Solar Resource Assessment For Pre-Feasibility and Feasibility Studies

Date created: 25th July 2008

Version: 1.1

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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) 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^2/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 covert 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.

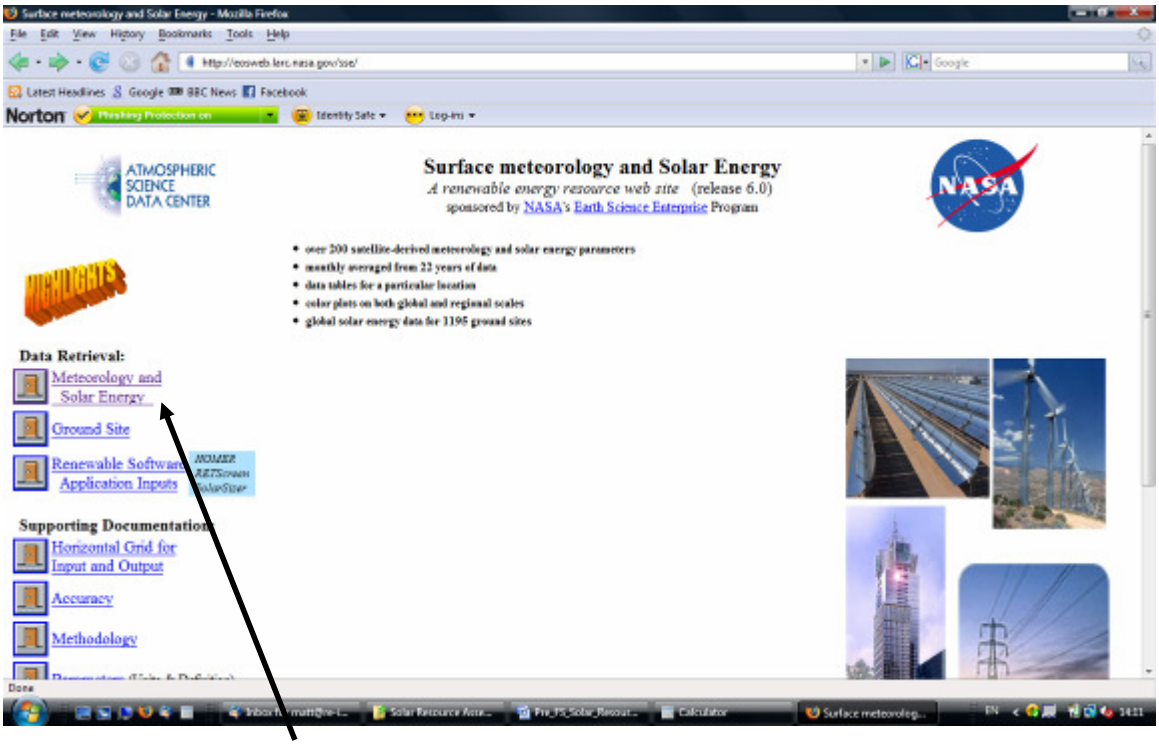
Check 'NASA Surface meteorology and Solar Energy' website

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:

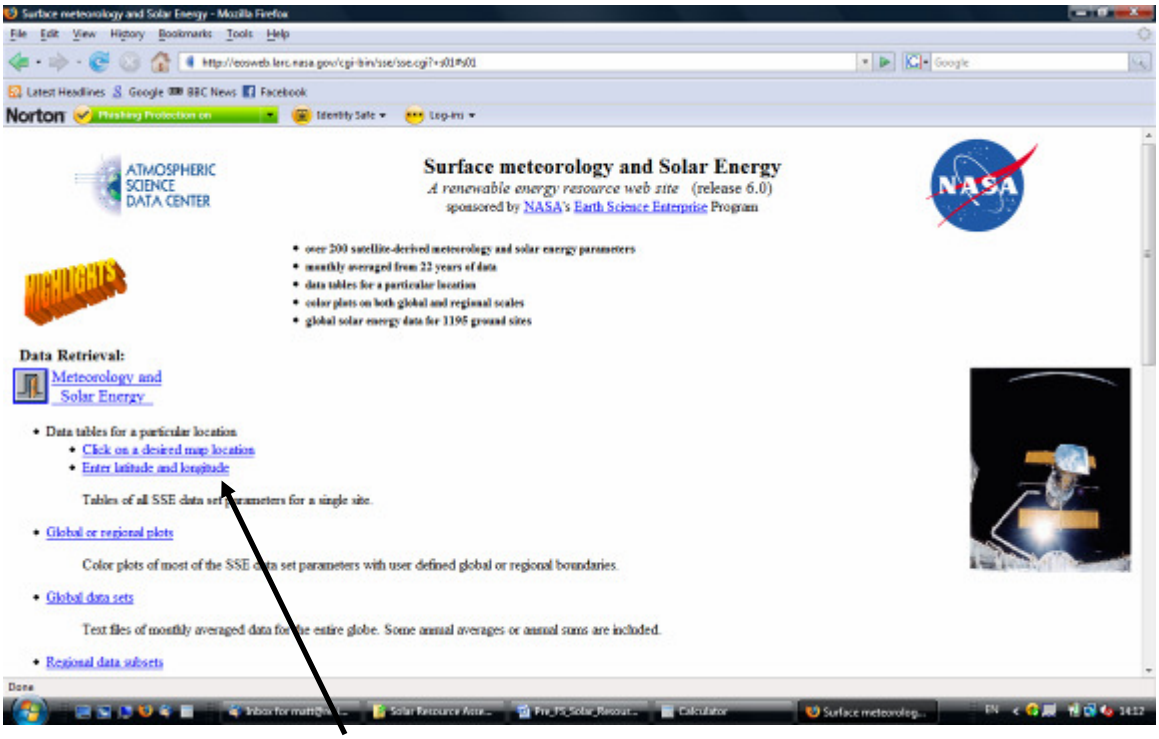
http://eosweb.larc.nasa.gov/sse/

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

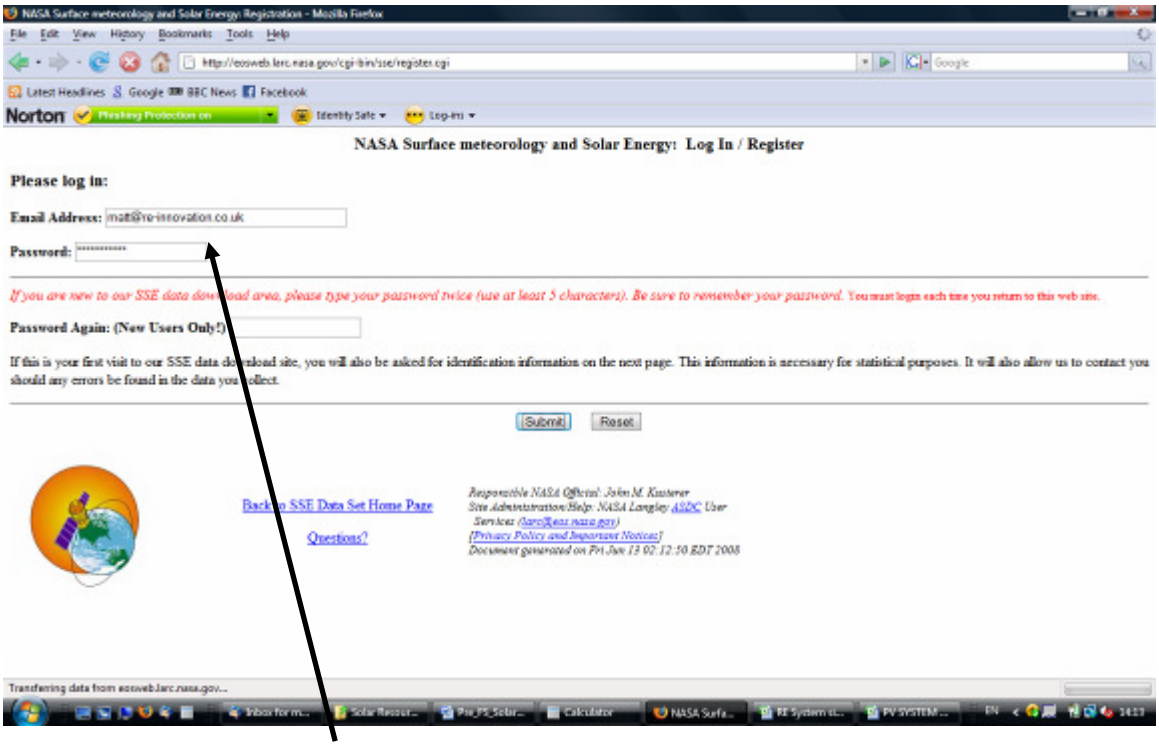
Firstly open the website in a browser.



