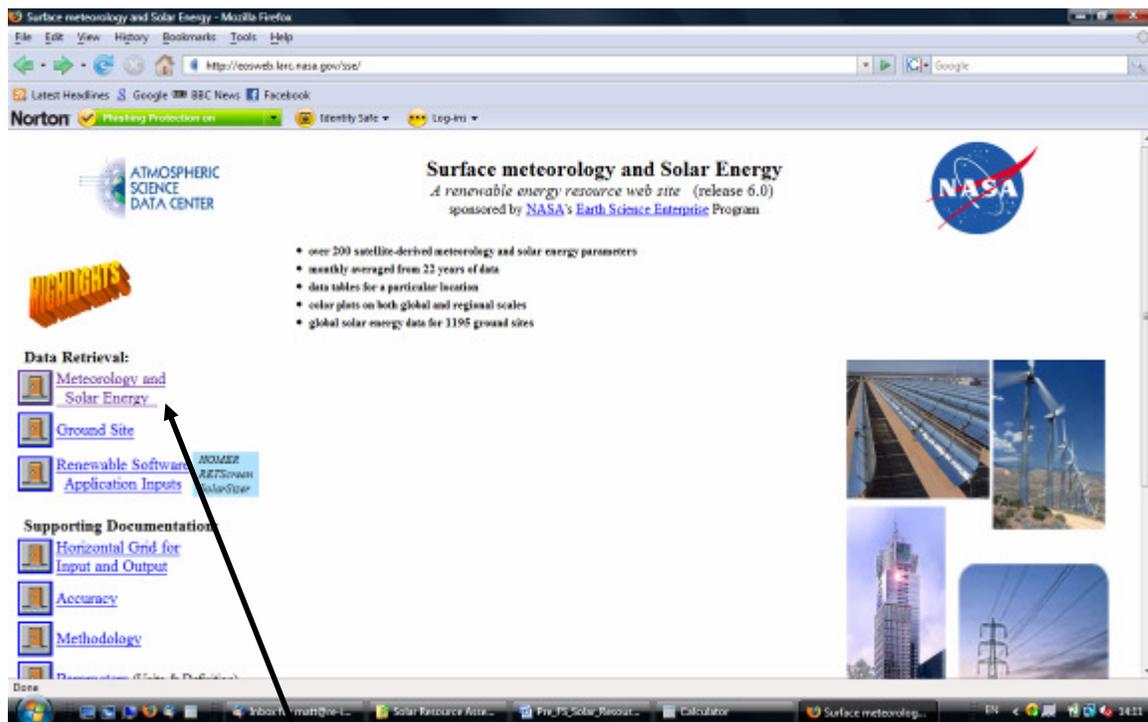
### *Check 'NASA Surface meteorology and Solar Energy' website*

NASA has mapped the planet and has produced a very good guide to the available solar resource at any location in the world. This information is available at:

<http://eosweb.larc.nasa.gov/sse/>

This guide will go through the process of acquiring the correct data.

Firstly open the website in a browser.



Click on 'Meteorology and Solar Energy'.



Surface meteorology and Solar Energy  
A renewable energy resource web site (release 6.0)  
sponsored by NASA's Earth Science Enterprise Program

- over 200 satellite-derived meteorology and solar energy parameters
- monthly averaged from 22 years of data
- data tables for a particular location
- color plots on both global and regional scales
- global solar energy data for 1195 ground sites

**Data Retrieval:**

- [Meteorology and Solar Energy](#)
- Data tables for a particular location
  - [Click on a desired map location](#)
  - [Enter latitude and longitude](#)

Tables of all SSE data set parameters for a single site.