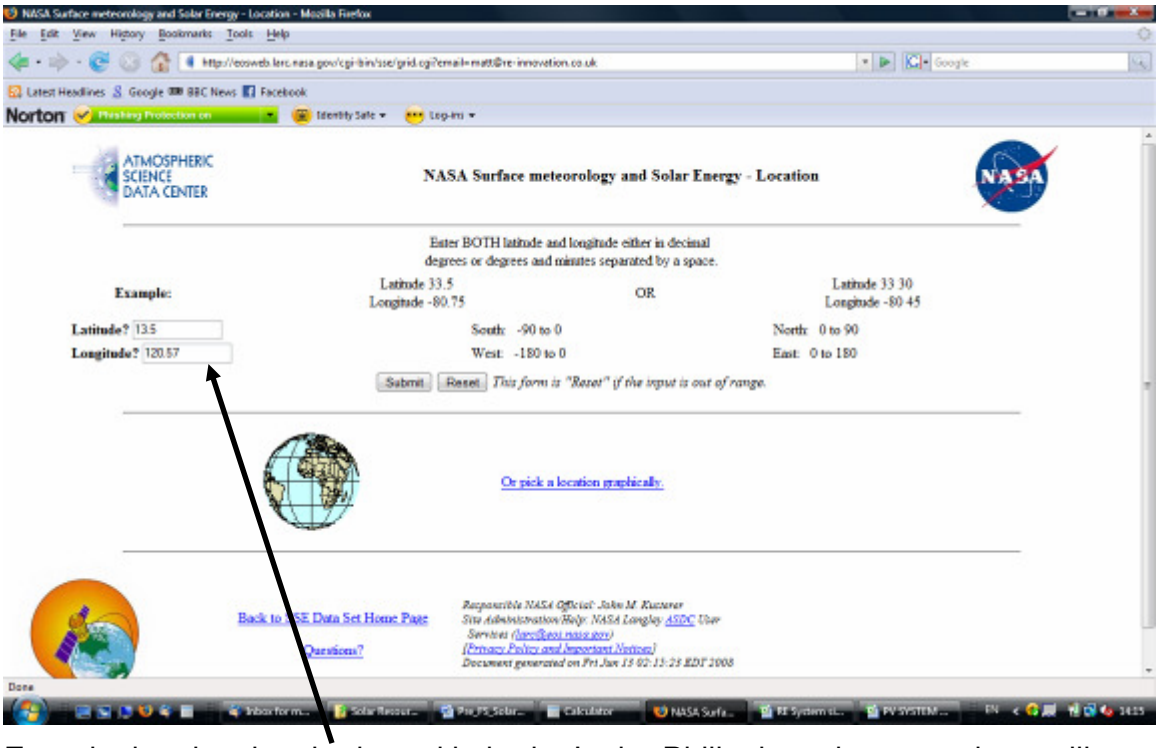
Click on 'Meteorology and Solar Energy'.