- [Global or regional plots](#)

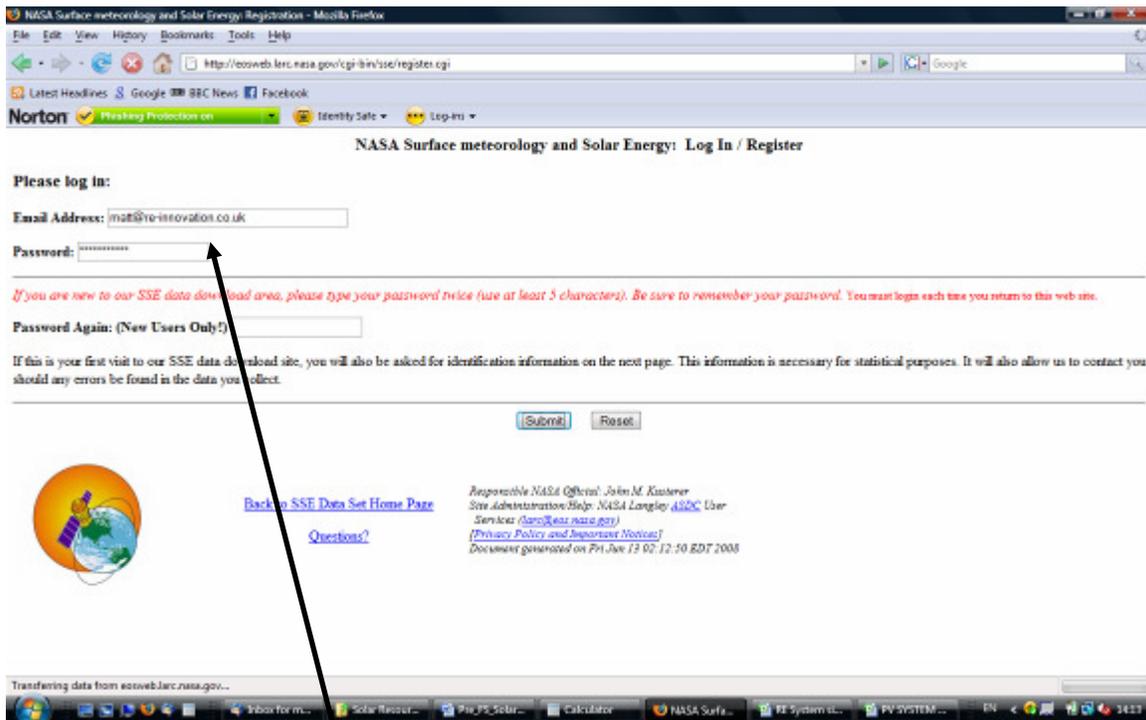
Color plots of most of the SSE data set parameters with user defined global or regional boundaries.

- [Global data sets](#)

Text files of monthly averaged data for the entire globe. Some annual averages or annual sums are included.

- [Regional data subsets](#)

Click on 'Enter latitude and longitude'



NASA Surface meteorology and Solar Energy: Log In / Register

Please log in:

Email Address:

Password:

*If you are new to our SSE data download area, please type your password twice (use at least 5 characters). Be sure to remember your password. You must login each time you return to this web site.*

Password Again: (New Users Only!)