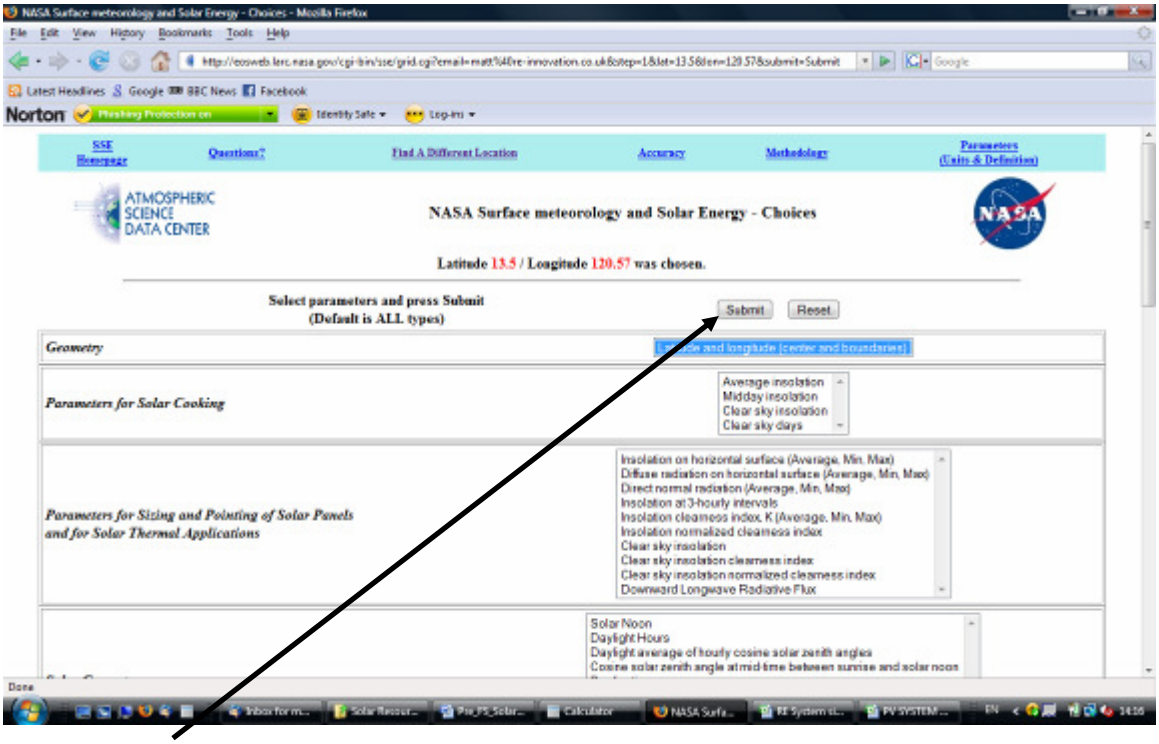
Click on 'Enter latitude and longitude'



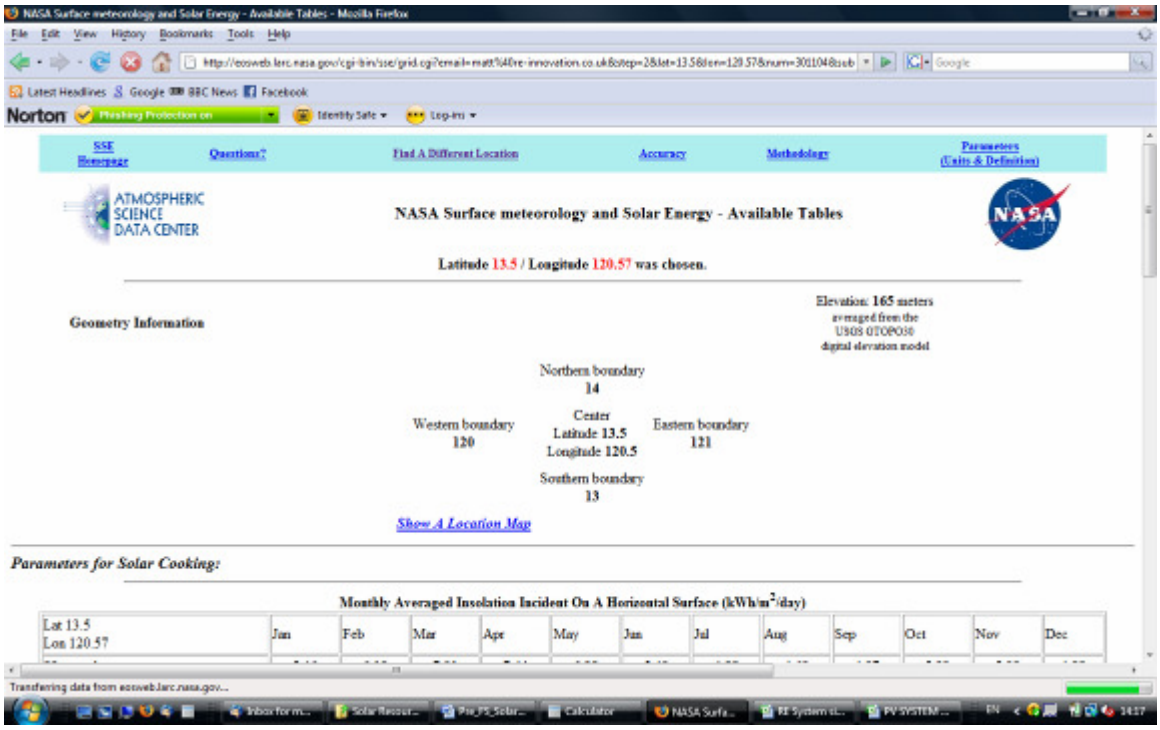
Enter an email address and password. If you have not used the site before then follow the instructions for signing up – you will have to enter a password twice and put in your name and a phone number.