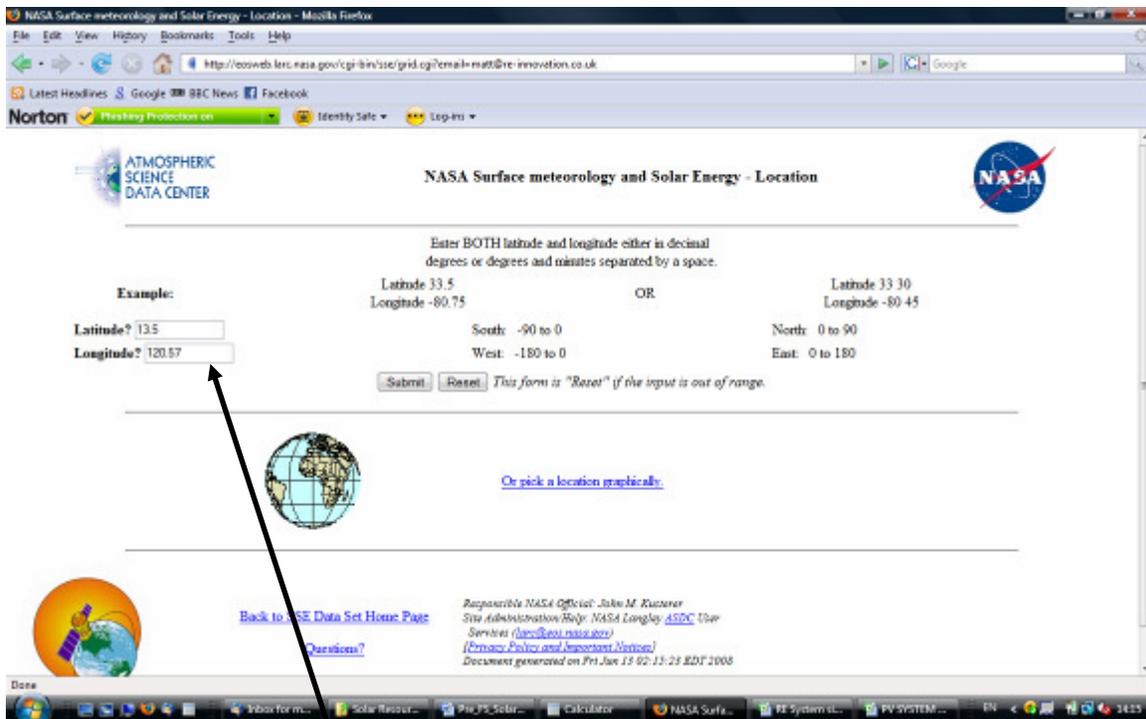
If this is your first visit to our SSE data download site, you will also be asked for identification information on the next page. This information is necessary for statistical purposes. It will also allow us to contact you should any errors be found in the data you collect.

[Back to SSE Data Set Home Page](#)

[Questions?](#)

Responsible NASA Official: John M. Kusner  
Site Administration/Help: NASA Langley ASQC User Services ([users@leas.nasa.gov](mailto:users@leas.nasa.gov))  
[Privacy Policy and Important Notices](#)  
Document generated on Fri, Jan 13 02:12:50 EDT 2005

Enter an email address and password. If you have not used the site before then follow the instructions for signing up – you will have to enter a password twice and put in your name and a phone number.



NASA Surface meteorology and Solar Energy - Location

Enter BOTH latitude and longitude either in decimal degrees or degrees and minutes separated by a space.