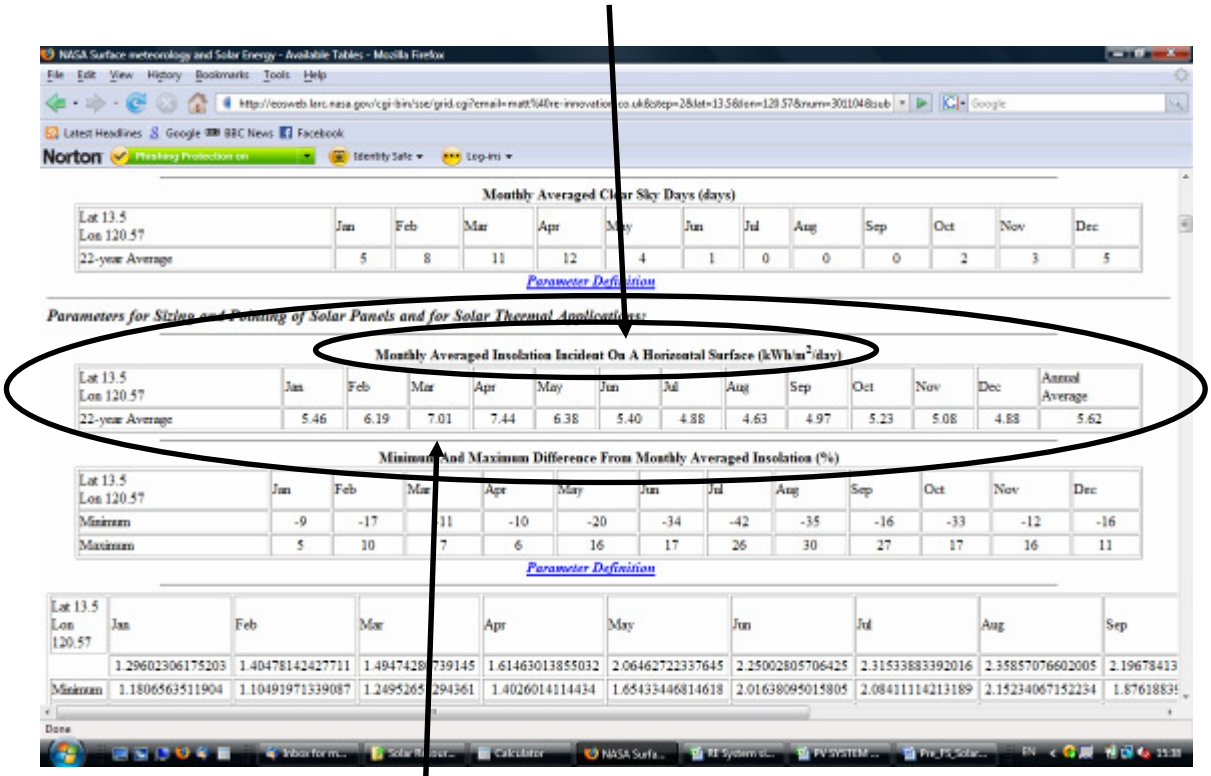
Enter in the sites longitude and latitude. In the Philippines these numbers will both be positive.



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



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^2/day)' in the 'Parameters for sizing and pointing of solar panels for solar thermal applications' section.



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

Note the data in this table:

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

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.