Example: Latitude 33.5 Longitude -80.75 OR Latitude 33 30 Longitude -80 45

Latitude? 13.5  
Longitude? 120.57

South: -90 to 0  
West: -180 to 0

North: 0 to 90  
East: 0 to 180

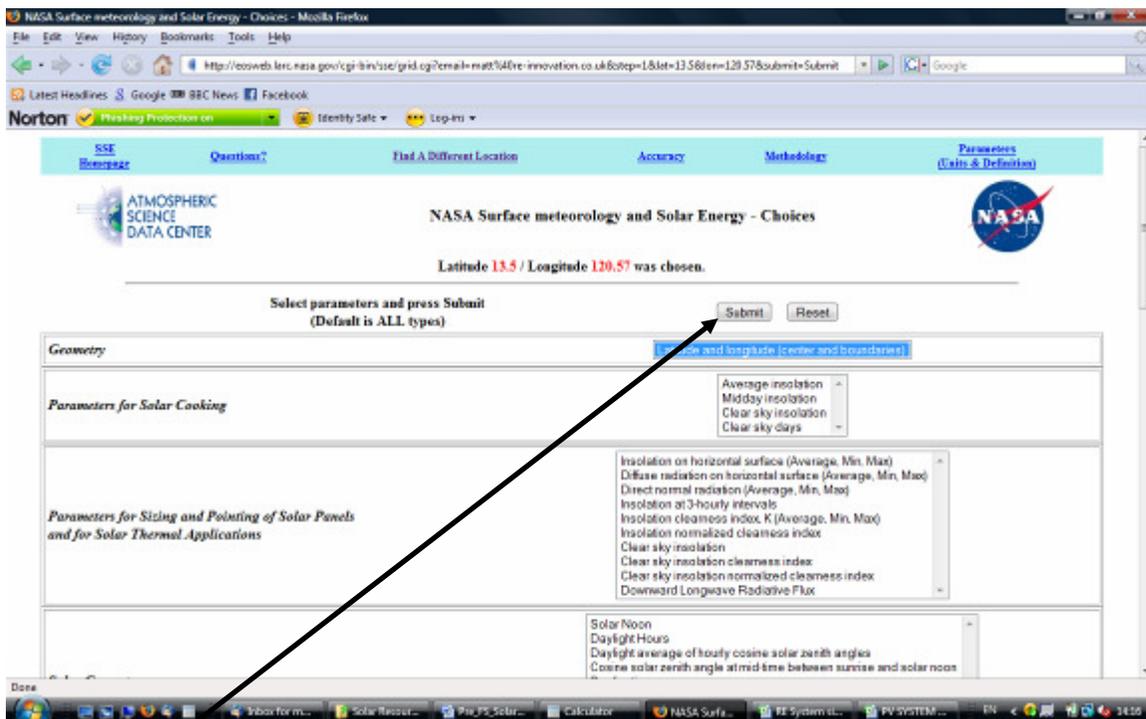
Submit Reset This form is "Reset" if the input is out of range.

[Or pick a location graphically.](#)

[Back to SSE Data Set Home Page](#)

Responsible NASA Official: John M. Kusner  
Site Administration Help: NASA Langley ASDC User Services ([help@eos.nasa.gov](mailto:help@eos.nasa.gov))  
([Privacy Policy and Important Notices](#))  
Document generated on Fri Jun 15 02:13:23 EDT 2006

Enter in the sites longitude and latitude. In the Philippines these numbers will both be positive.



NASA Surface meteorology and Solar Energy - Choices

Latitude 13.5 / Longitude 120.57 was chosen.

Select parameters and press Submit (Default is ALL types)

Submit Reset

[View and toggle \(close and boundaries\)](#)

Parameters for Solar Cooking

- Average insolation
- Midday insolation
- Clear sky insolation
- Clear sky days

Parameters for Sizing and Pointing of Solar Panels and for Solar Thermal Applications

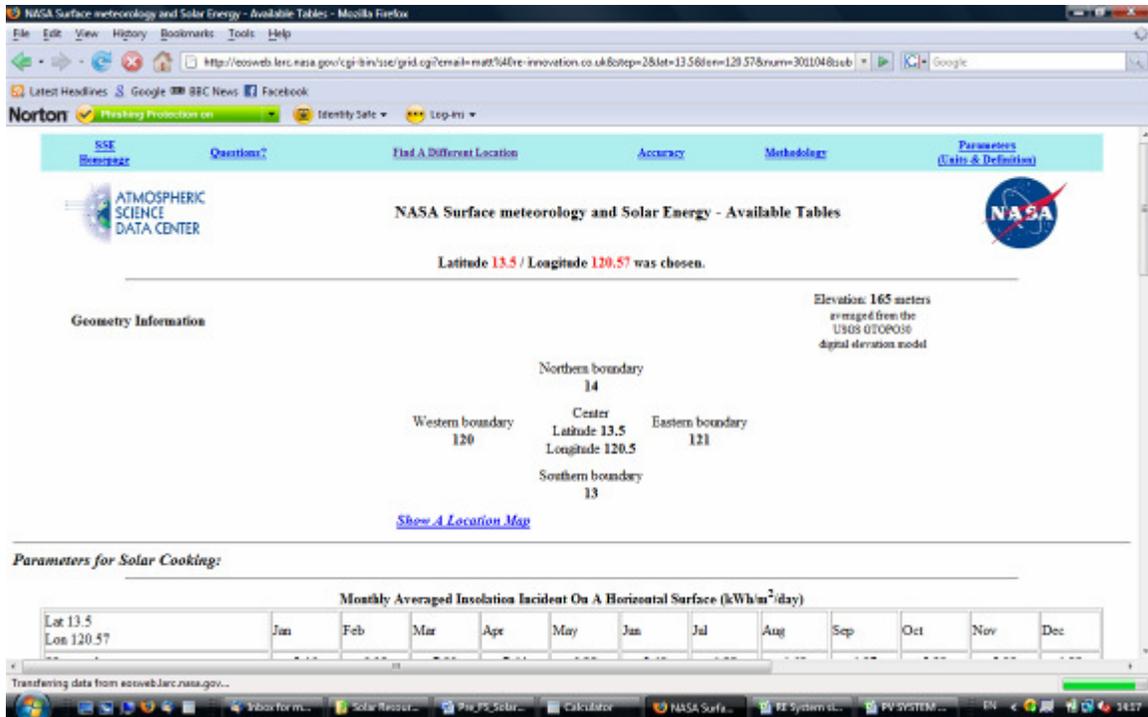
- Insolation on horizontal surface (Average, Min, Max)
- Diffuse radiation on horizontal surface (Average, Min, Max)
- Direct normal radiation (Average, Min, Max)
- Insolation at 3-hourly intervals
- Insolation clearness index, K (Average, Min, Max)
- Insolation normalized clearness index
- Clear sky insolation
- Clear sky insolation clearness index
- Clear sky insolation normalized clearness index
- Downward Longwave Radiative Flux

Solar Noon

- Daylight Hours
- Daylight average of hourly cosine solar zenith angles
- Cosine solar zenith angle at mid time between sunrise and solar noon

Done

Click submit (the default is to acquire all the parameters)



NASA Surface meteorology and Solar Energy - Available Tables

Latitude 13.5 / Longitude 120.57 was chosen.

Elevation: 165 meters averaged from the USGS OTOPO36 digital elevation model

Geometry Information

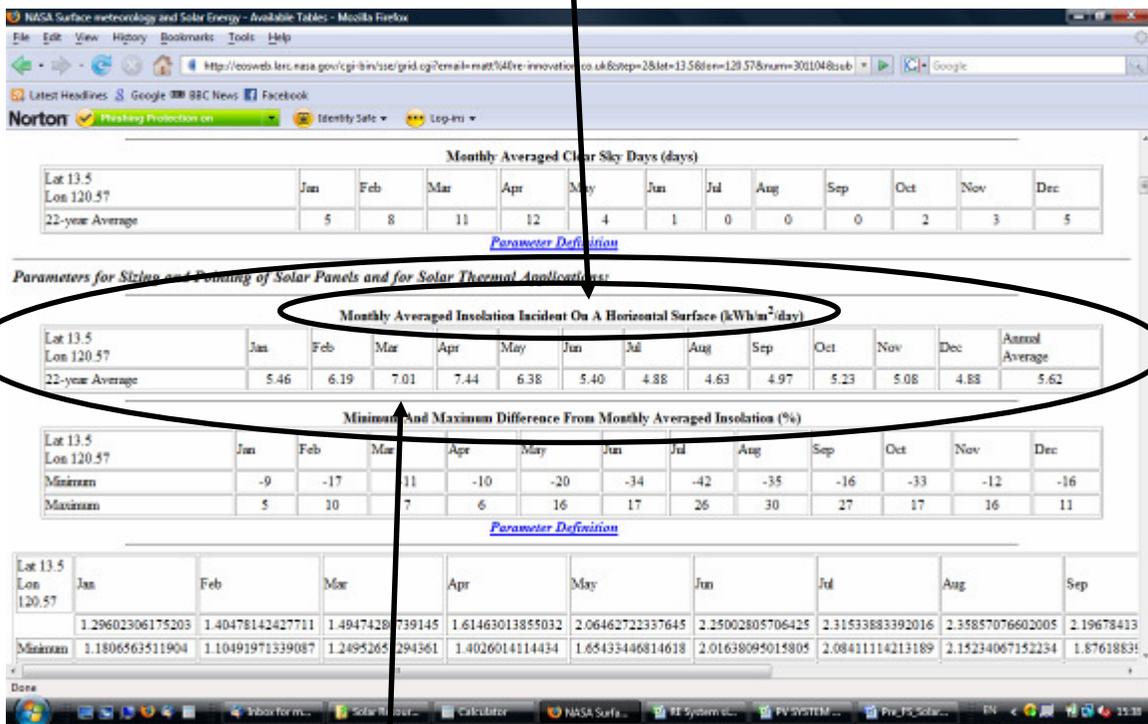
Northern boundary: 14  
Western boundary: 120  
Center: Latitude 13.5, Longitude 120.5  
Eastern boundary: 121  
Southern boundary: 13

Parameters for Solar Cooking:

Monthly Averaged Insolation Incident On A Horizontal Surface (kWh/m<sup>2</sup>/day)

Lot 13.5 Lon 120.57	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
22-year Average												

This will bring back a lot of information about the meteorology of the location. This may take a while to download. Scroll down to see 'Monthly Averaged Insolation Incident on a Horizontal Surface (kWh/m<sup>2</sup>/day)' in the 'Parameters for sizing and pointing of solar panels for solar thermal applications' section.



Monthly Averaged Clear Sky Days (days)

Lot 13.5 Lon 120.57	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
22-year Average	5	8	11	12	4	1	0	0	0	2	3	5

Parameters for Sizing and Pointing of Solar Panels and for Solar Thermal Applications:

Monthly Averaged Insolation Incident On A Horizontal Surface (kWh/m<sup>2</sup>/day)

Lot 13.5 Lon 120.57	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
22-year Average	5.46	6.19	7.01	7.44	6.38	5.40	4.88	4.63	4.97	5.23	5.08	4.88	5.62

Minimum and Maximum Difference From Monthly Averaged Insolation (%)

Lot 13.5 Lon 120.57	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	-9	-17	11	-10	-20	-34	-42	-35	-16	-33	-12	-16
Maximum	5	10	7	6	16	17	26	30	27	17	16	11

It is this data that should be recorded for the resource assessment.

Note the data in this table:

<b>Month</b>	<b>Insolation (kWh/m<sup>2</sup>/day)</b>
Jan	
Feb	
Mar	
Apr	
May	
Jun	
Jul	
Aug	
Sep	
Oct	
Nov	
Dec	
<b>Annual Average</b>	

This value will help in the decision of whether solar PV is a viable energy source. The higher the annual average value then the cheaper the system will be to produce the same energy. The average daily load will suggest the area of solar panels required and hence the cost of the system. This should be compared with other renewable energy sources - solar is usually the most expensive but might be the only available renewable energy option.

If this is to be a battery based system (i.e. an electricity supply, not water pumping system) it is useful to also look at the difference between the minimum and maximum daily energy generated. This shows the seasonal variation, which can affect the system design. If the difference is large (i.e. the maximum is more than 50% higher than the minimum), then the minimum value should be used for performing design calculations, as the energy cannot be stored over the period of a year.

The data from this assessment can be used in writing the pre-feasibility study report and the feasibility study.

This data can be used in the 'Load\_Calculations\_and\_System\_sizing.xls' Excel spreadsheet to help size and cost a potential renewable energy system.